Places and Technologies 2015

# KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES

Nova Gorica, Slovenia, 18.–19.6.2015

PLACES

## BOOK OF CONFERENCE PROCEEDINGS

*A healthy city is one that is continually creating and improving those physical and social environments and expanding those community resources which enable people to mutually support each other in performing all the functions of life and developing to their maximum potential.*
*Health Promotion Glossary (1998)*

## ORGANIZERS:

Универзитет у Београду - Архитектонски факултет
University of Belgrade - Faculty of Architecture
www.arh.bg.ac.rs

University of Belgrade,
Faculty of Architecture, Serbia

URBANLAB
PROFESSIONAL ASSOCIATION URBAN LABORATORY

University of Ljubljana,
Faculty of Architecture, Slovenia

University of Ljubljana
Faculty of Architecture

Professional Association,
Urban Laboratory, Serbia

SPLOŠNA BOLNIŠNICA "DR.FRANCA DERGANCA" NOVA GORICA

General Hospital, »Dr Franca
Derganca« Nova Gorica, Slovenia

## SPONZORS:

kreal
Creative together

KREAL, Creative Aluminium, Kidričevo, Slovenia

## SUPPORTERS:

MESTNA OBČINA
NOVA GORICA

AIU IGSRP ISOCARP

ISOCARP
Knowledge for better Cities

Skgz
SLOVENSKA KULTURNO-GOSPODARSKA ZVEZA
UNIONE CULTURALE ECONOMICA SLOVENA

DUPPS TSPAS
DRUŠTVO URBANISTOV IN PROSTORSKIH PLANERJEV SLOVENIJE
TOWN AND SPATIAL PLANNING ASSOCIATION OF SLOVENIA

Tempus

RESARCH
Restrukturiranje studijskog programa Arhitekture u program sa integrisanim Masterom, usklađen sa standardima Evropske Unije

GO
European Grouping of Territorial Cooperation
Gruppo europeo di cooperazione territoriale
Evropsko združenje za teritorialno sodelovanje

CIP - Kataložni zapis o publikaciji
Narodna in univerzitetna knjižnica, Ljubljana

614:711.4(082)(0.034.2)

INTERNATIONAL Academic Conference Places and Technologies (2 ; 2015 ; Nova Gorica)

Keeping up with technologies to make healthy places [Elektronski vir] : book of conference proceedings / [2nd International Academic Conference] Places and Technologies 2015, Nova Gorica, 18.-19. 6. 2015 ; editors Alenka Fikfak ... [et al.]. - Ljubljana : Faculty of Architecture, 2015

ISBN 978-961-6823-68-5

1. Gl. stv. nasl. 2. Dodat. nasl. 3. Fikfak, Alenka

279986432

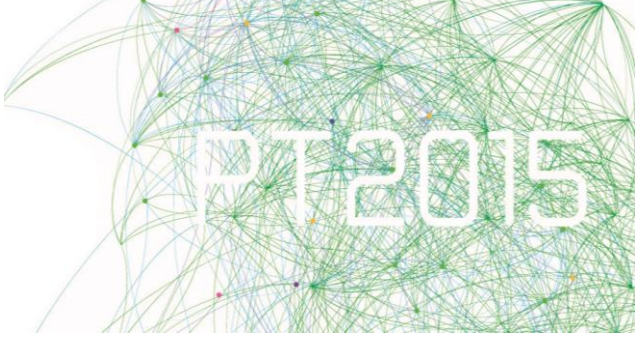
**Places and Technologies 2015**

# KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES

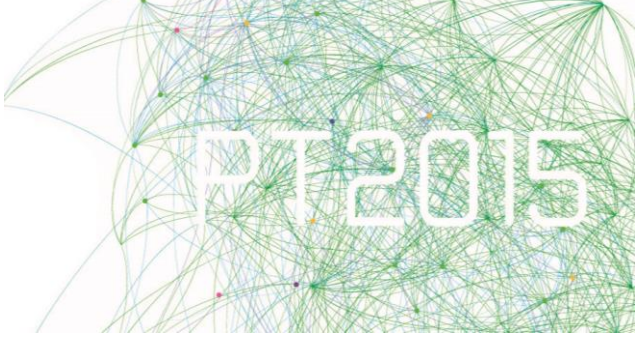
BOOK OF CONFERENCE PROCEEDINGS

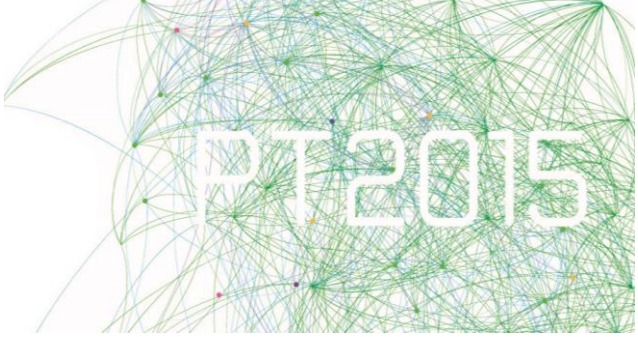
**Editors:**
Alenka Fikfak, Eva Vaništa Lazarević,
Nataša Fikfak, Milena Vukmirović, Peter Gabrijelčič

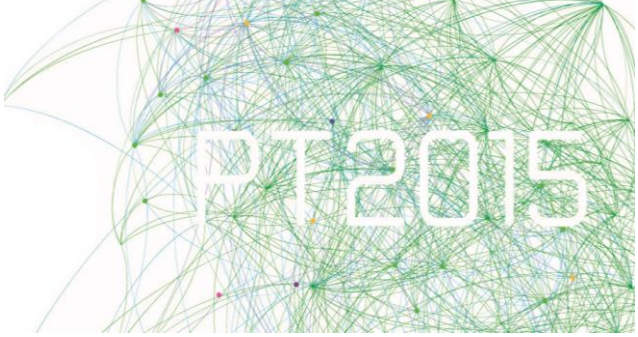
Nova Gorica, Slovenia

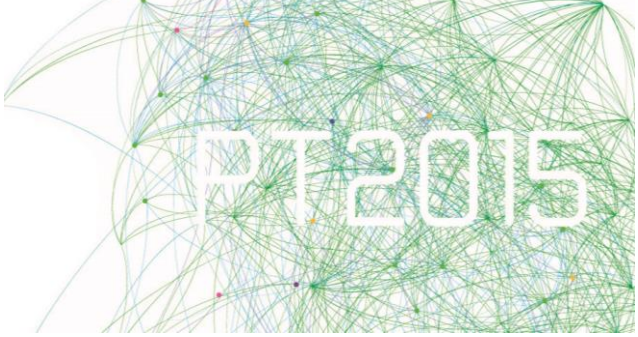


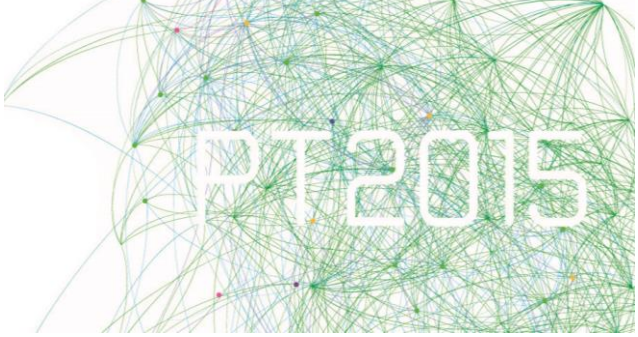

# Contents

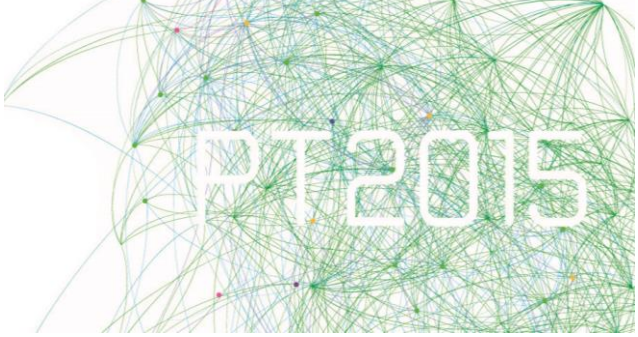


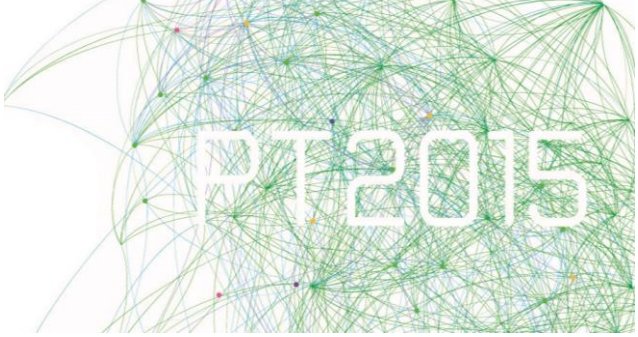


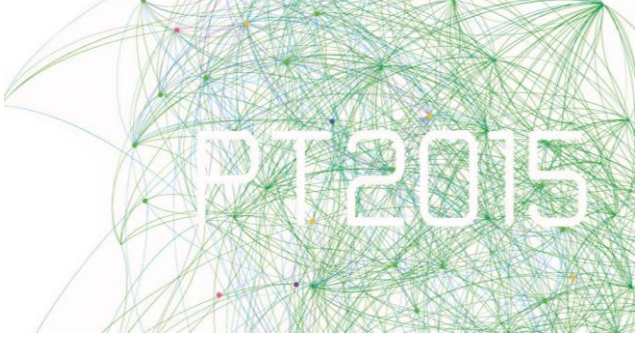




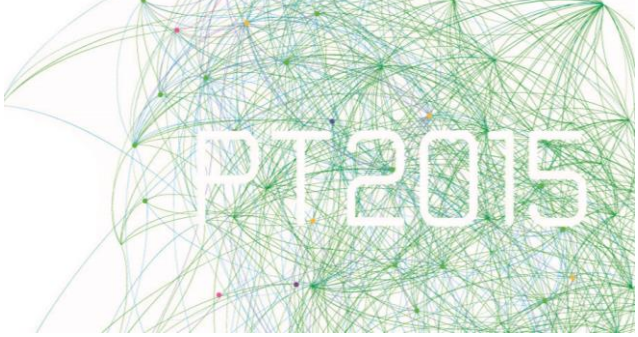









# INTRODUCTION




# HEALTHY CITY - TECHNOLOGY AND URBAN RESILIENCE

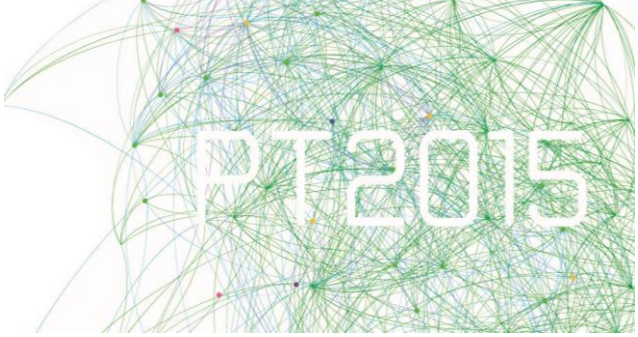
**Eva Vaništa Lazarević**
Director of The P&T Conference, PhD, Professor, *University of Belgrade, Faculty of Architecture, Belgrade, Serbia*

*At the time when advanced technologies reached accomplishments like human & heart regeneration through new types of proteins or the discovery of rejuvenating elements for time reverse or a New Graal of the 21.st. Century; it is more than obvious that architecture has to stand closely related and concerned of health-care of today. That is why the significance of health-care's field of research is fully underlined as the new focus of the 2nd International Scientific Conference "Places and Technologies" 2015.*

*Belgrade's based Academic International Conference organized by the Faculty of Architecture, University of Belgrade and "Urban Lab" gathered, after a long period of rough times, the Deans of Faculties of Architecture from the region of South East Europe. In the enthusiastic tone of afresh meeting the Deans and the Organizers agree that the Conference should be spreaded around the region each two years and be back to Belgrade's home as the axis - under the scope of new technologies research. The main goal was, of course, to maintain the fragile scientific links back together and become more banded and recognized with EU colleagues and friends.*

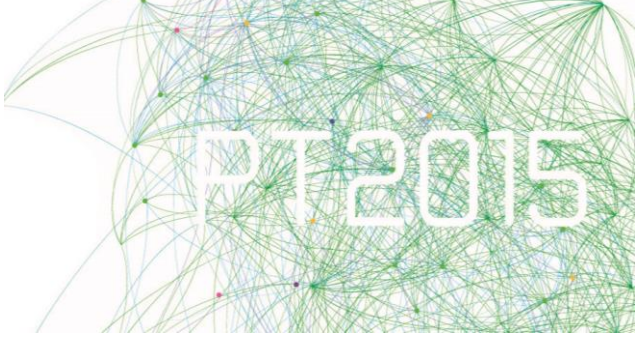
*In that sense, our kind Slovenian partners of this 2015 placed the Conference in the first Modern planned city in Slovenia after the II world war: Nova Gorica. Young PhD researchers, and professors will meet together from both architecture and health-care sectors in order to hear each other's needs. P&T Conference participants, already friends, from FYR of Macedonia, Albania, Greece, Serbia, Montenegro, Bosnia and Herzegovina, Republic of Srpska, Romania, Bulgaria, Hungary, Croatia, Austria, Italy and Slovenia but also from all over Europe from UK and The Netherlands to Poland and Portugal will meet again hoping that this event should overcome poor economic times, becoming an annual tradition. This year, our Slovenian hosts will include their own partners and colleagues from all over Europe and the synergy circle will become more powerful and spread further, to Switzerland, Russia and Latvia.*

*I would like to thank to my reliable partner and spiritus movens of this Conference: Dr Milena Vukmirović as well as my colleagues from The organizing Committee - The Regional Director Assist. Prof. Dr Alenka Fikfak, fully in charge for this year's event. The 2015 Conference would not be possible without the support, enthusiasm and persistence of our main host and my long-standing friend: Prof. MSc Peter Gabrijelčič, the Dean of the Faculty of Architecture University of Ljubljana.*




*Our keynote speakers of this year's Conference are well known and reputable names from our profession and I am so proud and grateful to have them on our side. Ninety research papers developing diverse thesis on architecture's new technologies interlaced with health-care - will be published openly in order to enlighten and improve previously conceived field of knowledge. New scientific contacts and friendships will be established in Slovenia in hopefully nice early summer's month of June.*

*From the professors and scientist's prospective through glasses what could be of bigger importance then the assignment of organizing such a Conference?*



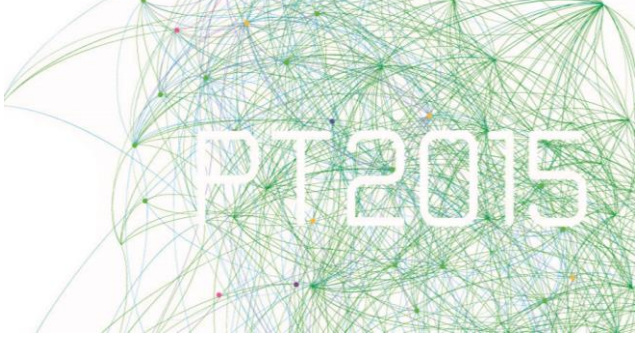

# A PLACE FOR PLACES: LIVE AND STAY

**Nataša Fikfak**
Prim., General Hospital, »Dr Franca Derganca« Nova Gorica, Slovenia

*From the times of Hippocrates, medical knowledge concerning diseases has not changed much. We know much more about the causes of diseases – that much is true – and we are aware of the many successful ways of prevention and treatment, because there is always somebody taking a shortcut to discover the causes of disabilities and how to prevent them. And there is a place for technology: man discovered machines, tools and other equipment to shorten the time for making diagnosis, which means earlier treatment or a possible cure. And there is a place for places: a healthy place to live in and stay there during treatment means as much as the right diagnosis and treatment. What do they have in common – medicine and architecture? Is it the technological development and solutions in search of a better place and living? Or is it the art of wellbeing?*

*This meeting is the result of the art of looking, looking for news, wondering, and communicating with each other. We would like to share our experiences and find the solutions to please the healthy and the sick. And more, we want to build bridges among ourselves and make this experience useful in everyday activities – and also build bridges between different countries, languages, and cultures. We want to make boundaries disappear and speak the same language used in everyday life.*

*I wish you a wonderful experience, joy in working and spending time together – with a promise to meet again very soon.*




# NOVA GORICA

**Matej Arčon**
Mayor, City Municipality of Nova Gorica, Slovenia

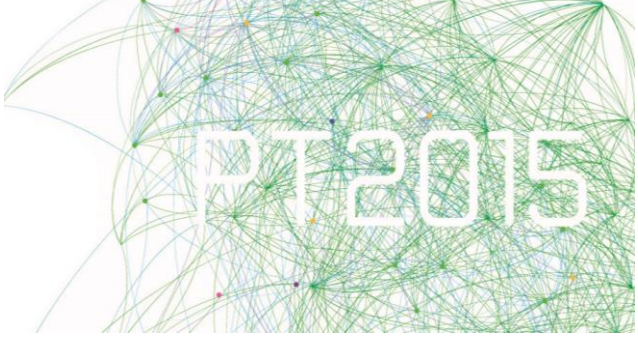
*Nova Gorica cannot simply be regarded as one of smaller cities in Slovenia, even though it is classified as such on a national scale, in accordance with the population statistics (17,084). It can only be understood in the cross-border context of a multi-cultural urban conurbation consisting of Nova Gorica ("New Gorizia"), Šempeter-Vrtojba and Gorizia (in Italy). On a Slovenian statistical scale, it comes right after Ljubljana and Maribor. Hence, in the Slovenian Spatial Development Strategy Nova Gorica is placed among urban centres of national significance.*

*This cross-border centre is also a regional centre. The Province of Gorizia (Provincia di Gorizia, Italy) and the Goriška statistical region (Slovenia) together cover a very diverse and economically interesting area. They are connected by the Soča/Isonzo river that extends from the Alpine region, flows across the Karst Plateau and the plains until it finally meets the sea. This territory comprises hilly, sparsely populated areas, with exceptional natural qualities, extending to Monfalcone, the northernmost port of the Adriatic Sea.*

*In the past, Gorizia was among the biggest promoters of Slovenian economy and culture (e.g. the "Trgovski dom" building in Gorizia, designed by the architect Max Fabiani). It was also one of the central leisure and recreation areas of the Austro-Hungarian Empire, also known for its cultural diversity (the languages used were Italian, Slovenian, German, and Friulian). Due to a combination of natural, cultural, and, not least, economic reasons, the need to connect was always present, and collaboration was always there, despite the so-called iron curtain. Nowadays, the Slovenian minority in Gorizia is one of the main drivers of territorial integration and cultural dialogue.*

*For historical reasons, the areas of Gorizia, Nova Gorica, and Šempeter-Vrtojba had double infrastructure (sport centres, regional hospital, public utilities, transport infrastructure, etc.). Despite its generally negative connotations, the border was, in fact, a powerful generator of economic development (price differences, logistics platform of the customs area, different regulatory framework regarding gambling services, excise duties, etc.). Following the elimination of the border, the city faced major development challenges in the sense of the so-called "sewing" of the urban fabric, i.e. in the light of the development objectives pursued.*

*Over the years, the co-operation progressively took on a central role in the economic, social, and infrastructural redevelopment of the area.*




*The collaboration was formalised after Slovenia's declaration of independence, and even more after the accession of Slovenia to the EU. This was followed by the initiatives to establish a cross-border office and the project involving the collaboration of three administrations. The establishment of the European Grouping for Territorial Cooperation (EGTC) builds on all the efforts invested so far, on the fundamentals brought about by the new European legislation. The Convention on the establishment of the European Grouping for Territorial Cooperation was officially signed by the mayors of the founding municipalities on 19th February 2010 in Gorizia. The Slovenian Government approved the establishment of the EGTC in June 2010, and the Italian Government in May 2011. The EGTC was registered as a legal entity on 15th September 2011. The first Assembly meeting of the newly established EGTC was held on 3rd February 2012.*

*The cooperation in the culturally and administratively diverse environment calls for great efforts of the administrations, and a subtle understanding of the cultural character of the area. It is difficult to maintain appropriate relationships in the representation of the various cultures, which must be able to recognise themselves in all the activities connected with the management of the area. This is also a question of promoting equality within diversities, which are definitely regarded as beneficial; however, the process is very demanding in the sense of finding and developing solutions in all areas.*

***Area of spatial planning***

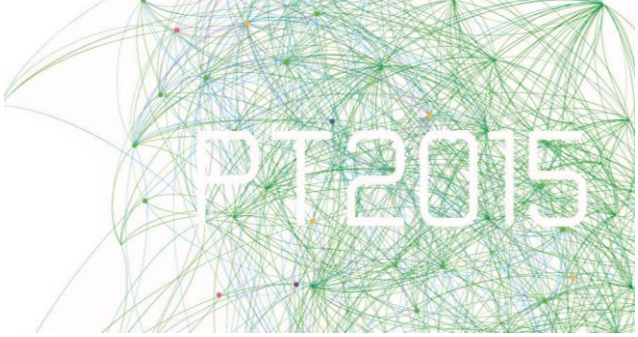
*For the conurbation, the multi-cultural aspect of architecture is highly important, and also one of the key generators of spatial identity. Indeed, we must not forget how and why Nova Gorica, as a separate entity, was created and the importance of the preservation of the diversity in identity of the common conurbation in a globalising world.*

*The importance of architecture and urban design was recognised by the City Municipality of Nova Gorica in its Annual Culture Programme adopted by the City Council in July 2014.*

*The questions that the conference PLACES AND TECHNOLOGIES 2015 addresses are the central focus of the conurbation in the framework of the EGTC; indeed, in the next period, the conurbation must take the basic steps towards a joint spatial management. Human health, ecology and innovation are key topics of the EGTC GO strategic document, and are developed in three thematic interdisciplinary projects:*

- *THE SOČA/ISONZO – establishment of the Soča/Isonzo Cross-border Park (tourism, recreation, drainage, green areas of the conurbation)*

- *CROSS-BORDER HEALTHCARE SERVICES*

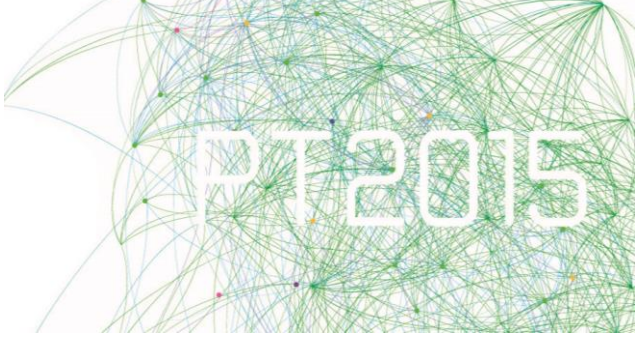



- *The restructuring of the customs border area into a REGIONAL LOGISTIC CENTRE.*

*The first two projects will be financially supported by the Cross-border Cooperation Program Italy – Slovenia 2014-2020.*

*The envisaged operation and the strategic goals of the EGTC fully coincide with the central themes of the PLACES AND TECHNOLOGIES 2015 conference, which represent an opportunity to upgrade the current approach, building on the knowledge of other environments and the exchange of good practices. This is a great opportunity for us to extend our knowledge and establish a wider context of co-operation with the institutions that are the generators of development in individual fields and, as such, are of key importance for the conurbation area. At the same time, the conference participants are given the opportunity to see how relevant problems are addressed on a concrete example, and to develop guidelines for the continued operation of the EGTC GO.*

*The conference will be part of the activities organised on the occasion of the 150th anniversary of birth of the architect, innovator, philosopher, and multicultural humanist Max Fabiani (in the framework of the conurbation), who distinguished himself in the post-war reconstruction projects of the devastated area of Goriška, and the Posočje region (the area along the Isonzo river), in the aftermath of the Isonzo Front (the year 2015 marks the 100th anniversary of Italy's entry into the war with the Austro-Hungarian Monarchy and the beginning of the Isonzo Front). His designs (Gorizia, Šempeter, Vrtojba and Solkan, directly in the conurbation) technologically modernised the town planning in the region.*



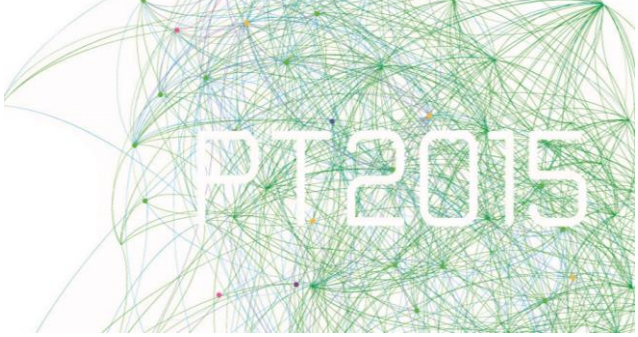

# HEALTHY CITY - TECHNOLOGY AND URBAN RESILIENCE

**Ružica Božović Stamenović**
PhD, Professor, *University of Belgrade, Faculty of Architecture, Belgrade, Serbia and National University of Singapore, Singapore*

*Endemic challenges of rapid urbanization are not generated by growth per se but by multidimensional facets of urban living under the pressing conditions. Although sanitation, safety and efficiency of urban services and systems still defines public health, the imminent future of city as a healthy place transcends dependency on system provisions and relies on urban resilience. The city resources are becoming increasingly scarce, outdated, inefficient and inflexible. At the same time urban population is steadily getting older, self-centered, stressed and socially and economically poorer. Therefore, technology and design strategies for enhancing the well-being of urbanites will increasingly depend on their relevance regarding social cohesiveness, social capital values, food and water provisions, productivity and possibilities for recuperation.*

*The resilient city relies on robustness of all urban processes and participating parties engaged in preservation, reuse and redevelopment of city resources. The new urban-scape recycled from the modernist urban heritage on premises of resilience will present itself as ecosystem, as a living entity composed on interdependent systems and agents. However, achieving these goals in practice is not an easy task and requires rethinking of the common design methods and strategies. The possible image of this resilient healthy city is already emerging with ideas of salutogenic healthcare spaces, cohousing models for elderly and young urbanites, vertical villages, urban agriculture and integrative public spaces. Characteristic for all new ideas is their dependency on connectedness and mobility between micro, meso and macro urban levels. In that sense technology integrated in hybrid design models facilitates links between individuals and spaces while overcoming physical distance as an obstacle for integration.*

*Ultimately, the question is how public health would be redefined and managed within the new urban resilience framework and with already established habits of daily life? In that sense the main role of technology might be to facilitate the affective relations with urban spaces and help with putting forward the people-centered, holistic and socially sensitive public health model and respective design instead of the currently prevailing bureaucratic one. Or, as raised in many instances, the healthy city should not be just livable but loveable one to be resistant to predicaments of the future.*




# INNOVATING AT LISBON'S WATERFRONT PLACE, THE "TAGUS PLATFORM" PROJECT

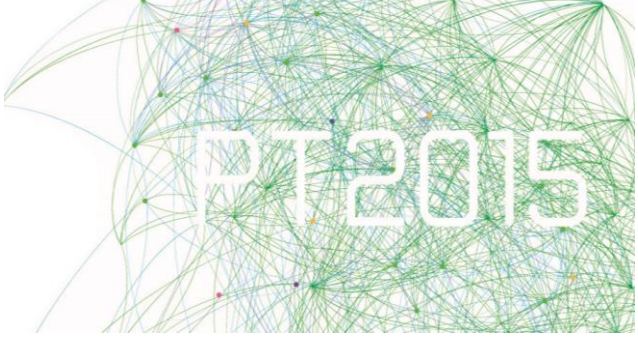
**Pedro Ressano Garcia**
PhD, Professor, *Universidade Lusófona, Lisbon, Portugal*

*At Lisbon waterfront, the project Tagus Platform presents a holistic perspective in which city and port are seen as part of the same system. It presents a new connection between the city of Lisbon, and the port. The project reshapes the morphology of the surface of the landfill built over the river with a new building.*

*The project makes use of the place to introduce new technologies merging disciplines that are often presented separately – architecture and public space – Tagus Platform challenges the current convention that public open spaces are located between buildings. Here public space stands over functions working below inside the building structure and reshape the morphology of the landfill surface.*

*The barrier of railway and/or heavy traffic is central to this project. It succeeds to remove the presence of the barrier and blur its effect with a low budget project. The fruitful dialogue between city and port is oriented to a specific project rather than general urban planning.*

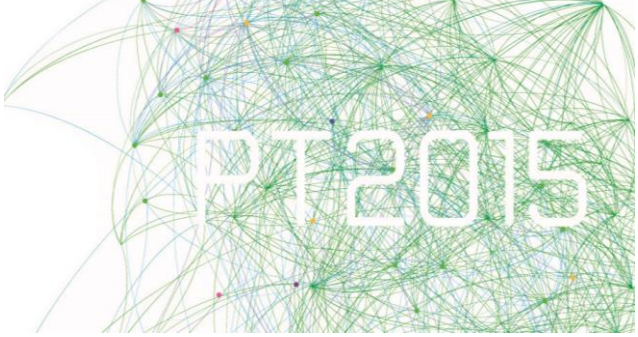
*The sustainable development of ports cities challenge the present situation and offer a new paradigm with opportunities for both port and city, to successfully negotiate and work towards mutual improvements. New public space at the waterfront adds value to the urban environment when mixed with port related activities. Tagus Platform links both, urban environment and port atmosphere increasing port city's culture. The project brings value to urban life, to port, to city's image, to tourism and mainly, to people who uses, accesses and enjoys new facilities. The creation of new waterfront public spaces increases port city identity and consequently strengthen the public support for the port, the environment and the necessary use of green modes of transportation. The holistic transformation affects the heart of urban life and the idea citizens have of their own port city for tomorrow.*




# TOPIC I:

# Architecture and Health

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# HEALTHY BUILDINGS: THE ICF CLASSIFICATION AS A DESIGNING TOOL

**Alberto Arenghi**[1]
Assistant Professor of Building Technology, University of Brescia, Via Branze 43 – 25123 Brescia – Italy, alberto.arenghi@unibs.it

**Daniele Malgrati**
Medical Doctor, San Francesco Clinical Hospital, Via IV Novembre 7 – 24128 Bergamo - Italy, daniele.malgrati@cdcsanfrancesco.it

**Michele Scarazzato**
Medical Doctor, Domus Salutis Clinical Hospital (Fondazione Teresa Camplani), Via Lazzaretto 3 – 25123 Brescia – Italy, michele.scarazzato@ancelle.it

## ABSTRACT

*In recent years, the issue of health has been increasingly linked to that of building design and urban planning. In fact, the expressions healthy buildings, healthy cities, healthy architectures and others are more and more recurrent in literature.*

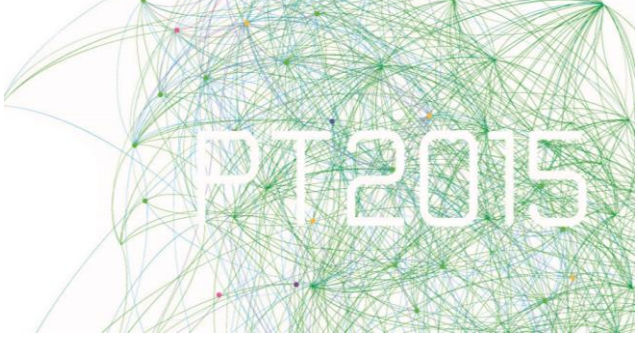
*There are many and certainly different reasons: medical advances, the spread of the concepts related to sustainability, the studies on the toxicity of building materials, but also negative factors, such as the increase of pollution.*

*But what concept of health are we considering? How design can affect human health? What operational meaning the expressions above mentioned assume?*

*We will look for possible answers to the previous introduced questions through an interdisciplinary approach, starting from the etymology of the word "to design" (which in Latin is pro jacere, namely "to throw ahead"). If a project has to be intended as the realization of a "being there", always projected forward, if a project entails the attention one has of himself and of other persons; then a project needs to take care of its surrounding world, and therefore of health.*

*As a result, health and environment come to be strictly intertwined. In 2001 the WHO proposed the ICF (International Classification of Functioning) offering the world of medical sciences the unique opportunity to interpreting "health" as a condition that affects and relates in a mutual way with social life, also through the environment. Following this perspective, design simply cannot leave aside an extensive analysis of "health", supported or disadvantaged by the environment*

[1] Corresponding author




*(built and not), and we suggest the ICF might become a valid operational tool useful for defining and building healthy and proactive environments.*

***Keywords**: healthy buildings, health, ICF, active design.*

## INTRODUCTION

A way to understand the connection between the environment and health in the Western countries could be the understanding of how the relation between life and disease has changed in the past 150 years. The rising life expectancy is the result of medical, technological, social and cultural achievements.

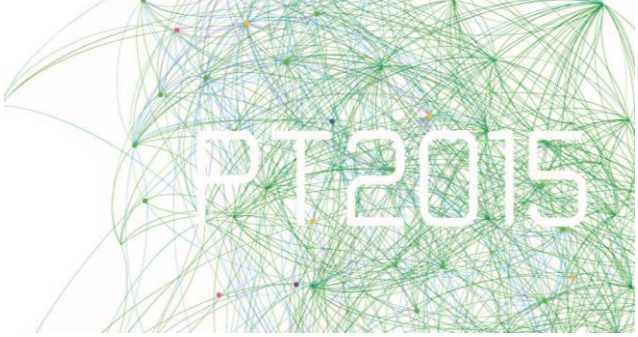
Science achievements in social sphere have been used to fight epidemic diseases which were the major cause of early mortality. These science achievements have lead to issue laws concerning hygiene and prophylaxis, in order to eliminate the sources of infection by regulating disposal systems, sewage systems, territorial remediations and introducing rules of personal and community hygiene.

The combination of medicine and technology has been the successful model at the time when the relationship with the disease was to survive the disease itself. The achievements of the Unions have permitted to regulate timing, methods and working environments by significantly improving the early psycho-physical strain thanks to the advent of technologies that serve loads and repetitiveness. The increase in life expectancy inevitably leads to the change from infectious etiology as dominant cause of disease in the chronic as a source of wear due to the effect of the long life and the characteristics of the environment in which it is spent.

The degenerative process due to the growing age is expressed as a progressive loss of body functions to the extent estimated as 1% per year over 30 years of age (Singh-Manoux et al. 2003). This para-physiological evolution can be experienced in a positive way if the environment in which we live is able to compensate for, or prevent loss of functions by maintaining a good quality of life. The needs of a person change over time and the environment must be adapted to face this change. When people grow old the subjective perception of the health status does not necessarily correspond to the actual condition (Baum et al. 2003; Lehr 1991).

## THE ICF AS A DESIGNING TOOL

The close link between the chronic disease and the design of environment that allow an appropriate daily life requires a farsighted planning that permits a high flexibility for the necessary adjustments that a chronic condition implies. The design should provide an analysis of the social context within which it is expressed

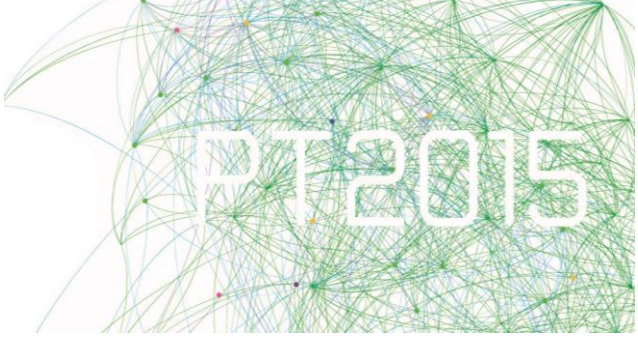



in order to clarify the main causes of social or personal malaise, so as to understand the issue core. Actually the word "design" derives from Latin "*pro jacere*", namely "to throw ahead". It has to be intended as the realization of a "being there", always projected forward. To project entails the attention one has of himself and of other persons, it means to take care of our world and therefore of our health. Designing expresses the close and binding connection between health and environment and guarantees well-being if the environment satisfies the status of health or illness, and even better of disability, if seen as a health condition in an unfavorable environment.

The real problem is not the health status or its cause, but how it can be placed in a context unable to receive it, which isolates the suffering person considering him as a neglect and unwanted subject, belonging to a minority group whose rights are not considered as a primary asset. Good health could become illness if placed in an unsuitable environment; on the opposite, a well designed environment makes a biological suffering condition acceptable if not livable. The paradigm that results is that each of us could be in a precarious environmental context and develop even temporarily a state of disability that can be determined by an unexpected accident.

In this perspective, the design of a house should meet requirements that consider the home as an essential condition to ensure the well-being and comfort. Designing and building with sustainable costs allows to reach a largest number of people, considering the families financial constrains as a primary source of discomfort. With low impact energy solutions, by joining a project of a clean environment and considering the pollution as the major source of respiratory diseases. With accessibility that directs to more movement instead of the use of lifts, with easy to run stairs and ramps suitable for an aging and overweight society but also suitable for the use of wheelchair in a status of disability. Any proposed project environment is tightly bound to the solution of problems that significantly affect the health status. Low back pain - caused by prolonged obliged postures - affects a huge number of people and is the main cause of work absence. Cinemas, theatres and public spaces are the example of an incorrect project design where the furniture are in lack of ergonomics principles. People in work places suffer from posture damage, sight problems caused by poor lightning and musculo-skeletal stress caused by improper lifting.

In 2001 the WHO approved and ratified the ICF (International Classification of Functioning, Disability and Health). It is an improvement for the medical science and not only; it recognizes the existing *continuum* between health and disability that concerns all of us, but especially emphasizes, in a bio-psycho-social complex, the importance of the multiple interaction between people, health and environment. A focus entirely centered on the concept of disease, it is replaced by a vision of society in which the result of a well-made intervention is measured in terms of participation. Health must be monitored in its possible changes with tools to

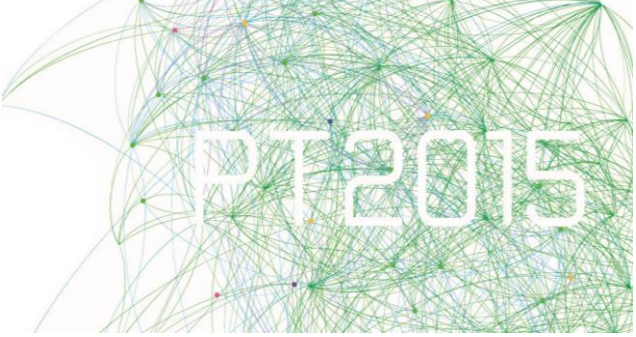



measure it and to measure the solutions (facilitators) once the limits (barriers) are identified. The ICF describes the person in his inseparable value body-function-environment. Any occasional, accidental, voluntary intervention express variations on one of three values affects so indispensable the others by favoring or limiting the core human values: the freedom to be active and involved in life, which is a fundamental condition to guarantee well-being, health and happiness.

In this perspective, design must carry out an extensive analysis of the health status favored or denied by the environment (built and not), so that the ICF may become an useful instrument to build and define healthy and proactive environments. In the "Health and Building Grid" (Figure 1) a first attempt to overlay the ICF concepts to the design demands is proposed. For example, if we consider the design issues related to noise, this will involve the hearing and nervous system, negatively influencing activities such as learning, general tasks and demand, communication, domestic life and interpersonal interactions. Conversely, if we consider the communication activity, it will involve nervous, visual, hearing, musculo-skeletal and psychological system, so that it will be necessary to find design solutions concerning the noise control, adequate and proper lighting, the requirement of accessibility, information and communication systems.

Analyzing the project by what the ICF dictate is not enough if we do not take into account the limits of the human physiopathology, which are disability, childhood, adulthood, aging and its needs and the problems that these limits bring about in the relationship with the environment. It is well-known that old and young people learn in different ways: the old learns by doing; the young learns by memorizing (Ratti, Amoretti 1991). In other words it is impossible to design for people we do not know and if we ignore the positive or negative interaction between biology and environment. On the other hand we may not want to operate on the environment if we have not the cultural means to change it, the knowledge of laws, the knowledge of materials.

The analysis of the project according to the ICF immediately matches the principles of the Universal Design, to be integrated with the newer principles expressed by the Human Centerd Design and by the Active Design. The project, therefore, has to contribute to encourage, stimulate and maximize the people capabilities through an enabling environment. The focus must move from "cure" to "take care" since our society is characterized by chronic diseases that the people must face in environments which mitigate their negative consequences.

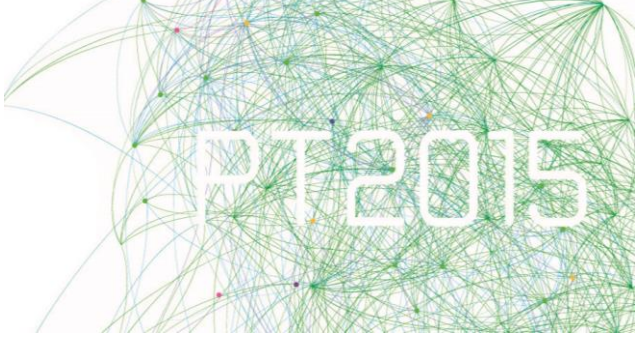



**Health and Building Grid**

The goal of this grid is to highlight the elements in a building that may have a direct impact on people's health.

| Considerations that should be taken into account to reduce the health impact of buildings | | Body Functions & Structures | Human activities (WHO classification) that can be impacted → Activities → Partecipation | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | LEARNING | GENERAL TASKS AND DEMAND | COMMUNICATION | MOBILITY | SELF-CARE | DOMESTIC LIFE | INTERPERSONAL INTERACTIONS | MAJOR LIFE AREAS | COMMUNITY, SOCIAL AND CIVIC LIFE |
| | INDOOR AIR QUALITY | RESPIRATORY / VISUAL | X | | | | X | X | | | |
| | THERMAL COMFORT | RESPIRATORY / CUTANEOUS | X | X | | | X | | | X | |
| | ERGONOMICS | MUSCULO-SKELETAL | | X | | X | X | | | | |
| | NOISE | HEARING / NERVOUS | X | X | X | | | X | X | | |
| | SIGHT AND LIGHT | VISUAL / MUSCULO-SKELETAL | X | X | X | X | X | X | | | |
| | HYGIENE | ALL OF THEM | | | | | X | X | X | | |
| | DAILY DUTIES | NERVOUS / MUSCULO-SKELETAL | | X | | X | X | X | | | |
| | ACCESSIBILITY | NEUROMOTOR / PSYCOLOGICAL / MUSCULO-SKELETAL | X | X | X | X | X | X | X | X | X |
| | COMMUNICATION / INFORMATION | PSYCOLOGICAL / NEUROMOTOR | X | | X | X | | | X | X | X |
| | LEISURES / FREE TIME | PSYCOLOGICAL / NEUROMOTOR | | | | | X | | X | | X |

**Figure 1: Health and Building Grid (this is the reworking of a grid presented by Foyer Rémois (Reims) in 2012).**




## CONCLUSIONS

For the designer is request to have an active role in the research of healthy situations (that according to the WHO is a "status of complete physical, psychological and social well-being and not just the absence of illness") often with a prominent role in providing a therapeutic environment that is an environment that structurally encompasses within itself the means of access and appropriate use of all the capabilities in an interaction without barriers. The designer must therefore become a health operator since his work affects the area of freedom and autonomy of each person.

In this context ICF is a tool that allows the designer to have a correct approach to the project, by connecting person-health and environment in an efficient manner and by giving a deep meaning to the expressions: healthy buildings, healthy cities and healthy architectures.

## REFERENCES

Arenghi A., Malgrati D., Scarazzato M. 2006. "Per un'ergonomia del territorio". *Ergonomia*, no 4 (Gennaio/Maggio): 24-34.

Baum E.E., Jarjoura D., Polen A.E., Faur D., Rutecki G. 2003 "Effectiveness of a group exercise program in a long-term care facility: a randomized pilot trial". *Journal of the American Medical Directors Association*, Vol. 4, no.2 (March–April): 74-80.

Boone Beard B. 1991. *Centenarians: The New Generation.* Westport: Greenwood Press.

City of New York. 2010. *Active Design Guidelines: Promoting Physical Activity and Health in Design.*

Lehr U. 1991. "Aspetti sociali e psicosociali della longevità". *Giornale di Gerontologia*, no 10:517-20.

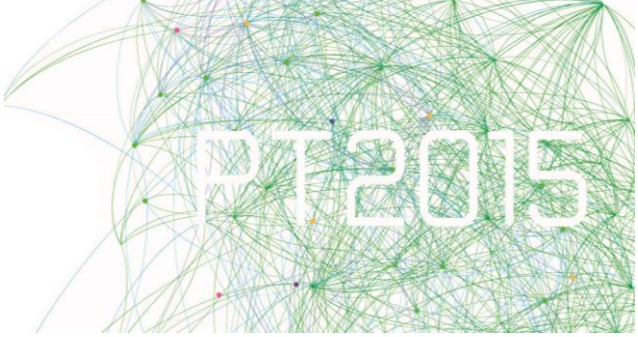
Malgrati D., Scarazzato M., Arenghi A. 2007. "Le basi culturali della progettazione accessibile". In *Design for All. Progettare senza barriere architettoniche*, edited by Arenghi A., 1-12. UTET.

Ratti MT, Amoretti G. 1991. *Le funzioni cognitive nella terza età.* Firenze: NIS.

Singh-Manoux A., Richards M., Marmot M. 2003. "Leisure activities and cognitive function in middle age: evidence from the Whitehall II study". *Journal of Epidemiology and Community Health*, Vol. 57, no.11:907-13.

World Health Organization. 2001. *International Classification of Functioning, Disability and Health (ICF [ICIDH-2])*. Geneva.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# THE HEALTH ASPECTS OF SUSTAINABLE ARCHITECTURE

**Kosara Kujundžić**
PhD student at University of Belgrade, Faculty of Architecture; private address: Njegoseva 171, Kotor, Montenegro; kosarak@gmail.com

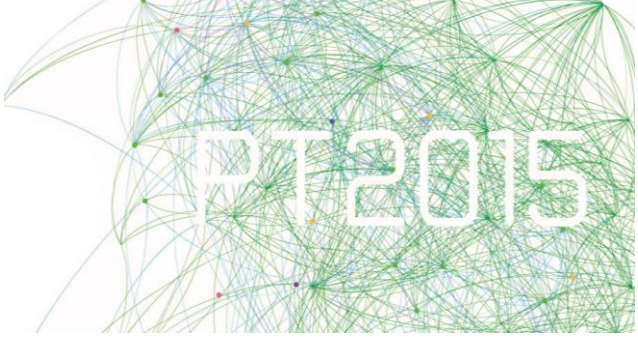
## ABSTRACT

*Sustainable architecture is defined as a regardful and responsible artificial environment creation and management leading to the reduction of its negative impact on the natural environment. The sustainable design principles are deeply embedded in nature. The most influential aspects of the natural environment are: climate, land configuration, soil composition and vegetation. Sustainable architecture benefits from all these factors by using sunlight, wind, rain, natural local materials and autochthone plants in order to provide healthy environment. Furthermore, water, earth, fire and air are the four basic, constitutive cosmic elements. All four are crucial for sustainability and for the health as well. Since the ancient times, the human body is considered to be a result of the combination of these four elements. The issue of health/illness referred to the influence of the environment on us and the balance of these four elements. Likewise, the sustainable architecture is successful only if it achieves the harmony of these four elements creating the artificial environment in synthesis with nature. The quality of the water (potable or surface water) and air (indoor and outdoor) directly reflects on our state of wellbeing. The sense of connection to the earth, "to the roots", gives one a sense of belonging and orientation. The usage of local, natural materials helps in achieving this. The cosmic element of fire relates to our body temperature and life energy, directly affected by sunlight and insolation. Solar energy is also crucial for sustainable architecture as essential way of providing thermal comfort for building occupants.*

***Keywords**: sustainable architecture, health, water, air, earth, fire.*

## INTRODUCTION

Sustainable development is a conceptual model of the development and natural environment established through the relation: socio-economic system-environment- the cycle of renewal of nature. The sustainable (ecological, green) architecture emerged from the sustainable development as a regardful and responsible artificial environment creation and management leading to the reduction of its negative impact on the natural environment.




The most influential environmental aspects sustainable architecture relies on are: climate and microclimate, land configuration, soil composition and vegetation. Sustainable architecture benefits from all these factors by using sunlight, wind, rain, natural local materials and autochthone plants in order to provide healthy surrounding, both, outside and inside the building.

The four constitutive, cosmic, natural elements recognized since the ancient times are water, air, earth and fire. The presence and balance of these elements have a great impact on sustainability and health. Providing the air, thermal, visual and acoustic comfort of the building occupants is one of the primary objectives of sustainable architecture. This can be achieved through the well balanced combination of the four fundamental cosmic elements that our sense of wellbeing directly depends on such as: the presence of the active water features in the surrounding, regulation of the indoor and outdoor air quality, intensifying the sense of the connection to the earth and "roots" and the increased exposure to the sun (solar energy, sunlight).

## THE ELEMENT OF WATER

The philosopher Thales of Miletus considered water the originating principle of all the matter. Water is mobile; it flows through all living beings. It is means of transporting substance and warmth, essential for life.

Freshwater makes only the 3 per cent of the world's water. Lake Baikal in Siberia contains 22 per cent of this limited amount. Most of the potable water originates from rivers and artificial water supply systems polluted by industrial and agricultural chemicals that makes it unhealthy for drinking.

Through its cyclic movement in nature, water is exposed to temperature differences, gravity, capillarity and other natural elements: air, fire and earth, that makes it finally good for drinking. Furthermore, when exposed to the sun, rainwater evaporates and loses its lightweight and healthy ingredients, while the heavy and unhealthy substances stay on the ground. After a while, the evaporated, healthier substances come back again through the rainwater that makes it suitable for drinking (after some basic purification processes). This is why the rainwater collection is the sustainable design principle important for health.

Furthermore, active surface water improves the microclimate. Through the evaporation it reduces air temperature, freshens and ionizes air fulfilling it with the healthy negative ions. This is why the rainwater collectors- channels enabling water movement in the uncovered outdoor or indoor spaces are a sustainable design method that enriches the environment and improves health.

## THE ELEMENT OF AIR

Ancient Greek philosopher Anaximenes believed air is the primordial constitutive cosmic element. The air is spacious, dynamic, transformed by cosmic forces, renewed by life processes, sensitive to the daily and seasonal rhythms and changes. It contains a mixture of smells, sounds and light and carries environmental information about climate, land or vegetation. It affects vigour and vitality and therefore is very important for health.

One of the important objectives of sustainable architecture is providing air comfort for the building occupants. The ingredients of air, highly influential on its quality, are: oxygen and carbon dioxide, carbon monoxide, tobacco smoke, smells, house dust, ions, undesirable products of building materials and air humidity.

The air quality can be improved by plants. Vegetation enriches air and makes it healthier by: increasing the concentration of oxygen, regulating air temperature and humidity, tying the dust particles, absorption of the pollution and creation of negative ions. Furthermore, the buildings covered by vegetation are aromatic and season sensitive fostering the connection with nature, important for the state of wellbeing. Some plants' aromas have therapeutic effects. In addition, plants decrease the noise level and therefore improve the acoustic comfort of the building occupants.

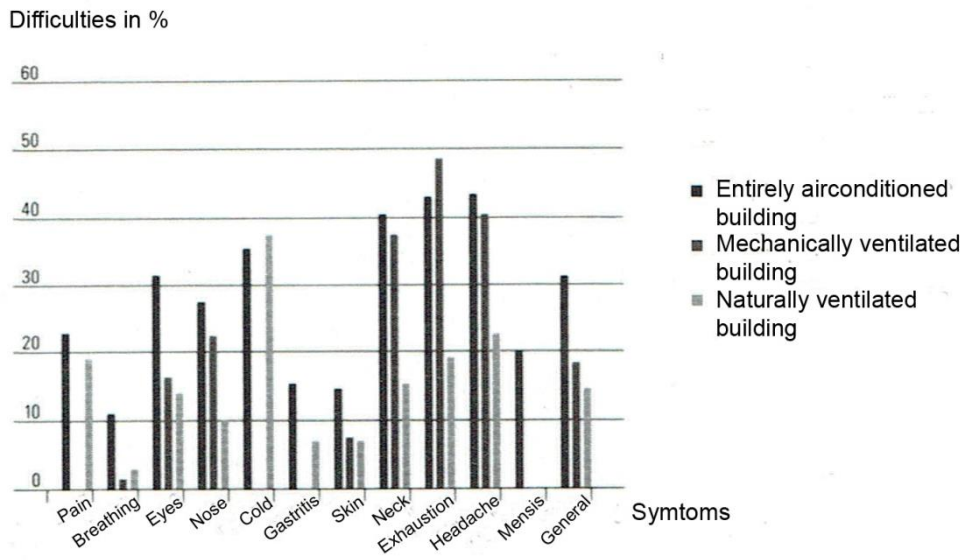
Another sustainable design principle for improving indoor air quality is *natural ventilation*. This method enables: higher oxygen and lower carbon dioxide concentration, removal of the unpleasant odours and polluters (air particles), reduction of the relative humidity level and the maintenance of the thermal comfort when outside temperature is high. In the absence of the natural ventilation a so called Sick Building Syndrome occurs. This is medically undefined health disorder where subjective constraints decrease working ability. On the other hand, research show natural ventilation triggers significantly less symptoms or health disorders compared to the mechanical ventilation or entirely air conditioned buildings (figure 1).

The air flow has many positive effects on health. It stimulates neurons, nerve endings on the skin as well as vascular system and causes pleasant subjective feeling. Also, it disintegrates house dust containing potentially pathogen bacteria.

The important factor that affects health is air ionization. Ions are molecules that have lost electrical stability. The air becomes negatively ionized when electrons separate from molecules making them "electron hungry". The high concentration of negative ions can kill or disable spreading of pathogen bacteria. On the contrary, positive ions decrease serotonin level causing depression, hypertension and breathing difficulties. Negative ions can be created by solar energy and sunlight,

as well as by air and water flow. This is one more argument for planning moving water features and natural ventilation as the sustainable architecture methods.

**Figure 1: The results of SBS study of J. Röben (health disorders in relation to the ventilation systems: natural ventilation, mechanical ventilation and air conditioning).**



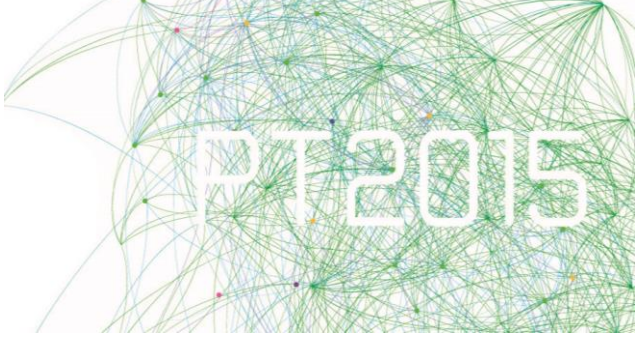

## THE ELEMENT OF EARTH

In the Ancient Greece, it was Euripides, the student of Anaxagoras, who first claimed the elements of earth and air were the archetypal, cosmic elements.

The element of earth is attached to stability, to the roots. Buildings are anchored in the geography, ecology and climate. The connection to the place of origins affects our sense of identity, defines us and is therefore important for the health in psychosomatic sense.

The land topography is an important factor of the building "rooting". Instead of adjusting the land to the house, natural and man-made environment should be homogenised by adapting the house to the land configuration. Also, earth sheltering is an efficient sustainable design principle since the earth is good thermal insulation and reduces heat loss inside the building.

Building according to the region by using local resources and materials is one of the principles and preconditions of the ecological and cultural sustainability. Autochthone materials, originating from the close surrounding carry the traces of time and, at the same time, help in creating a feeling of the building belonging to the place of origins, since they have been transformed by the natural climatic factors of the surrounding. In such a way, stone and brick change the shape over




time (smoothing the edges) and gain patina, wood changes the colour from natural towards grey, old wall paint becomes pale and coated with patina. The usage of local materials enforces the sense of genius loci and enables easier orientation in space and time, in contrast to the some industrial, universal materials almost inert to the surrounding, unattached to the place of origins.

Another important tie to the earth (place) is vegetation. Seasonal transformations of plants reflect climatic and geographic influential factors of the surrounding. At the same time, they are ephemeral and tie the building to the time frame.

## THE ELEMENT OF FIRE (HEAT)

The Greek philosopher Heraclitus from Ephesus claimed the basic constitutive, cosmic element was fire. The fire (heat) is archetypal element on which depends the survival of living beings. In sustainable architecture, we associate it with the energy of the sun (the source of heat, light and renewable natural resource).

Life exists in a very limited temperature span of human body including only a few degrees. Metabolism creates heat, mostly during the day, the most by activity (10-60 times more), the least during night. Overheating may lead to exhaustion and eventually death. On the other hand, if we lose heat too quickly, we feel unpleasantly cold which can lead to hypothermia. Thermal comfort relates to the sense of optimal agreeability (not too hot, not to cold) when the thermal balance of the body is achieved.

Warm rooms are colder than the human body. So, what we consider heating is actually not heating but reducing the rate at which we cool. The heat transfers through conduction, convection and radiation. Radiation and conduction warm up body deeply, while convection heats only the surface layers (skin and lungs). The thermal comfort can be achieved even if the air temperature is lower than optimal when radiant surfaces exist in the surrounding.

Sun is the main source of heat due to radiation. Sustainable architectural methods include captivation and accumulation of solar energy, so that it can be used later for heating indoor space. The accumulation of solar energy is achieved through thermal mass or heated surfaces of water or solid matter that radiate heat. The most frequently used is trombe wall, painted in dark colours (preferably black) in order to attract more solar energy. If the radiant surface is heated water, it transfers heat through all its volume, not just on the surface level as in the case of solid matters.

## CONCLUSIONS

The four archetypal, cosmic elements: water, air, earth and fire are the fundamental constitutive elements of nature and living beings. Their combination and balance enable vitality and vigour. Each one is of crucial importance for sustainable architecture and health in terms of providing comfort for building occupants.

Moving water features enrich microclimate and improve air quality by creating negative ions. Rainwater is healthy and should be used as much as possible in the household, because of the scarce resources of freshwater worldwide.

Air comfort, of a crucial importance for health, can be achieved through sustainable design methods such as: vegetation, natural ventilation and moving water features inside the building.

The element of earth relates to stability, roots, and a sense of identity. Earth sheltering ties building to the ground. The usage of local, autochthone materials fosters genius loci, while seasonal transformations of the plants carry information about time. All these are important for health in a psychosomatic sense.

The fire (heat) is important in terms of the heat regulation of the body, essential for health. The crucial renewable resource of the most useful radiant heat is solar energy. Thermal comfort is provided by sustainable design methods of capturing and accumulating solar heat by thermal mass (trombe wall, heated water), afterwards used as the heating source.

## REFERENCES

Daniels, Klaus. 2009. *Technology in Ecological building.* Belgrade: Jasen.

Day, Christopher. 2002. *Spirit&Place: Healing our environment.* Oxford: Architectural Press.

Kosoric, Vesna. 2008. *Ecological house.* Belgrade: Gradjevinska knjiga.

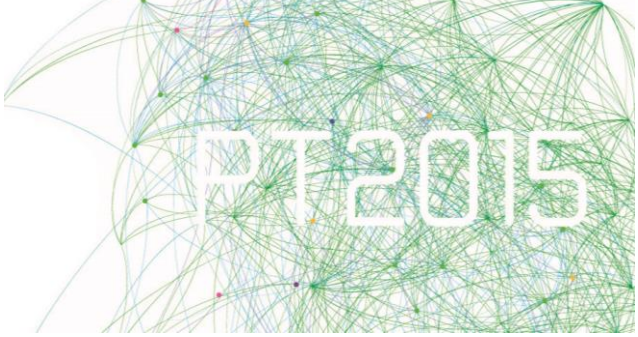
Slessor, Catherine. "Building with the elements: in the quest to evolve a more ecologically balanced approach to living and building". *The Architectural Review, ISSN: 0003-861X, 2004.*

Schweitzer, Marc, Gilpin, Laura and Susan Frampton: "Healing spaces: Elements of Environmental design that Make an Impact on Health". *The Journal of Alternative and Complementary Medicine,* Volume 10, Supplement 1, 2004, pp. S-71-S-83.

Vitruvius. 1999. *Ten Books on Architecture*. Zagreb: Golden marketing.

Figure 1: Daniels, Klaus. 2009. *Technology in Ecological building.* Belgrade: Jasen. p. 66.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# UNIVERSITY AND DWELLERS' ASSOCIATIONS TOGETHER FOR CREATING SUSTAINABLE AND HEALTHY URBAN ENVIRONMENTS

**Lucia Martincigh**[1]
Professor, Architect, Roma Tre University, Department of Architecture, via Madonna dei Monti 40, Rome, Italy, lucia.martincigh@uniroma3.it

**Francesco Bianchi**
Professor, Architect, Roma Tre University, Department of Architecture, via Madonna dei Monti 40, Rome, Italy, fbianchi@alice.it

**Cecilia De Marinis**
PhD, Research Assistant, Architect, Roma Tre University, Department of Architecture, via Madonna dei Monti 40, Rome, Italy, arch.ceciliademarinis@gmail.com

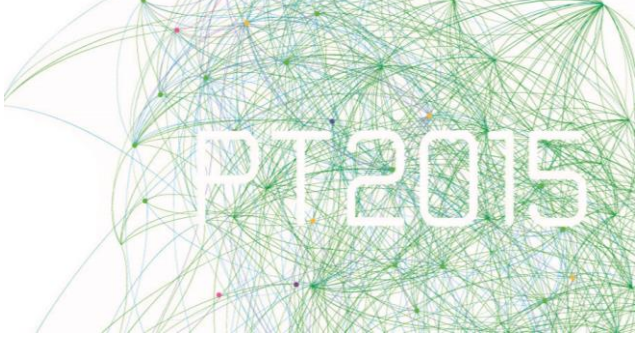
**Marina Di Guida**
PhD student, Research Assistant, Architect, Roma Tre University, Department of Architecture, via Madonna dei Monti 40, Rome, Italy, marina.diguida@uniroma3.it

**Giovanni Perrucci**
PhD student, Research Assistant, Architect and Engineer, Roma Tre University, Department of Architecture, via Madonna dei Monti 40, Rome, Italy, giovanni.perrucci@uniroma3.it

## ABSTRACT

*It is widely proved the need to limit atmospheric pollution in urban areas and control the urban heat island effect, both strongly connected to building characteristics and use. The current challenge is to raise inhabitants' awareness of the actual intervention possibilities that are suitable for increasing the positive interaction of private living space with public urban space, and the coexistence of the exigencies of both those who live in and use them.*
*This paper presents a work carried out by scientists and students of the Master course in "Eco-sustainable Design", at Roma Tre University, in two consecutive years, in collaboration with an association representing the inhabitants of a historic working-class district in Rome: Testaccio. In some workshops of the master, students applied a specific methodology apt to answer, on the one hand, to the exigencies stated from the inhabitants of social housing blocks built in the twenties of the last century and, on the other hand, to improve the buildings energy efficiency, reducing at the same time the negative effects on the public and common spaces, in order to improve their healthiness.*

[1] Corresponding author



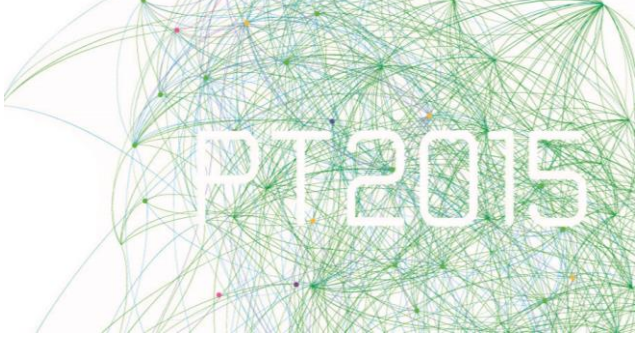

*This methodology brings together technicians and inhabitants' delegates, both during the feasibility study and during seminars where various solutions are presented and selected and local politicians, dwellers and students are invited. The identified design proposals, concerning roofing, facades and courtyards, are environmentally conscious and of passive solar type; they focus on the use of natural materials (green roofs and walls, permeable paving) and renewable energies (photovoltaic and geothermal). The central idea of these proposals is the economical and technical feasibility of the interventions.*
*The whole process, aimed at defining shared targets, spawning initiatives that contribute both to increase the civic sense and to improve life and health conditions, create the preconditions for a real sustainability of the district.*

***Keywords:*** *public health, building renovation, energy efficiency, dwellers' association, bioclimatic architecture.*

## INTRODUCTION

It is estimated that over 80% of Europe's population will live in urban areas by 2030 (World Energy Outlook 2008-2009). This process of concentration of population influences distribution of energy, environmental and public health.
A critical consequence of these processes, amplified by global warming, is the so-called phenomenon of the Urban Heat Island caused by the rising of surface and air temperatures, reaching in the cities a much higher level than in rural areas (Hassid, 2000). This is due to the greater absorption of solar energy and to the lesser evaporative cooling caused by the characteristics of materials, sealing of the soil, lack of moist surfaces, building density and residual heat. The UHI has severe implications on the performance and energy costs of buildings, representing around 40% of the total energy end-uses consumption and 36% of $CO_2$ emissions in Europe. The Urban Heat Island is a problem affecting not only the energy issue. In conjunction with the increase of air temperature, there is a greater emission of pollutants and the creation of smog. This situation causes discomfort and an intensification of health problems (Santamouris, 2007). Human activities too contribute to the heating of urban areas, both directly, by traffic, heating and air conditioning systems, and indirectly, by altering the radiative properties of the atmosphere, due to high levels of pollution. To protect health and quality of life in cities, this phenomenon must be managed properly, using the available planning tools, with the goal of defining mitigation measures[2].

[2] The attention by the European Union on these issues is demonstrated by the project "*Development and application of mitigation and adaptation strategies and measures for counteracting the global Urban Heat Islands phenomenon, UHI*" - Program "Central Europe 2007-2013".




## THE ROLE OF UNIVERSITY IN RAISING AWARENESS

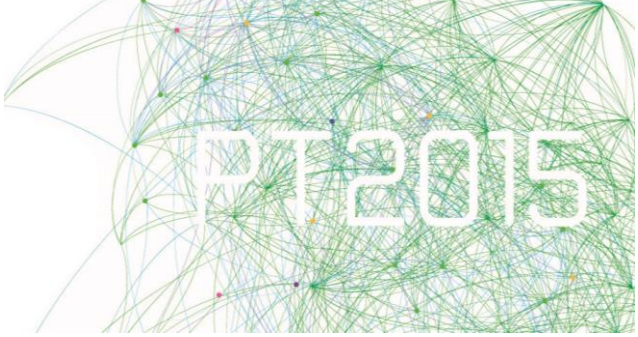
People who, in many cases, are themselves producers of pollution, not only due to vehicular traffic but also to incorrect behaviors, starting from air conditioning at home, often underestimate environmental problems. Assessing the interest of the community in environmental issues, it is evident that the lifestyle and trend production/consumption do not show a full understanding of the crucial role the environmental system plays in people existence; then it is important to increase citizens' awareness of the central role of the environment. A critical approach to scientific culture, available technologies and innovation is the best confirmation of the need to inform, disseminate and stimulate the citizens' awareness on the risks of the current development model, not yet sufficiently oriented towards sustainability. International studies and experiences prove the need of involving people, by establishing shared goals, even at small-scale, as a premise to a true sustainability of the territory, in the sense both of the environment and of appropriation of the life sphere; this means that architecture finds its meaning and legitimacy in creating places where community can identify itself (Raiteri, 2005).

The involvement of citizens finds its natural application in awareness campaigns that increase the correct knowledge of the environmental issues, especially at the district micro-urban scale, often supported by town and district municipalities or other institutions. In this context it is crucial the role of University in fostering awareness, disseminating environmental knowledge and social opportunities arising from correct behaviors (development, safety, quality of life). The architectural education should hold a leadership in sustainable design and produce research towards that direction, aiming at innovative design that always focuses on producing buildings of profound architectural and environmental quality (Alexandrou, 2011). Teaching sustainability in architecture can only be successful if sustainable thinking and design methods are integrated in the architectural program across a School of Architecture (Unterrainer, 2013). As architecture, sustainability is a question of culture.

## THE CASE STUDY AREA

This paper presents a work carried out by scientists and students of the post-degree's course in "Eco-sustainable Design"[3] in two consecutive years, in collaboration with an association representing the inhabitants of a historic working-class district in Rome: Testaccio, which is characterized by a regular orthogonal grid, typical of the 18$^{th}$ century.

[3] Post-degree course in: Eco-sustainable Design (60 CFU) open to architects and engineers interested in professional activity, Roma Tre University, Department of Architecture; directors: Lucia Martincigh and Francesco Bianchi; secretary: Eugenia Scrocca tel. 0657332949. For more info: http://prgsostenibile.uniroma3.it.




This course, now at its third edition, aims to train technical figures able to operate in the fields of sustainable design and upgrading, at building and urban scale, applying appropriate methodological and operational tools, focused on energy efficiency, renewable sources and eco-compatibility of the interventions.

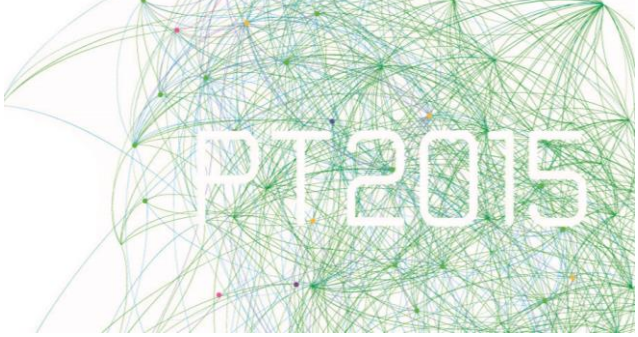
The workshop, which results are reported in this paper, is a project activity aimed at applying the knowledge deepened in the course, characterized by theoretical and operational contributions. The collaboration with the association of social promotion "Piattaforma Testaccio" represents a milestone for which university wishes to be a strong reference for the know how and the design of environmental sustainability issues in the process of renovation of the district. The association brings together Testaccio dwellers and gives them voice in the research of solutions to problems, ranging from heavy vehicular traffic to widespread decay, but also in a careful upgrading aimed at existing buildings energy saving and environmental and social sustainability, making the district become a pilot project for best practices to be applied in other parts of the city.

In fact, the huge flows of traffic in Rome (about 1 million 800 thousand cars, 659 cars per 1000 inhabitants) threaten the liveability of the urban environment, as evidenced by the ISPRA report on the "Quality of the urban environment 2014 ". The sample spot surveys of vehicular flows, carried on in the Department of Architecture of Roma Tre University[4], confirms this phenomenon in the Testaccio district, identifying as the most congested streets the perimeter and through ones. Moreover in these streets the fastest speeds were measured in dangerous concurrence with the most important pedestrian flows. This high number of vehicles results in a considerable density of pollutants: the concentration of nitrogen dioxide has an average value of 54 $\mu g/m^3$, compared to the required 40[5], and the amount of PM10 is 29.4 $\mu g/m^3$, below the threshold of 40 prescribed by the abovementioned decree (Legambiente, 2014). In particular, with regard to Testaccio, it is possible to say that the average annual concentration of nitrogen dioxide ranges between 42.57 and 62.81 $\mu g/m^3$ (compared to the required 40); PM2,5 are present with an average value of 21.30 $\mu g/m^3$ (compared to the required 25); polycyclic aromatic hydrocarbons (PAHs) are present with an average annual value of 2.73 $ng/m^3$, well above the threshold of 1 $ng/m^3$ prescribed by this decree (ISPRA, 2013).

**LISTENING TO THE NEEDS AND INTERVENTION PROPOSALS**

The methodology used in the workshops, held in the academic years 2012/13 and 2013/14, is based, on the one hand, on the accurate survey of the existing environmental and building situation and, on the other hand, on the definition of

[4] Applied work within the course of "City and Environment", year 2013-2014, Master Degree in Urban Design, Department of Architecture.
[5] The data refers to the limits prescribed by Legislative Decree 155/2010.




the dwellers' requirements in order to predict actions that, while satisfying the users of the district, improve their quality of life and are compatible with the buildings and the urban environment, increasing their performances and decreasing the environmental and energy effects.

The chosen field of action is an open and crossable court, delimited by two C shaped residential buildings, which contains green areas. The stairwells protrude inside the courts, giving to the buildings an articulated profile; the entrances are marked with small overhangs. "Piattaforma Testaccio" provided, by an enquiry, dwellers' needs, drawings and data about the buildings. The main requirements concern the recovering of the social dimension, by gardens and vegetables gardens on terrace roofs and courtyards, the easing of diversified waste collection and composting, the improvement of mobility within the district and in the creation of bicycles parking. As regards the buildings, the requirements concern the reduction of energy bills and the improvement of indoor comfort.

The students, organized in groups, beside making a general energy audit, worked on three themes based on the upgrading of rooftops, courtyards, indoor parts, and on a fourth theme on measures improving the energy performance as required by a thorough energy audit.

Common problems were identified: the limited use of rooftops by inhabitants, the bad rainwater management both on flat roofs and courts, various phenomena of rising damp and washing away of facades, the bad organization of spaces and paths for sojourn and social interaction, the presence of architectural barriers and unshielded and smelly waste bins, the excessive exposure of the facades to summer solar radiation. Furthermore, inside the flats cross ventilation lacks and there is "foul" air. The energy audit showed that the flats consume much energy (electric or not) and have many splits for summer cooling scattered on the facade. Students formulated, supported by professors and researchers, proposals for action that take into account not only inhabitants' requirements but also site constraints, ease of implementation and economic sustainability. The groups who dealt with rooftops[6] proposed green roofs, a grid connected photovoltaic system to reduce the cost of shared electricity bills, rain water harvesting for cleaning common areas and greenery irrigation in the courtyards[7]; these students, for the courtyards, proposed also the removal of architectural barriers, the LOGES system integration with the aim to improve the accessibility for people with reduced mobility (PRM) and permeable paving. In some cases, in order to improve thermal comfort inside flats, it was proposed the use of green walls on the facades overlooking the courtyard, made with different types of vegetation, depending on the analysis of the solar radiation.

[6] Works of the groups formed by I. V. Bardi, G. Cascetti Castaldo, M. Mastrangeli, G. Schiavo (year 2012/13) and by F. Galan, M.C. Lupi (year 2013/14).
[7] Works of the groups formed by D.Yilmaz – M.Salinas – M.Fontana – G.Lommi (year 2012/13) and by R. Di Berardino, L. Hernandez, P. Riccardi (year 2013/14).

**Figure 1: The picture of the case study block and the proposal for one of the courtyard façades. The bearing structure and the partition of the green wall: evergreen and deciduous plants in the lower and upper parts.**
**(Sources: Google Maps, 2013; Results of the workshop 2013/14 by R. Di Berardino, L. Hernandez, P. Riccardi).**

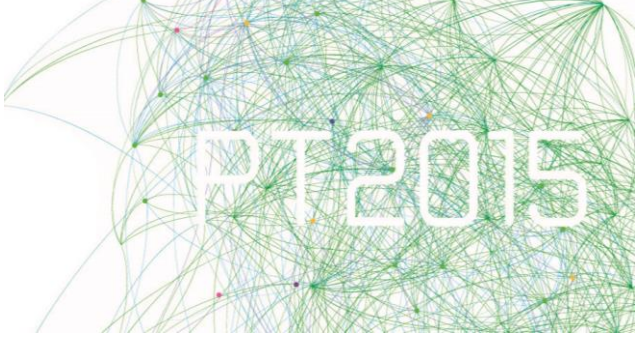
The groups that deepened the upgrading of indoor areas in common[8] and of the flats[9] attempted to improve air quality and thermal comfort and reduce energy consumption (in terms of costs and $CO_2$ emissions), providing in some cases passive cooling strategies by the use of geothermal heat exchange below the court, and to increase the performance of the transparent and opaque envelope (indoor insulation with a counter-wall or ceiling, thermal coat on the facade); it was also proposed a high efficiency system of mechanical controlled ventilation with heat recovery and the provision of external and thermoregulation probes without replacing the generator of the heating system.

These proposals have obvious repercussions on the surroundings for the urban heat island mitigation, the reduction of emissions and the decrease of dust and pollution levels. The proposals of the two workshops were presented at public meetings and technical seminars in presence of institutional figures of the municipal and regional administration, in order to create a discussion forum among students, dwellers and institutions on University contribution to the proposals for environmental upgrading at urban and building scale.

## CONCLUSIONS

It is well known that there are constant failures and extreme difficulty whenever one tries to establish guidelines for a global environmental policy (from the Kyoto Protocol to the most recent meeting in Rio de Janeiro Rio+20), from which to draw indications for smaller scales planning policies (Sferra, 2013). The proofed failure in following a hierarchical order of priority, apt to coordinate the action of all,

[8] Works of the groups formed by E. Buffo, A. Colella, C. Carones, N. Lazzaro, A. Mangione (year 2012/13) and by P. Cara, D. Dobromyslova (anno 2013/14).
[9] Works of the groups formed by M. Di Giulio - D. Filippi - P. Fracasso - A. Fumi (year 2012/13) and by L. Antognoli, C. Grassi (year 2013/14).




however does not exempt each one from the duty to exercise his decision-making power, even if limited, in order to pursue objectives of environmental compatibility. Even the most limited action, contributing to a widespread awareness of the problem importance among administrations and local authorities, citizens and operators, will never be irrelevant. The participation in decisions, then inevitably recalls the importance of knowledge (Raiteri, 2005). In a rapidly evolving world, it is important that research and continuous education represent an ongoing process. University has the task to prepare future architects and, by producing research and activating post graduate courses, helps them to continuously increase their knowledge in order to respond to both current and future needs, constantly aiming at innovative design that produces architecture of high quality.

## REFERENCES

Alexandrou, E. 2011. "Environmental issues and sustainability in the architectural technology teaching process", *Teaching a new environmental culture – The environment as a Question of Architectural Education*, ENHSA/EAAE 2010 International conference proceedings, Nicosia Cyprus: 47-58.

Hassid S, Santamouris M, Papanikolaou N, Linardi A, Klitsikas N. 2000. "The effect of the heat island on air conditioning load." *Journal of Energy and Buildings,32(2)*:131-141.

ISPRA. 2013, *Stato dell'ambiente. 39/2013*. Roma: ISPRA Editoria.

Legambiente. 2014. *Ecosistema urbano. XXI Rapporto sulla qualità ambientale dei comuni capoluogo di provincia*. Napoli: Marotta&Cafiero editori.

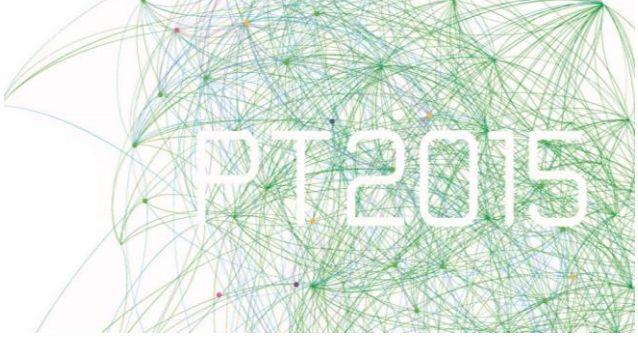
Raiteri, R. 2005. "La sostenibilità degli interventi nel rapporto con il territorio e gli enti locali." In *Progetto e innovazione. Nuovi scenari per la costruzione e la sostenibilità del progetto architettonico*, edited by Mario Losasso, 45-56, Napoli: CLEAN.

Santamouris M. 2007. "Heat island research in Europe, the state of the art". *Advances Building Energy Research*, *1*: 123-150.

Sferra, A. 2013. *Obiettivo "Quasi zero". Un percorso verso la sostenibilità ambientale.* Milano: Franco Angeli.

Unterrainer, W. 2013. "A ´Laboratory Approach´ to Integrate Sustainability into Architectural Education", *Architectural Education and the Reality of the Ideal: Environmental design for innovation in the post-crisis world*, ENHSA/EAAE 2010 International conference proceedings, Napoli Italia, 105-118.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# "VERTICAL" CITY

**Damjana Lojaničić**
Bachelor of Architecture, University of Belgrade, Faculty of Architecture, Boulevard of King Alexander 73/II 11 000 Belgrade, Serbia; damjana.lojanicic@yahoo.com

## ABSTRACT

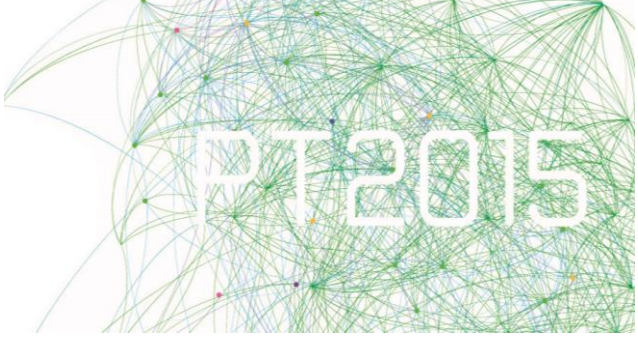
*High-density cities are a regular occurrence today. The growth of urban population will not stop. As the available space is a constant and population is growing and growing, the question of quality of life "in this issue" and whether it is possible to determine the (only) optimum population capacity of given space arises. Cities high population density is forced to use every inch of available land. However, the question is how the given land is to be occupied and with what architecture. One of the consequences of poor design of high-density cities is their spatial congestion. This in itself is not a fact. It is rather an interpretation of space. As a consequence it creates a sense of stress. Spatial congestion is delt with open public green spaces, whose presence positively impacts on human health. The problem is subjecting the land to a solely "green" purpose. If we look at the volume of a given area (not just the surface), the solution appears in the form of vertical designs. By which it is implied that the greenery and functions should be designed vertically.*

*The result of "bad" overpopulated city is a large number of cars. If every household owns a car, the produced negative effect is reflected through several aspects: environmental pollution, economically profitable, endangered human health. The negative effects are manifested on the principles of sustainability. We should strive to reduce the need for individual vehicles and actualization of urban public transport, especially cycling and pedestrian movement. Difficulties of realisation of this concept are the fact that these cities are characterized by large distances. Designing vertically the distance lessens, horizontally at least (examples: Singapore, Hong Kong…). "Good" high-density cities are "healthy" cities with a healthy population. Sustainability is no longer recommended, but obligations.*

***Keywords**: density, vertical, design, health, sustainability.*

## INTRODUCTION

The fact is that currently applied concepts of life in today's cities do not lead to a healthy, "comfortable" and sustainable environment. Therefore, the new concepts




of cities are being considered, which include regrouping of zones' functions and changes in design methods.

One of the "new" ways of designing cities is the concept of "the vertical city". First of all, the given concept is based on the organization of "local facilitiies" vertically. The consequences of such an arrangement of functions reflect on the environmental, formal and sociological aspects.

## ASPECT 1: ENVIRONMENT

Traffic is an extremely important factor in any urban area. In the cities, which are organized in "today's conventional" manner, transport is a link between other urban elements. Transportation is a feature of every (larger) city. Given the importance, it is almost unimaginable to think of households without a car. Studies have shown that a user who, going to their workplace, travels 30km a day, they spend a larger amount of energy than is needed to heat his house. In context of urban planning, a significant percentage of the overall (urban) territory is occupied by roads (from 25% to 35%). Such organized cities have problems with atmospheric pollution emissions, and inadequate representation of space for movement of cyclists and pedestrians.

If we apply the concept of "vertical city", the horizontal distance is enormously reduced, and, consequently, the need for motor vehicles and the transportation of large areas dedicated to them is reduced. As the percentage of the city's traffic territory reduces, the representation of pedestrian and bicycle paths grows. The basic connection of urban elements are done vertically, and small horizontal distance can be overcome by bike or walking.

The quality of human life (and thus health), is improved by the quality of air that is not burdened with a variety of toxic gases. Also, the reduced use of cars which are replaced with walking or biking, makes individuals more active, which has a positive effect on their health. "Liberated" territories can be "filled in" by greenery, which, in all respects, improves the quality of the environment.

## ASPECT 2: FORM

Greater density and the endeavor to achieve an adequate quality of life in such areas leads to the designing vertically. The architectural structure that emerges is a skyscraper.

### Example 1: NODO

One of the examples of the concept of vertical design that are being developed is primarily aimed at Beijing (and other Chinese cities), where the question of overpopulation is a most obvious one .

Architectural office: ANDO - AndaluciaOffice

**Figure 1: Supertall Skyscraper in Beijing, China. Figure 2: Transformable unit. (Source: http://www.archdaily.com/255689/international-mock-firms-skyscraper-competition-proposal-ando-andalucia-office/)**

The basic idea of the concept is expressed through a unique transformable unit and a static core with vertical communication. The aforementioned units may be residential, business, commercial, public, or with any other function. Regardless of its function, the unit can be disassembled and assembled in accordance with the needs of the community.

The concept is at an early stage of development and technology is (currently) unmanageable, but it certainly shows the pursuit of this type of architectural structures.

**Sustainability tower**

Sustainability skyscrapers such structures is often questioned. The conventional wisdom is that the towers are energy parasites that survive at the expense of others "urban ecosystems". The term "green skyscrapers" is an absolute contradiction.

**Example 2: Singapore**

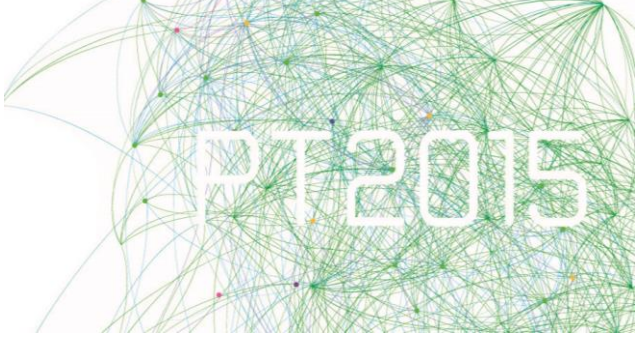
Sustainable "Vertical City" is a new concept of urban Singapore.

Architectural office: Foster & Partners

The most important theme is the sustainability of the project. Planned sustainability is achieved by using alternative energy sources. They are designed following these methods: vertical green spaces, vertical openings with thin solar strips for collecting solar energy, cuts facades are designed according to the influence of the wind, which are directed towards the ground for the sake of the cooling system for the accumulation of rainwater. This example indicates the type of a concept where the skyscraper is a completely sustainable architectural structure.

**Figure 3: South Beach, Singapore**
**(Source: http://www.arup.com/Projects/SouthBeach_Singapore.aspx).**

**Figure 4 and 5: Representation of sustainability of this skyscraper**
**(Source: http://www.arup.com/Projects/SouthBeach_Singapore.aspx).**




## ASPECT 3: SOCIOLOGICAL

The concept of "a vertical city" expresses a number of improvements in the context of ways of life. Primarily, improving the provision of health and financial aspects of the individual. However, significant improvements are taking place in the field of human relations, caused by the layout of facilities in these new structures.

### Hybrid buildings

The neighborhood or a city is an artificial ecosystem regulated by the rules similar to the rules of natural ecosystems. The balance of the mentioned "ecosystem" is conditioned by the number of users and the necessary harmonization of their lifestyle.

The principle of "a vertical city" implies the design of architectural structures with a wide variety of functions - designing hybridly. It is necessary that every structure meets the needs of housing, employment, health, education etc. Placing all of these functions vertically in skyscrapers, horizontal space can be given to the nature and recreation. This is the principle of "functional islands".

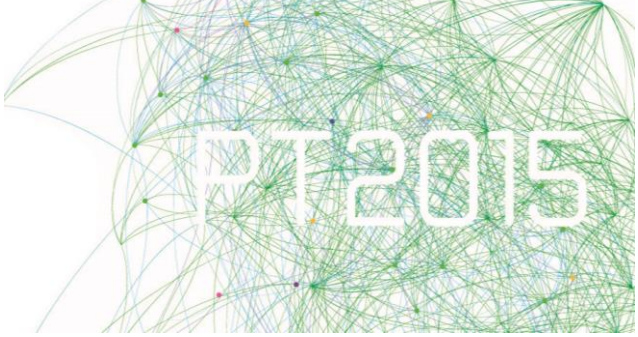
It forms common "machinery" with "maximum" options. Each user has the ability to create their own way of life in a given structure by selecting certain options. Members gather around shared content and interaction of people from different sociological backgrounds occurs. This system enables people with various neighborhood livability, finally leading to urban and sociological diversity.

## CONCLUSIONS

"Vertical City" is a concept that provides a healthier environment, it creates bigger green surfaces in cities and it forms intense interpersonal relationships of diverse population. A number of people are fascinated by the given concept. They believe in the "life of vertical" and "green skyscrapers".

However, there is a group of people who do not believe that "vertical city" is a concept of the future life. A certain proportion of the total population still gravitates towards " the American dream" which means living in a house with a garage for two cars. Due to the problems of overpopulation, which appears increasingly, this kind of housing is becoming unreasonable, unsustainable and ultimately, impossible.

The concept of "a vertical city" might not be the only way of life that will free the future of nowadays problems. However, well-designed "vertical city" is a sure and viable option of living in overcrowded environment.



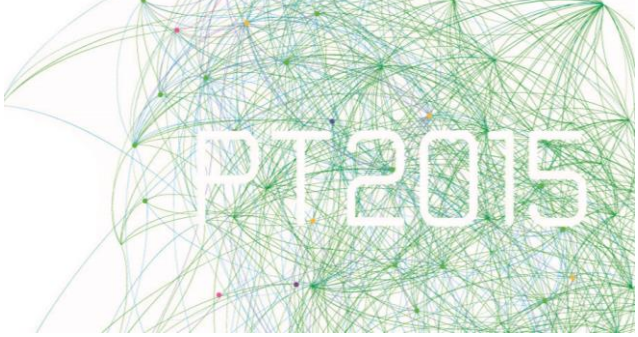

## REFERENCES

Guallart, Vicente.2004.*Sociópolis : project for a city of the future / Vicente Guallart*. Barcelona : Actar.

Yean, Ken. 1999. *The Green skyscraper : the basis for designing sustainable intensive buildings / Ken Yeang*. Munich ; London ; New York : Prestel.

Google. 2014. "treehugger."Is the Vertical City a viable solution for sustainable living. Last modified November 27. Accessed March 21, 2015. http://www.treehugger.com/urban-design/vertical-city-viable-solution-sustainable-living.html.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# HEALTHY WORKPLACE: UTOPIA OR REALITY OF MODERN ARCHITECTURAL DESIGN IN BOSNIA AND HERZEGOVINA

**Tijana Vujičić**[1]
PhD student, University of Belgrade Faculty of Architecture; Senior Teaching Assistant, University of Banja Luka, Faculty of Architecture, Civil Engineering and Geodesy, Stepe Stepanovića 77/III, 78000 Banja Luka, Bosnia and Herzegovina, tvujicic@aggfbl.org

**Tanja Trkulja**
PhD student, University of Belgrade Faculty of Architecture; Senior Teaching Assistant, University of Banja Luka, Faculty of Architecture, Civil Engineering and Geodesy, Stepe Stepanovića 77/III, 78000 Banja Luka, Bosnia and Herzegovina, ttrkulja@aggfbl.org

## ABSTRACT

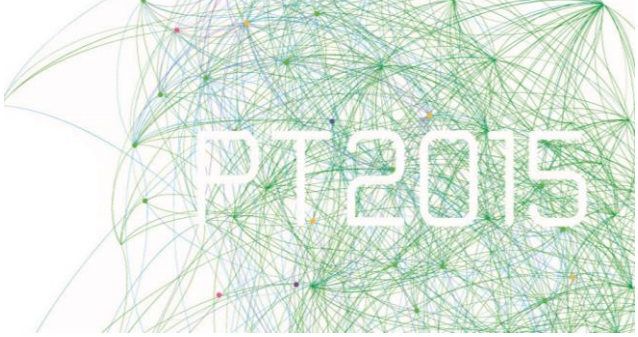
*Concept of business based on small and medium sized (SMS) enterprises which emphasises profit generation has led to radical degradation of workplaces in Bosnia and Herzegovina (B&H) where human aspect of industrial and business facility design is neglected or ignored. In response to the crisis of system in this field, the paper introduces a concept of a healthy workplace developed by World Health Organization (WHO). Elaborating some aspects of WHO concept, this paper considers human aspect of architectural design of industrial buildings through two examples of small and medium sized enterprises in B&H. Main focus is on the analysis of general organisational patterns of workplaces with the accent on presence and quality of social and service facilities.*

***Keywords**: healthy workplaces, WHO model, SMS enterprise, B&H.*

## INTRODUCTION

The introduction of business concept based on the principle of small and medium sized enterprises has led to radical changes in industrial building design in Bosnia and Herzegovina (B&H). Competitiveness, greater business productivity and profit generation became primary objectives of business, while the architecture is treated as a necessary precondition - a mere physical framework of business. In this context, human aspect of industrial and business facility design is neglected, and physical, psychological and social needs of workers are ignored. Even if developed countries consider physical work environment as a key topic of occupational health and safety at workplaces, which had been adopted a long time ago, extensive research of legal framework indicates that these requirements have not been met

[1] Corresponding author




so far in B&H. There is no legal framework which controls and regulates this field. The employers manage design process and dictate the patterns of spatial organisation in which human aspects are neglected. Therefore, this paper presents introductory considerations related to the research problem and aims at defining recommendations and guidelines for architectural design in this field in accordance with WHO model of healthy workplaces.

## HEALTHY WORKPLACES –WORLD HEALTH ORGANISATION (WHO) MODEL

Definition of a healthy workplace has evolved greatly over the past several decades. From an almost exclusive focus on the physical work environment in the realm of traditional occupational health and safety (dealing with physical, chemical, biological, ergonomic and other types of hazards), the definition has broadened to include: a) health practice factors (lifestyle); b) psychosocial factors (work organization and workplace culture); and c) a link to the community where each of these factors can have a profound effect on employee health (Burton, 2010). Any definition of a healthy workplace should encompass definition of health of World Health Organisation (WHO): "A state of complete physical, mental and social well-being, and not merely the absence of physical disease" (WHO, 1946). Furthermore, a 'Healthy Workplaces' model entails not only health protection, but also health promotion (Burton, 2010). According to the WHO, a healthy workplace is one in which workers and managers collaborate to use a continual improvement process to protect and promote the health, safety and wellbeing of all workers and the sustainability of the workplace by considering identified needs: a) health and safety concerns in physical work environment; b) health, safety and well-being concerns in psychosocial work environment including organization of work and workplace culture; c) personal health resources in the workplace (support and encouragement of healthy lifestyles by the employer); d) ways of participating in the community to improve the health of workers, their families and members of the community (WHO, 2014; WHO, 2010). Based on identified needs, WHO model suggests consideration of four *avenues of influence* in order to create a workplace that protects, promotes and supports the complete physical, mental and social well-being of workers: a) the physical work environment, b) the psychosocial work environment, c) personal health resources in the workplace and d) enterprise community involvement (Burton, 2010). These are four ways that an employer working in collaboration with employees can influence the health status of not only the workers but also the enterprise as a whole, in terms of its efficiency, productivity and competitiveness. As such, the four avenues are not discrete and separate entities, rather each intersects and overlaps with the others. To successfully create such a healthy workplace, an enterprise must follow a process that involves continual improvement, a management system approach, and which incorporates knowledge transfer and action research components (WHO, 2014). The process recommended by WHO is a cyclic or iterative process that continually plans, acts, reviews and improves on the activities of the programme.

## ORGANISATIONAL PATTERNS OF SOCIAL FACILITIES IN THE INDUSTRIAL BUILDINGS OF SMALL AND MEDIUM ENTERPRISES – MODEL OF ANALYSIS

A healthy workplace model developed by WHO is a significant step towards the improvement of working conditions and a basis for taking action at the global and local level. However, it proclaims general principles which need to be elaborated and amended in the framework of various professions that deal with this subject or which can be influenced by it (medicine, occupational health, architecture, economics, management, etc.). In the field of architecture, the subject of healthy workplace can be considered in the context of creation of physical workplace environment that is designed to fulfill the different needs of employees while achieving a certain level of comfort. There is an assumption that the business based on the concept of small and medium-sized enterprises has led to the neglect of workers' needs due to the significant reduction in the number of employees and space saving, which results in the complete absence of supporting social infrastructure, its downsizing or decreased level of comfort within these areas.

In the context of this research it is necessary to distinguish between two key levels of human needs: basic needs (physiological and safety needs) and social needs (psycological and self-fulfillment needs) (Maslow, 1943). Basic needs of workers are considered at the level of organisation of space necessary to meet basic physiological needs: restrooms, dressing rooms and restaurant, whereas social needs are considered in the context of organisation of additional facilities that strengthen healthy lifestyle and social interaction: a gathering place for workers, sports and recreational activities, leisure activities, etc.). In terms of a healthy workplace defined by the WHO, a proposed model of analysis is based on its two main domains: *physical work environment* and *personal health resources*. In this way, relations between the physical work environment and the workers' personal needs are established in this paper. Furthermore, valorisation and evaluation of the quality of physical characteristics of workplace are carried out in the context of meeting basic and social needs of employees as well as minimal comfort conditions that are necessary for acquiring a *healthy workplace status*. In order to enable such a valid and effective valorisation of industrial buildings a criterion system is being developed within case study analysis model (Figure 1) (author, according to Damjanović, 1972.; Dančević 1967.; Alikalfić, 2004., Fejzić et al., 2010). It primarily involves an analysis of certain facilities, and then the assessment of their quality in the context of disposition, organisation, equipment and comfort level (lighting, ventilation, heating and view).

## WORKPLACE QUALITY ANALYSIS OF AUTO SERVICE CENTRES IN BANJA LUKA

Case study has involved the analysis and assessment of workplace quality of the two auto service centres in Banja Luka (B&H), which present typical companies that operate on the concept of small and medium-sized enterprises and

contemporary principles of service economy. They are characterised by the business concept based on the car sale and maintenance. In this context, there are two basic zones in spatial organisation: contents intended for customers that are available to the public (auto salon) and a part of content with limited access intended for employees, within which there are intensive work (service) zone and administration zone. According to the proposed model, case study has been carried out through: direct observation and inventory *in situ*, valorisation of the state of supporting social facilities within workplaces and employees survey.

Model of analysis and results of research (presented through Figure 1. and following text) shows that supporting social facilities have been downsized in both service centres. Size, equipment, comfort, functional and aesthetic quality of this spaces are generaly on the low level. Furthermore, research shows that employees' requirements in terms of fulfillment of their basic and social needs are very modest. Auto service centre 1 (AC1), which belongs to medium-sized enterprises (24 employees), has recorded inadequate organisation of meals and dining area, which resulted in its non-use. Namely, 10 out of 13 employees that have been surveyed (there are 14 employees in the service centre) are not satisfied with the organisation of space for dining and relaxation, and as the main reason of dissatisfaction they refer to inadequate position of these areas (vicinity of administration – lack of privacy). Under these conditions, the workers spend their breaks in the nearby restaurants or at the workplace. It is indicative that 8 out of 13 employees rather spend their breaks having coffee than a meal which they have in the working process. Auto service centre 2 (AC2), which belongs to small enterprises (7 employees), has recorded absence of dressing rooms. However, the indicative fact is that 17 employees that have been surveyed (AC1-13 and AC2-4) do not use (AC1) or do not have need to use dressing rooms (AC2), which raises up a dilemma about necessity of the existence of dressing rooms. The key reasons listed in survey by employees that have led to this behaviour model are: coming to work by car, time saving and habits. Considered from the aspect of spatial comfort, dressing room area in AC1 is inadequately organised and equipped: lack of light, ventilation, lockers or benches for changing clothes, etc. (Figure 1).

As examples of positive practice, there are concept of dining within AC2 and recreational programs for workers within AC1. In fact, all workers in AC2 expressed satisfaction with the organisation of dining area. The key qualities of the area are: size, number of places, lighting, view, heated space, good equipment and the possibility of using the terrace in the summer season. In AC1, 11 out of 13 workers expressed their satisfaction with the recreational activities. Although physical recreation is organised outside of the building, in rented spaces, it is an important factor of social cohesion of working groups as well as collective team building.

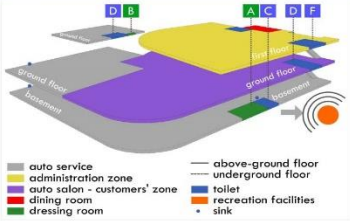
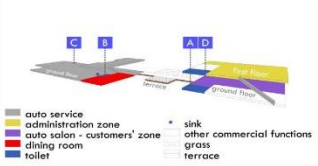
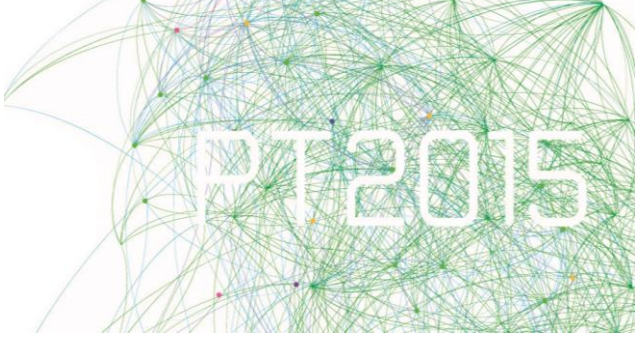
| BANJA LUKA | AUTOSERVICE CENTRE 1 | AUTOSERVICE CENTRE 2 |
|---|---|---|
| **Functional diagram** |  |  |
| Total number of employees | 24 | 7 |
| Number of employees in the service | 14 (13 of employees surveyed) | 4 (4 of employees surveyed) |
| Area of the building (m2) | 1972 m2 (service center occupies 1290 m2) | 435 m2 (service center occupies 286 m2) |
| **Dressing room** | **Dressing room** | **Dressing room** |
| A dressing room | yes, two dressing rooms (A, B) | No |
| Dressing room area | 5m2 in A and 1m2 in B | / |
| Number of employees who use the dressing room | 3 employees - infrequently | / |
| Number of cabinets | 3 cabinets in A, and 2 in B | / |
| The bench for changing clothes | No | / |
| Natural lighting | A- no, B- yes | / |
| Natural ventilation | A- no, B- yes | / |
| Heating | Yes | / |
| Air-condition / mechanical ventilation | Mechanical ventilation | / |
| **Toilet** | **Toilet** | **Toilet** |
| Separate toilet for employees of the service center | Yes, 4 toilets (C,D,E,F) | Yes, 4 toilets (A,B,C,D) |
| Area of toilets | C-5m2, D-10m2, E-10m2, F-10 m2 | A-10m2, B-3m2, C-1m2,D-10m2 |
| Number of sinks | 5 sinks in toilets + 3 within workspaces | 5 sinks in toilets + 1 within workspaces |
| Number of showers | 1 shower | Zero |
| Number of toilets | 7 toilets | 6 toilets |
| Natural lighting | C-No, D-No, E- Yes, F-Yes | A-Yes, B-No, C-Yes, D-Yes |
| Natural ventilation | C-No, D-No, E- Yes, F-Yes | A-Yes, B-No, C-Yes, D-Yes |
| Heating | Yes | A-Yes, B-Yes, C-No, D-Yes |
| Mechanical ventilation | Yes | A-Yes, B-Yes, C-No, D-Yes |
| **Space for dining and relaxation** | **Space for dining and relaxation** | **Space for dining and relaxation** |
| Length of the pause | 30 minutes | 30 minutes |
| Are meals organised inside the building? | No | Yes |
| Space for dining and relaxation | Yes, on the first story within administrative part of building | Yes, within auto service |
| Dining room area | 10 m2 with kitchen | 45m2 with kitchen |
| Number of employees (in the service center) who use the dinnig room | 2 employees - infrequently | 4 employees |
| Number of seats | 5 bar chairs | |
| The possibility of using outdoor terrace in the summer season | No | Yes |
| Cardinal directions | Southwest | East |
| Natural lighting | Yes | Yes |
| Natural ventilation | Yes | Yes |
| Heating | Yes | Yes |
| Air-condition | Yes | No |
| Level of equipment | Good, but there is no classic table and chairs | Good |
| Quality of view | Medium good | Good |
| **Recreation facilities for empl.** | **Recreation facilities for employees** | **Recreation facilities for employees** |
| Recreation facilities for employees | Yes | No |
| Number of employees who practice the recreation organised by the employer | 7 employees constantly +<br>4 employees occasionally | / |

**Figure 1: Results of analysis of workplaces quality of auto service centres in Banja Luka.**




## CONCLUSION

On the basis of the above findings, it can be concluded that the two examples of auto service centres have undergone the downsizing of certain groups of supporting facilities intended for workers, inadequate organisation of space and reduced level of comfort. However, in the context of meeting the needs of workers, on the basis of the survey results, it could be concluded that the basic and social needs of workers are not disadvantaged and that they express medium to high level of satisfaction. With regard to the principles based on the WHO model, the key guidelines on the improvement of the workplace quality in B&H are as follows: a) re-examination and rethinking of inherited design patterns for social and other areas intended for workers in the context of meeting their needs, preferences and habits, b) adaptation of standards imposed by global corporations to the local social and regulatory context, and in accordance with the recommendations of the WHO model, c) development and promotion of good practice examples and d) education about importance of health and healthy working environment for both workers and employers.

## REFERENCES

Alikalfić, Vera. 2004. *Industrijski objekti i industrijski kompleksi*. Sarajevo: Arhitektonski fakultet u Sarajevu.

Burton, Joan. 2010. *WHO healthy workplace framework and model: background and supporting literature and practices*. World Health Organization. Last modified June 13, 2014. Accessed March 20, 2015. http://apps.who.int/iris/bitstream/10665/113144/1/9789241500241_eng.pdf?ua=1&ua=1.

Damjanović, Vojislav. 1972: *Industrijski kompleksi i zgrade*, Beograd: Građevinska knjiga.

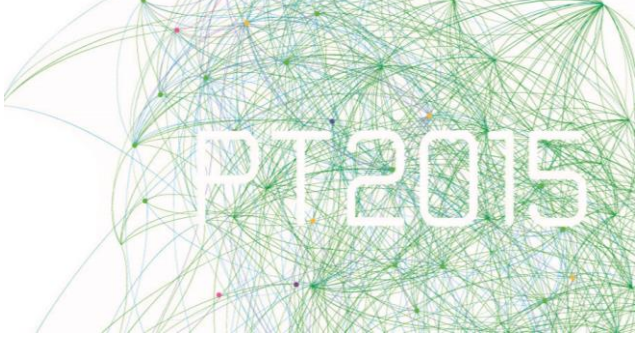
Dančević, Desimir. 1967. *Industrijski objekti*. Niš: Zajednica zavoda za zaštitu na radu.

Fejzić, Emir., Kevac, Lazo., Vujičić, Tijana., Trkulja, Tanja. 2010. Industrijski objekti - skripta, Banja Luka: Univerzitet u Banjoj Luci Arhitektonsko-građevinski fakultet.

Maslow, Abraham. 1943. "A Theory of Human Motivation", *Psychological Review*, no. 50(4): 370-396.

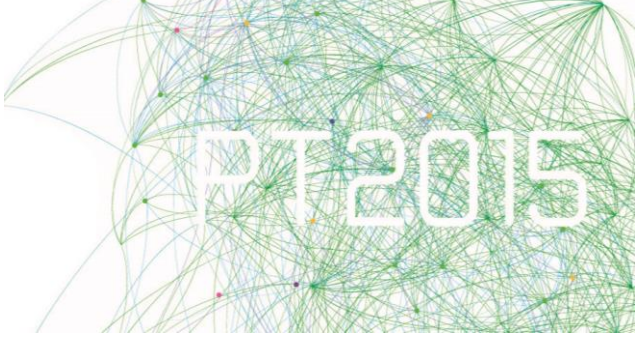
WHO. 1946. "WHO definition of Health". Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June 1946, and entered into force on 7 April 1948.

WHO. 2010. *Healthy workplaces: a model for action - For employers, workers, policy-makers and practitioners.* Last modified April 27, 2010. Accesed March 20, 2015. http://whqlibdoc.who.int/publications/2010/9789241599313_eng.pdf?ua=1.




WHO, 2014. „Five keys to healthy workplaces". Last modified March 27, 2014. Accessed March 31, 2015. http://www.who.int/occupational_health/5_keys_EN_web.pdf?ua=1.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# SUSTAINABLE DESIGN FOR IMPROVEMENT OF HEALTHY BUILT ENVIRONMENT

**Aleksandar Petrovski**[1]
Assistant, Faculty of Architecture, Ss Cyril and Methodius University, bul Partizanski odredi 24, Skopje, R. of Macedonia, petrovski.aleksandar@arh.ukim.edu.mk

**Ognen Marina**
Professor, Faculty of Architecture, Ss Cyril and Methodius University, bul Partizanski odredi 24, Skopje, R. of Macedonia, ognen.marina@arh.ukim.edu.mk

**Georgi Dimkov**
Assistant, Faculty of Architecture, Ss Cyril and Methodius University, bul Partizanski odredi 24, Skopje, R. of Macedonia, georgi_64@hotmail.com

**Dimitar Papasterevski**
Assistant, Faculty of Architecture, Ss Cyril and Methodius University, bul Partizanski odredi 24, Skopje, R. of Macedonia, papasterevski@gmail.com

## ABSTRACT

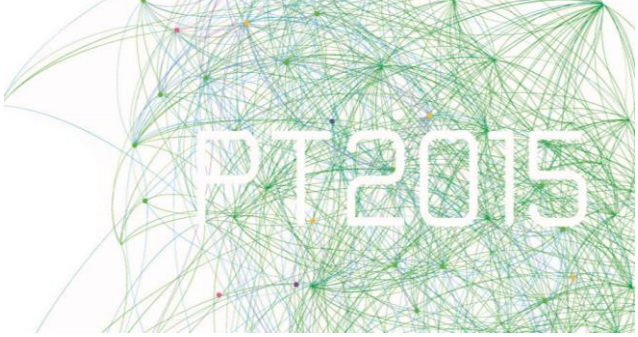
*Buildings as main consumers of energy and resources are responsible for waste and greenhouse gasses creation for which they have caused serious implications to the environmental and human health. Sustainable architecture considers reasonable resource exploitation and improvement of the built environment, human wellbeing and health. Its implementation in a building's design is a demanding task due to multitude of aspects it grasps.*

*This paper proposes a design process, tested on a case-study, which integrates the projects participants and determines common indicators on the buildings environmental, social and economic performance. The chosen indicators are of various importance for the buildings design. Thus, for each of them respective weights are determined by the project team. During the design process three alternatives of the case-study are proposed and analysed.*

*The results have shown that supporting the design process with tools for decision making enables choosing the most sustainable design alternative for creation of a healthy built environment.*

***Keywords**: sustainable design, design process, health, analytic hierarchy process.*

[1] Corresponding author




## INTRODUCTION

That our buildings are the largest contributors to the detrimentation of the human's built environment has been identified in numerous scientific studies, (Daily 1997; Kibert 2012). Poor building design, intensive non-renewable energy consumption, materials and other resources are amongst the human activities that threaten the future of the planet, (Smith 2005).

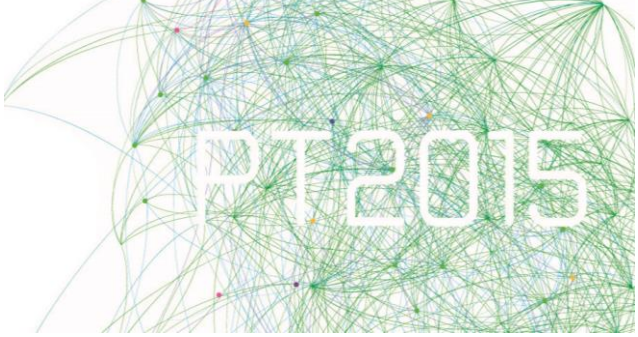
Lack of high-quality building design has contributed in creation of `sick buildings syndrome`. The overwhelming use of mechanical devices for heating and air conditioning, increased airflow and other active design techniques have been identified as cause for asthma, allergies, eye , fatigue and etc. (Fisk 2000). These causalities despite infringing the built environment health aspects decrease productivity of the buildings users.

Sustainable architecture in its essence considers reasonable resource exploitation not neglecting the human wellbeing and health as well as the economic and social circumstances in which it occurs. Many authors have stressed the benefits of sustainability in the creation of healthy built environment and the benefits to the mental and physical health of the habitants, (Handy et al. 2002; Northridge, Sclar, and Biswas 2003; Evans 2003; Jackson 2003; Srinivasan, O'Fallon, and Dearry 2003).

The measurement of design's sustainability has been extensively researched, (Ding 2005; Szokolay 2014; Azhar et al. 2011). The most widely used approach of tackling sustainability issues is by means of indicators, though potential problems occur, such as interaction between indicators, dynamic aspects, hidden nonlinearities etc., (Diaz-Balteiro and Romero 2004).

The integration of the indicators and their measurement in a building's design is a demanding task due to their heterogenic nature. The different aspects of the building's design and the different goals of the project team require new techniques to control and direct the design and decision-making process in order to create a healthy environment.

The goal of this study is to propose an approach for assisting the decision-making during the early design stage in order to achieve more sustainable and healthier built environment. Given that the most important part of the buildings life-cycle is the early design phase, (Bogenstätter 2000), the project indicators for the research are extracted from this phase. The results have shown that by utilizing the proposed approach the design process is guided towards development of the most optimal design alternative.




## METHODOLOGY

An approach is proposed in order to select a design alternative in the early design stage which has most compliance with the sustainability principles and creation of healthy environment. It is based on several steps such as: defining sustainability indicators; assigning weight factors; design alternatives performance evaluation; choosing most optimal design solution.

Sustainable indicators relevant for the early design phase are chosen according to a charrette where the stakeholders, i.e. the investor, architect and mechanical engineer have agreed on the most important aspects of the housing building, Table 1.

**Table 1: Project Indicators.**

| **Stakeholders** | | **Investor** | **Architect** | **Mechanical Engineer** |
|---|---|---|---|---|
| **Sustainability Criteria** | Social | Functionality | Functionality | |
| | Economic | Investment | Investment | |
| | Environmental | | Energy performance | Energy performance |
| | | South-West Views, glazing 90% | South-East wall 12-15% glazing | |

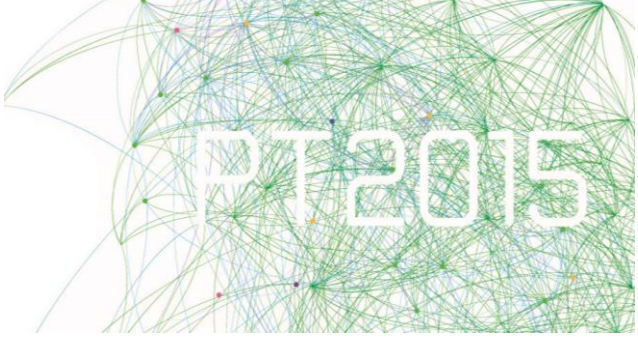
The investor was most concerned with the functionality of the building plan, the investment and had wanted a south-west wall glazed by 90%. The architect was more concerned with the energy performance thus requiring a south orientation with an optimal 12-15%, (Petrovski and Samardzioska 2013).

The sustainable design process is based on the integration of the project indicators and considering that each of them has a certain influence on the projects outcome it is necessary to determine their influence. Therefore an Analytical Hierarchy Process (AHP) is utilized, (Saaty 1987), based on three principles – hierarchy of the indicators, prioritization and consistency check.

**Table 2: Criteria Weights.**

| | **Functionality** | **Costs** | **En. Perf.** | **Views** | **Glaz. Perc.** | **Weight** |
|---|---|---|---|---|---|---|
| **Functionality** | 1 | 7 | 6 | 1 | 1 | .319 |
| **Costs** | | 1 | 6 | 7 | 8 | .032 |
| **En. Perf.** | | | 1 | 3 | 4 | .096 |
| **Views** | | | | 1 | 1 | .264 |
| **Glaz. Perc.** | | | | | 1 | .289 |

In order to assign criteria weights a pair-wise comparison is conducted, thus for *n* number of criteria there are total of $n(n-1)/2$ comparisons, Table 2. For conversion




of the qualitative values of the criteria into quantitative a scale of 9 to 1/9 is utilized. The stakeholder's goals are reflected onto the weight assignment onto the sustainability criteria, Table 2.

The inconsistency measure is useful for identifying possible errors in judgments as well as actual inconsistencies in the judgments themselves. The Consistency Ratio (CR) is 0,05 less than 0.1 which is deemed reasonable, (Saaty 1987).

## RESEARCH

The decision making approach integrating several sustainability goals is tested on an on-going design process of housing building where three design alternatives are analysed. The case study is a ground floor housing building where the walls, floors and roof are super-insulated with U value of 0,15 W/m$^2$K and windows with U value of 1,8 W/m$^2$K, and they are the same in all of the design alternatives. The variables in the alternatives are shown in Table 3.

**Table 3: Design alternatives performance.**

| Design alternatives | En. per. (kWh/m$^2$.a) | Costs (eur) | Views | Funct. | Glaz.% |
|---|---|---|---|---|---|
| **Alternative 1** | 28 | 55.000 | South-East | excellent | 12% |
| **Alternative 2** | 40 | 60.000 | South | good | 90% |
| **Alternative 3** | 48 | 60.000 | Sout-West | moderate | 90% |

As stated by Bentivegna et al., (Bentivegna, Brandon, and Lombardi 2003), it is a major problem to evaluate the quality of the built environment and to apply a measurement system in the planning process due to the different aspects of the building.

The parameters of the indicators are described as $S_2$ which represents the maximum value of an indicator of a category and $S_1$ is the minimum value. The normalized scale is defined by a range from 0 to 1, where 0 point gets the lowest indicator ($P_2$) between the alternatives for a given indicator and the maximum 1 point gets the highest performance indicator ($P_1$) among the alternatives. $S_i$ is the value of the third indicator of a given category and $P_i$ represents the value of the interpolated indicator. Results are shown in Table 4 and calculated with Eq. 1.

$$P_i = \frac{(S_i - S_1)(S_2 - S_1)}{S_2 - S_1} + P_1 \qquad (1)$$

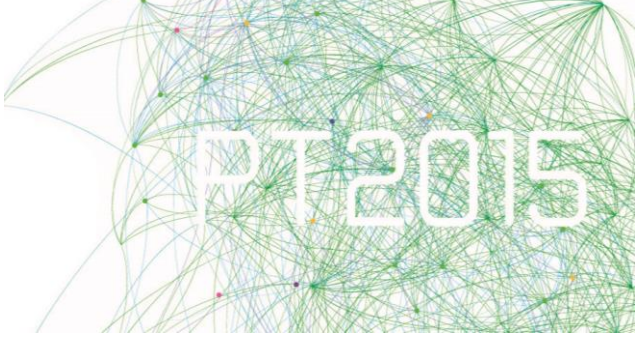



**Table 4: Point scale interpolation.**

| Design alternatives | En. per. (kWh/m$^2$.a) | Costs (eur) | Views | Funct. | Glaz.% |
|---|---|---|---|---|---|
| **Alternative 1** | 1 | 1 | 0 | 1 | 0 |
| **Alternative 2** | 0.4 | 0 | 0.5 | 0.5 | 1 |
| **Alternative 3** | 0 | 0 | 1 | 0 | 1 |

To make the ranking of the alternatives the values of the matrix from Table 4 are multiplicated with the criteria weight values from Table 2. The aggregation of the points of the three alternatives, as well as the ranking is shown in Table 5.

**Table 5: Aggregation of points and ranking.**

| Design alternatives | Aggregated points | Ranking |
|---|---|---|
| **Alternative 1** | 0.447 | 3 |
| **Alternative 2** | 0.638 | 1 |
| **Alternative 3** | 0.553 | 2 |

It could be concluded that the most optimal design alternative reflecting the project team goals are incorporated in design alternative 1, followed by alternative 2 and 3.

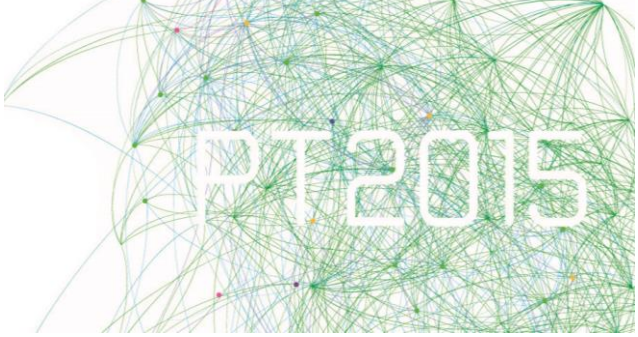
## CONCLUSIONS

Applying the proposed approach during the design process enabled the project team in delivering optimal design that incorporates certain aspects of the sustainability concept that were defined as feasible. Structuring the defined goals and making the process transparent enabled quick iterations of design alternatives intended to drive the design towards creation of healthy built environment. In order to rank the alternatives multi-criteria decision-making tool was used which was concluded as convenient for efficient decision making, speeding-up the design process.

To further improve the proposed approach it is necessary to incorporate sensitivity analysis. Also in order to speed up the process it is recommended to implement automation of the computation, starting from the weight assignment, pair-wise comparison, linear interpolation, multiplication of the matrices and ranking. Therefore this research could serve as a layout for building such an automated tool.

## REFERENCES

Azhar, Salman, Wade A. Carlton, Darren Olsen, and Irtishad Ahmad. 2011. "Building Information Modeling for Sustainable Design and LEED® Rating Analysis." *Automation in Construction*, Building Information Modeling and Changing Construction Practices, 20 (2): 217–24. doi:10.1016/j.autcon.2010.09.019.




Bentivegna, Vicenzo, P. S. Brandon, and Patrizia Lombardi. 2003. *Evaluation of the Built Environment for Sustainability*. Taylor & Francis.

Bogenstätter, Ulrich. 2000. "Prediction and Optimization of Life-Cycle Costs in Early Design." *Building Research & Information* 28 (5-6): 376–86. doi:10.1080/096132100418528.

Daily, Gretchen. 1997. *Nature's Services: Societal Dependence On Natural Ecosystems*. Island Press.

Diaz-Balteiro, Luis, and Carlos Romero. 2004. "In Search of a Natural Systems Sustainability Index." *Ecological Economics* 49 (3): 401–5.

Ding, Grace K. C. 2005. "Developing a Multicriteria Approach for the Measurement of Sustainable Performance." *Building Research & Information* 33 (1): 3–16. doi:10.1080/0961321042000322618.

Evans, Gary W. 2003. "The Built Environment and Mental Health." *Journal of Urban Health: Bulletin of the New York Academy of Medicine* 80 (4): 536–55. doi:10.1093/jurban/jtg063.

Fisk, William J. 2000. "Health and Productivity Gains from Better Indoor Environments and Their Relationship with Building Energy Efficiency." *Annual Review of Energy and the Environment* 25 (1): 537–66. doi:10.1146/annurev.energy.25.1.537.

Handy, Susan L., Marlon G. Boarnet, Reid Ewing, and Richard E. Killingsworth. 2002. "How the Built Environment Affects Physical Activity: Views from Urban Planning." *American Journal of Preventive Medicine* 23 (2 Suppl): 64–73.

Jackson, Richard J. 2003. "The Impact of the Built Environment on Health: An Emerging Field." *American Journal of Public Health* 93 (9): 1382–84. doi:10.2105/AJPH.93.9.1382.

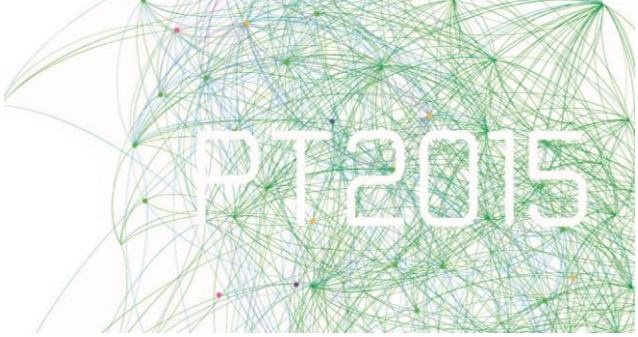
Kibert, Charles J. 2012. *Sustainable Construction: Green Building Design and Delivery*. 3 edition. Hoboken, N.J: Wiley.

Northridge, Dr Mary E., Dr Elliot D. Sclar, and Ms Padmini Biswas. 2003. "Sorting out the Connections between the Built Environment and Health: A Conceptual Framework for Navigating Pathways and Planning Healthy Cities." *Journal of Urban Health* 80 (4): 556–68. doi:10.1093/jurban/jtg064.

Petrovski, Aleksandar, and Todorka Samardzioska. 2013. "Influence of Orientation, Shape and Glazing in the Energy Efficiency of Groundfloor Housing Buildings." In *15th International Symposium of MASE*. Struga.

Saaty, R. W. 1987. "The Analytic Hierarchy Process—what It Is and How It Is Used." *Mathematical Modelling* 9 (3–5): 161–76. doi:10.1016/0270-0255(87)90473-8.

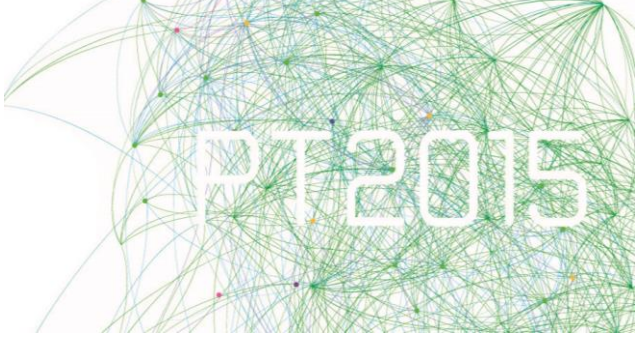
Smith, Peter Frederick. 2005. *Architecture in a Climate of Change: A Guide to Sustainable Design*. Elsevier/Architectural Press.




Srinivasan, Shobha, Liam R. O'Fallon, and Allen Dearry. 2003. "Creating Healthy Communities, Healthy Homes, Healthy People: Initiating a Research Agenda on the Built Environment and Public Health." *American Journal of Public Health* 93 (9): 1446–50. doi:10.2105/AJPH.93.9.1446.

Szokolay, Steven V. 2014. *Introduction to Architectural Science: The Basis of Sustainable Design*. Routledge.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# HEALTHCARE DESIGN REVISITED – NEW APPROACHES TO USER – CENTRIC, EFFICIENT AN EFFECTIVE DESIGN

## EXPERIENCES OF MILITARY MEDICAL ACADEMY (MMA) IN BELGRADE - 3 DECADES AFTER ITS FAMOUS DESIGN

**Eva Vaništa Lazarević**
PhD, Professor, University of Belgrade, Faculty of Architecture, Blvd. Kralja Aleksandra 73/II, eva.vanistalazarevic@gmail.com

**Jelena Marić**
Teaching Assistant, University of Belgrade, Faculty of Architecture, Blvd. Kralja Aleksandra 73/II, jelena.maric1989@yahoo.com

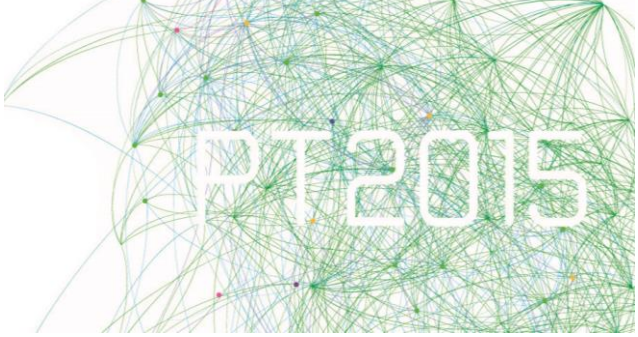
**Milena Vukmirović**
PhD, Research Associate, University of Belgrade, Faculty of Architecture, Blvd. Kralja Aleksandra 73/II, milena.vukmirovic@urbanlab.org.rs

**Goran Radović**
PhD, Professor, University of Podgorica, Faculty of Architecture, Blvd. George Washingtona bb, Podgorica, Montenegro, rgoran@ac.me

## ABSTRACT

*The purpose of this paper is to reflect on the paradigm change and different experiences of using the healthcare design guidelines in the last 3 decades, through the case study of the Belgrade's Military Medical Academy (VMA).*

*Designed in 1973 after a large national competition, when architects Osojnik and Nikolić won the first prize, an extraordinary leaf shaped volume was raised in 1982 as the biggest healthcare center in former Yugoslavia. The 14-story building is covering 180.000 square meters of space on 21 hectares of land of Belgrade quarter of Banjica, divided in 60 different technical-technological entities. It represents still today one of the landmark and recognizable mega-architectural structure of the City of Belgrade. The most contemporary "state of the art" healthcare design guidelines were incorporated along with the most unusual interior design conceived as an U boat. More than thirty years after, its functional organization has been over passed and needs rethinking and upgrading. Its voluminosity and compactness represent major obstacles that need to be re-thinked. This paper presents an assessment of the healthcare design of the MMA. The paper has two parts. In the first part a specific set of criteria is defined based on theoretical research of strategies and documents, today's healthcare standards and norms. The second part provides a set of analysis through examining 3 types*




*of users: patients, medical staff and experts: architects and engineers. Some conclusions and ideas in form of guidelines for regeneration and improvement will be presented at the end of the paper.*

***Keywords**: new standards for healthcare design; elements of psychological, physical, functional and aesthetic guidelines for today's healthcare design; user's satisfaction, change of paradigm.*

## INTRODUCTION: HEALTH CARE DESIGN

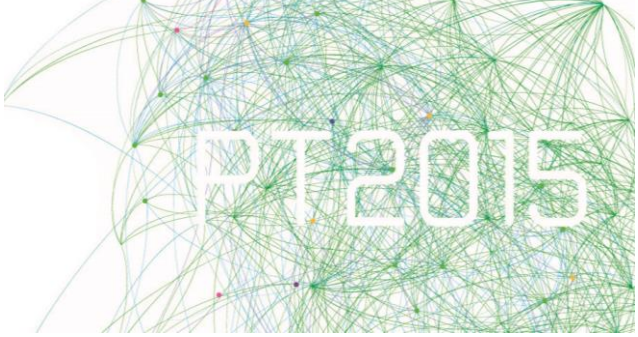
A century ago patients were still treated mainly at homes, and were sent to health care facilities only in exceptional cases. After years of building health and social care facilities during 20th Century, we face today consequences of cuts in government sending's: patients are offered to be treated at home, while their condition is monitored online.

Pavilion type of hospitals largely known from old pictures and movies were mainly used until the end of the XIX century, when the idea of all medical facilities working under one roof has been introduced. In 1907 in Chicago, a "monoblock" type of hospitals was firstly advocated[1]. The completely opposite idea from pavilion type of health care design founded in the era of tuberculosis showed its benefits but also needs some readjustments today. In this paper we will discuss this issues through analyzing monoblock design of one of the biggest hospital in Serbia ever built: the Military Medical Academy (MMA) in Belgrade.

The MMA was designed in 1973 – years characterized by magnitude in actions; after a large national competition was concluded with the first prize going to the architects Osojnik and Nikolić. An extraordinary leaf-shaped volume rose after almost a decade from its design, in 1982 as one of the biggest healthcare centers in former Yugoslavia. It is still one of the landmark and recognizable mega-architectural structures of Belgrade. A "state of the art" healthcare design guidelines were applied, as well as the unusual interior designed shaped as a "U boat". More than thirty years after, its functional organization has been changed and needs rethinking and upgrading. Its voluminosity and compactness represent major obstacles that need to be rethinking.

This research focuses on proposing possible design guidelines for upgrading and fine-tuning the monoblock type from 1970s to reach today's health care design standards. In doing so, we will also take into account the wider context - poor socio-economic situation in Serbia.

[1] Vodička M. (1994). Bolnice, Zagreb, Školska knjiga.




## HEALTH CARE IN YUGOSLAVIA

First, we will enlighten the time when the MMA was built. Regarding planning documents from 1970s - healthcare and public health in Yugoslavia were deeply rooted in decision-making agendas of the time. After World War II a completely new central political planning system was introduced[2] as a consequence of socialist organization: the health institutions were under the full control of the central government with the majority of health care staff employed in the public sector. During the late 1970s, decentralization was slowly introduced but it was only in 1980s when the health system slowly changed its strict central political position alongside with introduction of multiparty parliamentarism and privatization. World bank has pronounced Yugoslavia as one of the 32 industrialized countries in the field of health care system development, while it could still benefit from European and UNDP funds as belonging to developing countries. The system was famous for free health care assurance.

The Socialist Federative Republic of Yugoslavia was consisted of 6 republics and 2 autonomy provinces that assured free health care to all its citizens - a sort of a rare and pioneer case. We can even say that it represented a preview for a system later known as a 'Scandinavian welfare system'. The level of social security and human dignity was elevated, while medicaments and health care were ensured for all.

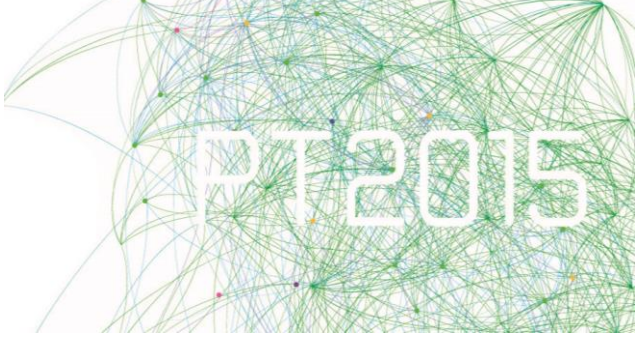
In the frame of the general welfare system and socialist propaganda, the massive open competition for the MMA was announced. At that time, the Yugoslav Army was highly recognizable, since balancing smartly between the East and the West. By the early 1970s, the first propulsive years, the momentum for launching the mega project with a focus on new and completely modern design structure was achieved. At the symbolic level, it marked the years of greatness and importance. It seems that the health care was used as a highly political issue. Nevertheless, the benefit for citizens in general was enormous.

In the same year, 1973, another big medical center was launched with enthusiasm, this time in Ljubljana. These two centers still remain the biggest medical centers in the region. The countries of the region could not replicate these monumental medical buildings ever since today (having in mind the context of civil wars and slow reforms).

## HISTORY AND ORGANIZATIONAL PATTERN OF THE MMA BUILDING

The Military Medical Academy (MMA) has been designed as a medical, educational and scientific-research oriented institution. But speaking from today's

[2] http://eurpub.oxfordjournals.org/content/2/3-4/211
The Eurepean Journal of Public Health; Ed in Chief: Peter Allebeck: Primary Health Care in Yugoslavia.




paradigm: everything has changed since that period. MMA is now part of a much smaller in post-transition and severe recession country, with negligible role of the Army. However, the institution managed to maintain its international reputation in terms both of treatment and expertise of its medical staff. Within its modern building it represents also a great Medical School committed to creating further generations of military doctors. It is also recognized as a scientific research center of excellence. At the time of its launch, it was designed as the best possible version of the 'up to date', modern structure, both from the functional and the architectural point of view. MMA represents an example of a hospital built in characteristic "monoblock" type of hospital design of that era.[3] This type/principle of hospital design has both advantages and disadvantages, which is presented and analyzed in this paper, after examining the perceptions and beliefs of three types of its users.

The whole MMA complex has been designed large scale: the significantly large area of 21 hectares contains a large 180.000 sq. and the capacity of 1200 beds. The Military Medical Academy has even today 27 clinics and 17 institutes, the Specialist Outpatient Clinic, the Poison Control Center, the Emergency Department and the Solid Organ Transplantation Center performing more than 5000 diverse diagnostic and therapeutic procedures. The MMA operates today in completely different political circumstances but still as a part of the Ministry of Defense. Thanks to its persistent military organizational structure and commitment to providing the highest quality medical care, it has been rewarded and recognized as a medical institution meeting the top world standards. After its completion in more distant 1981 it became already one of the architectural symbols of Belgrade, both for its design and stature as well as position in health care system. One of the representing parameters of its greatness as mega project may be also the full number of its employment staff: over 3000. The significant change of new era represents the fact that it serves and is open today also for civilians/not only military families, two days per week in app. 40 % of its full capacity. Annually 600 000 people are examined, 30 000 are hospitalized and 20 000 of surgery interventions are done in this facility.

The building of MMA has a unique appearance (Figure 1, Figure 2) due to its exceptionally dynamic shape with four wings, colossal structure and horizontal stripe-like lines that dominate the façade. In the complex of MMA hospital there are several objects and big area of open green space including forest and parks. The main accommodation space is divided in two parts, in the basis it has the shape of a half cross-rounded at angles and is raised on to the columns, forming four powerful wings. Vertical communications including elevators and stairs are concentrated in the center of the building, as well as in north and south wing (Figure 3, Figure 4).

[3] Mitrović, M. (2012) *Arhitektura Beograda 1950-2012*, Beograd, JP Službeni glasnik.

1 2 3

**Figure 1: Position of MMA in city landscape.**
**(Source: http://www.panoramio.com/user/996078/tags/Београд? photo page=2).**
**Figure 2: façade of the MMA hospital.**
**Figure 3: Floor organization of the MMA hospital.**
**(Source: http://vma.mod.gov.rs/en/about-mma/about-mma-building#.VTKSpUuKiFI).**

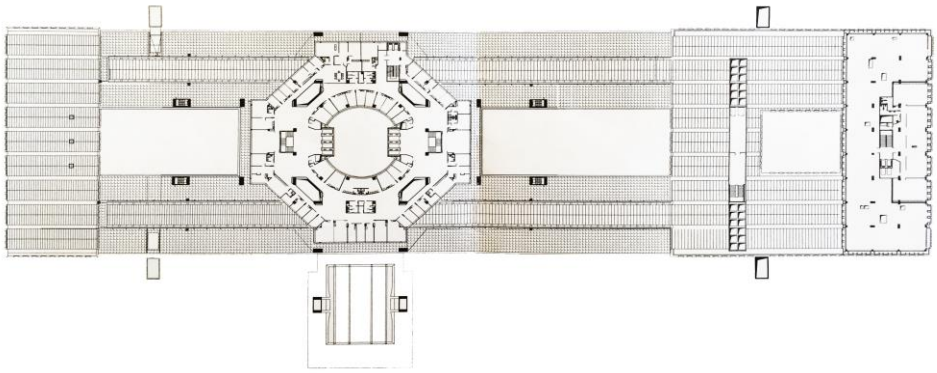


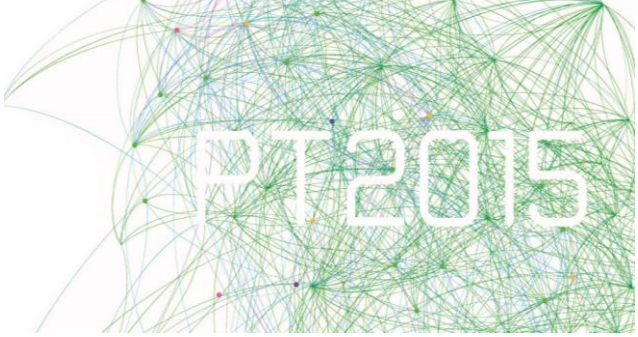
**Figure 4: Floor organization and communications of the MMA hospital.**
**(Source: http://vma.mod.gov.rs/en/about-mma/about-mma-building#.VTKSpUuKiFI).**

## NEW RESEARCHES

### Evidence-based health care architecture (EBD)[4]: Searching for dignity

The most important task for designers of health care development is to create a place where sense of human dignity could be preserved to the fullest extent. We have to try to reduce psychological constraints of patients, a sense of disorientation and fear acquired from the disease. Dignity health is making health care more accessible and more successful. Residents of all ages and backgrounds have to openly access by preserving dignity to primary care, preventive treatment, clinical support, chronic disease management, trauma services and a host of medical and

[4] EBD is a process used by architects, interior designers and facility managers in the planning, design, and construction of commercial buildings. An individual using "evidence-based design" makes decisions based on the best information available from research, project evaluations and evidence gathered from client operations.




therapeutic specializations. To encourage those most needed aspects, as professionals we already know the key elements: a lot of natural lights & fresh greenery, warm colors, "homey" entourage, peaceful and comfort and private spaces that reflect confidentiality. The general conclusion is that the new 21st century approaches need much more than just ordinary and plain health care. New patients' needs are more and more complex and multilayered.

To reach further knowledge, architects and designers have been fully aware that evidence-based design incorporates specific design principles that have been elaborated to improve clinical and satisfaction outcomes for patients and staff. The Center for Health Design defines evidence based design as the process of basing decisions about the built environment on credible research to achieve the best possible outcomes. Evidence-based health care architecture creates safe and therapeutic environments for patient care and encourages fully family involvement. It promotes efficient staff performance and is restorative for workers under stress. This type of design ultimately improves the organization's clinical, economic, productivity, satisfaction and cultural satisfaction. The health care environment has to enhance the dignity of the patient through features that allow primarily privacy and confidentiality.[5]

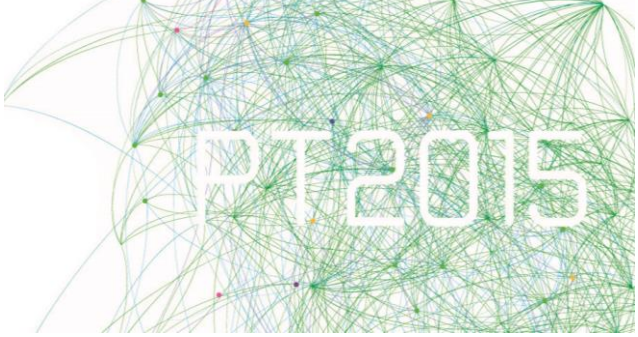
Research has defined key hospital design goals as: patient-centered care (since the patient is the hospital's reason for being), efficient operations, clinical safety, optimal functional relationships, modern systems, flexibility for expansion and adaptation, implementation of new technology. Sustainable design requires also reduced energy usage and pollution control and overall design that reduces stress including art and hospitality, not only science and technology[6].

The facility conveys a message to patients, visitors and staff about the organization and the medical care being provided there starting with the approach to the facility, the drop-off area, the parking lots and the street signs. Ideally, that message should be welcoming, caring, showing comfort and compassion, commitment to patient well-being and safety. Stress should be relieved, safety net provided, respect reciprocated, competence symbolized, way-finding facilitated and families - accommodated. The physical space of the institution also influences employee service attitudes and behaviors.

In recent years, nearly all healthcare design work in developed countries has been in some format of integrated and collaborative process. Collective "ownership" of the design challenge and the solution is an empowering tool. Healthcare architecture accommodates interaction between medical staff and people in need of care; therefore this research has mainly collaborative and participatory character,

[5] Shaller,D.(2007) *Patient – centered care: What does it take?*

[6] Sprow,R. (2012) AIA *Planning Hospitals of the Future.*




since guidelines given in the results are mainly and primarily based on user satisfaction and we would add – human dignity.

MMA has been planned during 1970s and finished in 1980s – era still oriented and defined mainly by functionalism of Post-modern movement. Patients were treated in a different way that led to health care facilities with sometimes weak relation to everyday life. Some of the weaknesses of such hospitals are: lack of privacy, connection, orientation, etc.[7]. USA, for example, is currently working on a project of 180 billion dollars investment in hospital re-construction; re-adjusting aging facilities (built in 1950s and 1960s) that no longer support efficient and safe cares delivery. Modern principles of hospital design include patient and family centered care[8].

Rational and smart design of guidelines is essential in the case of Serbia and its poor financial means. We will build upon the existing knowledge stating a strong link between the design of health care facilities and perceptions and beliefs of patients, medical staff and concerned families. Starting from this assumption, we will examine patients, staff and designers / architects of MMA in order to learn more about the building and its use.

Considering new approaches in design we have to focus primarily on stress reduction as a main factor of disorder. For that we need the results of investigation - opinions of users but as well of designers. Mainly; psychologically, as designers we have to obtain several focal points in order to achieve better health care design:

1. Social support (patients, family, staff)
2. Control (privacy, choices, escape)
3. Positive distractions (artwork, music, entertainment) and
4. Nature (plants, flowers, water, wildlife, nature sounds).

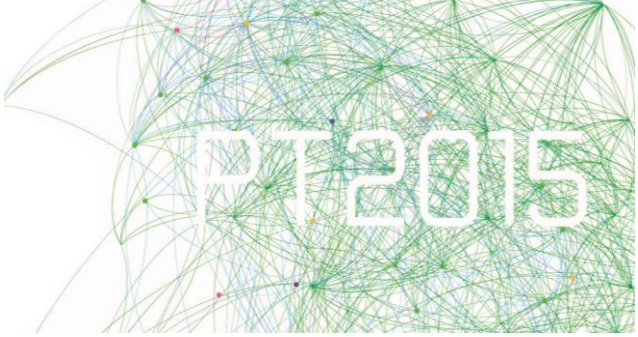
It is easy to observe upon the analyze at first glance - of our case study: MMA entirely miss 3.th and 4.th point: positive distraction and involvement of nature. How can we improve it in poor socio-economical frame? How can we choose priorities? The proposal of some possible guidelines represents a focal point of this research.

## METHODOLOGY

The methodological framework used in this research consists of: literature review shown in the chapter above and the analysis of in-depth interviews and returned questionnaires with patients, medical staff and experts-engineers working at the MMA. Under that scope the quality assessment of the MMA hospital in order to provide clear criteria for evaluation could be define as below:

[7] Wagenaar, C. (2010) Architecture and health, Symposium.

[8] Levin,D. and Joseph,A.(2009) The center for health Design, Planning, Design and Construction of health Care Facilities, Second Edition, USA.




**Defining criteria for assessment**

Based on the principles of good hospital design, we have centered our research interest primarily on user's experience, by making use of previous research of principles, strategies and documents, as well as analysis of observations and interviews done in the complex. Assist. Jelena Marić, one of the authors of this research accomplished the part concerning observations, interviews and questionnaire analysis.[9] Assessment criteria's are divided in two: A. Physical and functional criteria and B. psychological and aesthetic criteria.

**A Physical and functional criteria**

Outdoor design

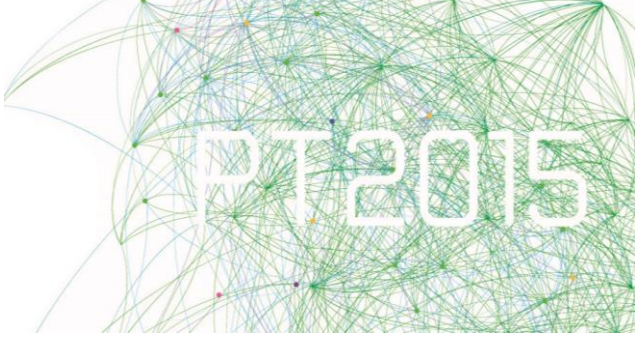
The site/location: This criterion is defined by the hospital position and the connection with the urban tissue of the city. Large hospitals like MMA should be located in peaceful parts of the city away from traffic and noise, but easily accessible from every part of the town[10] not only for patients but also for everyday users like medical staff and other employees. Providing access convenient both for community and service vehicles, with paved roads and accessible entrances that are well-marked, available parking lot and green areas & open spaces are the key elements of good design. Other criteria in this part especially important for MMA hospital could be defined as: building capacity, workforce shortages, new technologies, etc.

Indoor elements

Many sustainable design features can be incorporated into health care facility design including energy and water consumption and conservation, nontoxic materials and finishes, sustainable operations and maintenance, as well as environmental pollution control and flexibility & adaptation to climate change. Flexibility is an essential part of the design, since the technologies as well as needs are rapidly changing. Functionality means adaptation to changing needs of users.

Adaptation to climate change (the resilience factor) is of great importance in locations such as Belgrade where a potential for floods, earthquakes and other natural disasters is high. Planning and design shall consider the need to protect the life safety of all health care facility occupants and the potential need for continuing services following such a disaster. For those facilities that must remain operational

[9] Ass. arch Jelena Marić interviewed in this research a total of 100 patients, 50 medical staff members and 3 experts designers, one from the original period of MMA building - which were surveyed through listed criterions. This investigations represent the anex of this research.
[10] Balzareno, D. (1997) *Programiranje, projektovanje i izgradnja bolnica*, Beograd.




in the aftermath of a disaster special design is required to protect systems and essential building services such as power, water, medical gas systems and air conditioning.

Users are naming these factors as significant for their overall experience: air conditioning, amount of natural light and fresh air, easy access to green and open spaces in the hospital complex, internal communications, adequate room equipment and security.

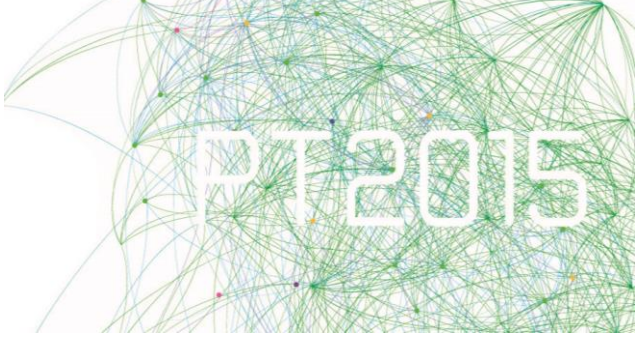
**B. Psychological and aesthetic criteria**

Psychological criteria

Good design in the health care facility starts by recognizing the basic functional needs but does not end there - it must also meet the emotional needs of those who use such facilities at times of uncertainty, dependency and stress.

The psychosocially supportive design or healthy workplace design is one of the biggest challenges for architects and designers. Having a great impact on people's motivation, creativity, state of mind and general well-being it can also influence the physical healing process. This is explained by the fact of synergy: how the individual interprets the perception of stimulation and how one experiences impacts to one's environment[11]. Earlier research in environmental psychology and need has shown that architectural dimensions such as stimulation (intensity, variety, complexity, noise, light, odor, color, crowding, visual exposure, proximity to circulation), coherence (organization, thematic structure, pathway configuration, distinctiveness, floor plan complexity, circulation alignment, exterior vistas), control (crowding, boundaries, climatic and light controls, spatial hierarchy, territoriality, symbolism, flexibility, privacy, depth, interconnectedness, functional distances, focal point, furniture arrangement), and restoration (minimal distraction, stimulus shelter, attraction, solitude) - are closely linked to the perception of psychological well-being or stress.[12] The detailed architectural and interior design philosophy of the hospital needs to start with this feeling of hospitality and of providing a link to nature and the world beyond. The facility design has to provide a safe & comfortable environment and reduce stress and confusion for patients, families, and staff. Natural sounds, especially water have a calming, relaxing effect and effectively mask other undesirable noise. Music, which stimulates the body's release of endorphins and lowers heart rates can have similar positive results. Classical music played in operating suites has been shown to lower patient anxiety and even reduce the need for anesthesia. People are shown to heal faster and feel

[11] Antonosky, A. (1979). Health, Stress and coping: new perspectives on mental and physical well-being. Jossey-Bass, San Francisco.
[12] Dilani, A. (2007)A New Paradigm of Design and Health.




better and are reduced anxiety, naturally comfortable in smaller communities that they can relate to.[13]

Color is an essential element of visual stimulation with well-documented psychological and physiological effects. Warm colors especially when accompanied by high illumination levels have been found to encourage activity, while cool colors promote more passive behavior. Based on this and user experience from MMA hospital we can extrude several indicators for psychological criteria such as: noise, safety, comfort, floor plan complexity, intimacy (acoustic and visual privacy), cleanliness, exterior vistas, fresh air and daylight.

Aesthetic criteria

An aesthetically pleasing facility is a key aspect of the perceived quality of care. Pleasantness of décor could be measured through users' perception of beauty and harmony of building itself, material and textures, colors, landscape / green areas, etc. Good design will create a mental map, which means we can remember architectural environments for long time in our life. Our memory will be triggered to place and design when we see a landmark or attractive design that seems familiar to our attention and mental process.

Facility design and elements of the indoor environment contribute to real and perceived quality of care measurements, as defined by the Centers for Medicare & Medicaid Services (CMS)[14].

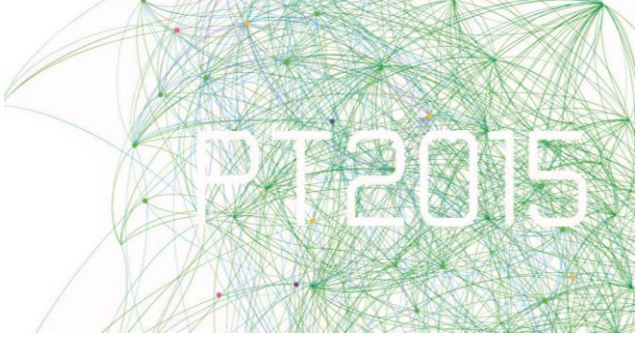
## RESULTS – USERS EVALUATION

In this chapter the results from the users-experience evaluations are analyzed and presented. The research was conducted in two parts. A total of 100 patients, 50 medical staff members and 3 experts were interviewed, which represents over 10% of total patients and employees number. Interviews were semi-structured in the way to learn more about the interviewee's perceptions and beliefs on main advantages and disadvantages of design and their overall experience of the MMA hospital.

### Patients' experiences

Interviewed patients are mainly satisfied with comfort, hygiene, privacy and modern design of the MMA hospital especially in comparison to other healthcare facilities in Belgrade and wider in Serbia. However, as a main problem patients have listed the complexity of floor plan and inner communication, as well as an outdated, confusing and subtle signs for directions. Way finding for patients and

[13] Lombard, J and Brown, S. (2010) Designing for Health and Well-Being, AIA.
[14] http://www.cms.gov/




their families is an uncomfortable and complex challenge. Patients often seek for help from medical staff for directions inside the building, which represent a significant problem for the work of the institution. Although every room has windows offering daylight and a view on green landscape and forest; a significant problem represents a lack of fresh air, places for recreation, connection with nature and access to open green spaces.

**Medical staff experiences**

During the interviews medical staff has shown great emotional connection with the working space and the MMA building in general, due to its aesthetic and functional characteristics but also due to time spent in hospital and the nature of their work. Considering volume of this monoblock hospital system medical staff argued both advantages and disadvantages. One of the main potentials is that this type of hospital has many sectors under the same roof and the fact that patients can solve complex medical problems in one building. On the other hand big capacity leads to many problems like crowding - due to lack of organization in parking lots and inner vertical communication since all employees are arriving to work at the same time. The elevators are shared for medical staff and patients. This is recognized as an important problem especially for staff working at higher floors. Lack of daylight in horizontal communication and long hallways, offices mostly without natural light, lack of oxygen and temperature differences between indoor and outdoor spaces are all stated as factors affecting work efficiency of the staff.

**Expert observation**

Many of specific data used in this research is gathered from experts-engineers working in the Sector for Logistics in the MMA. This sector is charged with providing material and technical support for all organizational units in the MMA, as well as creating favorable conditions for employees and patients. Here are some of the advantages from their perspective: air conditions are using fresh air and providing equal temperatures in whole facility; all tehnical systems are working under proper mechanical maintenance; new technologies are applied in medical treatments and diagnostic procedures; spaces in the building have great flexibility regarding possibility for adaptations and re-use. The experts also name the disadvantages: the complete renovation (needed every 30 years) is currently impossible because of the volume and the capacity of the hospital as well as a poor socio-economic frame; there is a significant shortage in staff for 24/7 maintenance of systems in building; there is an enormous amount of energy consumption thanks to outdated substation, lighting system and heat insulation; as well as significant problems of communications inside the hospital - horizontal and vertical; vast green spaces in the complex of the MMA are not enough put in use, etc.

In the second part of the research a total amount of 50 patients and 50 employees were asked to answer a questionnaire. All level of users were asked to evaluate

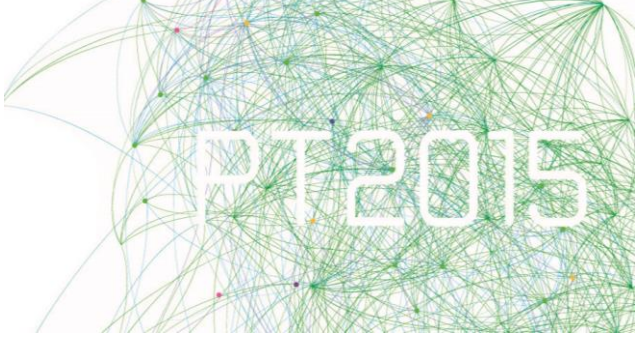
MMA design with a grade from 1 to 5 (1 being the lowest, and 5 being the highest grade) for each criteria, where [15] is based on their own perspective. In the table below (Table 1), all "satisfaction scores" have been presented. These results are showing the critical areas and main problems of the MMA, which are the complex floor plan and inner communications, shortages of fresh air and daylight, great amount of energy consumptions and lack of connection and usage of open green spaces.

**Table 1: List of criteria for assessment and users "satisfaction scores".**

| CRITERIA | SCORES 1-5 | | | CRITERIA | SCORES 1-5 | | |
|---|---|---|---|---|---|---|---|
| **Physical and functional** | patients | staff | experts | **Psychogical and aesthetic** | patients | staff | experts |
| site/location/connections | 4 | 4 | 4 | Human caracter | 4 | 3 | 2.5 |
| parking lots/entrances and acessibility | 3.5 | 3 | 2 | Intimacy (acoustic and visual privacy) | 3 | 3 | 4 |
| greenary and open spaces | 3 | 4 | 5 | Emotional connection | 3.5 | 4 | 4 |
| building capacity | | 4 | 5 | comfort | 4 | 4 | 4 |
| workforce shortages | | 3 | 3 | noise | 4 | 4 | 4 |
| new tehnologies in medical treatments | | 4 | 5 | fresh air and daylight | 2 | 2 | 3 |
| energy consumption | | 2 | 1 | safety | 4 | 5 | 5 |
| water consumption | | 4 | 4 | floor plan complexity | 2 | 4 | 4 |
| nontoxic materials | | | 4.5 | exterior vistas | 4 | 5 | 5 |
| environmental pollution | | | 4 | beauty of the building | 5 | 5 | 5 |
| flexibility | | 4 | 4.5 | harmony | 4 | 4 | 4 |
| adaptation to climate change | | 4 | 4 | material and textures | 4 | 4 | 5 |
| air conditioning | 2 | 2 | 4 | colours | 4 | 4 | 5 |
| natural lighting | 2.5 | 3 | 3 | landscape | 4 | 5 | 5 |
| acess to grean and open spaces | 2 | 3 | 3 | | | | |
| internal communications | 2.5 | 3 | 3 | | | | |
| room equipment | 4 | 4 | 4 | | | | |
| security | 5 | 5 | 4 | | | | |
| Overall user satisfication | 3.2 | 3.5 | 3.7 | Overall user satisfication | 3.7 | 4.0 | 4.3 |

Based on a previously presented research concerning modern principles in health care design and the analysis of interviews and questionnaires we tried to develop a set of specific guidelines for future improvements of the MMA hospital that we wish to present in this chapter. Participants, sharing their perceptions and experiences were also given a chance to present their views and beliefs on possible improvements, that we have also included in our conclusions.

[15] There are some criteria/questions that are specifically made for only one category of users regarding their competence for an adequate answer.



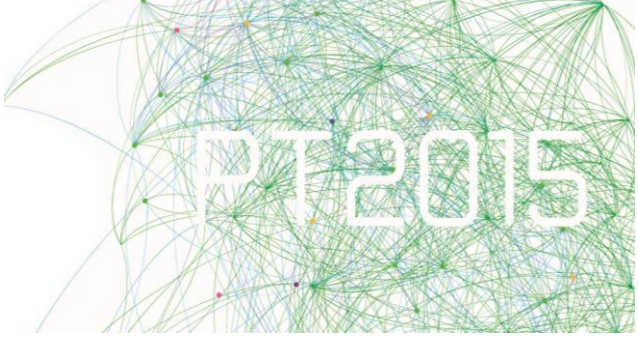

Most of the disadvantages are emerging from the volume of the building itself that affects the general disorientation and hopeless feeling of the patients. While patients state that the floor plan too complex, staff and experts have a different opinion. Perception collides also in the case of the lack of greenery highlighted by the patients but largely ignored by staff and experts. Al three groups are pretty unsatisfied with the poor air conditioning system and the lack of natural lighting. Internal communications are in the greater sense perceived as too long by the group of patients. All three groups perceive the lack of fresh air as main obstacle.

We have also observed the rankings of satisfaction with the humane character of the hospital, visual and acoustic privacy and the emotional connection with the hospital and on a scale from 1-5 it has been ranked with a grade 3. This is where we also see the space for improvements. All of three groups believe there should be an open access to patios in the middle of the building and to greenery – which would be possible only by re-adjusting the landscape design. Finally, security seems to be the best aspect of this building which is rather understandable for a military oriented building with strong hierarchal relations.

## CONCLUSION & GUIDELINES FOR POSSIBLE IMPROVEMENTS

The set of proposal of possible guidelines for improvements of the MMA could be introduced as:

- Reducing energy consumption is possible through several interventions. First, by using new or improved technologies such as replacing old substation, providing heat insolation in every part of the building and implementing new lighting system. Second, through using renewable energy resources such as sunlight. Experts working in the MMA are strongly supporting this idea and are working on improving the possibilities for implementing specific solar panels;
- Providing possibilities for direct usage of fresh air through several interventions: First, window opening in some areas of the building, that could increase the feeling of having a fresh air and increase the level of oxygen in crowded places. Second, releasing fresh air into the entrance halls would reduce the differences between indoor and outdoor temperature caused by constant air conditioning;
- Introducing spaces for different recreational activities that could reduce anxiety and stress of patients and medical staff. We could think of a library or lounge in the nature; or indoors walking area and wellness center. This could be done in the building itself, but also in the outdoor areas of the MMA hospital;
- Providing better and more modern usage of open green spaces that are already a part of the MMA hospital complex;
- Communications inside the hospital are proven to be a big obstacle for patients and families. Rethinking patient flow in hospitals is necessary.




Way finding is much more than signs consequently a stronger management concern for the user's experience is needed, meaning that endless standard signs has to be replaced by more informational, more interactive systems with neon colors. In this case every Clinique would have personal characteristic color which would ease way finding for patients and families not familiar with the hospital organization;

- Redoing time that staff is spending in parking lot and elevators could be dealt in several ways. First employees should be able to enter parking lot without the ticket, and secondly - separate elevators for staff and patients could contribute to reducing crowd problems;
- Implementing strategy for periodical renovation or "floor to floor" renovation could be a possible solution; in the case a complete renovation of the hospital is not possible.

These guidelines could significantly change the overall user's experience in this hospital and could be included into the strategies for development other "monoblock" type hospitals with similar characteristics and surrounding.

As a possible continuation of this study, we foresee research on design interventions that improve safety, workflow, efficiency and time spent in direct care. As a place dedicated to health, a hospital building must first be a healing, life-affirming space that plays an active role in helping patients and their families return to the health status. Hospitals of the future will need to re-adjust to emerging trends: higher patient acuity, shorter stays, and aging patients.

For rational and easier re-adjustment of the MMA facility in the time of crisis, we could think of financial models such as private public partnerships (PPP) funds and organization. In order for this model to be put in use, a strong rule of law and anti-corruption legislation is needed. To wrap this up, patient-centered design is just one side of the coin. Free healthcare from corruption and bribe are equally important parts for human dignity dimension of the health care system.

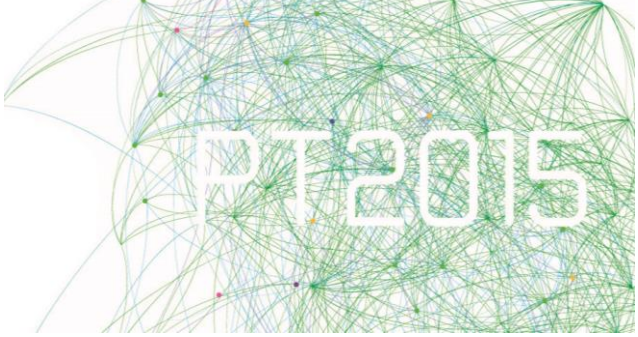
## REFERENCES

Antonovsky, A. 1979. *Health, stress, and coping*. Jossey-Bass, San Francisco.

Balzareno, D. 1997. *Programiranje, projektovanje i izgradnja bolnica*, Beograd, 5-31.

Bozovic - Stamenovic, R. 2010. *Healing Factor in Housing Design for Elderly – Singapore Paradigm for the Future. Design, Technology Refurbishment and Management of Buildings* (IAHS), 227.

Dilani, A. 1999. *Healthcare buildings as supportive environments*. World hospitals and health services: the official journal of the International Hospital Federation, 20-26.




Dilani, A. 2007. *A New Paradigm of Design and Health*.
Accessed March 20, 2015.

Dilani, A. 2008. *Psychosocially supportive design: A salutogenic approach to the design of the physical environment,* Design and Health Scientific Review, 47-55.

Guidelines for the Design and Construction of Health Care Facilities *by the Facility Guidelines Institute, 2010.*
Accessed April 5, 2015, https://tiduteba.files.wordpress.com/2014/06/building-type-basics-for-healthcare-facilities.pdf.

Kliment, S. 2000. *Building Type Basics for Healthcare Facilities*. New York: John Wily & Sons, Inc.
Accessed April 1, 2015, https://tiduteba.files.wordpress.com/2014/06/building-type-basics-for-healthcare-facilities.pdf.

Levin, D. and Joseph, A. 2009. *The center for health Design, Planning, Design and Construction of health Care Facilities*, Second Edition, USA.

Levi, L. 1979. *Psychosocial factors in preventive medicine* in *Healthy people. The Surgeon General's report on health promotion and disease prevention. Background papers. Washington: Government Printing Office*, 207-53.

Lombard, J and Brown, S. 2010. Designing for Health and Well-Being, AIA,
Accessed March 21, 2015, https://www.youtube.com/watch?v=e7mlaiVovFw.

Mens, N., and Wagenaar, C. 2014. *Health care architecture in the Netherlands. Hospitals*, 1750, 12.

Mitrović, M. 2012. *Arhitektura Beograda 1950-2012*, Beograd, JP Službeni glasnik, 137-139.

Shaller, D. 2007. *Patient – centered care: What does it take?*
Accessed March 22, 2015, http://www.commonwealthfund.org/usr_doc/Shaller_patient-centeredcarewhatdoesittake_1067.pdf?section=4039.

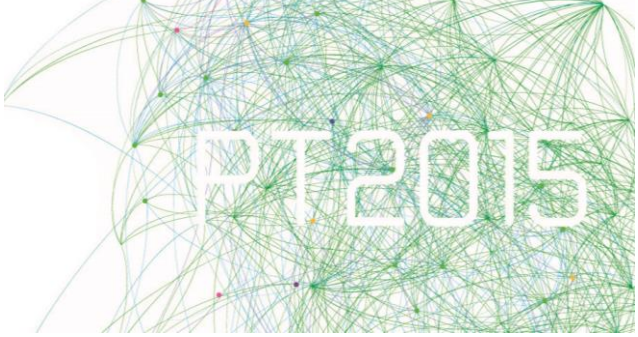
Sprow, R. 2012. *Planning Hospitals of the Future, AIA.*
Accessed March 15, 2015,
https://www.google.rs/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CB0QFjAA&url.

Trivic, Z., Bozovic-Stamenovic, R., & Hee, L. 2009. *The Role of Subjectivity and Seduction in Architectural Design.*

Vodička M. 1994. *Bolnice, Z*agreb, Školska knjiga, 65-129.

Wagenaar, C. 2010. *Architecture and health, Symposium*.
Accessed March 30, 2015, https://www.youtube.com/watch?v=e7mlaiVovFw.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# BUILDING MATERIALS AND HUMAN HEALTH: DESIGNERS' PERSPECTIVE

**Saja Kosanović**[1]
PhD, Assistant Professor, Faculty of Technical Sciences, Kneza Miloša 7, 38220 Kosovska Mitrovica, Serbia, saja.kosanovic@pr.ac.rs

**Alenka Fikfak**
PhD, Assistant Professor, Faculty of Architecture, Zoisova 12, SI-1000 Ljubljana, Slovenia, alenka.fikfak@fa.uni-lj.si

**Mirko Grbić**
PhD, Assistant Professor, Faculty of Technical Sciences, Kneza Miloša 7, 38220 Kosovska Mitrovica, Serbia, mirko.grbic@pr.ac.rs

## ABSTRACT

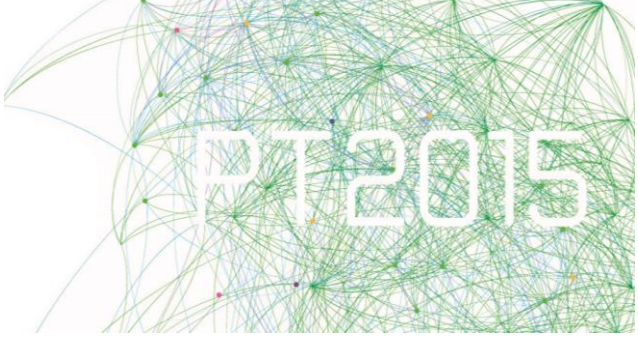
*The materialisation of spacehas always been an important and challenging aspect of design. The demanding designer's task is additionally compounded in recent times by requirements in terms of achievement of overall satisfactoryecological quality and selection of building materials with acceptable ecological characteristics. By defining and proposing the methodology to studying the impact of building materials on human healthfrom designer's perspective and demonstrating its application to various commonly used material categories, as well as by analysing the specific current conditions in the field, this paper aim to identify possible modes for including thehealth-related requirements and concerns into designing equation. The study showed that in current situation, characterised by many aggravating factors, the personal knowledge represents the first and the ultimate support on which adesigner can rely on. On the basis of this conclusion, the possible ways for knowledge development were elaborated in the paper.*

***Keywords**: health hazards, education, material selection, design.*

## INTRODUCTION

Building materials play important role in the achievement of good quality of indoor environment, but the significance is often underestimated; instead, the priority is given to the issues such as ventilation, smoking or thermal comfort. In other cases, the healthy environment is suppressed on account of aesthetically pleasant, energy efficient or economically feasible environment. Harmful effects of materials on human health are, in most of the times, recognized and "accepted" only when an obvious problem occurs; the prevention is rather a consequence than initiative.

[1] Corresponding author




Numerous cases and examples, from the materials containing asbestos, paints containing lead or volatile organic compounds, marble or granite containing radon, to the new and still open case of "malodorous buildings" in the Serbian capital - city of Belgrade, confirm that a designer must consider the impact of building materials on human health with the utmost attention. The main research question is: how can designers properly select building materials in current complex situation, where conditions on the market are rapidly changing, manufactures don't provide the content of produced materials, legal authorities don't give sufficient importance to the issue, and the scientific community doesn't involve in multidisciplinary studies in sufficient scale?

## PROPOSED APPROACHES TO IMPACT DETERMINATION

By arguing that an univocal and universally accepted definition of "green building materials" still doesn't exist, Franzoni (2011) defined two basic characteristics of building materials in regard to their ecological quality: sustainability during the whole life cycle, and impact to human health. Life cycle sustainability is determined by the use of life cycle analysis methodology, where a building material may potentially have negative environmental impact in any phase of life cycle (Jovanović Popović and Kosanović, 2009). In relation to the harmful effects of building materials on human health, many authors take into consideration only those impacts which may occur during the phase of use and maintenance (due to the presence of volatile organic compounds, hazardous fibres, gas radon, etc.). The direct impacts, however, may also occur in other phases of life cycle, meaning that a material affect not just the health of the users of a materialised space, but as well the health of other persons involved in processes related to other life cycle phases, such as of workers engaged in material production or installation. Further on, there is a whole range of those impacts of building materials, occurring again in different life cycle phases, by which the other living world or elements of nature (air, soil and water) will be affected before the negative changes in human health appear. The intricacy of the issue, additionally compounded by the fact that a material which is inert while used may still produce harmful health effects in other phases, indicate that the life cycle based methodology should also be applied when studying the impact of materials on human health, and not just when evaluating the overall sustainability. In conclusion, two basic approaches to studying the impact of building materials on human health are proposed: narrow-scoped, where the properties of a material in regard to human health are investigated, and the wide-scoped approach, where both material properties and the material-related process are investigated. The potential impacts on human health of some commonly used categories of building materials, determined by applying narrow-scoped approach, are shown in Table 1.

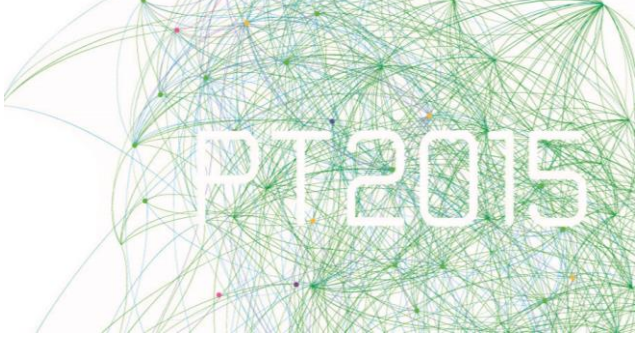
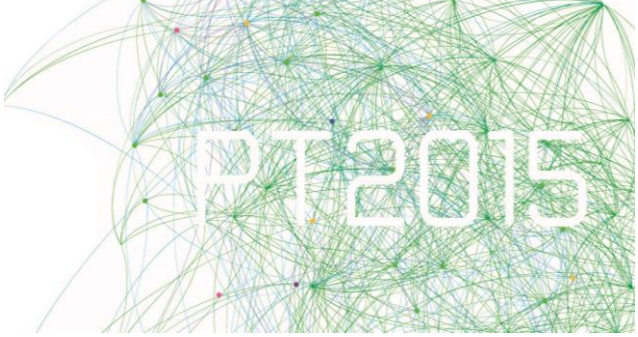



**Table 1: Impact of some commonly used building materials on human health.**

| Material category | Health impact |
|---|---|
| Untreated timber | Negative impact only if affected by bacteria, fungi or insects; otherwise, multiple positive impact |
| Wood-based materials | The use of synthetic binders containing formaldehyde potentially cause irritations, nausea, and carcinogenic effects |
| By-products and waste materials | Present toxic compounds and radioactivity carry many health risks, including the risk of cancer occurrence |
| Natural stone | Negative impact only if contains high percent of free silicone and/or natural radioactive substances |
| Natural-based gypsum | Health risks occur by adding regulators, correctors, or waste materials and industrial by-products, otherwise biologically safe |
| Artificial gypsum | Potentially contains heavy metals and radioactivity, which raise health risks, including the risk of a cancer |
| Cement | Scattering and dust generation, added toxic or radioactive waste materials and industrial by-products raise many health risks |
| Concrete | Joint impact of all included components, increased by use of additives/correctors with volatile organic compounds, toxic or radioactive waste materials and industrial by-products; Biological impact due to the formation of "Faraday cage" |
| Ceramics | Negative impact due to the presence of additives, harmful recycled materials, or radioactivity; otherwise biologically safe |
| Steel | Various risks to workers' health in production of new material, including the generation of dioxins (risk to cancer and damages to respiratory, immunological and endocrine systems) |
| Glass | Production followed by various health risks, while the final product is chemically inert and biologically safe |
| Polyvinyl chloride (PVC) | High risks to workers' health in production of base materials (such as chlorine) and final product, including the generation of dioxins; In use, potentially release phthalates (asthma triggers) and cause biological contamination with moulds |
| Inorganic thermal insulation | Recycled content and mineral fibrous structure generate risks to workers' and users' health (irritations, allergies, cancer) |
| Synthetic paints, coatings and varnishes | Emissions of volatile organic compounds during various life cycle phases: benzene, formaldehyde, toluene, methanol, etc. carry carcinogenic risks |

## DESIGNER'S SELECTION: AGGRAVATING FACTS AND POSSIBLE SOLUTIONS

The above table, generated by extensive literature review and authors' previous work, clearly demonstrates the importance of adequate selection of building materials in design process. In the table, however, only the impacts related to material categories (and not those of specific manufactures) are given. Possible differences in characteristics among materials of the same type, in terms such as manufacturing technology or material content were not taken into the consideration, which already points at possible variations in regard to the health impacts. From the same reason, the use of internationally created data bases with




listed ecological characteristics of materials available in regional/national markets is not considered reliable. To find out the manufacturing process or exact material content is often a difficult task for the designer. In many cases across the Europe, the manufacturers do not provide information about material's characteristics. By investigating Serbian market, for example, Kosanović and Jovanović Popović (2014) concluded that the occasional notes which indicate good ecological performance of a material and which are put on package following the producer's own initiative, most often carrying not more than the advertising message, may lead the designers to wrong selection decisions. Franzoni (2011) reports similar findings from the study of Italian market, with the main exceptions regarding paints, limited regarding composite wood, where the formaldehyde content is reported, and sporadic exception cases of ceramic tiles and bricks products which contain reports on radon emission.

The use of internationally available tools for evaluation of overall ecological quality of a project can neither help the designers to determine the impact of material choices on health, because these are neither adapted to national conditions, nor they include to the full scale the assessment of impacts on human health. Other, independent systems and tools which evaluate the characteristics of building materials are intended more for manufacturers that the designers who, due to the lack of data, can hardly use them.

Existing legislative in the field of impact of building materials on human health contributes to the above described climate. Additionally, national variations in terms of standards, regulation of manufacturing process, indoor air quality and maximum allowed concentrations of harmful substances often limit the application of research results obtained in specific context to other areas. Many published results are derived in laboratory conditions; few are based on the observation of impacts of installed building materials on human health through the time. Even in such cases, the researchers' conclusions often remain unused. New building materials constantly appear in the market; in most of the times, their health-related behaviour is unknown.

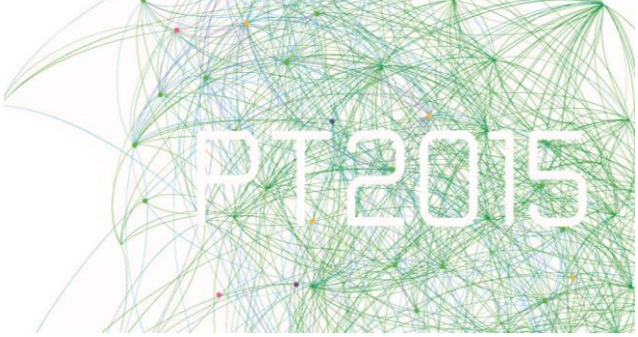
**Education**

Described complex circumstances certainly do not facilitate the designer's decisions in terms of selection of materials with optimal health-related characteristics; in the rather opposite case, the designer, being left nearly alone (Franzoni, 2011), must rely on the own knowledge. The education, hence, seems the best "available" current solution. "Through knowledge gaining, abstract vision is transforming into defined reality, and this transformation leads towards sustainable development" (Kosanović and Folić, 2014). Peer reviewed papers and books appear as the only referent published sources from which the professional designers may educate themselves, even though there is a general noticed lack of integration of several, for designer equally important issues: design, building

materials, and impact on human health. Therefore, the knowledge base, briefly presented in Table 1, may further develop, by using the described narrow-based approach, in a direction determined by specific material option and respective available research results. In a better case, the designer will also be able to establish the communication with a material manufacturer, in order to obtain necessary information and finally make correct choice.

The education of future professionals allows for a more comprehensive approach to learning about material-health relations. Among various pedagogical formats, the practical work in a form of design-built workshop supported by theoretical lectures on the issue, accounts for the most effective method of learning about materials in general. Characterized by limited duration and intensive work on specific problem, the workshop seems to be the ideal method for concentrating on a narrow scope of interventions (Fikfak, 2012). Students in the workshop acquire deeper understanding about the nature of building materials, which exactly was the goal of the design-build workshop organised by Faculty of Architecture in Ljubljana in April 2015. "Working with stone" workshop (Figure 1), as a part of Drago did project, is one in a series of workshops in Croatian Dalmatia dedicated to the construction of dry-wall structures made of local stone, earth and sand, and without the use of cement, metal, or synthetic additives, coatings and varnishes.

**Figure 1: Students during the workshop "Working with stone" (author: Alenka Fikfak).**




## CONCLUSIONS

Ideally, the designer would have at disposal the information about the ecological quality of every specific building material available on market, including those related to describe narrow-ranged and wide-ranged impacts on human health. In this imagined situation, characterised by significantly improved overall conditions, the selection of building materials during the design process would be significantly facilitated. In present context, oppositely, the selection of building materials for designer resembles a task which cannot be completed with full success. It may be said that all stakeholders involved in design and construction processes share the responsibility for the present state characterised by general low awareness. The education based on personal engagement of a designer represents the only reliable solution for current unfavourable state in the field. Proposed narrow-scoped approach to studying the impact of building materials on human health aims to set the knowledge base which will further develop in a direction determined by specific material consideration and respective available research results. The integration of research methodology with designers' perspective on materials in published sources, that for a time being are two completely separated topics, would certainly bring benefit to better understanding of the complexity of issue, i.e. to the more correct material selection.

## REFERENCES

Fikfak, Alenka. 2012. "Workshops as a Form of Empirical Learning: Researching the Term "Sustainable Development"". In *The Creativity Game: Urban Design Workshops, Urban Architectural Workshops and Spatial Planning Workshops*, edited by Gabrijelčič, Peter, and Fikfak, Alenka, 41-7. Ljubljana: Faculty of Architecture.

Franzoni, Elisa. 2012. "Materials Selection for Green Buildings: Which Tools for Engineers and Architects?" *Procedia Engineering* 21: 883-90.

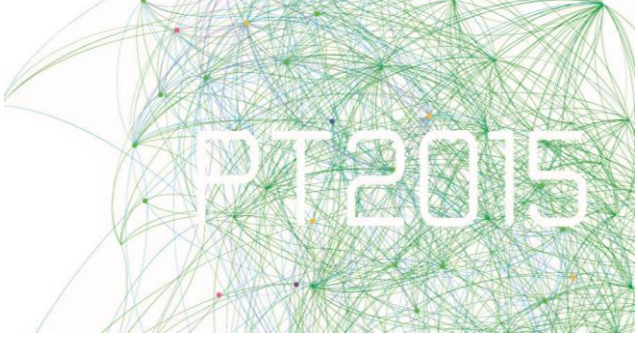
Jovanović Popović, Milica, and Kosanović, Saja. 2009. "Selection of Building Materials Based upon Ecological Characteristics: Priorities in Function of Environmental Protection". *Spatium* 20 (September): 23-7.

Kosanović, Saja. 2009. *Ekološki ispravne zgrade - uvod u planiranje i projektovanje*. Beograd: Zadužbina Andrejević.

Kosanović, Saja, and Folić, Branislav. 2014. "Reviewing the Sustainability in Students' Design Work". In *Book of Proceedings of the Scientific Meeting on the Topic of Urbanism, Ljubljana, University of Ljubljana, Faculty of Architecture, 19-21 June 2014*, edited by Fikfak, Alenka, 117-24. Ljubljana: Faculty of Architecture.

Kosanović, Saja, and Jovanović Popović, Milica. 2014."Ecological Assessment of Building Materials in Serbia: Constrains and Possibilities".*The New Arch* 1, no. 1: 51-8.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# TOWARDS A NEW UNDERSTANDING OF HEALTHY PLACE

**Saja Kosanović**[1]
PhD Architect, Assistant Professor, Faculty of Technical Sciences, Kneza Miloša 7, 38220 Kosovska Mitrovica, Serbia, saja.kosanovic@pr.ac.rs

**Eva Vaništa Lazarević**
PhD Architect, Full Professor, Faculty of Architecture, Bulevar Kralja Aleksandra 73, 11000 Belgrade, Serbia, eva.vanistalazarevic@gmail.com

**Slađan Timotijević**
PhD, Primarius Doctor of Medicine, Clinical Hospital Centre "Bežanijska kosa", Bežanijska kosa, bb, 11080 Belgrade, Serbia, sladjant@open.telekom.rs

## ABSTRACT

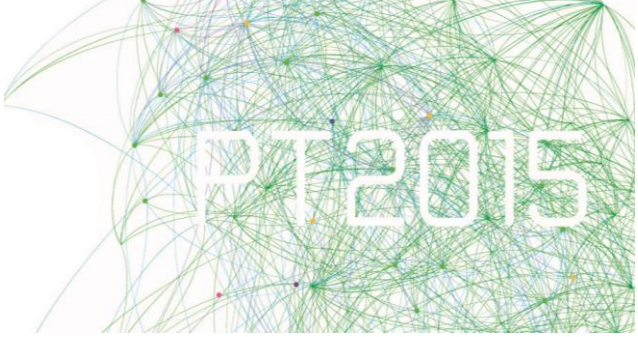
*By adopting and applying medical approach to health and unhealth conditions, medical definitions and terminology, as well as the research methodology based on logical argumentation, comparative analyses, scientific description and comprehensive literature review, this paper investigates the impact of a place on individual user. In order to achieve the main research aim that is to propose a new understanding of healthy place, several specific objectives were set and fulfilled, such as the identification of determinants of place in regard to health and the identification of types of impact of a place on health potential. It was concluded that a healthy place, in order to be named as such, should at least prevent the occurrence of sickness, while health-promotive and healing places are characterised by additional, upgraded qualities.*

*Keywords: health, unhealth, healthy, health-promotive and curative places.*

## INTRODUCTION

Different authors today indicate the necessity to reformulate the rooted definition of health, established for the occasion of constitution of the World Health Organisation (WHO, 1946). Bircher (2005), for example, considers health as a "dynamic state of wellbeing characterised by a physical, mental and social potential, which satisfies the demands of a life commensurate with age, culture and personal responsibility". The definitions of conditions which are contrary to health are also elaborated in the literature. Marinker (1975) described three possible manifestations of the "unhealth": disease, illness and sickness. The disease is pathological process, most often physical, sometimes undetermined in origin, but

[1] Corresponding author

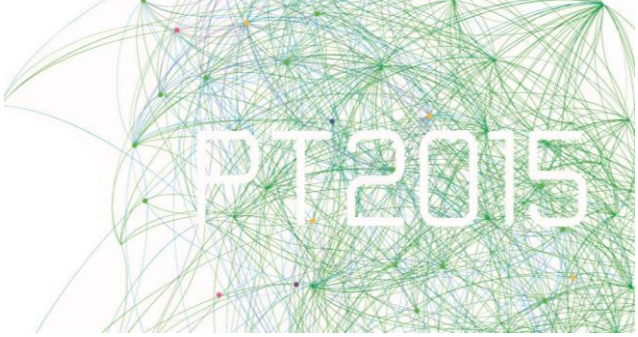



always identified by some deviation from biological norm. The illness is a feeling, unique experience of unhealth condition with its physical, psychological, social and cultural aspects (Marinker, 1975; Helman, 1981; Green et al., 2002); it often accompanies disease, although the disease may be undeclared. In some cases, the illness exists where no disease can be found, which leads to the difficulties in treatment (Eisenberg, 1977). Illness-based approach allows physicians to refocus on the patient-centred experience of illness (Green et al., 2002). "The third mode of unhealth is sickness. If illness is interior and personal mode for the patient, sickness is the external and public mode of unhealth. Sickness is a social role, a status, a negotiated position in the world, a bargain stuck between the person henceforward called "sick" and a society which is prepared to recognize and sustain him" (Marinker, 1975). The sickness is also understood as a concept which combines the biomedical model (disease) with the socio-cultural context of the patient (illness) (National Center for Cultural Competence, no date). The health is, therefore, also what individuals create with their families, schools, communities and workplaces, in the parks and playgrounds; it is the air people breath, water they drink and choices they make (Alberta Government, 2014).

## PLACE AND HEALTH - DETERMINANTS AND IMPACT

Terminological determination of the spatial-time concept which people create, use and in which they maintain, improve or degrade physical, social and mental health status vary in different sources, so that there exist various descriptions of the relationship between: built environment and health, built space and health, or place and health. According to Tuan (1979), buildings and cities are places because they can organise space into centres of meaning. As the "meaning" is crucial for understanding of certain aspects of health and wellbeing, such as emotional or spiritual, the term "place" seems to be the most appropriate for studying the effect of complex multidimensional frame on individuals.

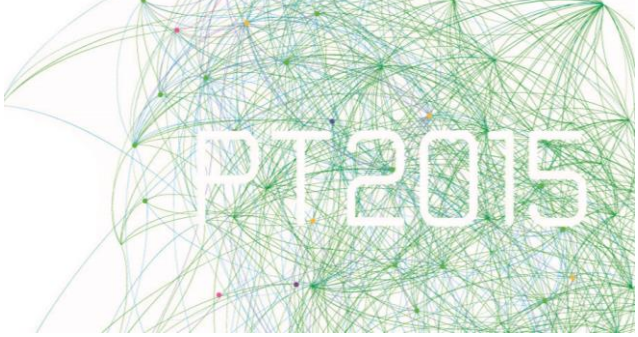
*The determinants of place in regard to health*, as elaborated in this paper, are those characteristics of a place that are significant for studying the effects on the health of individual user. Based on logical argumentation, analyses and comprehensive literature review, a series of determinants of place in regard to health were defined. Parallel, three basic types of impact on health potential were set, according to Bircher's definition: physical, mental and social. It was noted that identified characteristics of place rarely impact just one aspect of health and that not all types of responses occur at the same time, because of which the difference between predicted first and the secondary - postponed or indirect reaction(s) was made, as presented in Table 1. Nonetheless, the individual sensitivity or resilience may influence the occurrence of variations among different users of a same place, i.e. of presented order of occurred effects. Cultural differences between the places account for the additional factor which may stimulate alterations (especially in domain of social aspect of health). Presented list and order, therefore, may be




viewed as general, based on commonly recognized interrelations between the conditions of place and health manifestations.

**Table 1: Determinants of place and impact on health.**

| Impact | Determinants of place in regard to health |
|---|---|
| Variable | Conditions at location in which a place is "set" |
| Variable | Resilience of place/Preparedness for disaster |
| MS | Residential density |
| MS | Built space typologies and distribution of physical structures |
| PM, S | Land use and spatial organisation |
| PM, S | Incorporation of nature contact (Frumkin, 2003) into built tissue |
| P, M | Air, water and soil quality |
| P, M | Allergens and other biological contaminants |
| M, S | Municipal noise |
| P, M | Accessibility to other places/facilities, especially to health care services |
| P, S | Transportation |
| PM | Walkability and bicycle use |
| P | Infrastructure |
| M, S | Open space design and dimensioning |
| S, M | Common space design |
| S, M | Social life and common activities |
| PM | Green space design and dimensioning |
| PM, S | Sports/recreation and other spaces for physical activity enhancement |
| M, SF | "Intended" spaces (e.g., healing corners, educative spaces or child care community places) |
| M, S | Spatial equipment |
| P, M | Safety in relation to injury/accident occurrence |
| PM | Ease of moving |
| Variable | Safety in relation to crime, violence and social disorders |
| M | Flexibility and adaptability of the design |
| S, M | Social structure, justice and inclusion |
| S, M | "Third places" (Manuel and Thompson, no date) introduction |
| PM | Actions and programmes for health promotion (healthy lifestyle, nutrition, obesity, physical activity, substance abuse, targeted or future predicted (e.g. Davies, 2015) sickness prevention, etc.) |
| S, M | Promotion of positive social values and relations |
| M, S | Image of the place: aesthetics/attractiveness/identity/diversity |
| M, S | Perception of the place (pleasant, attaching, hoping, supportive, healthy, happiness enhancing, etc., vs. depressive, dark, cold, strange, etc.) |
| M | Scent of place as memory trigger |
| M | Capacity of place for support in emotional crisis and the stress absorption |
| M | Spiritual dimension of the place |
| PM, S | Hygiene |
| PM | Indoor environmental quality (including comfort aspects) |
| P | Chemical content of construction materials |
| PM | Quality of construction |
| Abbreviations: P- physical health; M - mental health; S - social health. | |



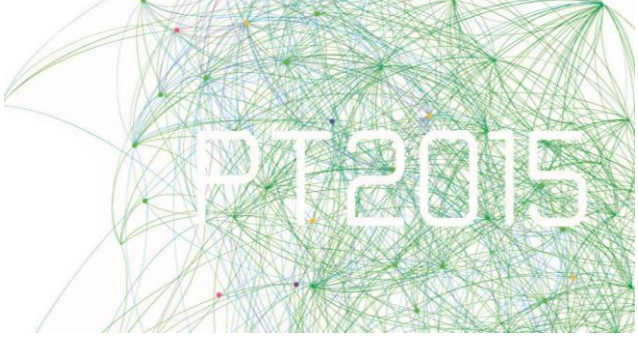

## DEFINITION AND CATEGORISATION OF HEALTHY PLACES

The medicine is commonly described as the science and practice which deals with sickness prevention, diagnosis and treatment. Especially in recent time, the health sector also pays a lot of attention to the health promotion - usually through various actions and programmes achieved in cooperation with other, non-medical bodies and institutions. Accordingly, the preventive, promotive, and curative potential of a place represent specific research subjects of this paper. However, the power of a place to cause the appearance of "unhealth" of its users should neither be underestimated; it is, therefore, also needed to investigate how can a place contribute to the appearance of sickness. In conclusion, the healthy place, in order to be named as such, should own one of the three identified qualities: basic – preventive, promotive, or enhanced - curative.

Every human activity has a recurrent effect. People create and use places; in return, the places impact people and influence their physical, social or mental health and wellbeing. There are many worldwide examples and references (for example, Smyth, 2005) which, from a wide range of reasons, indicate that not all places are healthy. The unhealth of individual user comes as the result of weak quality of one or more of determinants of place. Tangible aspects of a place, such as its physical (material) quality, or ecological parameters with the set indicators, allow for easier identification of relation between the cause and the sickness, although the issue hasn't been sufficiently explored to-date. On the other hand, in those cases in which a place provokes illness without straightforward connection with the classified disease, the detection of a cause appears as more complex task. A wide range of qualitative, intangible, social and psychological factors which influence in worse the health of individuals are still waiting to be scientifically explained. Additional aggravating circumstance is represented by subjective experience and individual sensitivity, resistance or weakness.

Healthy place prevents the occurrence of sickness of its users and is, as such, characterised by the absence of the main recognized health risks. In order to avoid confusion, misuse of the terms, production of unstable concepts and theories, and easy assignment of the label "healthy" to a place which doesn't own sufficient quality, it is necessary to develop the evaluation system and to set the conditions - criteria, including the lower threshold of a healthy place, by taking into consideration present cultural context.

Health-promotive place promotes good health for all people, quality of life, healthy personal development and healthy behaviours for all social groups. In more particular terms, health-promotive place contributes to the achievement of longevity, well-being, satisfaction and happiness. Clearly, health-promotive place has embodied the well-defined social programme, while at the same time it owns




adequate physical qualities inspiring enough to provoke positive life-style (changes). It is a place of users who are educated and have developed skills to improve and maintain their good health and well-being.

Gesler (1992) elaborated the concept of therapeutic landscapes - the geographic metaphor for aiding in the understanding of how the healing process works itself out in places. Indeed, the built component of a place, with its physical and chemical properties cannot (yet) be curative. Except for the brownfields and other devastated landscapes, the empty space cannot be less healthier than the built one. But the content of a place, its social, symbolic and psychological component, or natural benefits, may have the healing power. The question raised by Manuel and Thompson (no date): "Who makes places, really?", actually points at some healing potential of a place.

## CONCLUSIONS

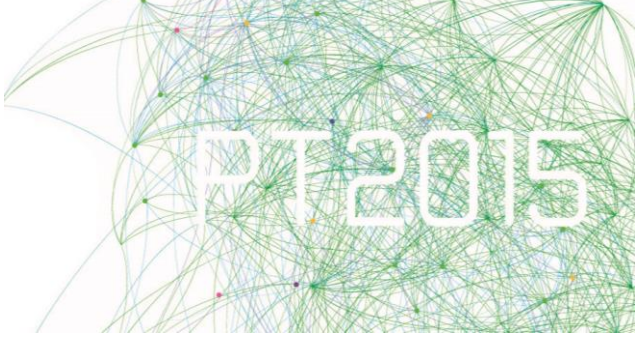
The proposed approach to healthy place understanding allows for better elaboration of the complexity of issue as well as for further work on the formation of criteria and indicators based on which the evaluation of places in regard to their impact on individual health may be conducted. Nonetheless, it should be noted that the cultural component of specific spatial sample could cause shift in given order of health responses, especially in domain of social health, which is why it is necessary to study healthy places on regional or even local scale. According to the given list of determinants of place in regard to health, it may be concluded that the right scale of a healthy place actually is the neighbourhood. Besides including socio-cultural dimension as a variable in healthy place equation, the time factor, i.e. the time relations between the design, implementation and change of overall conditions represent another important issue for consideration. Transformative nature of a place in time, therefore, needs to be taken into account while designing new or reshaping for improvement the existing places. Individual architectural-urban interventions and their joint composition possibly produce negative impact on every type of health potential - physical, mental or social; on the other side, when it comes to the improvement of health conditions, the meaning of a healthy place from the perspective of spatial designers is rather understood as intangible concept.

## REFERENCES

Alberta Government. 2014. "Alberta's Strategic Approach to Wellness. Health for All... Wellness for Life". Accessed April 3, 2015. http://www.health.alberta.ca.

Bircher, Johaness. 2005. "Towards a dynamic definition of health and disease". *Medicine, Health Care and Philosophy* 8: 335-41.

Davies K.D. Wayne. 2015. "Healthy Cities: Old and New Solutions". In *Theme Cities: Solutions for Urban Problems* edited by Wayne K.D. Davies, 477-531, GeoJournal Library.




Eisenberg, Leon. 1977. "Disease and illness. Distinctions between professional and popular ideas of sickness". *Cult Med Psychiatry* 1, no. 1 (Apr): 9-23.

Frumkin, Howard. 2003. "Healthy Places: Exploring the Evidence". *American Journal of Public Health* 93, no. 9: 1451 - 6.

Gesler, M. Wilbert. 1992. "Therapeutic landscapes: medical issues in light of the new cultural geography". *Soc Sci Med* 34, no. 7: 735 - 46.

Green R Alexander, Carrillo J Emilio and Betancourt R Joseph. 2002. "Why the disease-based model of medicine fails our patients". *West J Med.* 176, no. 2 (Mar): 141 - 3.

Helman, G Cecil. 1981. "Disease versus illness in general practice". *J R Coll Gen Pract.* 31, no. 230 (Sep): 548 - 52.

Manuel, Patricia, and Thompson, Kate. No date. "The Role of Third Place In Community Health and Well-being. A summary of research findings from a pilot project to document, define and understand the importance of Third Place in a suburban Halifax, NS neighbourhood". Accessed on March 10, 2015. http://www.cuhi.utoronto.ca.

Marinker, Marshall. 1975. "Why make people patients?" *Journal of Medical Ethics* I: 81 - 4.

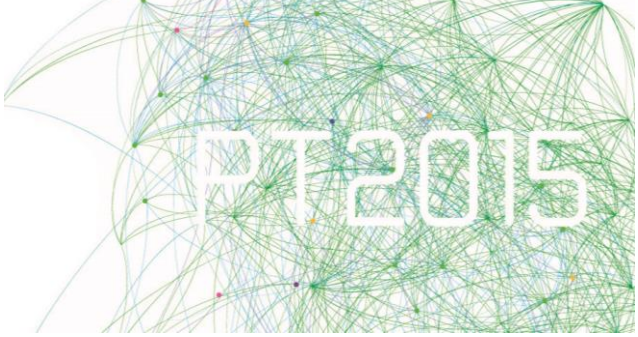
National Center for Cultural Competence. No date. "Towards a Biophysical-Spiritual Model of Health". Accessed on March 16, 2015. http://nccc.georgetown.edu/body_mind_spirit/definitions_health_sickness.html.

Smyth, Fiona. 2005. "Medical geography: therapeutic places, spaces and networks". *Progress in Human Geography* 29 no 4: 488 - 95.

Tuan, Yi-Fu. 1979. "Space and Place: Humanistic Perspective". In *Philosophy in Geography. Theory and Decision Library / Volume 20* edited by Gale Stephen, and Olsson Gunnar, 387-427. D. Reidel Publishing Company.

World Health Organisation Website. Accessed on March 16, 2015. http://www.who.int.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# ENVIRONMENTAL FEATURES OF BUILDING MATERIALS OF TRADITIONAL OHRID HOUSE AND THEIR CONTRIBUTION TO ITS HUMAN DESIGN

**Radmila Tomovska**
PhD student, Teaching Assistant, Facility of Architecture, MIT University, Bulevar Treta Makedonska Brigada 69, Skopje, Republic of Macedonia, radmila.tomovska@mit.edu.mk

**Ana Radivojević**[1]
PhD, Associate Professor, Faculty of Architecture, University of Belgrade, Bulevar Kralja Aleksandra 73/II, Belgrade, Serbia, ana@arh.bg.ac.rs

## ABSTRACT

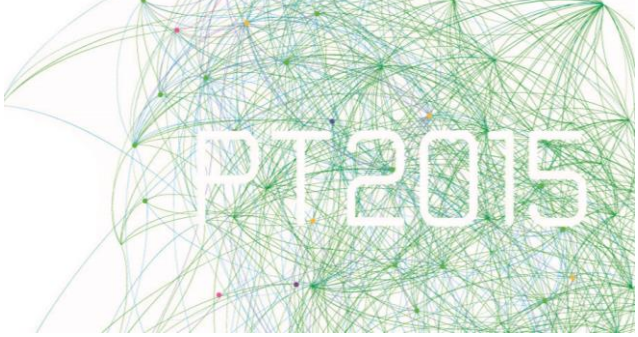
*Selection of materials for the construction of a house can significantly affect the extent to which it will be characterized as a "healthy home". Having this in mind, the paper discusses the environmental impact of applied building materials in the case of a traditional Ohrid house which was selected as a representative of vernacular architecture in the Balkan region. Respecting the principle of relying on local resources which is a characteristic of vernacular architecture, materials used for the construction of Ohrid houses are natural, non-toxic, most of them are organic, and none of them causes environmental pollution during the deconstruction, i.e., does not threaten its natural course.*

*Consideration of the impact of building materials on the environment emphasizes the positive characteristics of selected natural materials as well as sustainable character of building principles of Ohrid masters. The following criteria were analysed: the amount of energy embodied in the particular material; the use of natural materials; locally produced building materials; use of durable materials; level of toxicity; recyclability; waste minimization; reuse of materials and the biodegradability of materials.*

*The aim of this paper is to point out that the principles of environmentally responsible construction applied on the case of the Ohrid vernacular architecture are timeless guidelines in construction of healthy and sustainable architecture. The established character of being ecologically friendly and healthy which is typical for applied materials on selected examples of vernacular architecture, offers the opportunity for a review of sustainable strategies that are used for several centuries, but still keep their significance in contemporary sustainable practices and environmental design.*

***Keywords**: traditional Ohrid house, natural materials, non-toxic materials, low-embodied-energy materials, biodegradability.*

[1] Corresponding author




## INTRODUCTION

Sustainable construction is defined as "the creation and responsible management of a healthy built environment based on resource efficient and ecological principles" (SABD, 2002). Careful selection of environmentally sustainable building materials is the easiest way for architects to start with incorporation of sustainable design principles in buildings. Having this in mind, the issue of the use of materials is increasingly being observed through their ecological aspect, i.e. their environmental profile. This term represents a method for identification and assessment of environmental impacts associated with building materials, covering various aspects of interaction between a material and the environment: embodied energy and pollution, waste generation and recycling possibilities, but also the issue of energy conservation and energy efficiency (Jong-Jin and Righton, 1998). Negative environmental impact can be mitigated through the use of sustainably harvested building materials and finishes, materials with low toxicity in manufacturing and installation, as well as through reuse or recycling of building materials (SABD, 2002).

The principles of Life Cycle Design provide important guidelines for the selection of building materials (Jong-Jin and Righton, 1998) since the environmental impact of each step of the manufacturing process is examined -from the extraction of raw materials, manufacture, distribution, and installation, till the ultimate ending in a form of reuse, recycling or disposal. Material's life cycle could be observed into three phases: Pre-Building, Building, and Post-Building (Jong-Jin and Righton, 1998) that correspond with the life cycle phases of the building itself. Evaluation of an environmental impact of a building material at each stage enables creation of a healthy built environment, based on resource efficient and ecological principles. The objective of this paper is to identify an environmental impact of building materials that were applied in the Ohrid vernacular architecture in all three phases of material's life cycle. The study was conducted through the following steps: elaboration of the basic characteristics of the traditional Ohrid house, followed by identification of applied building materials as a direct object of this research. Finally, the generally accepted sustainable qualities of building materials were presented as criteria for determination and elaboration of "green features" of analysed building.

## BASIC CHARACTERISTICS OF THE TRADITIONAL OHRID HOUSE

The term Ohrid's vernacular architecture refers to the traditional secular architecture of the town of Ohrid represented by the traditional, Ohrid house. This house can be characterized as a regional variant of the Ottoman type of urban house with specific indigenous characteristics, which are specifically related to the spatial plan and structural details. The Ohrid region has a Mediterranean - continental climate, which imposed that this house is organized in two parts – a winter and a summer apartment (Чипан, 1982). Even though the buildings form a very dense

urban matrix, every house enjoys plenty of sunshine, fresh air, and a beautiful view (Fig. 1).

**Figure 1: House of the Robev family and part of the house Uranija (left),Traditional Ohrid houses along the street St. Sofija (right).**

The traditional Ohrid house is constructed from various traditional building materials, presented and described in Table 1. Two main building materials - stone and wood, were applied in the two constructive systems: massive stone masonry - lower part of the house representing the winter apartment, and a light wooden structure, the so-called *bondruk* system -upper parts of the house representing the summer apartment (Хаџиева Алексиевска, 1985). In that way the house responses in the best way to the climate conditions during the year (Чипан, 1982).

**Table 1: Building materials of traditional Ohrid house.**

| **Type of building material** | **Origin, basic characteristics of the material and its application on the Ohrid house** |
|---|---|
| **Stone** | untreated (crushed) and/or treated stone blocks, excavated from the immediate surroundings or from the local quarry;<br>the treated stone blocks originated often from previous buildings and monuments from the site; |
| **Wood** | beech or fir wood from the immediate surroundings; |
| **Mud mortar** | the most common binder of the stone walls; |
| **„Čok“ plaster** | traditional plaster applied to the exterior surfaces of the *bondruk* wall;<br>made of hydrated lime, fine sand, offcuts of timber, and straw or animal fibber; |
| **Lime based plaster** | traditional plaster applied to the interior surfaces of the *bondruk* wall;<br>made of hydrated lime or dry pulverized lime, river sand, and a small amount of a material with pozzolanic features (ground volcanic stone, powder dust from clay tiles or pozzolanic earth); |
| **Glass** | glass commonly used at the territory of the Balkans in the 19$^{th}$ and at the beginning of 20$^{th}$ century; |
| **Clay tiles** | made of clay from the immediate surroundings; |

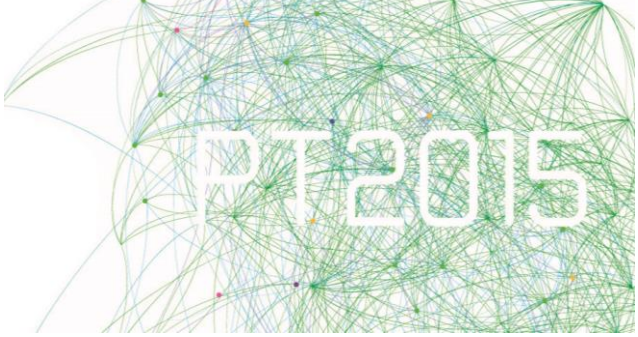
The massive system was constructed of stone walls, built of stone blocks and bonded with mud which was the most common binder, although there are examples where lime mortar was also applied. It represented a very durable structure. On the other hand, the *bondruk* wall which was constructed of basic timber frames consisting of post and beam structures with trusses or braces supporting at the corner points. This type of timber frames was widely applied, since it allowed the houses to be built quite quickly and the timber material did not have to be of a top quality (Radivojević et al., 2014). One of the peculiarities of the Ohrid house is the *bondruk* wall itself - 18 cm thick wall. Such wall, which is a combination of two layers of wooden-frame walls and an intermediate air layer represents a very light construction with good insulating properties.

## THE SUSTAINABLE QUALITIES OF THE ANALYSED BUILDING MATERIALS

Three groups of criteria are identified in this research on the basis of material's life cycle. They are used in further analyses in order to determine and compare environmental or "green" features of the building materials used for construction of the traditional Ohrid house (Table 2) that represent sustainable qualities of a particular material that was designed, manufactured, and applied with environmental considerations (Jong-Jin and Righton, 1998). The presence of one or more of "green features" in a building material can assist in determining its relative sustainability.

**Table 2: Sustainable "Green" Features of Building Materials of Ohrid Traditional House.**

| **Material's life cycle phase** | **Criteria** | stone | wood | clay tiles | earth (mud) | čok plaster | interior plaster | glass |
|---|---|---|---|---|---|---|---|---|
| **Pre-building phase: Manufacture** | waste reduction | + | + | | + | + | + | |
| | pollution prevention | + | + | + | + | + | + | |
| | recycled content | | | | | + | + | |
| | embodied energy reduction | + | + | + | + | + | + | |
| | use of natural and/or naturally based materials | + | + | + | + | + | + | + |
| **Building phase: Use** | reduction in construction waste | + | + | + | + | + | + | |
| | use of local materials | + | + | + | + | + | + | |
| | energy efficiency | + | + | | | | | |
| | use of non-toxic or less-toxic materials | + | + | + | + | + | + | + |
| | durability | + | | + | | | | + |
| **Post-building phase: Disposal** | reusability | + | + | + | | | | |
| | recyclability - hypothetically | | + | + | + | | | + |
| | biodegradability | | + | + | + | + | + | |




The organic material basis of the house, as well as its characteristics of biodegradability, reveal a natural cycle of these buildings. The use of local, natural, non-toxic, and biodegradable materials enables a comfort in the quality of life during the whole lifecycle of the building. In many cases materials were obtained locally, even at the building site itself. Natural materials used in the example of the Ohrid house are lower in embodied energy and toxicity, in comparison with man-made materials. They required less processing and are less damaging to the environment. Their biodegradable feature enables saving energy in the process of disposing of the construction waste in the post-building phase.

Application of durable materials with low maintenance requirements represent another sustainable feature detected in the example of the Ohrid house. The ground floor of Ohrid house is built from treated and untreated blocks of stone, which is a material that is well-known for its durability. The applied treated stone was usually in form of a stone capital, part of tombstone, etc. It originated from the 6$^{th}$ till 9$^{th}$ century and in 18$^{th}$ or 19$^{th}$ century was incorporated into the massive walls of Ohrid houses (Н.У. Завод и Музеј Охрид, 2010). Unlike the stone, wood cannot be characterized as durable material. However, in the example of Ohrid traditional house beech wood from the immediate surroundings, which is hard and durable, was the most commonly used wood type. A significant ecological feature observed in the Ohrid house is the way the wood is protected and its life extended. Wood protection consisted of natural resources, such as: vinegar, oil, wax and tar (Чипан, 1982). They are non-toxic, eco-friendly products, while today, most commonly used materials for wood protection are chemical coatings that are often toxic and significantly more expensive than the natural materials.

From today's point of view, the materials implemented in the traditional Ohrid house (such as wood, clay tiles, and glass) can be easily dismantled, sorted into common groups of materials, and recycled. Some of the materials used in the construction of Ohrid house posses the so called recycled content feature of a building material. In the analysed case, the traditional plasters applied to the interior and exterior surfaces of the *bondruk* wall of Ohrid houses can be characterized as materials produced partially from construction waste.

## CONCLUSIONS

It can be concluded that the identified "green features" implemented on the analysed case that are in correlation with the contemporary defined sustainable "green" features of building materials. Saving energy and resources were the primary goals of the master-builder of the traditional Ohrid house. The economy and rationality, as important virtues of the master builder, contributed in a large extent to finding smart solutions with regards to on-site waste minimization. Even in the pre-building stage, i.e. in the very process of design and the organic perception of architecture, the basic, conceptual foundations of the modern sustainable architectural design could be traced. The use of standard dimensions

and the modular coordination in the design process (Хаџиева Алексиевска, 1985) allowed reusability of the elements of construction and finalization. Implementation of this sustainable strategy, the so-called design for reuse (Jong-Jin and Righton, 1998) reveals the relevance of the concept of this vernacular architecture for the modern, sustainable practice. This kind of building cycle represents a perfect form of circulation of the material that is in a good shape, so the use of new raw materials and resources is kept to a necessary minimum.

The use of non-toxic materials for the construction of buildings is vital to the health of construction workers and the user house. Local, natural and non-toxic materials (stone, wood, earth, sand, pozzolana, gravel, animal hair, straw, brick and glass) representing the material base of Ohrid houses are responsible for a healthy indoor environment ecological house. Applied organic materials are biodegradable, so during the deconstruction they do not pollute the environment.
From the results of presented analyses one can assume that the sustainable architecture is not derived just from the application of the latest technological advances to reduce negative impact of buildings on the environment, but it is also achieved by a simple application of local materials and building techniques, good site planning, smart management of the building materials and environmentally conscious design. It is believed to be the solution for creating healthy, ecological and timeless architecture. This is also a strong argument for the significance of the protection and conservation, not only of this particular type of traditional house, but of vernacular heritage in general.

## REFERENCES

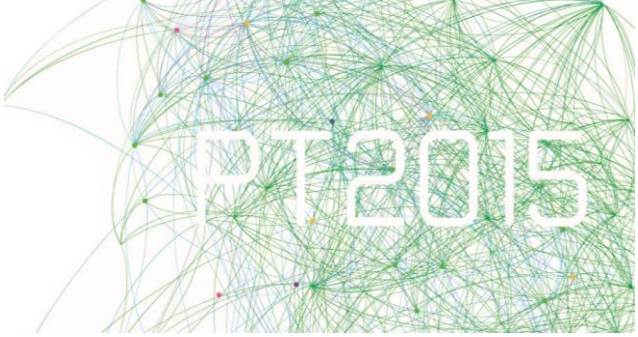
Jong-Jin Kim and Brenda Righton. 1998. *Sustainable Architecture Module: Qualities, Use, and Examples of Sustainable Building Materials.* Michigan: National Pollution Prevention Center for Higher Education, College of Architecture and Urban Planning, The University of Michigan.

Н.У. Завод и Музеј Охрид. 2010. *Елаборат за ревалоризација на стариот дел на градот Охрид*. [Study on the revalorization of the old part of the town of Ohrid] Охрид: Н. У. Завод за заштита на спомениците на културата и Музеј-Охрид.

Radivojević Ana, Mirjana Roter Blagojević and Aleksandar Rajčić. 2014. "The issue of thermal performance and protection and modernization of traditional half-timbered (*bondruk*) style houses in Serbia." *Journal of Architectural Conservation* 20-3: 209-225.

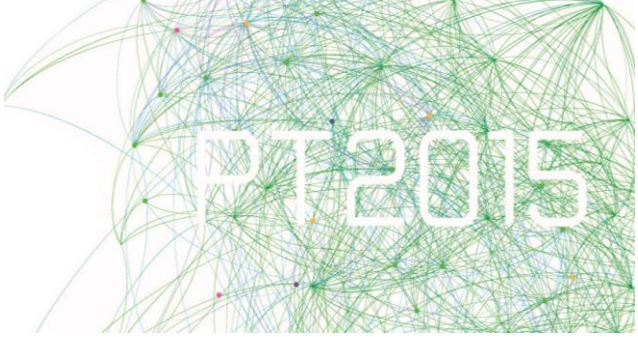
Sustainable Architecture and Building Design (SABD). Last modified August 10, 2002. Accessed November 24, 2009. http://www.arch.hku.hk/research/BEER/sustain.htm/

Хаџиева Алексиевска Јасмина. 1985. *Мерки, Антропоморфност и модуларни пропорции кај старата македонска куќа*. [Measures, Anthropomorphism and modular proportions in the old Macedonian house] Скопје: Студентски збор.




Чипан Борис. 1982. *Старата градска архитектура во Охрид*. [The old urban architecture in Ohrid] Скопје: Македонска книга.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# HEALTHY ARCHITECTURE AS A RESULT OF BALANCED INTEGRATION OF ARTIFICIAL AND NATURAL RULES

**Dženana Bijedić**[1]
PhD, Assistant Professor, University of Sarajevo, Faculty of Architecture, Patriotske lige 30, 71000 Sarajevo, Bosnia-Herzegovina, dzenanab@af.unsa.ba

**Rada Čahtarević**
PhD, Professor, University of Sarajevo, Faculty of Architecture, Patriotske lige 30, 71000 Sarajevo, Bosnia-Herzegovina, radac@af.unsa.ba

**Senaida Halilović**
PhD candidate, Assistant, University of Sarajevo, Faculty of Architecture, Patriotske lige 30, 71000 Sarajevo, Bosnia-Herzegovina, senaidah@af.unsa.ba

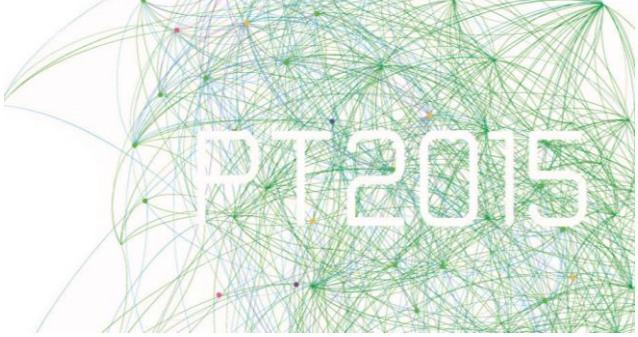
## ABSTRACT

*The processes of formation of the built environment, buildings and supporting infrastructure of human settlements, have a very large impact on all aspects of the system stability of the entire biosphere. Relations between the human activities and the health of biosphere are closely related and increasingly dysfunctional. They are, among other factors, caused by an uncontrollable growth of built places and their disintegration with a natural environment and cultural background. Degradation of natural environment through increased consumption of natural resources is dealing with alienated identity and balance of human life, which inflicts diverse social and economic burdens to the entire human population, thus creating unhealthy living environment.*

*Architectural places and spaces are very complex, enveloping many different levels in mutual interconnections, from local to global scales. Solutions that could integrate artificial and natural dynamic processes are possible to reach by investigation and integration of different levels of their structural rules. Based on complex, dialectical dynamical loops between abstract and concrete levels, we could assume possible predictions and solutions to noticed problems. These include examining their efficiency and results at the concrete material level including complex dynamical processes of natural environment and life forms, human individual and social groups, alongside with artificial, manmade items and technological infrastructure.*

*The creation of sustainable human habitats is essential, for not only health, prosperity and well-being of people, but also for the state of the global environment, including all ecosystems and living species. Architectural design*

[1] Corresponding author




*should integrate abstract conceptualization and planning with unplanned processes, individual participation and complexity of natural environment. All of these measures have aim of providing adaptations required for the change of the current conditions, securing and supporting flexibility and sustainability of healthy human individual on the one hand, and well-being of the entire society on the other.*

***Keywords**: architecture, artificial and natural, balanced integration, health.*

## INTRODUCTION

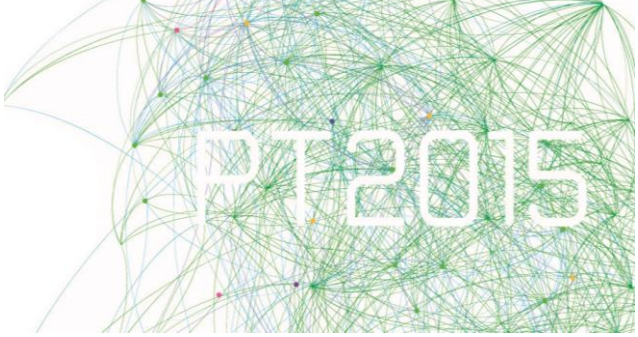
Creation of the built environment, buildings and supporting infrastructure of human settlements, has a very large impact on all aspects of the social system stability, as well as on all levels of the natural environment system's stability. Above all, construction, use and maintenance of buildings physically interfere with the given environmental space. At the same time, those processes are consuming large amounts of energy, water and material resources, thus changing the state of particular natural system. These impacts are affecting the entire biosphere, primarily ecosystems and their sustainability.

Uncontrollable growth of built places and their disintegration with natural environment and cultural background contexts, often coupled with degradation of natural environment itself, through increased consumption of natural resources, are confronting with alienated identity and balance of the human life. This generates situation that leaves significant social and economical consequences, such as the creation of unhealthy environments. Relations between human activities and the health of biosphere are closely related and definitely dysfunctional, affecting lives of many biological organisms, including humans. Loss of balance within the natural processes of the environment consequently has devastating impact to the quality of human life – its individual and social levels of existence. It is necessary to re-evaluate principles of architectural and urban design through active search for solutions that provide integrated balance between artificial and natural dynamical processes, as well as sustainable future of the individual and the society within the built environment.

## HUMAN HEALTH AND BUILT ENVIRONMENT

"Health ultimately depends on the ability to manage successfully the interaction between the physical, spiritual, biological and economic/social environment" (Habitat Agenda 21, 1992).

The main function of built environment is the protection of humans from natural environmental endangerments and perturbations, providing safer, more stable and comfortable conditions for living, working and other specialized activities. In developed industrial societies, human life is mostly concentrated within built spaces. Quality of built spaces has a direct impact on the quality of human life,




including health as the most basic level of human performance. "From the perspective of exposure to environmental conditions and hazards, housing and indoor environments have important public health consequences for both physical and mental health" (WHO, 2003). Various factors of built environment, as thermal conditions, lightning, qualities of air and water, materials and spaces, energy supply and its safety, have great impact on human health. Exposure to pollution and toxic materials, inadequate lightning and ventilation, create unhealthy environment, leading to various health hazards.

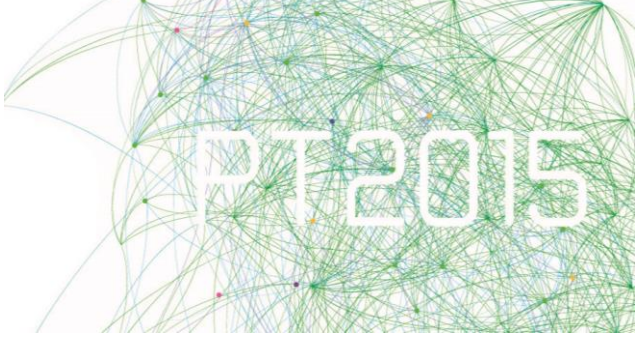
Modern architecture has been breaking the traditional architectural spatial patterns of urban and architectural spaces, aiming to open narrow spaces and provide more open, healthy, dynamic urban life. Human life in modern urban societies has been improved regarding some constraints and problems of the past, but it remains somehow framed in abstract dimensions and inhuman proportions within geometric realms and technology. Modern architecture divided connections in inherited spaces, fragmenting main networks that provided life through integration with natural environment and traditional ways of living. Urban growth and technological progress of modern human society, brings with it disintegration and destruction of physical environment and exhaustion of natural resources, producing crisis in sustainable development.

Searching a way to environmentally responsible approach in defining and materialization of architectural space that would be less destructive to environment, i.e. allowing degradation to a certain limit, using non-violent environmental strategies, cannot be the answer. "The only solution is to change the philosophy of the approach to the process of formation of architectural space. Only by a holistic approach, i.e. the transition from fragmentation to integration of the entire process with a definite change of the paradigm, we can achieve excellence, creating a built environment positively integrated into the natural environment, and at the same time healthy for humans" (Bijedic, 2012).

## HOLISTIC DESIGN AS INTEGRATED APPROACH TOWARDS COMPLEXITY OF NATURAL AND BUILT ENVIRONMENT

Basic principle of holistic design is the integrity of approach. The main drivers of environmentally harmonized creation of the built environment are arising from the holistic approach, building balance between global environment, local ecosystems, human health, as well as the economy and the overall development of society. The main positive effects can be summarized as reduced impacts on energy and environmental plan; lower operational costs throughout the life cycle of the building; improvement of physical and mental health, comfort and productivity of the user.

Many practitioners, as well as researchers, offer a number of definitions of the basic rules underlying environmentally sustainable built environment. Environmentally




sustainable facilities shall display excellence in different ways, such as the quality of the indoor climate, efficient energy use through endurance and flexibility. Furthermore, environmentally responsible design should be an act of reparation, restoration and renewal of natural systems environments.

Based on the key principles of the integrated approach, numerous *'principles of ecological design', 'principles of green buildings', 'sustainability principles of built environment'*, and similar have been developed. These are mostly general guidelines presenting lists of different instructions (defining what specifically needs to be done). Against this, principles of environmentally harmonized, sustainable architecture can be summarized in the following fundamental ideas of sustainability of built environment (Bijedic, 2012):

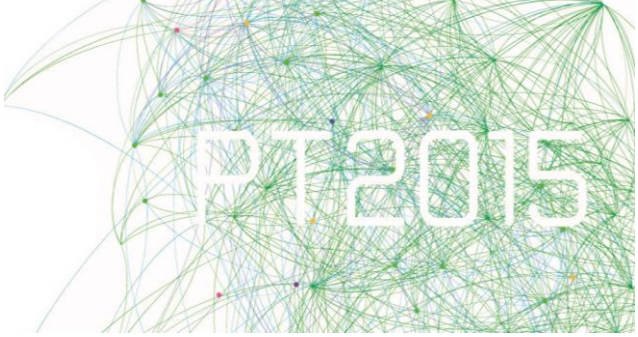
1. provision of the coexistence of man with nature: principles of land use;
2. maximum energy efficiency: the use of solar and wind energy; energy use of other renewable resources;
3. compliance of built environment with the place: adequate constructive solutions depending on the capabilities of local building materials; respect for local culture and traditions of spirit and matter;
4. eliminating the concept of waste: the principle of reuse and recycling of materials;
5. selection of healthy building materials and sustainable building technologies.

**Complexity of natural and built environment**

When we observe specific environmental effects, we should look at the entire chain with which they are connected, and avoid focusing merely on the intermediate impact. The links between these effects are not linear chains, but complex networks; each issue or use of resources can cause many changes in the quality or quantity of air, water, land and resource stocks. In turn, these changes in the quality of the environment as well as the quantity of resources can produce different adverse effects, not only in the environment, but also in human mental and physical health.

The long-term effect of the majority of natural processes is in fact impossible to predict, because natural environment is not a linear system, but behaves according to the characteristics of complex systems. Such systems are characterized by a large number of elements; richness in structure; self-organization and adaptability; dynamic order between chaos and stability. Human individual itself is a living being, complex biological and psychological entity, existing in complex dynamical states, perceiving and acting in its natural and artificial environment.

Physical experience of built, architectural space includes dynamical processes of natural environment and natural life forms, including human individual and social groups, alongside with artificial, manmade objects and technological



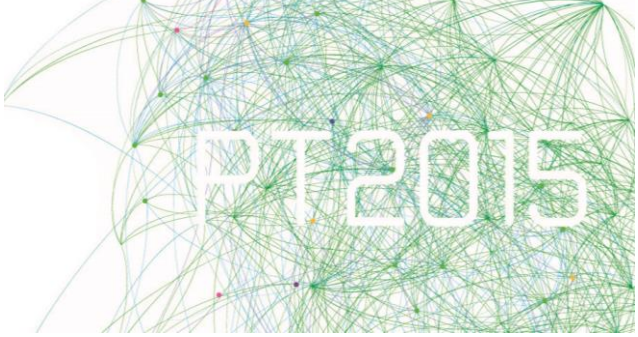

infrastructure. Shultz considered architectural place as "qualitative totalities" that have a complex nature (Shultz, 1980). Architectural spaces have kinetic, emotional and psychological values. Inner and outer spaces, local and global structures are intertwined in the dynamical emergence and growth, maintaining existential spatiotemporal continuity and dynamical stability. Built environments are very complex existential spaces, enveloping many different levels of experience and activities, meanings and functions. All those levels are in mutual interconnections, from the individual organism to the environment, from local to global levels.

## INTEGRATION OF ARTIFICIAL AND NATURAL RULES

H. Simon raises the question about the unclear borders between the natural, biological and artificial environment. Scientific impact and human treatment of the environment should have integrated approach. "If science is to encompass these objects and phenomena in which human purpose, as well as natural laws are embodied, it must have means for relating these two disparate components." (Simon, 1996)

Architectural places and urban spaces in contemporary architecture are on the one hand products of regulated planning and design, while on the other, they are result of unplanned processes and participation of the individual and collective cultural influences. Those two main impacts are often in conflict, based on different characters of their internal rules. First is based mainly on top-down linear analytical planning and second have more complex and unpredictable framework.

From Vitruvius to Corbusier, among others, architects have been trying to define rules and schemata for the appropriate "language" of architectural form. Rules of architectural and urban planning can be considered in two meanings, first as rules of geometry, a scientific system that reflects the logical structure of the laws of space, its structure and representation, and second as rules of composition and grammatical rules of combining parts and spatial modules. The application of certain geometric and compositional rules brings the possibility, from simple principles that define the rules, to develop a wealth of variations and solutions, applying simple rules in multiple plans, and different levels of detail. In this way, the unity and similarity of all parts of a designed object, which become part of universally defined whole, can be achieved. Classical rules of architectural design are embedded in a top-down structure - from very abstract definition to the specific instances of design types. Recursively applied simple rule system could provide richness and varieties of design solutions (Mitchell, 1990). Classical architectural design is based on linear sequences of elements, arranged in hierarchical order, from top to bottom, from lower level details to finest levels of their materialisation. Steadman considered application of scientific approach, as rational thinking in design, as "dangerous idea" (Steadman, 2008). The danger that Steadman sees is a danger of linear abstracted process of design that could repress the complexity of living processes in designed spaces.



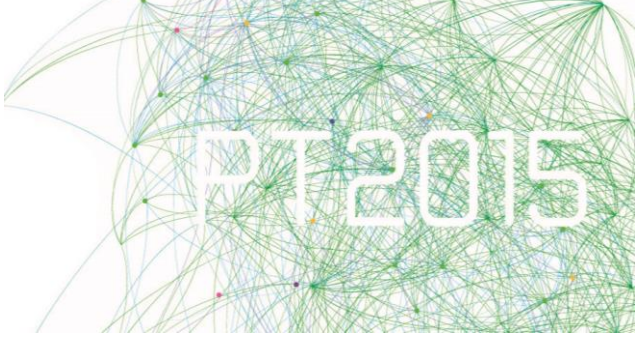

**Designing complex systems**

Both, the design process, and the product of design, should be integrated on the same principles, providing life by supporting complex, open networks of creative flow. Designed space, as complex system, has multileveled structure that must provide possibilities of interactions on different space-time scales. This multileveled structure Simon interpreted as a hierarchical structure, constituted of the subsystems of the complex system, including processes of variation and selection in the process of interaction. (Simon, 1962)

Complexity theory covers the systems constituted of many different parts, connected in a nonlinear, dynamical network, and acting as a whole. In complex system, characteristics of the parts are not in direct correspondence to the properties of the whole system. Its behaviour cannot be predicted by analytic and linear approach. Complexity is a resultant of the internal connections of the components of a multilayered system, but also of the connections between the system and its environment. Dynamics of the complex systems enables transformation, mutation and adaptation (Batty, Torrens, 2001). Interactions on lower levels of the systemic whole, lead to global emergent patterns and behaviours – system is more than the sum of its parts. "An emergent whole at one level is merely a component of an emergent system at the next higher level" (Heylighen, 1980). Complex systems can adapt and evolve in response to the changes in their environment.

Representation of unpredictability and unstable dynamics of complex systems is complicated endeavour; namely, it cannot be designed or predicted by applying traditional scientific models. Efficient approaches are based on the abstraction and modularity, trying to design paths to variable solutions. Different levels of abstractions allow interrelations and parallels between top-down and bottom-up approach (Johnson, 2005). On the higher level of abstraction, conceptualizing the problems, we could assume possible predictions and solutions to noticed problems. Solutions could be applied to lower levels of abstractions, examining their efficiency and results. At the same time on the level of existing state, new elements and new connections could be established based on the solutions developed on the higher level of abstraction (Johnson, 2005).

Integrated approach to design should be based on the integration of top-down and bottom-up directions, as two different representations of the holistic process of design. Higher, abstract, conceptual levels could be limited to preferred predictive directions of global development, while changes in system should be regulated internally in the overall system of the components (Jonas, 2005). Complex modelling and conceptualization on multileveled spatiotemporal scales should in complex systems replace linear prediction that was appropriate for mechanical systems. Instead of optimal solutions, complex modelling should provide solutions as alternative projections and development of different scenarios that could provide maintenance and stability of the system (Jonas, 2005).




## CONCLUSIONS

In order to understand the complexity of the problems related to the influence of the built environment on the human life, we cannot rely only on analytical linear approach instead we must consider more complex approach. By understanding the problem, it could be concluded that the invasion into the complex, multi-layered, dynamical system of the environment, either natural or designed, produces overall impact on the global system and all its subsystems.

Our decisions in a complex reality directly depend upon the model of the world that we include in its considerations. In such a complex system, it is not enough just to optimize subsystems and processes, expecting that a better, more environmentally friendly built environment will occur by itself. Optimal decisions in a simplified model will rarely be optimal in the real world. Decision makers can select the optimal decisions arising from the simplified world, or satisfying, good enough decisions, arising from a world that is closer to the complex reality.

Architectural design should integrate abstract rules of regulated planning with unplanned processes, individual participation and complexity of natural environment. New spatial patterns of architectural space have to be open up to redesign and adaptations to changing conditions and possible crisis, securing flexibility and sustainability. Complex architectural systems should, at least, be open and have ability to evolve through variations and selection. All of these measures have an aim of providing adaptations required for the change of current conditions, securing and supporting flexibility and sustainability of healthy human individual on the one hand, and well-being of the entire society on the other. The creation of integrated, balanced and sustainable human habitats is essential, for health, prosperity, and well-being of people, as well as for the state of the global environment, including ecosystems and living species.

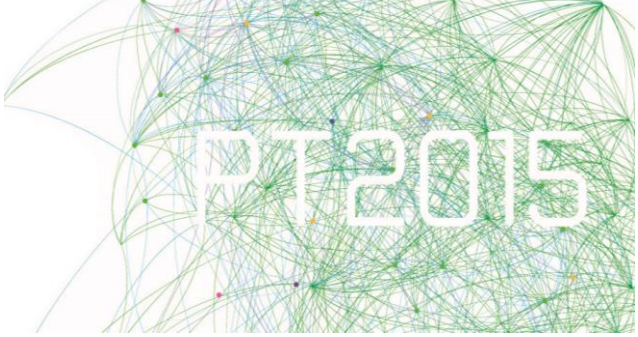
## REFERENCES

Batty, M. Torrens. P.M. 2001. "Modeling Complexity: The Limits to Prediction*"* in 12th *European Colloquium on Quantitative and Theoretical Geography*, St-Valery-en-Caux.

Bijedić, Dženana**.** 2012. *Arhitektura, Holizam umjesto optimalizacije, Integralni pristup u arhitektonskom stvaralaštvu.* Sarajevo: Univerzitet u Sarajevu.

Heylighen, F. 1989. "Self-Organization, Emergence and the Architecture of Complexity" in Proceedings of the 1st European Conference on System Science, AFCET, Paris. p. 23-32.

Jonas, W. 2005. "Designing in the real world is complex anyway - so what? Systemic and evolutionary process models in design*",* in ECCS *Embracing Complexity in Design*, The Open University, p. 49-59.




Johnson, J. "Multidimensional Multilevel Networks in the Science of the Design of Complex Systems" , in *Proceedings of the European Conference in Complex Systems* - workshop Embracing Complexity in Design, The Open University, 2005. p. 33-48.

Mitchell, W. J. 1990. *The Logic of Architecture*, MIT Press, Cambridge MA, p. 8, p.141.

Schulz, C.N. 1980. *Genius Loci, Towards a Phenomenology of Architecture*, Academy Editions, London.

Simon. H.A. 1996. *Sciences of the Artificial*. MIT Press, Cambridge MA, p. 3.

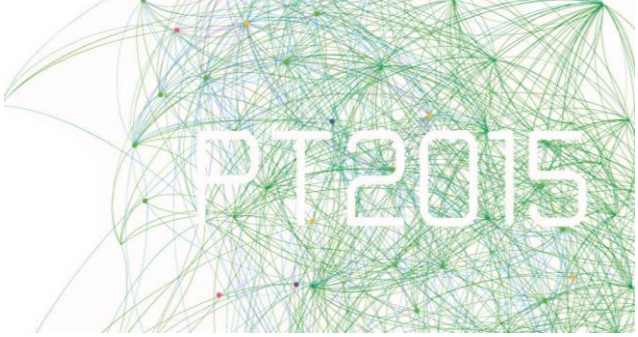
Steadman, P. 2008. *The Evolution of Designs, Biological Analogy in Architecture and the Applied Arts*. A revised edition, Routledge, New York pp. 2-3.

Simon, H.A. 1962. "The Architecture of Complexity"*:* in *Proceedings of the American Philosophical Society* 106, Vol. 106, No. 6, p. 467-482.

The United Nations Conference on Environment and Development. 1992. "Habitat Agenda 21", "*Rio Declaration on Environment and Development"*. http://habitat.igc.org/habitat/agenda21/a21-06.htm, Chapter 6 and 7. Accessed April, 2015.

World Health Organization, 2003. "*The World Health Report 2002 – Chapter 4: Environmental Risk*, Geneva, 2003, http://www.who.int/whr/2002/chapter4/en/index7.html. Accessed April, 2015.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# HEALTHY ARCHITECTURE FOR CHILDREN

**Julija Aleksić**
PhD, Teaching Assistant, Faculty of Technical Sciences, Kneza Miloša 7, 38220 Kosovska Mitrovica, Serbia, julija.aleksic©pr.ac.rs

## ABSTRACT

*Kindergartens are places where spatial standards and quality of construction are adjusted to the interests of the individual - child and the community. The architecture for little people should be regarded as a city with indoor and outdoor surfaces, as a space which protects them from noise, sun, hail, views, as an ensemble composed of various transparent, multifunctional and affordable circuits. Spatial organization and sensory experiences about the kindergarten influence the physical and psychological development and prepare a child for future life among other people.*

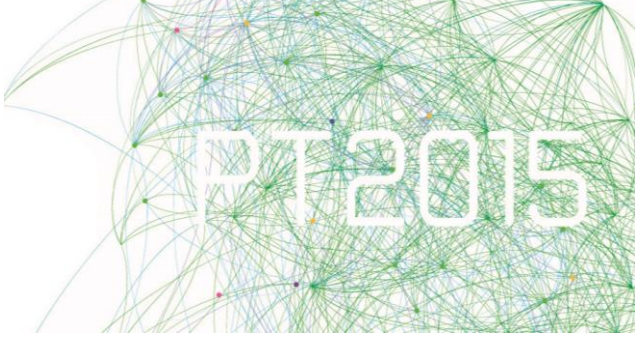
*In line with the thesis that planning of a healthy environment represents one of the most important issues in provision of good quality of life, this paper explores design standards and concepts of facilities for children as well as their impact on physical, psychological and social growth and health. The analysis aims to define the principles of a healthy temporary care in kindergartens, while the results should open a new debate on the definition of the problem of designing a healthy architecture subordinated to a scale of the child.*

***Keywords**: kindergartens, healthy childhood, design standards, stimulation space.*

## INTRODUCTION

"Civilized society is one that is struggling to make a better world for our children" (Kline, in Dudek, 1996, p. ix).

The kindergarten is a place which should, with its attractive, responsive and protective indoor and outdoor spaces and carefully defined social programme, provide the children with the opportunity to build great childhood memories and to prepare for future, real-life conditions. The main purpose of the kindergarten is to promote child's physical, psychological and social development, including communicative, cognitive and physical skills, creativity, etc. At the same time, the kindergarten is an educational space in which the pedagogical process, intertwined with game and socialization, promotes friendship, sharing, cooperation, self-respect and respect for others, successful problem solving, etc. Designing the kindergarten, from all said, is a complex task for the architect who must own a good knowledge about the psychology of space.




This paper illustrates some of possible practical answers to a wide set of design parameters. Design in kindergarten should include comfort, health and safety conditions for small users - children, by respecting the environment. Spatial configurations, light, noise, heat and air quality have been consistently proved to have a significant impact on children in kindergartens. The challenge is how to apply these findings in order to achieve optimal design solutions.

## DESIGN, SENSING, THINKING AND BEHAVIOUR

Architects pay more attention to the architecture of building when designing the spaces for children, instead of reflecting on the children's desires. Architect has to create environments that help children to quickly adjust to the new surroundings, forming an interesting and stimulating space that occupies their attention in the absence of parents. Architect should be a designer, psychologist, parents, teacher and educator. The aim is to create a structure that will correspond with the wishes of the child, complex, stimulating environment that will provide sufficient opportunities for the expression of the creative possibilities of a child, positive emotional climate and communication, socialization and interaction with peers. The architect should plan different small worlds: the mini-space and mini-workshops, spaces for fun and games both indoors and outdoors, adequate space planned for drawing and painting. Many of researches show that small, intimate and personalized spaces seem to be better for absorbing, memorizing and recalling information and motivate users.

In physical terms, the kindergarten can be organized as: independent, free-standing and specially “intended” structure; in purpose designed space as a part of larger, multifunctional whole (within residential buildings, schools, office buildings, industrial complexes, shopping malls, etc.); adapted space (such as, converted house); and mobile structure (containers, kindergarten on wheels, etc.). Any type of a kindergarten, however, must fulfill distinct standards; the creation of healthy indoor environment accounts for one of the main design prerequisites. A healthy kindergarten is characterised by the provision of all comfort types: thermal, air, acoustic, visual, light, spatial, aesthetic, health, etc. Taking the best of location and parcel (by adequate orientation, for example) and the design techniques (such as the distribution of physical volumes, for example) are accompanied with the use of equipment and furniture in order to satisfy these demands. Criteria for site selection involve meeting the hygiene requirements and give advantage to quiet zones with abundant green surfaces, separated from busy roads and other sources of noise and air pollution. Healthy kindergarten environment is a place without sharp borders between “built” and “natural”; instead, it promotes the integration of the two equally important spatial components and provides abundant daylight in both. Principles of designing a space for children involve relations between the closed area under the building and proper connections with open areas and nature- pulling

the nature towards the building, with the affirmation of movement and games, in order to induce and improve children's curiosity.

All accessories, equipment and fittings should be of standardized size and dimensions, custom made for a child; the best ergonomic measures tailored for the children will encourage their productivity and creativity in learning and growing. The absence of ergonomic principles in kindergarten design, oppositely, may cause significant problems in child's physical development. In Malasya, for example, where the most of kindergartens do not fulfil the requirement of ergonomics design for children, many cases of musculoskeletal disorders and pain have been identified (Adawiyah, no date). Irregular physical development during the early childhood may further cause various permanent consequences, in terms of physical, psychological and social health.

Space inside of the kindergarten should stimulate and increase users' engagement, which is achieved with colors, textures and shapes. With regard to psychological effects, appropriate colors can create an environment that promotes physical and mental development; many cases of attention deficit and behavioral problems are directly associated with the wrong conditions in the environment, including the badly planned solution related to lighting and color of interior. Whether the color is used outside or inside is of a great importance. Sometimes one color which is perfect for façade can cause a different reaction when applied to the inner space. Appropriate color scheme for certain facilities and functions have been established; warm, bright colors made to reduce tension, nervousness and anxiety. It should allow children to decorate their own space, with drawings and colors on the walls, to avoid monotony and develop a sense of belonging in the kindergarten. Colours and shapes, united with ergonomics measures in kindergarten's space, greatly influence the behaviour of small users. The successful examples of completed kindergartens, such as of the one presented in figures 1a and 1b, indicate the importance of integrated design approach. The architecture has real cognitive consequences (Warden, 2007).

**Figures 1a and 1b: Kindergarten Tromso** (Source: http://www.archicentral.com/).

Two types of elements in the environment are recognizable: natural (soft) elements like plants and water; built (heavy) elements like tall buildings and traffic. "Soft" texture animates the landscapes and allows users to link what they see with their

sense of touch, causing interests of children, promotes recreational activities, improves physical and cognitive development; encourages imaginative play and stimulate empathy.

Good designs cause and promote the transition from the building to the courtyard, from the enclosed space to the natural openness.

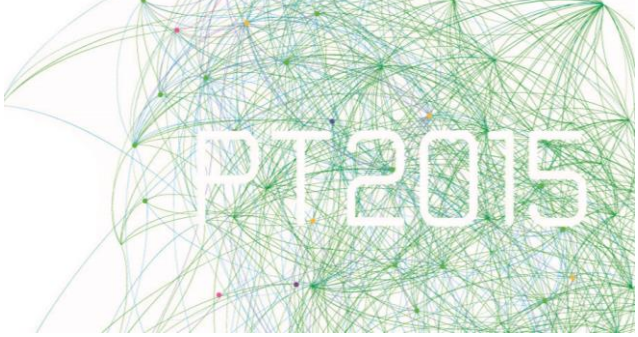
Successful design concept which unites all mentioned aspects of a healthy kindergarten is recognized in Xieli Garden, in Wuxi, China (Figure 2). It is a spiralling, three-storey structure whose sloping green roof wraps around a centralized courtyard with outdoor playground and a curved ramp shielding the children from the traffic and city noise. This ramp also reinforces safety by allowing quick access from the sidewalk to the third floor. Each level of the building has floor-to-ceiling window glazing which bathes its rooms in natural light (Tag Archives, 2014).

**Figure 2: Kindergarten Xieli Garden** (Source: Tag Archives).

In contrast to the above example, kindergarten Tesla- science for life is an example of neo-modernism in New Belgrade. Kindergarten got an abstract expression of the modernist urban context with a streamlined and transparent playground (Figure 3). Excessive use of the white color in the interior for children is an abstraction inappropriate for their age (Super Prostor 2013). This example, which is cold, colorless and simplified design of the interior space, with minimal accents of color, reduces the environmental quality of design "for the children".

**Figure 3: Kindergarten Tesla- science for life** (Source: SUPER PROSTOR).

Comfortable environment customized to child's scale, serving to enhance proper physical development, should always be shaped by following the principles of




ergonomic design. "When children feel comfortable in their physical surroundings, they will venture to explore materials or events around them." (Rui Olds, 1987). Referring to the study conducted by Mayers-Levy, Lehrer (2011) points at some aspects of the relation between physical space determinants and psychological reactions. It was found that the users of airy spaces feel freer, and that the rooms with lofty ceilings lead users to engage in more abstract styles of thinking (Lehrer, 2011).

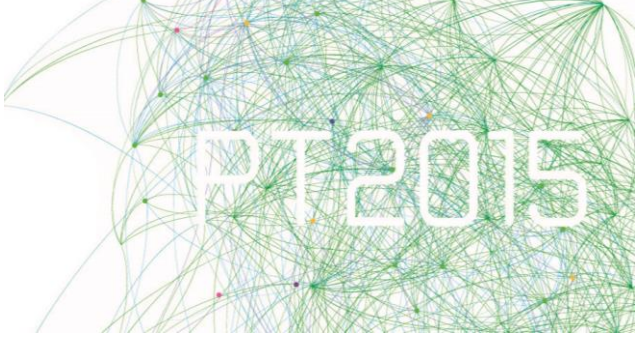
Referring to the study conducted by Mlinarević V. (2004), there are two key principles to create an environment customized for every child: children learn through their own experiences and interactions with the world around them; educators encourage development and child development, building on the interests, needs and abilities of each. Isenberg and Jalongo (in Mlinarević 2004) design space defined in kindergarten through five criteria: the environment should send a message to child about his desired behavior, facilitating freedom of movement and encourage creativity learning; the importance of "monitoring" of the child in order to ensure its proper guidance by the teachers; availability of materials - open shelves, available toys increase a sense of ownership in children; the differences in the vision area of children and adults due to a difference in perspective; "flow" - the free movement in space, without barriers and borders.

The psychology of spaces for children is a significant issue. Over a century ago, models like Montessori and Waldorf started promoting the idea that a great deal of attention should in kindergarten design should be put into the fabrics, the materials, the colours and the overall organization of space. Within the carefully shaped environment, the children obtain general awareness of space which surround them, stimulate and directly influence to their behaviour, thoughts, feelings and imagination.

"Imagine a world where the lines were harsh and unyielding, the textures were consistent and variation is unheard of. Does it inspire you? Now imagine a place where the carpet change every day, the ceiling is a myriad of different colours, light, shadow and movement. The feelings and movement completely surround you, sometimes breezy, sometimes cold, others warm. Unexpected wonders fly by, sometimes full of colour and sometimes full of noise and movement. If we really want children to thrive we need to let their connection to nature nurture them" (Warden, 2007).

## CONCLUSIONS

Kindergarten - a society of miniature is a space for children to wake and expand their potentials for learning, their ability to get along with others, and their interest in reaching out to the world. Children are very demanding consumers and architecture for children should affirm healthy life, joy, happiness, and in such environment kids should be participants rather than observers in the area.




Healthy architecture for children: develops a sense of belonging to community; provides a safe and stimulating environment in which children can feel happy and secure, using appropriate ergonomic measures, colours and forms in space, in the respective healthy environment; promotes learning through play and healthy growth; encourages the emotional, social, physical, creative and intellectual development of children both indoors and outdoors; and provides opportunities to stimulate interest and imagination.

Natural elements and appropriate levels of motivation are conditional for good design of kindergartens. Although these individual strategies can improve performance for the construction of a kindergarten, only analysis and integrated design can have a positive impact of the built environment for the benefit of children in kindergarten. There is no universal best living environment of kindergarten which would be used as a model, but there are general principles how the physical space can support teaching and learning process.

"The child has three teachers: first - other children, second - tutor, the third - space" (Swedish proverb).

## REFERENCES

Adawiyah, Nurrabiatul. No date. "Assessment on Space and Furniture's Ergonomics for Children in Kindergarten". Accessed Mart 25 2015. http://www.academia.edu/975699/ASSESSMENT_ON_SPACE_AND_FURNITURE_S_ERGONOMICS_FOR_CHILDREN_IN_KINDERGARTEN.

Dudek, Mark. 1996. *Kindergarten architecture: Space for the imagination.* London: E & FN SPON.

Lehrer, Jonah. 2011. The psychology of architecture. Last modified April 14, 2011. Accessed April 7, 2015. http://www.wired.com/2011/04/the-psychology-of-architecture/.

Mlinarević Vesnica. 2004. "Život i škola" br. 11(1/2004, Časopis za teoriju i praksu odgoja i obrazovanja, Osijek, Accessed March 25, 2015. https://bib.irb.hr/datoteka/183458.Vrtino_okruzenje_usmjereno_na_dijete.pdf.

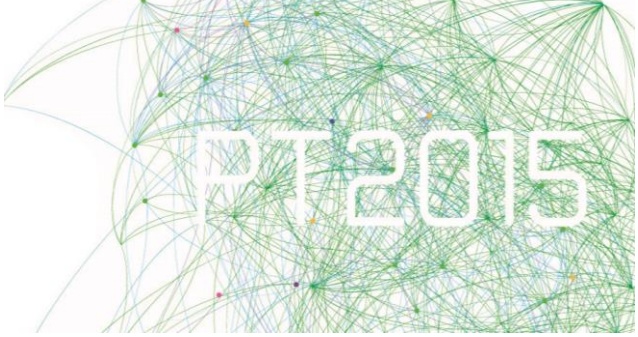
Rui Olds, Anita. 1987. *Child Care Design Guide.* New York: McGraw-Hill.

Super Prostor. 2013. "Novobeogradski neomodernizam: igra funkcije i oblikâ" Accessed March 30, 2015. http://www.superprostor.com/novobeogradski-neomodernizam-vrtic-tesla-belville.

Tag Archives. 2014. "Xieli Garden, gardening: Innovative School Proposes Lush Vegetation on its Roof" Accessed March 28, 2015. http://picturesdotnews.com/tag/xieli-garden.

Warden, Claire Helen. 2007. Nurture Through Nature. UK: Mindstretchers http://www.mindstretchers.co.uk/nature-kindergartens.cfm.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# MEDICINE AND ARCHITECTURE IN THE CONTEMPORARY SOCIETY

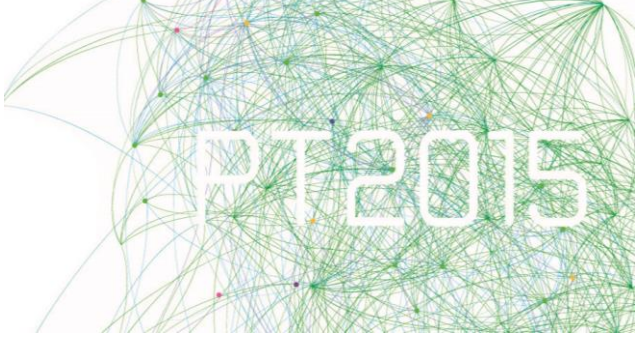
**Ilka Čerpes**
PhD, Assistant professor, Faculty of Architecture, University in Ljubljana, Zoisova 12, 1000 Ljubljana, Slovenia, ilka.cerpes@arh.uni-lj.si

## ABSTRACT

*In the time of crucial changes of human society on all levels and all around the world should architects and doctors play an important role because they both has a historically founded special responsibility to take care about peoples safety and health which are the most important values for each individual and for the society as a whole. Despite a very high ranked formal status in everyday life both professions are faced with accelerated process of diminishing their reputation. Further we argue that the erosion of the reputation is a product of shifting the goals in both disciplines: from serving the man to developing themselves as market competitive services. While medicine and architecture are no longer disciplines with public mission people don't trust them anymore and consequently their leading position in contemporary society disappearing despite enormous improvement of professional knowledge and skills based on development of new technologies. The history of 20th - Century architecture and city planning shows how destructive can be unlimited faith in power of technology. The leading personality of that period called Modern movement was Swiss-French architect and urban planner Le Corbusier. As an example of glorifying technology on account of human welfare we represent some of his famous ideas how to implement technology in building design which have great impact on architectural theory and praxis still today. One of the cities built in accordance to Le Corbusier visions is also Nova Gorica. Nowadays the city seems still unfinished with underdeveloped public space and some social and health problems which are not to underestimate. Among others is Nova Gorica on the fourth place of all cities in Slovenia with highest rate of criminal offense connected to drugs.*

*At the end we conclude that the responsibility of both professions in the time of new sustainable paradigm which promote healthy and inclusive cities must be change of actual professional praxis on the way that the technology would help us to bring people in the centre of our interests again.*

*Key words: architecture, medicine, profession, technology, public mission.*



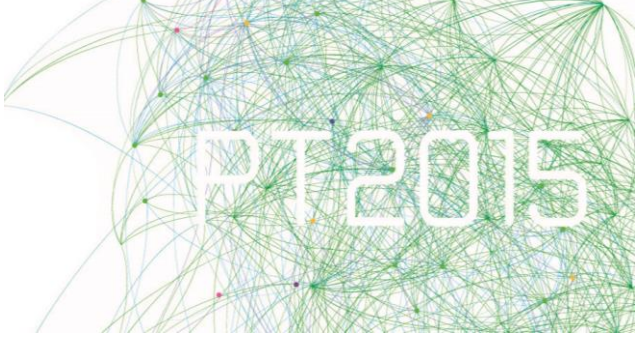

## INTRODUCTION

In the times of crucial changes of human society on all levels and all around the world should architects and doctors play an important role because they both has a historically founded special responsibility to take care about peoples safety and health which are the most important values for each individual and for the society as a whole. The public responsibility of two disciplines in contemporary European society based on welfare state was and still is confirmed by law: beside pharmacist, veterinarian, dentists, midwives and nurse doctor and architect are professions with common regulated educational contents and processes to ensure equal safety standards for the people in all member states of European Union. Despite a very high ranked formal status in everyday life both professions are faced with accelerated process of diminishing the reputation. For example after 2014 report of Architects Council of Europe architectural market modest 0,9 % of European construction (in Slovenia only 0,5 %) and in case of medicine we can practically every day observe discussions about doctors professional competences in public media, requests for second opinion etc., what is the sign that people doubt official medical doctrine. Famous Slovenian surgeon, former professor at both Slovenian Faculties of Medicine and former member of National Medical Ethics Committee dr Eldar Gadžijev described the situation: "… After my opinion we have made a great mistake when the selection of medical students was moved exclusively on the computer. Because of that decision many generations of doctors today are not like we want them to be. Most of them take more care about money as about their patients…" (Zgonik, 2015).

Further we argue that the erosion of the reputation is a product of shifting the goals in both disciplines from serving the man to developing themselves as market competitive services in the field of science, technique or arts and design. While medicine and architecture are no longer disciplines with public mission people don't trust them anymore and consequently their leading position in contemporary society disappearing despite enormous improvement of professional knowledge and skills based on development of new technologies.

## MISINTERPRETATIONS OF TECHNOLOGIES IN 20TH-CENTURY ARCHITECTURE

As we can see there is no guarantee that the connection between space, health and technology produce benefits for public wealth. The history of 20$^{th}$ - Century architecture and city planning shows how destructive can be unlimited faith in power of technology. It all starts with the massive production of cars in Ford Factory, USA in 1908. Architects and city planners were charmed by massive serial production, technical perfection and space flexibility of the new standardized industrial product .It seemed it was the wright answer to the question of that time actual dwelling lack and design basing on function without surficial ornaments. The leading personality of that period called Modern movement was Swiss-French architect and urban planner Le Corbusier. Started at 1921 he wrote a set of essays




known under common title Towards an Architecture (Vers une Architecture) which are serving as manifesto for several generations of architects and urban planners till today. He stated that the design of buildings should be standardized as the design of cars and other machines and further refined in function and aesthetic.

## TOWARDS AN ARCHITECTURE - ARCHITECTURE IN THE MACHINE AGE

Admiration of standardisation, functionality and pure geometrical forms is probably more powerful heritage from Le Corbusier concepts which still caused huge problems in today's architecture, especially in urbanism because of traffic congestions and air pollution. He described his fascination of the machines in the famous book of seven essays Vers une Architecture, 1923 (Towards a New Architecture, 1927, 2014, Towards an Architecture, 2008) published first in L'Esprit Nouveau (1921-1923). Le Corbusier claimed all the benefits of the so called Machine age for the architecture. At the begging of the book he pointed out that the buildings in the machine age should not be only pretty and luxury but first of all functional and simply in the manner of other engineer works. After Corbusier ornament and stile should be replaced by aesthetic of engineer architecture: "…The Engineer, inspired by the law of Economy and governed by mathematical calculation, puts us in accord with universal law. Hi achieves harmony…" (Le Corbusier, 2014: 59). The most influential essay which celebrates technologies and machines is one about liners, plains and automobiles. Corbusier stressed out that the beauty of form derived from accordance to purpose one can observe in the case of liners, planes and automobiles. …"Machinery contains in itself the factor of economy, which makes for selection. The house is machine for living… We must aim at the fixing of standards in order to face the problem of perfection." (Corbusier, 2014: 61). Futher he discussed construction of plains´ airfoil as an perfect product of artificial, rational, and industrial processes on the basis of properly defined problem, needs and technological conditions. He defined six axioms for "dwelling and room" design as follow: chairs are for sitting on, electricity provides light, windows are for lighting the room and looking out, paintings are made for meditation – not decoration, homes are made to be lived in and enjoyed (Le Corbusier, 2014). After his opinion moral problems appeared because architects and clients ignore this principles. Finally he stated standardisation of form as an indispensable part of industrial production thus allowing continued refinement of function and aesthetics like the automobile does. He claims also that after certain circumstances this process of refinement should lead even to classical forms, for example from automobile to Doric temple, what one can assess as a joke or even a provocation.

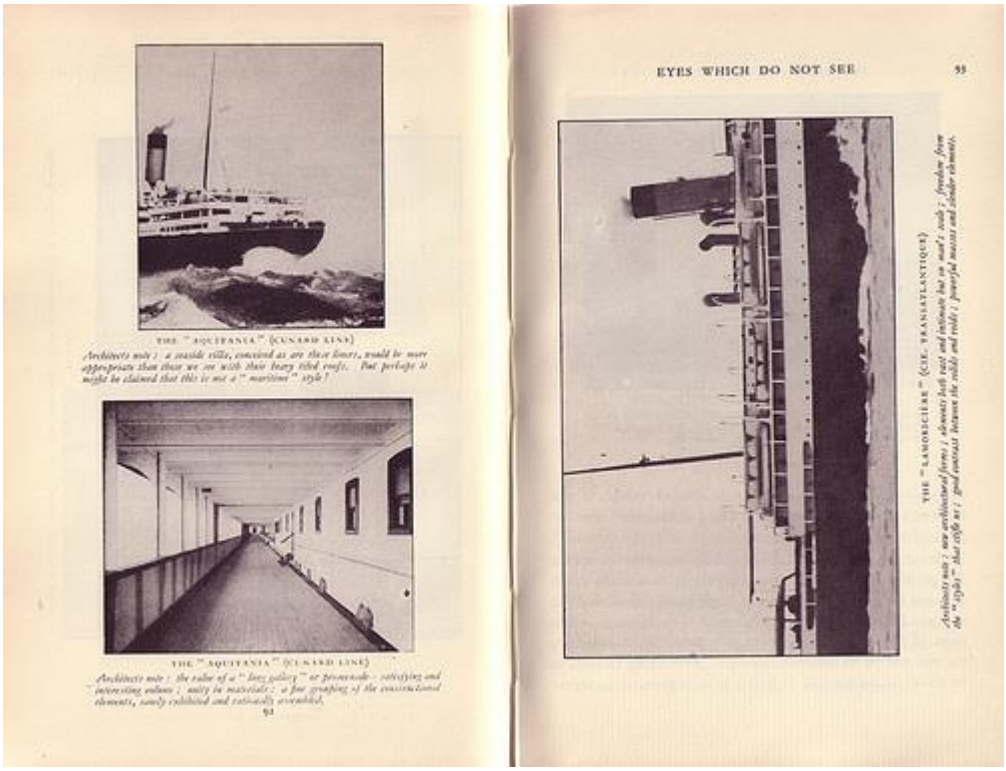



**Figure 1: Famous page from the Corbusier´s book Vers une Architecture, 1923, (Towards a New Architecture, 1927) shows the liner as an example of perfect form (Source: http://www.designers-books.com/towards-a-new-architecture-le-corbusier-1927/ Accessed May 20, 2015).**

## MODULOR- "PUTS US IN ACCORD WITH UNIVERSAL LAW"

Modulor measurement system was invented by le Corbusier between 1943 and 1955 in circumstances of unlimited almost Platonic believe in mathematical proportion and urgent need of coordinating the measurement system connected to building industry. It was the time of believing in mathematics as a potential source of universal truth based on Wittkower (1940) famous research on proportional system of renaissance architecture. It was a time of communication problems between architects, engineer and craftsmen when Corbusier has presented his idea about Modulor proportional measurement system at the Milan Triennale (1951) (Le Corbusier, 2000). His idea based on integration of Golden section rules and the height of human. Einstein summarised his idea as to make scale of proportion which "makes the bad difficult and the good easy" (Le Corbusier, 2000) and this comment of one of the famous physicist tell us a lot about banality of Le Corbusier idea. As basic unit he selected 1.828 (six foot) tall English male body with overstretched arm. It was overlapped with tree squares. The height of the body

together with the overstretched hand is defined on 2.20 meters and is divided into two squares, each 1.10 meter high. Finally the two squares are connected by the third which is rotated for 90 degrees. Obviously was the Le Corbusier's method of composing the unit of measurement system very arbitrary and express deep misunderstanding of the essence how the connection between geometry and nature should be interpret. Some scientists complained that the geometry didn't follow the mathematical rules and was mathematically not valid. They proposed to Le Corbusier corrections. He accepted some comments and additionally adapted the system for practical use by introducing smaller modules which were necessary for design some buildings parts. The end result was double scaled modular system: red one was based on unit 108 cm and the blue one on 216 cm.

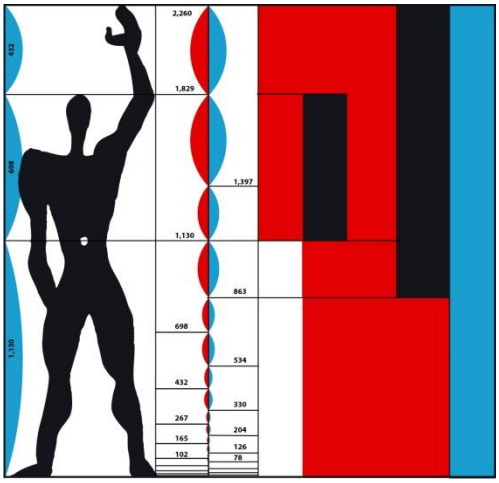



**Figure 2: Modulor (Source: http://www.neermanfernand.com/corbu.html, Accessed May 20, 2015).**

Le Corbusier tried to implement the Modulor but it didn't work and he argued that the system "does not confer talent, still less genius "(Le Corbusier, 2000: 147) what we can see as a dishonest excuse. If we look at the famous Corbusier's apartment building called Unite d'Habitation we can see materialisation of the Modulor idea in the dimension of the corridor which is only 2.20 m high and is 30 cm under today's minimal standard for living space. In reality this corridor looks scary and uncomfortable. A person rejected that kind of living conditions and today is living in the building only a symbol of status, especially for architects who tried to implement the idea in their projects still today. But nonetheless Le Corbusier didn't follow his own rules the idea impacted the architectural theory and practice since today.

**Figure 3: Berlin, Le Corbusier, 1959, Unite d'Habitation, the corridor (Source: author).**

**Figure 4: Le Corbusier, 1959, Unite d'Habitation, entrance wall with the relief of Modulor (Source: author).**

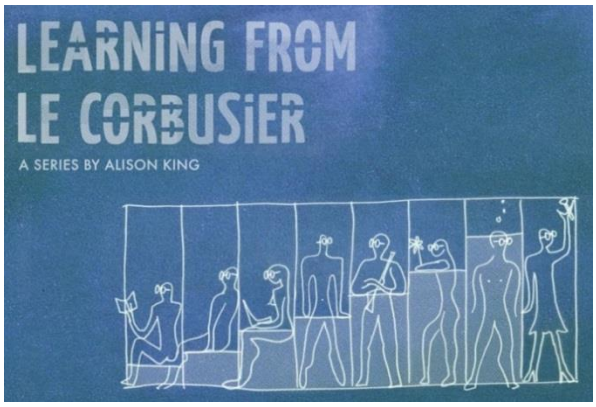


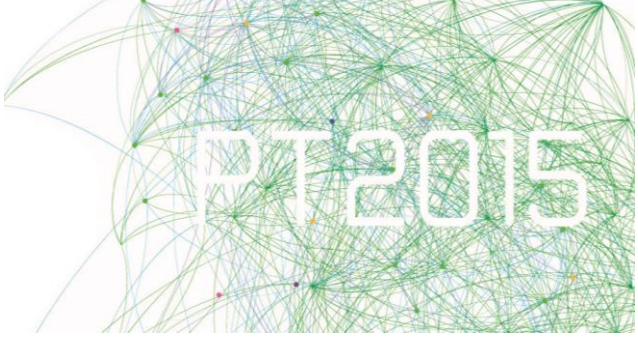

**Figure 5: An example of contemporary Modulor interpretation, 2013 (Source: http://bloomingrock.com/2013/10/03/le-corbusiers-studio-apartment-in-paris-1931-part-ii/; Accessed May 23, 2015).**

## CONCLUSION

First after the ideas of le Corbusier came truth in the form of many housing complexes and new cities built in 20th Century we can realise all the harmful impacts on the quality of living, cohesion of society and public health which were produced by so called technologically advanced approach. One of the cities built in that time and manner is also Nova Gorica where this meeting is held. It was founded after Second World War as a product of social experiment in Yugoslavia after the nearest historical town Stara Gorica (Gorizia, Italy) was assigned to Italy. Nova Gorica was an occasion for Slovenian architects to build Le Corbusier vision and ideas in natural scale, but only some small parts of the original plan were realised. Growth and development of the city took their own way more accommodate to the people needs and given economic circumstances. Nowadays the city seems still unfinished with underdeveloped public space and some social and health problems which are not to underestimate. Among others Nova Gorica is the fourth of all cities in Slovenia after the rate of criminal offense connected to drugs even before the capital of Ljubljana.

We can conclude that the responsibility of both professions in the time of new sustainable paradigm which promote healthy and inclusive cities must be to change the actual professional praxis on the way that the technology will help us to bring people in the centre of our interests again. Putting People First is the title of recent Danish Architectural Policy and it was the initial source for our discussion while it declares at the beginning an important new vison about the role of architectural profession in the future sustainable society: "…Architecture sets the framework for our lives and it affects us with its values and ideals. As an art form, architecture is about the spaces, cities and landscapes we move in and with its idea, shape, and materials it gives us an artistic interpretation of what it means to be a human being at a given place and time. At the same time the architecture solves certain basic human needs. Good architecture provides a secure, functional environment for our fulfilment, both as individuals and collectively..." (The Danish Governement, 2014).

**Figure 6: That's the way people like it: Piranesi Award 2014 – PIDA, Wine terrace and spa, Eger, Almagyar, Hungary, Péter Gereben, Balázs Marián, GEREBEN MARIÁN ÉPÍTÉSZEK KFT. http://www.pida.si/awards (23.5.2015).**




## REFERENCES

Le Corbusier. 2000. *The Modulor and Modulor 2*, Basel, Birkhäuser,

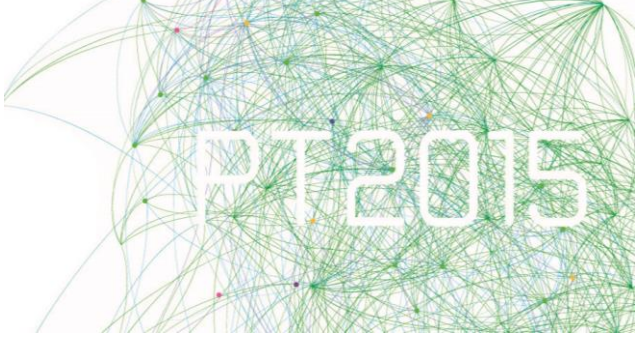
Le Corbusier. 2014 (1927). *Towards a New Architecture*, New York. Dover Publications Inc.

The Danish Government. 2014. " Putting People First". *Danish Architectural Policy*. July 10, 2014. Accessed February 2, 2015. http://kum.dk/uploads/tx_templavoila/Danish%20architectural%20policy_putting%20people%20first.pdf .

Topolovec, Taja. 2015. "Analiza: Kateri so z drogo najbolj obremenjeni kraji v Sloveniji". *Pod črto*, February 21, 2015. Accessed May 23, 2015. http://podcrto.si/analiza-kateri-so-z-drogo-najbolj-obremenjeni-kraji-v-sloveniji/.

Zgonik, Sašo. 2015. "Dr. Eldar M. Gadžijev, Intervju". *Mladina*, March 16. Accessed April 21, 2015. http://www.mladina.si/164916/dreldarmgadzijev/.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# MARGINALISATION OF LOCAL COMMUNITIES ALONG THE STRAIT OF SINGAPORE

**Magnus Nickl**[1]
MSc Arch ETH, TU Berlin, Architecture for Health, Technical University Berlin, Sekretariat A 42 , Straße des 17. Juni 152, 10623 Berlin, mnickl@student.ethz.ch

**Verena Stecher**
MSc Arch ETH, LSE City Design and Social Science; LSE Cities, The London School of Economics, Houghton Street, London WC2A 2AE, United Kingdom, V.Stecher@lse.ac.uk

## ABSTRACT

*The Strait of Singapore represents one of the world's most important shipping corridors and its adjacent coastlines in Indonesia, Malaysia and Singapore are increasingly taken over by water-related infrastructure serving global trade. Hence, urban development is being pushed inwards and the traditional relation of the region's inhabitants with the surrounding water space is being significantly impaired.*

*A rigid border system that criss-crosses the sea has been set in place to facilitate global trade while coexisting local layers of utilisation have been neglected and are increasingly being obliterated. Vernacular settlement structures, so called Kampongs, traditional fishing grounds and natural habitats are under constant threat of being marginalized by current trends of displacement and are increasingly being pushed back from the narrow waterway forming disconnected archipelagos in more quiet zones.*

*In order to counteract, public awareness of the remaining elements of cultural and natural importance needs to be raised. At the same time, social viability of local communities must be promoted through the enhancement of supporting infrastructures and a sustained environmental protection.*

***Keywords**: strait of Singapore, kampongs, urban development, social viability.*

## INTRODUCTION

The Strait of Malacca and its eastern extension, the Strait of Singapore, constitute the most crucial shipping channel bypassing the wide stretching land barrier across the East-West trade lane, facilitating exchange between the South China Sea and

[1] Corresponding author

the Indian Ocean. The sea's long history as gateway and shipping hub has influenced the fortune of the adjacent land in an enduring way.

Today, around 70,000 vessels are passing through the narrow waterway each year, carrying between 25 to 40 per cent of world trade (Simon, 2011). With growing importance in global commerce, the sea space and its subterranean extend are increasingly covered by a tight web of utilization and regulation, as Figure 1 shows.

The significance of the Strait as a maritime transit way along with its back infrastructure lining the shore led to the implementation of myriad borders crisscrossing the region, forming not only fragmentation, but also limiting accessibility to the coast.

Simultaneously natural habitats and traditional settlement forms that are situated at the interface of water and land are being marginalized. Their obliteration goes hand in hand with the artificial alteration of the coastline to serve economic interests, while most urban developments are taking place inland – disconnected from the sea, which formerly served as a hinge for the maritime region. The historic significance and the cultural and natural value of these areas are lost in the consciousness of the region's inhabitants. At the same time, younger generations are leaving traditional settlements due to the lack of infrastructures and declining income. In order to protect and consolidate remaining areas of social value, public awareness needs to be raised and emphasis should be placed on promoting a sustainable development of traditional settlement structures.

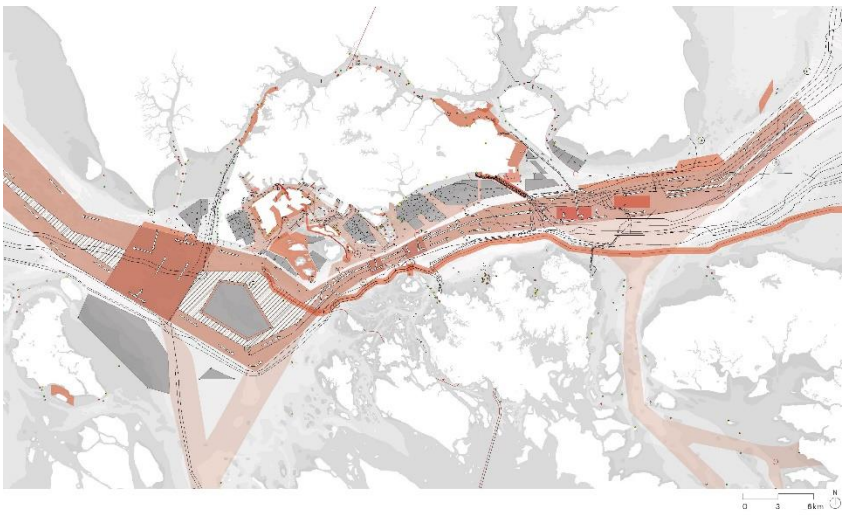
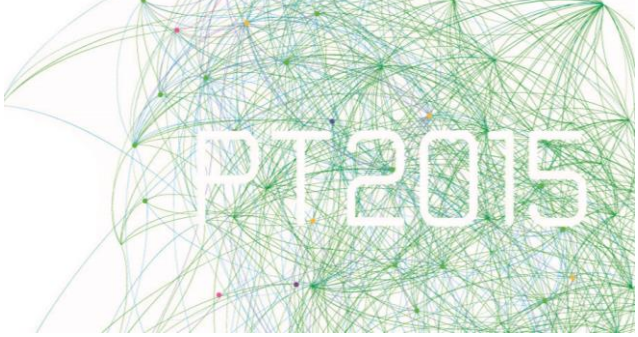


**Figure 1: Highly regulated water surface (the authors).**




## FRAGMENTED SPACE

Central to the increasing global importance of the Strait of Singapore is the decreasing intersection of multiple geographical scales. Hence the water lost gradually the comprehensive meaning that it had in the past. With the narrow waterway becoming a predominantly internationally integrated space, a phenomenon can be observed which Pierre Veltz describes as an increasing outmatch of 'traditional vertical relations with the hinterland' (2000: 33) by transnational horizontal ones. A development that is manifested in an increasing formalisation of recreational uses and cross-border connections demonstrated by the mushrooming of water sports centres, marinas and highly engineered beach parks. Besides, the formerly unregulated crossing of the sea has been replaced by frequently circulating cross-border ferries, which have to take predetermined routes to avoid a dangerous interference with the main traffic flow of the shipping lane.

While national borders have lost their importance for global shipping, where they have been replaced by a 'free trade regime', regional connectivity through linear ferry links is shaped by imposed restrictions on the flow of people. To quote Singaporean based sociologist Sharon Siddique from an interview we conducted with her in December 2013:

> '(During colonial times) (n)obody really bothered, if someone from (Singapore) … took a sampan (traditional Chinese wooden boat) and went over to relatives living on Batam Island. There were no passport controls … This status changed during konfrontasi (Indonesian-Malaysian Confrontation: 1963-1966), with Sukarno (first president of Indonesia, in office:1945-1967) declaring the borders …
>
> I think that was the time when the realization prevailed that there had to be boundaries in the sea similar to the ones on the land. People I talked to during my research would throughout remember this period in time when suddenly the border was no longer fluid, but it was demarcated by control boats and by attempts to establish some sovereignty.'

Through the superimposition of national borders on the sea, the water has lost its crucial role as a hinge for the region. Consequently the maritime nations have orientated their urban development inwards, placing their shoreline at the disposal of economic activities. The changed dynamic underlines the discrepancy between supranational connectivity and national containment. As Carlo Ezecieli elucidates: '(W)hile markets are establishing systems of planetary interdependence and metropolitan regions become more and more directly related to a global dimension, there appears to be a paradoxical tendency towards the reinforcement of local boundaries' (1998: 4).

## LOCAL SEA

The sea not only lost its porosity, but the former accessibility of the shore was reduced significantly as global economic forces occupy vast coastal stretches, obliterating not only the estuarine ecosystem and the marine habitat but also local

layers of utilisation. Drawing on Mark Cleary and Goh Kim Chuan the dilemma is 'between keeping the Strait as a sea-lane of enormous economic importance and maintaining it in an ecologically sound condition so as to be a source of fishery resources and healthy marine life' (2005: 56). This quandary elucidates the conflict between global and local, and the difficulty to delicately balance the two interests. Current struggles to safeguard the Strait's estuarine environment and to protect its integrity result in most ecosystems therein being under stress. The deterioration of environmental conditions in the waterway, and the increase in human activities put their toll on the Strait as a zone of high biodiversity – 'characterized by soft bottom habitats, fringing coral reefs, sea grass beds and mangrove swamps lining the coastlines', supporting 'a variety of coastal and marine species of flora and fauna' (Chua, 1998: 334).

A critical eye should especially be cast on the physical changes of the shoreline. While economic activity expands its influence onto adjacent territories, coastal ecosystems are under extreme pressure of being obliterated by foreshore reclamations (Tun et al., 1995) – providing new land for development, and better access to deeper sections of the sea. Consequently vast stretches of mangrove forests along estuaries and tidal waters were destroyed. In Singapore alone, 95 per cent (Friess, 2012) of the formerly existing mangrove forests have been eradicated foregoing their vital importance for the regional ecosystem as nursery habitat for many wildlife species, nesting ground for birds, and the mangrove's ability to maintain the stability of the coastline by being susceptible to erosion.

The interface between sea and land is not only a natural habitat, but also home to a common form of indigenous settlement – the so-called Kampongs (see Fig. 2 and 3): tightly clustered and raised wooden plank houses built along the shore with the sea outlining the limits of expansion (Chou, 2010). On the adjacent land, these villages most likely also encompass a cemetery, a place of worship, a market and a common bathing site. Generally of indigenous origin, Kampongs are according to Reimar Schefold (2009) usually mingled in terms of ethnicity and originated spontaneously following passed on traditions. Primarily characterized by low-rise buildings and a high population density, the local communities depict an unimpaired relationship between the sea and the land. Sustaining on small-scale fishing it is of importance for the income of the population to keep the surrounding maritime space in an ecologically sound condition.

While Kampongs are part of the region's cultural heritage, their continuing existence within the region is questionable. Authorities do not pay attention to indigenous communities and the protection of their habitat. Rapid urban development since the sixties has erased these traditional settlements not only in Singapore, but increasingly eradicates the remaining villages around the Riau Archipelago in Indonesia and the Johor Strait (Separating Malaysia from Singapore).

Furthermore, the inherent lack of infrastructure and services render future viability unlikely. With a vast majority of industrial employment opportunities inaccessible to the indigenous population (Perret, 2012), income has to be primarily generated through fishing, a domain most affected by environmental pollution. At the same time migration movements of younger generations towards larger agglomerations expedite the on-going displacement.

Even though rapid and uncontrolled urbanisation on Batam Island unleashes a destructive power, eradicating natural and cultural habitats along the coast and on the offshore islands, there are outlooks and tentative approaches, which show how change can be induced. The development of tourism resorts along the western coast and on nearby islands increases the possible access to infrastructure, especially fresh water, creates new job opportunities and ascribes value to keep the environment in a sound condition. While these developments tend to put development pressure on indigenous settlements requirements need to be set in place establishing a more integrative strategy including traditional Kampongs and existing communities in order to promote a sustainable development. Hence planning decisions should not only be driven by speculative interests, but also by environmental and cultural sensitivity.

**Figure 2: Kampong (the authors).**

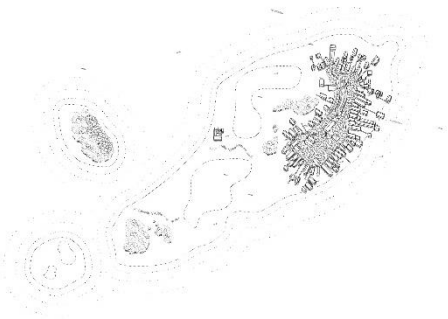
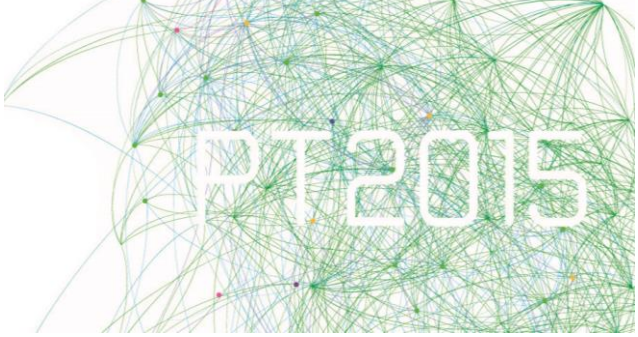


**Figure 3: Settlement Structure (the authors).**

## CONCLUSIONS

For a distinct population group the sea still provides a source on income and a living environment. Increasing development pressure leads to a marginalisation of traditional settlement forms and puts pressure on their inhabitants to move away and abandon their traditional way of life. Besides, the progressing destruction of the estuarine ecosystem and of the marine habitat upon which their livelihood depends renders their continuing existence unlikely.

Constant ambitions for economic growth and the accompanied commodification of the water space threaten not only these traditional forms of habitat with




extinction, but the declining accessibility of the coastline erases the collective memory of a maritime region.

Public awareness of the region's natural and cultural identity needs to be established in order to safeguard their continued existence. Therefore increasing accessibility to these sites and extending environmental protection are crucial measures. At the same time traditional settlements need to be upgraded to ensure future viability and to counteract the exodus of younger generations.

## REFERENCES

Chou, C. 2010. *The Orang Suku Laut of Riau, Indonesia*. London: Routledge.

Chua T., Natarajan R. & Ross S. A. 1998. Analysis of the State of the Marine Environment of the Straits of Malacca and Singapore. *Singapore Journal of International & Comparative Law*, 2, 323-349.

Clearly, M., Chuan, K. C. 2005. *Environment and Development in the Straits of Malacca*. London: Routledge.

Ezecheli, C. 1998. *Shifting Boundaries: Territories, Networks and Cities*. Mimeo.

Friess, D. The State of Singapore's Mangroves. World Migratory Bird Day. Sungei Buloh Wetland Reserve, Singapore. 12.05.2012, educational talk.

Perret, M. 2012. *Urbanization of Singapore's Hinterland. Archipelago City Batam*. Singapore: Architecture of Territory.

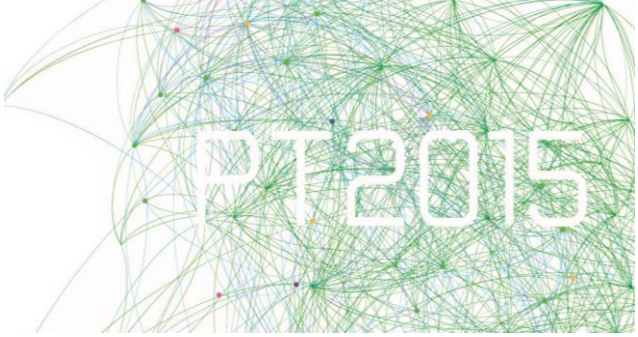
Schefold, R. (Ed.). 2009. *Indonesian Houses, Volume 2: Survey of Vernacular Architecture in Western Indonesia*. Leiden: KITLV Press.

Simon, S. W. 2011. Safety and Security in the Malacca Straits: The Limits of Collaboration. *Asian Security*, 7 (1), 27-43.

Tun, K. P. P., Chou L. M. 1995. Status of Watershed Management in Singapore. Second Workshop of the EAS-35 Project: Integrated Management of Watersheds in Relation to the Coastal and Marine Environment, Bangkok, 1995. Regional Coordinating Unit for the East Asian Seas (EAS/RCU), United Nations Environment Programme.

Veltz, P. 2000. European Cities in the World Economy. In Bagnasco, A., LeGalès, P. (Ed.), *Cities in Contemporary Europe*. Cambridge: Cambridge University Press, 33-47.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA



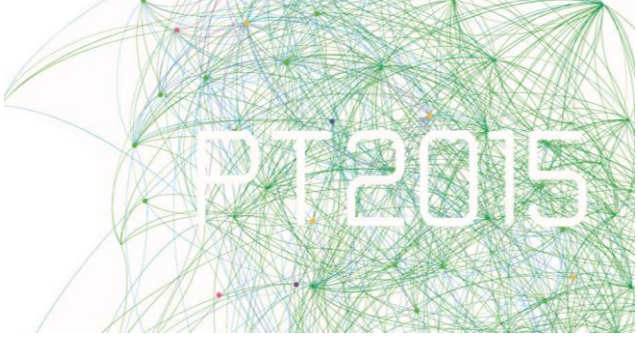

# THE SCALE OF ACUTE CARE HOSPITALS IN SERBIA - THE NEED FOR RETHINKING

**Marko Matejić**
PhD student, University of Belgrade – Faculty of Architecture, Bulevar kralja Aleksandra 73/2, marko.t.matejic@gmail.com

**ABSTRACT**

*Results, discussion and conclusions presented here are the integral part of wider research at PhD studies at University of Belgrade - Faculty of Architecture. The subject and problem of this wider research is the strategic reconfiguration of architectural-urban patterns of acute care hospitals. Strategic reconfiguration is a model of development of healthcare infrastructure based on previous detailed analysis of existing hospital infrastructure resources, concepts of welfare promoted in existing healthcare and spatial development strategies at the national level in Serbia and the international level, as well as the concepts of contemporary planning and design of hospitals. The hospital capacity planning is a major element in the overall process of planning the healthcare system resources. In the previous decades the important question in hospital planning was the need for downsizing by reducing the number of hospital beds, alongside with reconfiguration of overall hospital capacities, hospital organisational and functional structure, as well as reconfiguration of hospital physical component - infrastructure. These are all elements of discussion which question what is the optimal scale of acute care hospitals. International discussion especially stresses the oversized hospital sector as one of the inherited characteristics from socialist period and one of the major challenges for healthcare reforms in post-socialist countries. The significance of this problem has not produced a large number of studies, in contrary, as far as this research goes, there are no researches analyzing what would be the optimal hospital scale in Serbia. The ambition of this paper is not to define the optimal hospital scale. Rather, the ambition is more modest - to analyze the existing hospital scale in Serbia, making questions and creating the platform for other researchers with similar or different knowledge to research this problem further, which would be of great significance for the future planning and development of currently devastated and inadequate hospital infrastructure in Serbia.*

***Keywords**: Serbia, acute care hospital, hospital planning, hospital scale and configuration.*

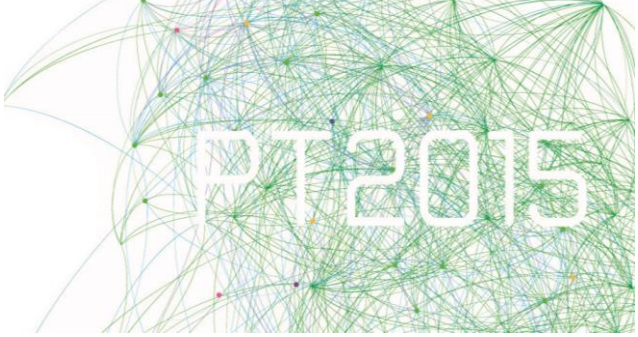



## INTRODUCTION

Results, discussion and conclusions presented here are the integral part of wider research at PhD studies at University of Belgrade - Faculty of Architecture. The subject and problem of this wider research is the strategic reconfiguration of architectural-urban patterns of acute care hospitals. Strategic reconfiguration is a model of development of healthcare infrastructure based on previous detailed analysis of existing hospital infrastructure resources. Strategic reconfiguration includes the concepts of welfare such as social cohesion and equity promoted in existing healthcare and spatial development strategies at the national level in Serbia (Republic Agency for Spatial Planning, 2011), as well as at the international level (WHO, 2012; WHO, 2013). The strategic reconfiguration also includes the concepts of contemporary planning and design of hospitals such as patient-oriented planning and facilities, humanisation of healthcare environment, adaptability and flexibility, etc. (Prasad, 2008; Verderber and Fine, 2000; Verderber , 2010). The hospital capacity planning is a major element in the overall process of planning the healthcare system resources (Ettelt et al., 2008). In the previous decades the important question or problem in hospital planning was the need for downsizing by reducing the number of hospital beds, alongside with reconfiguration of overall hospital capacities, hospital organisational and functional structure, as well as reconfiguration of hospital physical component - infrastructure. These are all elements of discussion which question what is the optimal scale of acute care hospitals. International discussion especially stresses the oversized hospital sector as one of the inherited characteristics from socialist period and one of the major challenges for healthcare reforms in post-socialist countries (Healy and McKee, 2001; Healy and McKee, 2002; Ho and Ali-Zade, 2001). The significance of this problem has not produced a large number of studies, in contrary, as far as this research goes, there are no research analyzing what would be the optimal hospital scale in Serbia. The ambition of this paper is not to define the optimal hospital scale. Rather, the ambition is more modest - to analyze the existing hospital scale in Serbia, making questions and creating the platform for other researchers with similar or different knowledge to research this problem further, which would be of great significance for the future planning and development of currently devastated and inadequate hospital infrastructure in Serbia.

## METHOD, RESULTS AND DISCUSSION

The research analyses the scale of acute care hospitals in Serbia by analyzing the data published in *Uredba o planu mreže zdravstvenih ustanova 1997* (Službeni glasnik Republike Srbije 13/1997, 58/1997, 31/1998, 1/1999, 37/1999, 21/2005) and *Uredba o planu mreže zdravstvenih ustanova 2006* (Službeni glasnik Republike Srbije 42/2006, 119/2007, 84/2008, 71/2009, 85/2009, 24/2010, 6/201). The hospital scale is expressed in the number of hospital beds, while hospitals are classified in groups as small hospitals, optimal hospitals and big hospitals (as shown in Table 1). Groups are defined with respect to research in developed

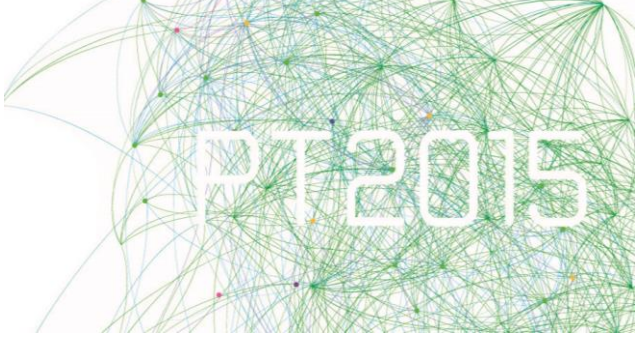



countries and the prevailing international opinion that the hospitals between 200 and 600 beds are of optimal scale when observed in relation to economy and diseconomy of scale (Posnett 2002; Healy and McKee 2002). The research of developed countries are used since this type of research are not carried out in Serbia, as we know, though several authors give their opinion of the preferred size of the hospitals. Mijić-Vučković (1988) stated that the optimal size of hospital is 500 beds, while the hospitals between 250 and 750 beds have appropriate size. Balzareno (1997) suggests that hospitals smaller than 150 beds should not be built, and that the optimal size of the hospitals is between 400 and 600 beds. Atanasijević (1986) takes the hospital scale as one of the criteria in determining the capacity of the intensive care unit. Thus, he classifies the hospitals as big (more than 800 beds), medium size (between 300 and 800 beds) and small (less than 300 beds).

The research covers all acute hospitals under the Ministry of Health on the secondary and the tertiary level of healthcare, in accordance with *Health indicators in Serbia - Data Presentation System - HIS-DPS* (Institute for Public Health of Serbia, 2013). The military hospitals, private hospitals and the hospitals in Kosovo and Metohija are excluded due to lack of the statistical data. This research does not include beds in day hospitals, neonatology wards, beds for persons accompanying patients, as well as beds in community health centres (dom zdravlja).

Data presented in Table 1 shows that the number of hospitals between 200 and 600 beds increased close to 8% in the given period and their share in total number of hospital beds increased between 12% and 13%, making 52.31% of all acute care hospitals and 48.51% of all acute beds in 2012. The number of hospitals smaller than 200 beds increased by a few, also resulting in increase of share in total number of hospitals for a few percent, making almost 28% of all acute hospitals in 2012, but only 7.51% of all acute beds. The number of big hospitals reduced by 11.75%, making 20% of all acute hospitals and 46.95% of all acute beds in 2012. It is obvious that the scale of big hospitals has also changed. While in 1997 hospitals between 800 and 1000 had a significant share of 22.35% in total bed number, in 2012 there is no hospital of this scale, leaving only hospitals between 600 and 800 beds with share of 22.19% and clinical centres or university mega-hospitals over 1000 beds with share of 24.76%.

It is notable that almost half of the hospital resources are located in the hospitals, which does not classify as the optimal scale hospitals. The share of big hospitals has reduced, while in the same period, the number of small hospitals has increased, and this could lead us to a conclusion that the process of downsizing was rather linear, covering all hospitals, then the result of strategic thinking. In *Bolje zdravlje za sve u trećem milenijumu* (Ministarstvo zdravlja Vlade Republike Srbije, 2003) is stated that there is unequal development of territorial distribution of hospital capacity in Serbia, as well as the inadequate structure of hospital beds in relation to medical specialities and the small number of hospital beds in certain specialities.




These facts indicate that the scale or configuration of acute hospitals in Serbia, as well as acute care hospital network, does not reflect the needs of population.

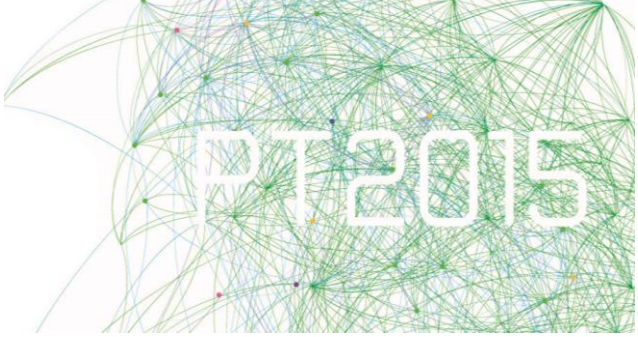
**Table 1: The scale of hospitals in Serbia.**

| | Hospital size [ beds] | Hospitals [N (%)] | | Hospital beds [N (%)] | |
|---|---|---|---|---|---|
| | | 1997 | 2012 | 1997 | 2012 |
| small hospital | **< 200** | **15 (23.81)** | **18 (27.69)** | **1950 (5.92)** | **2153 (7.51)** |
| | <120 | 4 (6.35) | 6 (9.23) | 260 (0.79) | 360 (1.26) |
| | 120-149 | 4 (6.35) | 7 (10.77) | 530(1.61) | 942 (3.28) |
| | 150-199 | 7 (11.11) | 5 (7.69) | 1160 (3.52) | 851 (2.97) |
| optimal hospital | **200 - 600** | **28(44.44)** | **34(52.31)** | **10837 (32.91)** | **13066 (45.54)** |
| | 200-399 | 15(23.81) | 21 (32.31) | 4585 (13.92) | 6352 (22.14) |
| | 400-600 | 13(20.63) | 13 (20.00) | 6252 (18.99) | 6714 (23.40) |
| big hospital | **600 <** | **20 (31.75)** | **13 (20.00)** | **20145 (61.17)** | **13469 (46.95)** |
| | 601-799 | 6 (9.53) | 9 (13.85) | 4125 (12.52) | 6366 (22.19) |
| | 800 - 999 | 9(14.28) | 0 (0.0) | 7360 (22.35) | 0 (0) |
| | 1000 -2999 | 4 (6.35) | 3(4.61) | 5170 (15.70) | 3953 (13.78) |
| | 3000 < | 1 (1.59) | 1 (1.54) | 3490 (10.60) | 3150 (10.98) |
| | **Total** | **63(100)** | **65 (100)** | **32 932 (100)** | **28688(100)** |

McKee and Healy (2002) stress that there should be arguments for different configurations of hospitals, which should provide high quality of healthcare and simultaneously insure that expensive hospital resources are used optimally. Ho and Ali-Zade (2001) state that reconfiguration of hospitals should be carried out using more structured and systemic approach based on an analysis of local population needs and utilisation patterns so that determined configuration of services shows as efficient as possible.

## CONCLUSION

The research has show that hospital scale in Serbia varies from small hospitals with few dozen hospital beds to university mega hospitals with more than a thousand hospital beds. On one side, research showed that close to one-half of these hospitals could not be considered to have optimal size. On the other hand, the results in this research should be taken with caution, as they were discussed only in relation to research and experience of developed countries. Anyhow, the research results indicate the need for detailed rethinking of acute care hospital in Serbia, which means the simultaneous rethinking of development of territorial distribution of hospital capacities, organisational structure of acute hospitals and physical configuration of buildings. Rethinking of hospital scale should be in direct function of population needs and many different factors, which comes from the specific




local context of Serbia. The process of rethinking should be in close relation to new financial mechanisms and expenditure in healthcare, development of new technologies, contemporary concepts of planning and design of hospitals (such as patient-oriented planning and facilities, humanisation of healthcare environment, adaptability and flexibility, etc.), as well as the concepts of well-being (such as social cohesion and equity in accessibility and quality of healthcare).

**REFERENCES**

Atanasijević, Veroljub M. 1986. *Intenzivna nega bolesnika kao deo opšte progresivne nege u savremenim bolnicama sa aspekta projektovanja* [*Intensive care of patients as part of a general progressive care in contemporary hospitals from the aspect of design*]. Doktorska disertacija. Kragujevac: Univerzitet u Beogradu, Arhitektonski fakultet.

Balzareno, Dragoš. 1997. *Bolnica: programiranje, projektovanje, izgradnja* [*Hospital: programming, design, construction*]. Beograd:autor.

Ettelt, Stefanie, Ellen Nolte, Sarah Thomson, and the International Healthcare Comparisons Network. 2008. *Capacity planning in health care: A review of the international experience. Policy Brief.* Copenhagen: European Observatory on Health Systems and Policies. Accessed December 22, 2013. http://www.euro. who.int/__data/assets/pdf_file/0003/ 108966/E91193.pdf.

Healy, Judith, and Martin McKee. 2002. "The role and function of hospitals." In *Hospitals in a changing Europe*, edited by Martin McKee and Judith Healy, 59-80. Buckingham, Philadelphia: Open University Press. Accessed December 22, 2013. http://www.euro.who.int/__data/assets/pdf_file/0004/98401/E74486.pdf.

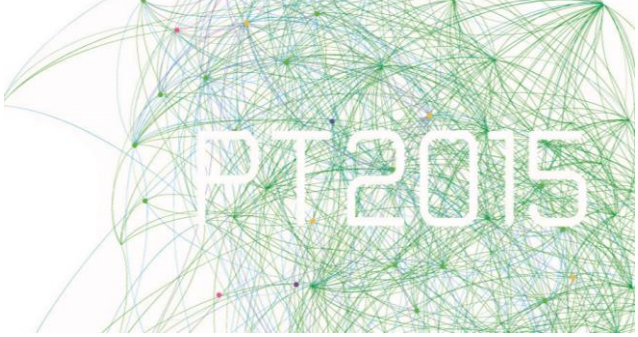
Healy, Judith, and Martin McKee. 2001. "Reforming hospital system in turbulent times." *Eurohealth* 7, no. 3 (Special issue): 2-7. Accessed December 22, 2013 http://www.lse.ac.uk/LSEHealthAndSocialCare/pdf/eurohealth/ vol7no3.pdf.

Ho,Teresa, and Narguiz Ali-Zade. 2001. "Eastern European hospitals in transition." *Eurohealth* 7, no.3 (Special issue): 8-14. Accessed December 22, 2013. http://www.lse.ac.uk/LSEHealthAndSocialCare/pdf/eurohealth/vol7no3.pdf.

Institute for public health of Serbia. 2013. *Health indicators in Serbia - Data Presentation System* . Accessed March 28, 2014.http://data.euro.who.int/hfadb.

McKee, Martin, and Judith Healy. 2002. "The significance of hospitals: an introduction." In *Hospitals in a changing Europe*, edited by Martin McKee and Judith Healy, 3-13.Buckingham, Philadelphia: Open University Press. Accessed December 22, 2013. http://www.euro.who.int/__data/assets/pdf_file/0004/98401/E74486.pdf.

Mijić-Vučković, Jelena. 1988. *Planiranje zdravstvenih objekata* [*Planning of healthcare facilities*]. Beograd: autor.




Ministarstvo zdravlja Vlade Republike Srbije. *Bolje zdravlje za sve u trećem milenijumu* [Better health for all in the third millennium]. 2003. Beograd: Ministarstvo zdravlja mRepublike Srbije.

Posnett, J. 2002. "Are bigger hospitals better?" In *Hospitals in a changing Europe*, edited by Martin McKee and Judith Healy, 100-118. Buckingham, Philadelphia: Open University Press. Accessed December 22, 2013. http://www.euro.who.int/__data/assets/pdf_file/0004/98401/E74486.pdf.

Prasad, Sunand. 2008. *Changing Hospital architecture*. London: RIBA Publishing.

RASP (Republic Agency for Spatial Planning). *Prostorni plan Republike Srbije 2010-2020* [*Spatial plan of the Republic of Serbia 2010- 2020*]. 2011. Beograd: Službeni glasnik.

*Uredba o planu mreže zdravstvenih ustanova 1997* [*The Regulation of the healthcare institutions network plan 1997*]. Službeni glasnik Republike Srbije 13/1997, 58/1997, 31/1998, 1/1999, 37/1999, 21/2005.

*Uredba o planu mreže zdravstvenih ustanova 2006* [*The Regulation of the healthcare institutions network plan 2006*]. Službeni glasnik Republike Srbije 42/2006, 119/2007, 84/2008, 71/2009, 85/2009, 24/2010, 6/2012.

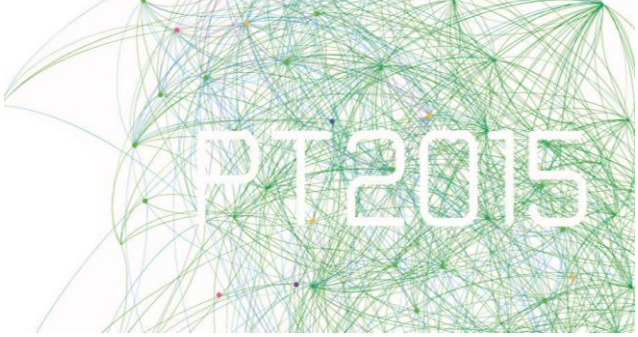
Verderber, Stephen., and David J. Fine. 2000. *Healthcare Architecture in an era of radical transformation*. New Haven and London: Yale University Press.

Verderber, Stephen. 2010. *Innovations in hospital architecture*. New York, London: Routledge.

WHO Regional Office for Europe. 2012. *Health 2020: A Europe framework supporting actions across government and society for health and well-being*. Copenhagen: WHO Regional Office for Europe. Accessed February 23, 2015. http://www.euro.who.int/en/publications/abstracts/health-2020-a-european-policy-framework-supporting-action-across-government-and-society-for-health-and-well-being

WHO. 2013. *The European health report 2012: Charting the way to well-being*. Copenhagen: WHO Regional Office for Europe. Accessed February 23, 2015. http://www.euro.who.int/en/publications/abstracts/european-health-report-2012-charting-the-way-to-well-being-the.-executive-summary.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# ARCHITECTURE AND HEALTHY LIVING SPACE

**Goran Radović**
PhD, Professor, University of Montenegro, Faculty of Architecture,
Džordža Vašingtona b.b., Podgorica, Montenegro, goran.radovic@ac.me

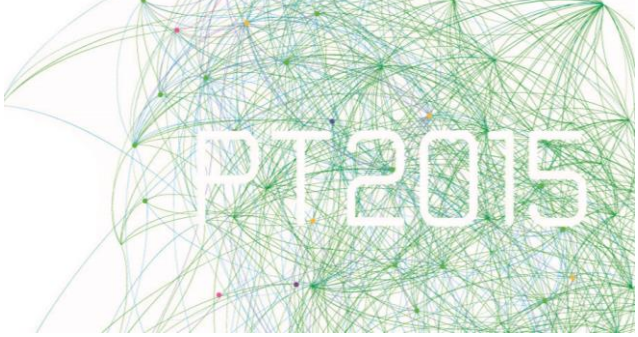
## ABSTRACT

*Since the very beginning of their life on Earth, people have been aware of their need to organize their living space. As early as in Neolithic period, people populated naturally protected spaces that were selected according the capacity to provide safety, ventilation and better heating which, at those times, were the conditions for a suitable place to live. That primordial need of a man to create a safe and healthy space has always been his ever-lasting basic need. To ensure a healthy living space it will be interesting to consider traditional ways of house placement and its orientation with respect to the sun and wind. In addition, a healthy terrain for house construction makes an important component. The selection of materials for house construction is the next important component for building a house as habitable space. Centuries-long human experience in the use of natural materials has proved that such materials are the healthiest for habitable space construction. The development of technology in 20 century has introduced many new artificial materials which have not stood the test of time. Some of the materials that were used in the past today are considered a health hazard, whereas some of them have high radiation levels. The application of unsuitable materials for the construction of houses in the second half of 20 century resulted in the term „Sick Building Syndrome" in which people showed the same symptoms of illness. In view of that fact, today, many types of houses are constructed by using solely natural materials. These are: eco houses, eco hotels, ecotourist settlements etc. In addition, the use of natural energy resources, such as sun, wind, ground waters and the like are the main topics the humanity deals with today by improving technology for using these resources to build a healthy space for people.*

***Keywords**: healthy dwelling, architecture, materials, natur.*

## INTRODUCTION

Caring for the quality of living in a dwelling space is people's primary concern and purpose. In addition to meeting basic existential needs for food and clothing, a roof over one's head i.e. living space has been the third most important human need from the very beginning. As early as in prehistoric period, a man felt the need to create a healthy living space. In those initial prehistoric times of human development, people populated naturally protected spaces that were selected




according their capacity to provide safety, ventilation and better heating as well as dry places which, at those times, met the conditions for a suitable place to live. Throughout centuries, people have continued to ensure these conditions for themselves and even today, these are the main conditions for a healthy and safe space for work and living. That primordial need of a man to create a safe and healthy space has always been his ever-lasting basic need. For this reason, throughout centuries, a man has developed construction methods and techniques which are characterised by different architectural periods, styles and art. Based on construction schemes, civilisations and their culture of living are analysed.. The development of science and engineering in XX century contributed to the invention and application of new artificial materials in the construction of housing and public spaces. This resulted in considerable deterioration of biological and environmental circumstances in residential and office buildings by the end of the twentieth century.

Many sciences investigate relationships between humans and environment, among which is the science dealing with the environment or surroundings, known as "environmental science". "Bio-construction" stems from this science and deals with environmental, cost-effective, ethical and humane construction principles. Bio-construction, as engineering scientific discipline, assumes that humans are only one of the links in the historic chain of mankind lifecycle, which points to the need to construct in harmony with natural surroundings. To achieve the harmony between natural and built environment, it is necessary to use healthy, natural materials in construction, which will provide healthy conditions in human environment.

## BASIC NEEDS AND FIRST FORMS OF DWELLING

In the beginning, humans used all benefits of immediate environment as their dwelling– dense shrubs, holes in the ground, caves and the like and subsequently, through different improvements or extensions, they gradually adjusted them to their needs thereby changing their immediate environment and acquiring knowledge and skills to create inexhaustible abundance of shapes.

The abundance of shapes used in the feats of living space construction is the consequence of different natural environments where the construction was carried out and different needs and circumstances of the community. This is how different construction techniques have developed and stood out. To make living space safe and protected from wild animals, enemies, floods and dampness, man builds an upper storey. "Such examples are houses- apartments on platforms, like the house in a Papuan village in New Guinea (Lindk "Picturesque New Guinea", London 1887) and a stilt house Giljaka in the North (Karutz "Die Volker Nord und Mittelasiens")"[1]

[1] Baylon Mate, 1985, *Stanovanje,Tema 7: Grupisanje*, edited by Arhitektonski fakultet Univerziteta

**Figure 1: Papuan vilages (New Guinee).**

**Figure 2: Haus Giiliac (New Guinee).**

**Figure 3: Abisin house from Gondar.**

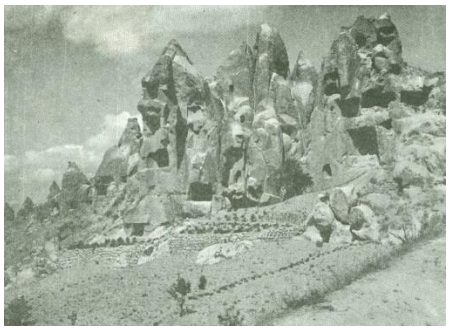


**Figure 4: Cave dwellings in Cappadocia.**

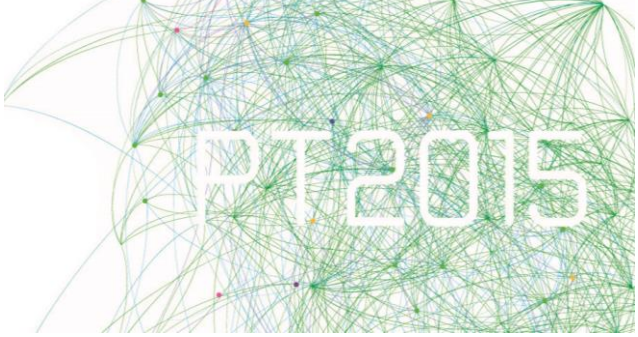
A good example of natural shapes are cave dwellings – cells, chiselled in the rocks in Cappadocia region in Turkey.
These examples and subsequent centuries-long construction activities speak about the fact that the primary obligation and aim of people was to take care of the quality of living in a habitable space. "Actually, this is the need to achieve the quality of relations in a dwelling environment which will stimulate physiological, psychological, emotional and social nature and sources of human actions"[2].

In fact, human beings base their life actions on creation, construction and life in the environment they strive to arrange according to their needs.

## PRINCIPLES AND CONDITIONS FOR HEALTHY DWELLING

The task and objective of architecture is not only to design buildings but also to create a healthy and comfortable space for all human and life activities. The field of architectural activities is wide and diverse, ranging from spatial and urban planning, architectural design and construction i.e. selection of the location in the

u Beogradu, page: 20.
[2] Aleksić Branko, 1985, *Stambena sredina, Humane – prostorne osnove*, edited by the Faculty of Architecture of the University of Belgrade, page: 2.




broadest sense of the word, to the creation of the most immediate human environment, which is a dwelling unit. In all fields of actions, for architects, the study of environment is a must because in that way a healthy life and dwelling is ensured.

Selection of the location provisionally defines an architectural structure environment quality level and for this reason, the selection of the location is the first step toward ensuring healthy dwelling and working conditions. According to P. Badovinac, location factors influencing dwelling quality may be divided into two main groups: natural location factors and created location factors. Group of natural factors is comprised of the factors relating to: climate conditions determined by latitude and longitude; soil and its morphological, pedological and geological characteristics and vegetation. The factors relating to the soil characteristics are: terrain configuration, terrain slope, terrain height, geological and pedological soil composition, physical stability, seismic sensitivity, bearing capacity, dissection and devastation of soil. In addition to the aforementioned, hydrogeologic and hydrographic soil factors are; ground waters and their courses, drainability of soil etc.

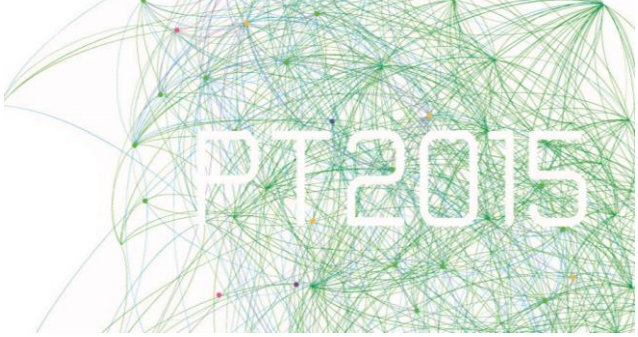
Apart from the above, very important natural factors are also those determining microclimate characteristics of the location, such as: exposure to sunlight, air temperature, precipitations, humidity and winds.

This points to the fact that the selection of the location for house construction is a very important factor. The terrain on which house construction is planned needs to be explored, particularly in relation to radioactivity.

The group of created factors on the location is comprised of the conditions which have occurred as the result of human activities in a particular area. Created conditions can be divided into more than one group: environmental, demographic, sociological, technological etc. For the quality of living space, particularly the quality of dwelling space, environmental factors are most important since they commonly occur as the result of degradation of natural conditions in the process of urban development of a particular space. Environmental factors are comprised of: air pollution, soil contamination, water pollution, microclimate changes, different harmful radiations, vibrations, earthquakes, unpleasant smells etc.

"Exploring location suitability for living and biogenicity of space, M. Gornik concludes that the main sources of harmful natural factors which make space pathogenic are the following occurrences: natural radioactivity of soil, water and air; creeping currents and currents of physical structures; electromagnetic radiations; electrostatic fields and ionization of the air"[3]. Researches of these occurrences record and describe the outbreaks of inexplicable diseases and events,

[3] Popović Jovanović Milica, 1991, *Zdravo stanovanje*, edited by BorivojeAndjelković, published by: the Faculty of Architecture of the University of Belgrade, page 3.



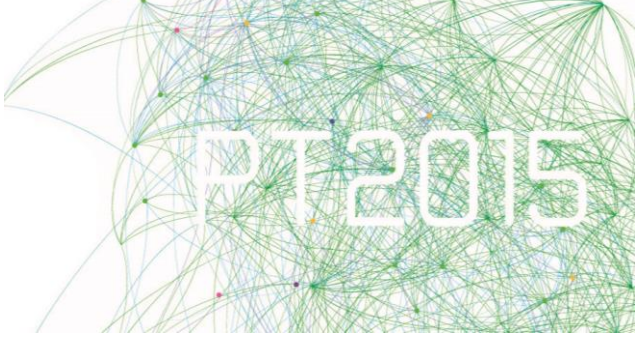

which a large number of scientists are not ready to accept, particularly when it comes to the process which includes the method of location determination. Nevertheless, the location quality also includes its comforts which are determined based on its boundaries and on external and internal impacts. There are four main forms of comfort stemming from the relationship between people and environment: aerial, acoustic, visual and thermal.

Aerial comfort quality relates to ensuring a clean air in dwelling and working spaces of people. Air quality in dwelling and working spaces largely influences people's quality of life and health. Air quality is analysed from two aspects: quality of outdoor air and quality in built space. It is difficult to speak about high quality of city air i.e. clean city air. Instead, it can be said that such air is more or less polluted. City air is comprised of: ozone, carbon monoxide, sulphur dioxide, lead and dust of organic and inorganic origin.

Air quality in dwelling spaces is influenced by: lifestyle, type and number of activities in the apartment, level of hygiene and materials from which the structure is built. The first three factors are the result of a lifestyle and can be easily changed, whereas the type of built-in materials is often an inherited factor which cannot be changed that easily.

To ensure that air is within the limits which provide healthy and pleasant stay in a dwelling space, constant ventilation is necessary in order to: ensure healthy breathing air, eliminate smells, eliminate pollutants, decrease high air humidity and maintain thermal comfort in summer periods. Minimum requirement for ensuring clean air in a dwelling space is defined by the number of air changes per hour or by volume of air cleaned per hour. Air comfort is provided in dwelling spaces through natural ventilation i.e. natural air-conditioning carried out in the apartments in three ways: by infiltration, window opening or canals.

Air infiltration is carried out through construction materials and by the joints of construction elements on the building. Brick and rendered structures, which were used in older buildings such as, for example, brick wall of 51 or 64 cm width, plastered from both sides, enabled air filtration into the dwelling space and vapour diffusion from the dwelling space outdoors. This process was termed "breathing wall". When reinforced-concrete structures were used in the construction of residential buildings, the structure of face wall was significantly thinner, which produced the whole set of consequences for the thermal comfort of the apartment. For this reason, thermal insulation layers are added to the face walls of the building which resulted in the creation of non-breathing walls i.e. the creation of wall structure through which air infiltration is not possible. New technologies for thermally insulated facade materials have partly ensured and improved air infiltration, usually along with the use of artificial materials.




In dwelling, acoustic comfort quality is an important factor the architects often omit to pay attention to. Noise is also often accepted by the occupants as a necessary evil. During the day, people react and object to noise only when it disturbs their regular activities, whereas at night, they object due to increased disturbance of sleep. At the same time, zoning is carried out according to the noise level and category so that the zones of light and quiet industries, business, trading and recreational centres are buffer zones of the urban residential zone.

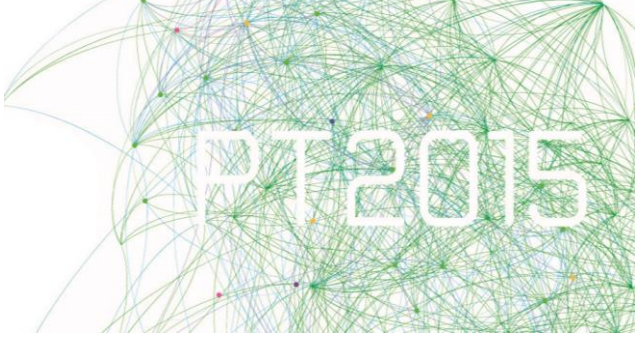
If we take into account different activities which are carried out in living spaces, we can conclude that different dwelling spaces have different sensitivity to noise. Working and living spaces in an apartment, such as living room, kitchen, dining room, bathroom and communications, are the spaces which by themselves generate a particular level of noise and are not considered too sensitive to external noise. Opposite to working spaces in an apartment, bedrooms and drawing rooms are quiet dwelling spaces sensitive to noise and require the provision of peace and quiet. This should be always taken into account in the design process and dwelling and working spaces should be oriented toward the noise source whereas quiet spaces should be directed toward protected space.

Façade lining of a building can largely diminish the impact of external noise on the dwelling space.

The quality of visual or lighting comfort enables good line of sight and accurate and fast perception. Visual comfort is achieved by proper illumination which is understood to: make the space cosy, provides a cheerful residential and working environment, reduces eye strain, increases visual perception, reduces accidents at work, eliminates harmful effects of light etc. Good lines of sight do not affect the quality of illumination in an apartment but have a considerable psychological impact on people.

Needs for visual comfort in living spaces differ depending on rooms. According to the activities carried out in the rooms of the apartment, visual comfort requirements can be divided into three categories: communications with the lowest level of requirements, except for safety; occupied areas of apartment without special working spaces with pronounced aesthetic requirements and working spaces in the apartment with visual comfort requirements.

Thermal comfort quality is determined by the space where the environment is thermally neutral and where people do not feel thermally uncomfortable, whereas thermal regulators of human system are minimally strained and thermal balance of the body is achieved. Thermal comfort parameters differ depending on: culture of living, lifestyle, social and financial status, type of activities, physical condition of the body. For this reason, thermal comfort assessment criteria vary from person to person.




## NEGATIVE EFFECTS ON LIVING SPACE

One of the huge effects which are rather aggressive and create harmful effects in living space influencing health is radiation. Natural radiations come from the sun, earth and natural materials whereas artificial radiations come from manufactured devices and equipment as the product of human technological achievements. One of very dangerous radiations for human life is ionizing radiation which is generated by radioactive decay of atomic nuclei of radionuclides.

Radioactivity may affect an organism in two ways: as external and internal radiation. **Negative effects from construction materials** cannot be neglected when it comes to the provision of a healthy living space. In the past, architects did not consider the problems concerning the impact of construction materials on the quality of dwelling. Inherited way of thinking and ranking of the materials was according to their mechanical properties and possibilities to shape them, whereas medical aspect of use of such material was neglected. This became a current topic in the second half of the twentieth century. For a long time now, it has been a common misconception that radiation from construction materials does not have any significant harmful influence on health and life of people. However, the researchers conducted in the last decades of the twentieth century have shown that any construction material contains radioactive particles as follows: radium 226, thorium 232 and potassium 40 as well as their decay products. Radiation in premises manifests itself in two ways: as $\alpha$ and $\beta$ rays from construction materials which, due to short range, stay trapped in the materials as well as $\gamma$ rays which are manifested in the room from the external side as well as in the body of a person. In construction materials, there is an existence of radon which stays in the air we breathe and radiates from within the body of a person.

In 1972, German Ministry of Science was the first to draw attention to these hazards. It warned about the need to use construction materials which do not exceed radiation threshold i.e. the need to avoid materials with high natural radiation. This particularly included the use of materials for building premises where people mostly stay during the day, such as: living room, bedroom, working spaces.

### Radioactivity in buildings

When selecting building materials for the construction of living and working spaces one should pay attention to use the materials the radioactivity of which is, according to the summary formula, less than one, such as: slate, limestone, marble, sandstone, natural stone, brick, brick dust, wood, clay, portland cement, clay concrete, lime, natural gypsum, synthetic gypsum (apalit), bitumen. Materials with high radioactivity coefficient, above one according to the summary formula, which must not be used for the construction of dwelling and working spaces or the use of which should be reduced to the minimum are: granite, breeze brick, red mud brick,

slag stone, blast-furnace slag, fly ash, slag cement, synthetic gypsum phosphorite, bauxite, asbestos cement.

Very low radioactivity, lower by 90 %, was recorded in houses built from wood, and subsequently in prefabricated houses built from the combination of wood, gypsum and some artificial materials. "Experiments made with wood as building material have shown that wood has insulating effects and that its radioactivity is 1 Bq/kg, whereas for concrete it is 50-60 Bq/kg, which means that radiation from concrete, is 50-60 times higher than from wood. Table 1 was obtained as the result of measurements carried out in 15 000 buildings in Sweden, whereby cosmic and internal radiation was not taken into account and the data relate to the mean values:

**Table 1[4]: Radiation level depending on the material.**

| Type of building | Measured radiation dose mSv/a |
|---|---|
| Wooden house | 0,10 |
| House of sandstone | 0,50 |
| Brick house | 0,60 |
| Siporex house | 0,80 |
| Concrete house | 2,50 |
| Granite house | 3,00 |

In the same research it was found that extreme radioactivity values were recorded in houses built from concrete and granite. Radioactive gas, radon, poses a particular hazard for increased radioactivity of a building.

## Radon radiation and its concentration in buildings

Radon 22 is the isotope of radon which occurs in nature, it is produced by the radioactive decay of radium 226, has a half-life of 3.8 days and produces α-rays. Since radon is a gas, people inhale it and it was noticed that at places where its concentration is higher, the percent of people suffering from lung cancer is increased. For this reason, in many developed countries, numerous projects and activities were initiated for the determination or radon concentration in nature and for the protection against its radiation.

[4]Terzić Radojica, 1997. *Bioizgradnja – Biološko-ekološka izgradnja i sanacija građevinskih objekata*, edited by Vojislav Brkovic, page: 27, publisher: Ekostan – Sprint Beograd, ISBN 86-82863-02-2.

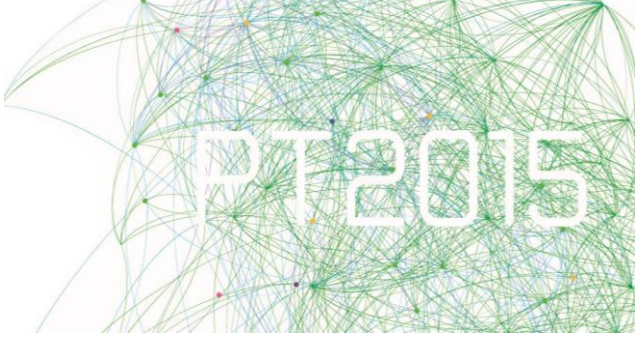



**Table 2[5]: Content of radium 226 in the soil below the house and in the construction material.**

| Material | Content of radium 226 in Bq/kg |
|---|---|
| Granite | 115 |
| Natural-cement rock | 85 |
| Red clay | 70 |
| Slate | 59 |
| Limestone | 52 |
| Quartzite | 44 |
| Sand | 37 |

Numerous researches have shown that the highest radon concentration comes from soil, and a smaller part, about 50 Bq/m$^3$ , comes from construction materials. In addition, it has been proven that radon plays a big role in the environmental pollution.

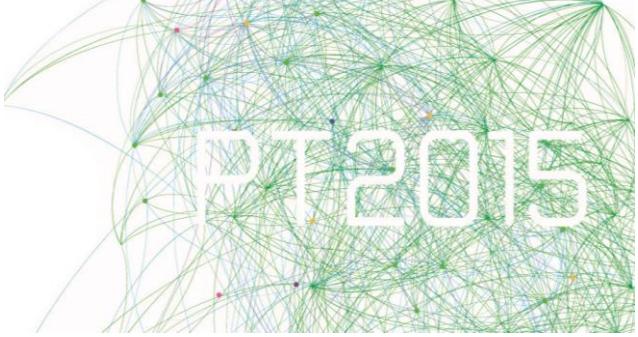
It is a common knowledge that radon is produced by the decay of natural radium Ra226 which, due to its mobility, easily finds way to the surface of the earth. Thus, through the cracks of the earth and permeable soils, radon comes to the ground below houses wherefrom it propagates in different ways into the interior of the buildings, such as: cracks in concrete flooring in the basement, lack of insulation layers in the basement floor, through the installation duct openings which run through the floor slab of the basement or, most easily through the basement floor which does not have a floor slab. In addition, heating of basement premises increases radon concentration in a house, whereas at the higher floors, the concentration of radon decreases. For this reason, it is desirable to make smaller windows in basement premises for the purpose of natural ventilation.

Radon quantity in construction material does not depend only on the radium quantity but also on the material's capacity to allow radon to pass. If a particular construction material does not allow radon to pass, then it stays trapped therein and has half-time of decay in 3.8 days.

Data on the content of radon in construction materials and soil are of interest for the designers, builders and producers of construction materials. The level of radiation of a future residential or office building largely depends on the selection of construction materials and their proper installation.

Average value of radon concentration in houses is 50 Bq/m$^3$, and outside the houses it is 14 Bq/m$^3$. Radon concentration of 100 Bq/m$^3$ can be considered a normal dose within the house and no curing measures are necessary. Based on the well-known harmful effects and hazards of radon radioactivity, some developed countries have

[5]Ibidem, page 31.




prescribed threshold values of radon exposure in houses, which is shown in the Table 3 below.

**Table 3: Threshold values of radon exposure in houses.**

| Country | Recommended threshold values for radon in Bq/m$^3$ | Note |
|---|---|---|
| Sweden | 1000/175 | old/new houses |
| Canada | 450 | |
| United Kingdom | 1000/200 | old/new houses |
| Germany | 250 | |
| USA | 150 | |

Curing radon comes down to its destruction. Since this is not possible, it is necessary to think of the ways to reduce radon concentration in the house. Basically, everything boils down to a couple of possibilities:

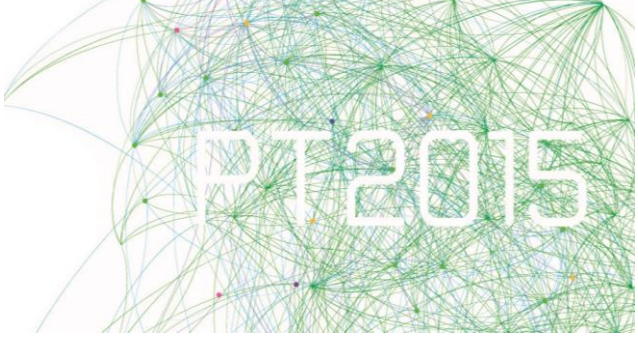
- Ensure that minimum possible quantities of radon permeate from the soil into the houses, whereby attention should be paid that instead of underpressure overpressure is created,
- Reduce the existing radon concentration in premises by natural or artificial ventilation,
- When constructing buildings, pay attention to the use of the construction materials which have lower radon permeability.

## "SICK BUILDINGS"

The term "Sick buildings" was used for the first time in 1970s, in the USA, after an epidemic which broke out at a convention. "This was an annual convention of American legionnaires (mercenaries) in Philadelphia where there was an outbreak of a disease which, in some participants, looked like a mild case of viral pneumonia whereas in the others it appeared as severe pneumonia with high fevers, while some persons felt muscle pains, fatigue and slight fever. The hotel where convention was held was new and recently opened, which is why it smelled of paint and artificial materials used in the building interior. Subsequent analysis produced the evidence that this was an infection caused by a bacteria which lived in cooling towers, formaldehyde used for the protection of piping and shower mixers. Then, for the lack of a more specific term, the name "*sick building syndrome"* was used for the first time and it is used even today, in all situations when a disease is of an unknown cause and clearly connected with an enclosed space "[6].

The second time this term was used in 1980s, when numerous cases of vague medical problems occurred in people who did office jobs. People who worked in office buildings where an artificial and limited air exchange system was installed for the purpose of energy saving and where premises were built from modern construction materials, suffered from different medical problems. The most

[6]Ibidem, page 45.




common problems were headaches, nausea, excessive tearing, breathing difficulties and the like, which indicated to the presence of an undiscovered biological agent or toxin.

The next example took place in Belgrade in 1970s. In a small residential building which was built in the beginning of the twentieth century and situated in the old part of the city, it was noticed that a large number of people living in that building suffered and died of cancer. Considering such symptomatic case, the research was conducted and showed the following. In the period between the two world wars, there was a doctor who had an office in that building and an x-ray device. It was clear that the x-ray radiation had spread to the whole building and the radiation exposure of such building was high. After measurements, it was confirmed that the whole building was sick.

In addition to these extreme examples, the researches carried out by the end of 20 century indicate to the general causes which may be connected to the "sick house syndrome", such as:

- Physical causes: insufficient ventilation, dry air, stale air, illumination, high or low room temperature, static electricity and permanent noises.
- Chemical conditions: dust, cigarette smoke, inorganic compounds, volatile organic compounds, biocides and smells.

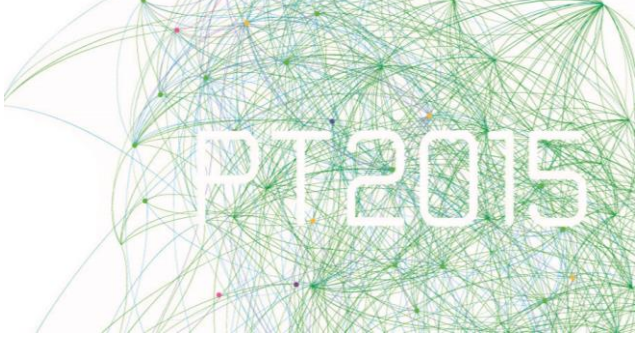
Biological factors: bacteria, fungi, viruses.

- Psychological factors: psychological strains (working in front of the monitor), difficulty at work, sleep disorder, mass hysteria.

The buildings in which "sick building syndrome" appears have common characteristics: fast prefabrication, use of a large number of synthetic materials, good sealing, poor air-conditioning, air-conditioning devices have high air consumption, large number of surfaces are covered by textile flooring, wall, ceilings and joinery are from artificial synthetic materials and the like.

## SYMPTOMS AND DISEASES CAUSED BY "SICK BUILDINGS"

General symptoms of diseases caused by sick buildings are permanent functional disorders, mental diseases and nervousness. In practice, there is an increasing number of persons with the symptoms of permanent fatigue, anxiety, depression and the like, and many of these are caused by physical and mental problems. However, the number of these diseases which can be connected with the influence of „sick building" on people's dwelling and working space is not small. All researches conducted to date indicate that respiratory organs, mouth, nose and lungs where the oxygen comes into contact with blood, are most affected by "sick building" impact. Respiratory organs are affected by different harmful evaporations of chemical substances from construction materials and furniture, of which the most common are: solvents, formaldehydes, vinyl chloride, cleaners and disinfectants used in large quantities in household and working premises. At




workplaces there are solvents, correctional liquids and glue, asbestos fibres from furnaces and hot-water heaters, artificial materials for thermal insulation such as: styrol, polyurethane, different mineral wools, natural gas, Radon, etc.

The consequences of these harmful effects on respiratory organs are different and they are manifested as chronic irritations with increased sensitivity to infections, constant nose congestion, allergies and other respiratory problems. Radon and asbestos are particularly dangerous and they represent cancer hazard.

In addition, it should be noted that under the influence of a sick building all organs are threatened and exposed to harmful effects on health and life of people and thus, many other diseases can be linked to this cause. For example, the connection between rheumatic diseases and sick buildings is still not fully explained but the fact remains that many people who live in sick environments suffer from rheumatic diseases and muscle pains.

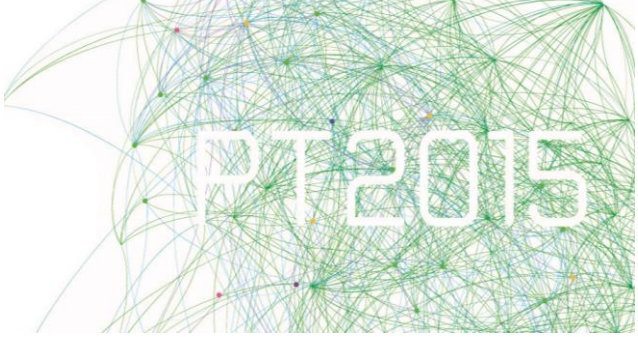
In addition, frequent headaches can be closely connected with sick building syndrome, particularly in premises containing high radon quantities and poor ventilation.

"The fact that in the world there is an increasing number of people suffering from one form of allergy or another is worrying and alarming. According to the statistics from 1950s and 1960s, the number of persons having an allergy in civilised countries was 1 %, whereas today, this percent rose to more than 25 %"[7].

## CONCLUSION

Based on the above and the conducted research, it can be concluded that the quality of living largely depends on architecture, whereas healthy living space, if neglected, can cause many negative effects on health and life of people. Selection of the location is one of the first starting criteria for house construction. Based on the numerous and different researches it can be clearly concluded that the selection of the location for house construction is one of the most important factors. The terrain where the house is planned to be built should be previously explored, particularly in terms of radioactivity. The terrain can be explored by instruments or in traditional manner used by our ancestors, as follows: take a few pieces of sand stone and arrange them on the terrain where the house is planned to be built. The soil should be slightly scratched and moistened by water. After some ten days, the stones should be removed and if under the stones insects appear (worms and reptiles) this indicates that the soil is suitable for house construction. When designing houses and apartments it is important that architects pay attention to ventilation and sun exposure of the premises. Favourable lines of sight, particularly

[7]Ibidem, page 53.




from daily occupied premises in the apartment, largely influence psychological condition of a persona.

In addition to parameters influencing the value and selection of the location, for house construction and healthy living, the selection of construction materials is also an important factor as well as equipment and furniture. Particular attention should be paid to the radioactivity of radon and use of construction materials with high radiation levels in terms of their curing and use to a smaller percent per one building.

## REFERENCES

Aleksić B. 1985. *Stambenasredina, Humane – prostorneosnove*, edited by the Faculty of Architecture, University of Belgrade.

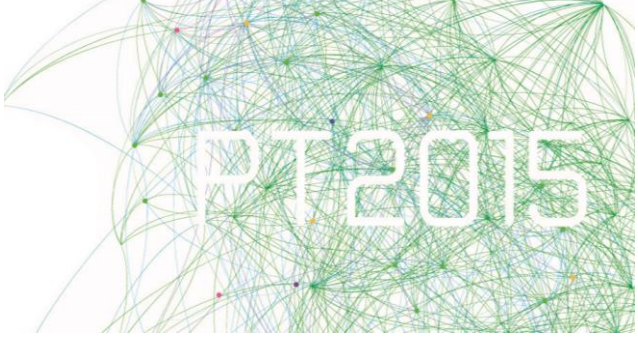
Baylon M. 1985. *Stanovanje, Tema 7: Grupisanje*, edited by the Faculty of Architecture, University of Belgrade.

Budisavljević B., Georgijević V., Jovanović Popović M., 1996, *Difuzija i kondezacija u arhitektonskim objektima*, edited by the Faculty of Architecture of the University of Belgrade, the Faculty of Civil Engineering of the University of Belgrade, Federal Standardisation Bureau, Institute IMS, Beograd, ISBN 86-80095-17-6.

Milenković B., Ralević M., 1993, *Unapređenje stanovanja*, edited by Milenković B., Ralević M.Milenković B., Ralević M. and the Faculty of Architecture of the University of Belgrade, Beograd.

Popović Jovanović M. 1991. *Zdravostanovanje*, edited by BorivojeAndjelković, published by: the Faculty of Architecture of the University of Belgrade.

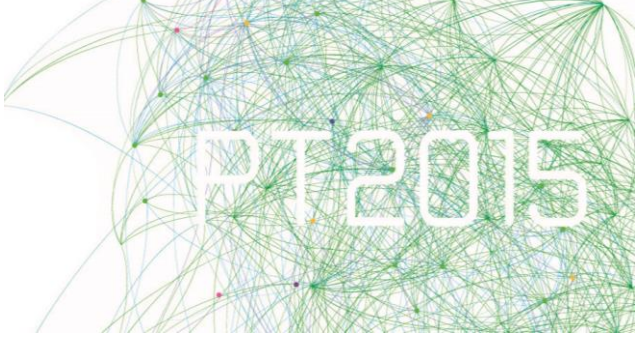
Terzić R. 1997. *Bioizgradnja – Biološko-ekološka izgradnja i sanacija građevinskih objekata*, edited by Vojislav Brkovic, publisher: Ekostan – Sprint, Beograd.




# TOPIC II:

# Physical Planning and Quality of Place

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# DEVELOPMENT DIRECTIONS OF URBAN STRUCTURE THROUGH REGISTRATION OF CHANGES OF SEGMENTS OF URBAN COMPLEX

**Velimir Stojanović**
PhD, Assistant Professor, University of Pristina in Kosovska Mitrovica, Faculty of Technical Sciences, Kneza Milosa No. 7, 38220 Kosovska Mitrovica, Serbia, velimir.stojanovic@pr.ac.rs

## ABSTRACT

*Urban structure is dynamic, unpredictable and uncompleted system which is, in spite of this, determined and recognizable at a given time – space moment. It has a characteristic to be used again but also to create completely new contents which apparently have no relations with the previous ones. The rules and laws of behaviour of complex assembly of the city have always been the essence of urban theory and practice. The final goal to subject to the order and predictable behaviour the urban structure, system and organization was never achieved because the arranged structure is disrupted by the new construction. That paradox is based on the fact that the law creates structure and the structure creates the law. The city is still perceived as a disrupted system where there is no order of events and where the future advancement cannot find the sustainable relationship with the past. The procedures of systematic theoretical process of urban planning correspond to the well defined systems, with the real city obviously not being that. The solution can be found in the development of urban computer expert systems based on the databases, synthesizing of urban ideas and methods of search in the depth, taken over from the theory of communication. This requests the access to the city as an urban complex divided into segment from which we would, by permanent analysis, obtain data which were until now hardly noticeable and which could not be followed clearly and in detail. The aim is the segment of urban complex as complicated but comprehensive category on the level of requested law an rules which leads to the appropriate quality of the city life.*

***Keywords**: structure, segment, development, rule, analysis.*

## INTRODUCTION

Information segment (fragment, element, clip) that is extracted from the overall time – spatial context as well as the context of urban structure, becomes, by the sole way of taking and extracting it from the current set, isolated and frozen in time, space and beyond all those influences which, before it was isolated, made it an integral part of the structure to which it belonged and which it was suppose to

present. Time – space segment thus becomes comprehended as a clip which lost its connection at the time of the separation, and frozen within all its interrelations and influences. This can happen in any form, anywhere and whatever the way is of the segmentation of the built space, from traditional representations of cities through maps, plans, projects and photos, to the most advanced access to analysis through monitoring, control and recovery of ongoing changes and data. Modern, as well as a future, technology for collecting, processing and classification of data, no matter how complex it is, cannot solve this basic problem. This problem is generic and cannot be solved with some peripheral interventions and approaches.

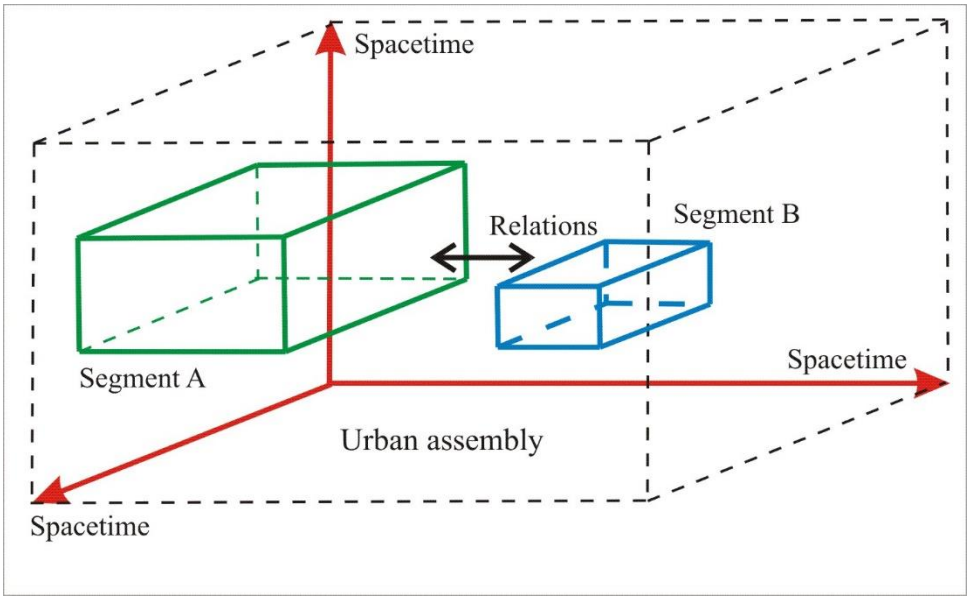
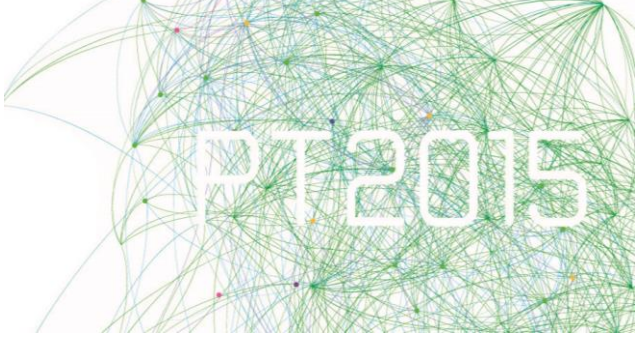



**Figure 1: Temporal – spatial segment and its relations within urban assembly (source: author).**

## NATURE AND DEFINITION OF URBAN INFORMATION SEGMENT

Extracting a segment from whole of urban and city area will, for a long time, be inevitable method of urban analysis. The alternative would be the analysis of the real urban space and time given in the context of its morphological, structural and functional current state which would, regardless of technological possibilities, be currently impossible. The segment, which in itself carries enough information, may be determined at many levels of its temporal and spatial structure and it is this flexibility than increases our analysis capabilities, in size, quality and content, especially when they comply with technology which is designed for that purpose and which provides it, as well (Figure 1).

The isolated segment can be analysed to a certain level and when it is exceeded and the information flows terminated, the data from such a segment becomes less usable and valuable. These ideas are not new. Analysing later, during the seventies,




general mathematical and geometric postulates of non – Euclidean geometry, which were applicable to system theory, Sklar (1976, Section B, p. 18) says: "Identical figures of different fields do not exist – identical figures exist through relations of their boundary, constant, line extensions – even though extensions of the boundary lines might be different." Establishing a reconnection of the segment with the surroundings it was isolated from, creates problems that are equivalent to a period of isolation. Otherwise, is either becomes the structure for itself or we have to find ways to renew and reconnected its broken connections. The essence of the information segment is not just to gather, categorize, level or in some other criteria, isolate the data on urban structure, but also to transfer the information from one segment area to another and to enable their smooth flow. Especially those essential and important information affecting the development of structures both in the segment from which they originate and in other segments reached directly or indirectly. This flow should, if possible, be hindered, as little as possible since in this way we are approaching the object of analysis and the desired goal – the urban structure in real space and time and its analytical performance. This position is also held by Gakovic (1991, p. 3): "The need for studying ad defining the spatial structure of a dwelling environment involves testing and determination of a whole and parts, as well as the condition under which these parts connect into a whole."

Every segment isolation without this transfer of information, whatever it is called and presented, is only a continuance and a confirmation of already seen, traditional, isolated displays of urban structure with limited use – value. The analysts as well as the analysts do not need, at least not in the practical sphere, to include into simulation all of the content of the simulated assembly , not only because it would be technically, mathematically and intellectually not possible, but because such a great and terrifyingly extensive and complicated bunch of data would not be usable at all levels and in all circumstances. Urban analysts do not tend to form parallel urban worlds only to be made and not to be able to analyze them later in a same way they analyze reality. According to in – depth analysis, and simulations of real urban structure based on separate relevant factors and groups f factors, could the basic requirements of the analytical insights as well as practical usability be met at the same time. Such findings and the results would at first occur in the form of observing the laws and rules of urban structure conduct within in the continuity past – present – future, then is conceiving new approaches to the development, prediction and planning and, finally, as a basis of development of new theoretical approaches, which would, at this stage, be enough. Segmentation then gets its full meaning, both in its dynamism and in the actuality and information usability. The segmentation would not present an abstract dealing with the city in order to retake the city that already existed, nor some blurred artistic performance, but the search and find for vales which could be used. This was assumed by Bobic (1992, p. 112): "The more complex the structures, are as well as the concentration of different individuals, contents and their interrelations in a small space, the more pronounced and delicate the problem is. In such circumstances, greater sensitivity of architects to conceive the true character of each existential space is required, but also desire

of residents to test the existing community standards. Such an idea of the city, and especially about the architecture, even though it sounds utopian, has to be put forward as a corrective within our contemporary action. An architect cannot take the role of a genetic engineer. His knowledge is not sufficient, not can he objectively in the conditions of today`s mercantile – oriented space production, overcome all the problems at once."

## CHANGES OF SEGMENTS OF URBAN COMPLEX AND THEIR REGISTRATION

### Directions of development caused by changes in segment assembly

The change of urban segment may occur first in itself, within its internal structure, system and organization. Depending on the type and size of the event within the segment as a kind of a subsystem, the changes resulting from it could influence its direct and indirect environment in a direct and indirect way. Any such change, event, impact and influence domains should be examined separately, since only then would it be possible to determine the rules and laws of conduct change, which would lead to their subsequent categorization, classification and specification (Figure 2). The aim of the analysis is, when a change occurs within the segment , to determine its nature, type, size and influence domain, both within the segment and beyond it. System theory and the process of modelling clearly emphasize the way of such an operation. Manheim (1980, p. 17) argues: "But only the operation in the process of locating within which the search and selection are cooperative with the location, presents the final form of operation. Indeed if we examine the flow of the process of locating, from the research through successful operation to final form, we could see that every successful operation results in finding the details and precision the specifications. For example, for establishing operations only the established aspects of locating are specified while the cross-section of the template is unspecified."

### Insight into directions of development and a new development flow as a product and a consequence

The relation cause – event (change) – consequence thus reflects the temporal – spatial reality both as segments of urban structure of the city and the urban structure as a whole. Such influences and processes are difficult to be modelled and simulated due to limitations in the technology field which still exist. Simovic (1990, p. 48) dealing with the general attitude of the relations between the city and the technology of the city, observes a mismatch between architectural and technological: "In his book `Towards a true architecture` Le Corbusier notes that the curse of architecture is that it is not necessary to monitor changes in order to survive, and that is reflected in its conservative attitude towards technical innovation of its time." And that monitoring techniques and technologies is not

easy and that it cannot be reduced to mere implementation of a new and modern, but should deal with the substance of the application, defines Svetel (1992, p. 18): "Any Architectural basic can be introduced as a system consisting of elements, their mutual relations, as well as, the relations of the elements with the whole. By defining one system all other possible solutions are implicitly presented. The problem of finding solutions comes down to the explicit listing of all different states of the system which correspond to given limitations." The issue of the relations between information and the built place, the author of this study, Stojanovic (2012, p. 32) previously defined as follows: "Distorted images of time and space, and the theoretical and practical application of theory in practice, as well as the feedback resulting from the practice to the theory , are the consequences of the connections of the same thing – perceptions, interpretations and experiences of time and space as a series of clips that do not need to be connected in any way, nor should they be seriously dealt with." Urban segment may carry a number of impacts through the urban environment as ever – changing module that has no pre – set shape, form, function or parameters, but is able to successfully transfer the required values through the urban structure.

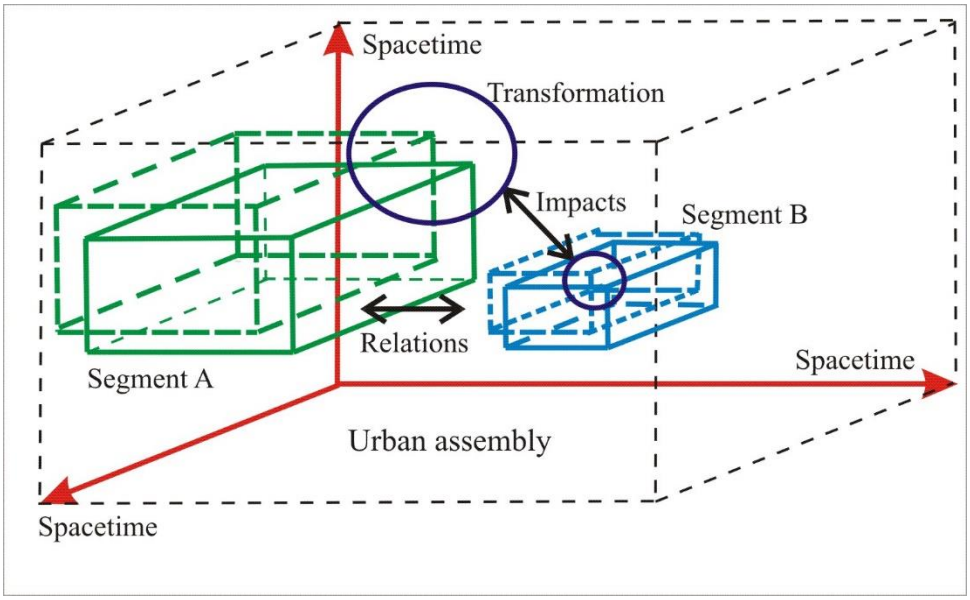
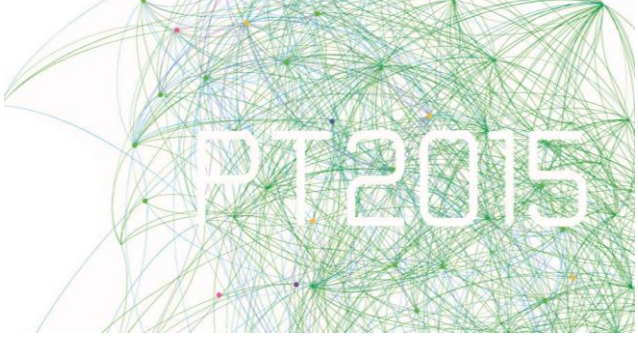



**Figure 2: The transformation of urban segment and its impacts (source: author).**

## CONCLUSIONS

Basic definition of information segment does not regulate, manage, not prejudge activities in all the spheres that the definition includes, is fulfilled with or is followed by. On the contrary it insists on their autonomy, regardless of how they are, within themselves and by themselves, defined and presented. Information




urban segment is independent integral phenomenon with many of his active sub – domains, contents and activities. It does not interfere into their flows because it is conceived as a medium of information flows that provide services to everyone, and especially serves as the analytical instrument. It is designed in such a way that it mostly resembles modern software applications of operating system which allow the overall interaction and search. It gives an opportunity to, sooner or later, depending on usage skills, initiate the process of converting the creative and selective quantity into quality, which would open unprecedented possibilities for new forms of research of the city and the environment. Classically established activities within the sphere of architecture and urban planning, as well as their bearers would continue to perform their work within in such an integrated framework. Information segment would be gathering point of everybody and all of them would be its consumers and creators in their own levels, but, most importantly, it would provide a dynamic image of urban reality, as opposed to static images and isolation.

## REFERENCES

Bobić, M. 1992. *Morfologija mesta: morfologija organizovanog prostora i vremena.* Beograd: Univerzitet u Beogradu, Arhitektonski fakultet.

Gaković, S. 1991. *Četiri stanja sklopa u strukturi stambene sredine*. Beograd. Univerzitet u Beogradu, Arhitektonski fakultet.

Manheim, M. 1980. "Hierarchical structure: A model of Desing and Planning Processes". *M.I.T. Report*, no. 7: 15-17.

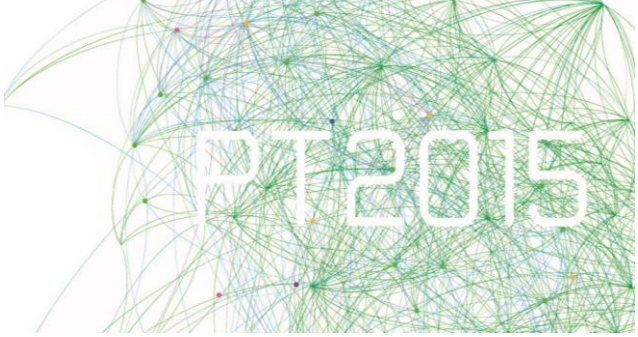
Simović, D. 1990. "Jedna mogućnost modelovanja strukture grada" *Bilten Instituta za ispitivanje materijala Srbije IMS*, no. 1: 48.

Svetel, I. 1992. "ARCH – program za sintetisanje arhitektonskih osnova." *Bilten Instituta za ispitivanje materijala Srbije IMS*, no. 1: 18.

Sklar, L. 1976. *Space, Time and Spacetime*. Los Angeles: University of California Press Berkley.

Stojanović, V. 2012. "Grupe faktora koje utiču na ostvarljivost urbanističkih planova i projekata." *Izgradnja* 66, no. 1-2 (January – February): 32.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# THE TRANSFORMATION OF THE SQUARE CARICA MILICA IN NOVI SAD (SERBIA)

**Ivana Sentić**[1]
MSc, Teaching Assistant, Faculty of Agriculture, University in Novi Sad, Trg Dositeja Obradovića 8, e-mail ivanab@polj.uns.ac.rs

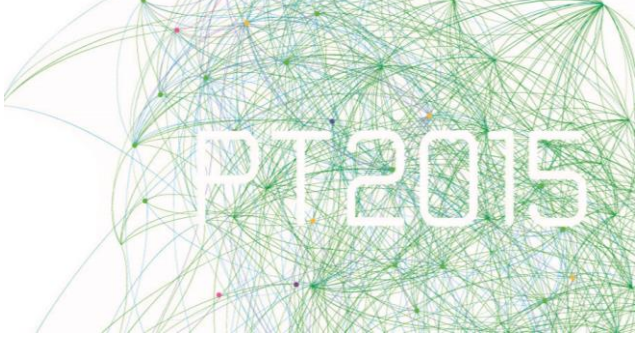
**Ksenija Hiel**
PhD, Assistant Professor, Faculty of Agriculture, University in Novi Sad, Trg Dositeja Obradovića 8, e-mail ksenija.hiel@gmail.com

## ABSTRACT

*Square represents one of the most important and oldest forms of urban public spaces. History emphasizes the great importance of squares. They were an essential element of the urban environment in the performance of the public life of the residents; places of mass holiday's gathering and assemblies; places of diverse cultural activities, trade, etc. In the past, the dominant feature of squares in Vojvodina, in Serbia, was development of various forms of socialization. However, at the beginning of the twentieth century there was modification in the ratio of the functional interpretation of the central town squares, by placing the road and rail traffic as integral part of the surface area. During this period, most of the squares were turned into the traffic roads, roundabouts and parking spaces. This image followed many of squares in the city of Novi Sad. One of them was the Square of carica Milica. In former period, the Square of carica Milica was located in front of the building „Dom železničara" („Railway home"), today's Health centre. The first urban transformation, the square received in the last century at the end of the seventies, when the construction of the street Maksim Gorki started. The square lost a part of its surface, which was landscape arranged. Finally its identity as square was lost in early eighties, when the sport business centre SPENS was built up. The square got its new purpose, namely it became a parking space. The study in this paper is based on an analysis of the transformation of the existing urban form, transport elements and elements of landscape architecture, as well as on the impact of this transformation to the existing design space. The results showed low level of ambient values, and design of the space that does not meet criteria of squares in general.*

***Keywords**: square, urban transformation, ambient values.*

[1] Corresponding author




## INTRODUCTION

The square is built, partly green, open urban space, edged with buildings, lines of roads, or exceptionally, tree-lined alleys (Ogrin, 2010). According to Cullen Gordon (1995), the square is not just a physical space, but also a human space with number of activities. The social aspect is primarily associated with contents of objects that surround the square with the usage of free open spaces. For Camillo Sitte squares are so called "urban rooms", open air stages, and urban spaces of the highest quality (Sitte, 1965). Paul Zucker believes that they are complex of art works, which development lasted for centuries and still is ongoing. Many of the squares have become symbols of their cities as the Square Etoile in Paris or St. Marco square in Venice (Tepavčević, 2008).

In physical terms, the square consists of undeveloped areas and buildings around it. Facilities with its position, shape and size, outline the open space, and with their specific purposes give certain character to the square. Undeveloped areas (traffics, free open spaces or green areas), enable the development of specific programs in the square and ensure its functioning. There are few squares that have only one function. Their purpose is usually multiple. Basic contents within buildings, as well as programs in open areas and activities of people in the built and undeveloped areas of the square, cause its functioning and character. Depending on the purpose of surrounding objects squares can be: religious, with market, entertainment and representative purpose, then monumental, and depending on the surface, can be traffic, pedestrian, park area (the Square of Pisa) or recreational area (seasonal skating rink at Rockefeller square in New York). They can be differently organized and used, but always open to the public. Therefore, square has characteristic of dynamism and openness to the public (Đokić, 2009).

Over the time, squares experienced considerable transformation. Thus, the concept of square has been changed, meaning by adapting to social changes and needs, as well as by developments in urban planning principles and theories of urbanism (Tepavčević, 2008).

The Square of carica Milica, which is the subject of this paper, is located in wider centre of the city of Novi Sad. During its existence, it has undergone several transformations. The most striking is the one that occurred during the reconstruction of urban matrix, i.e. the transport network in that part of city. From formerly regulated park square, the Square of carica Milica loosed much of its surface and became a plateau, at the end it was reorganized as the parking space. Unfortunately, the 21st century, as the century of great technological changes, brings also a lot of negative incomes in terms of losses the tradition and history of certain spatial elements, including squares, that in the city of Novi Sad has a similar destiny - they are becoming the parking spaces.

## HISTORICAL BACKGROUND OF THE SQUARE CARICA MILICA

Urbanization is one of the fundamental characteristics of the European civilization. Cities and formed urban networks were always important factors in the development and shaping of their surroundings. The processes of urbanization showed cycles of evolution that spread in different ways through the space. Patterns of changes are different for metropolitan cities, towns, villages etc. Therefore, detailed inventories of landscape conditions and monitoring of changes are urgently needed in order to obtain reliable data for good decision-making (Antrop, 2014).

The Square carica Milica in the city of Novi Sad, during its existence, has undergone several transformations. The reason for that was the process of urbanization. Originally, it was arranged as a park square, with a lot of planed planted greenery, places for rest and recreation. It was located directly in front of building named „Dom železničara“ („Railway home“) (Figure 1).

**Figure 1: The Square carica Milica, view from period of 1966 (Source: Archive of the Institute for Urban Planning).**

On the map, shown in Figure 2 clearly it can be recognized central axis of the square that divided the space into two green open spaces, based on the grass cover, shrub forms of vegetation and floral ornaments. Whole space was located at elevation, lower than the elevation of the surrounding roads. It was surrounded by tall planted trees, which isolated the place from the noise and made it pleasant for staying period.

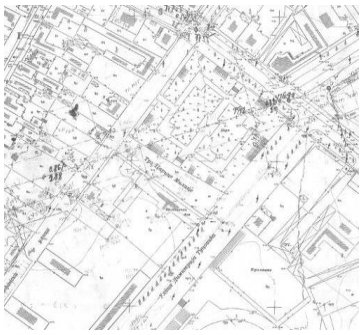


**Figure 2: Old map of the square, period of the 70's .**
**(Source: Archive of the Institute for Urban Planning)**

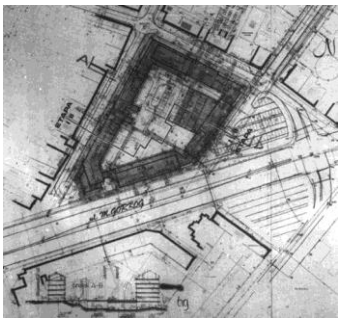


**Figure 3: Plan of the city from the eighties.**

During eighties, the square experienced a major transformation. Due to the process of urbanization, expanding the city's transport network and the construction of the sport centre "SPENS", the square was "cut", where one part remained as a green area and another one occupied a newly constructed road - Maksim Gorki Street and parking space (Figure 3). Shortly thereafter, the square lost completely its original purpose and function and became entirely parking space. The vegetation was lost, the land was paved, and the ambient was made unpleasant for longer stay and recreation (Figure 4).

**a. The view to the square from Sremska street.**

**b. The view to the restaurant and business building on the square.**

**c. Residential and commercial buildings that surround the square.**

**d. ''Railway home'' in front which is located the current square and part of the former square.**

**Figure 4: The present state of the Square carica Milica.**

## OVERVIEW OF THE CURRENT STATE OF THE SQUARE CARICA MILICA

In the form of the kind it exists today, the Square carica Milica is in rectangular shape, approximate with the area of 1,7ha. The largest part of the square is sunny throughout the whole day. The square ventilation is good for open space, but the exposure to exhaust fumes is great, because there are no adequate barriers in the form of vegetation that would mitigate the effects of pollution. From adult woody species on the square there can be seen *Aesculus hippocastanum* L., *Fraxinus excelsior* L., *Tilia platyphyllos* Scop., *Betula verrucosa* Ehrh., *Celtis* sp.. They are in good condition and have less mechanical damages, dry rot branches, as well as entomological and phytopathological damages. The species *Fraxinus excelsior* L. is in good biological state, without mechanical or other damages, and without phytopathological and entomological damages. From shrub species on the square there can be noticed: *Juniperus horizontalis* L., *Mahonia aquifolium* Nutt., *Symphoricarpos orbiculatus* Moench, *Ligustrum ovalifolium* Hassk., *Forsythia x intermedia* Zab., *Pyracantha coccinea* Roem., *Prunus laurocerasus* L., *Spiraea x vanhouteii* Zbl. and *Hibiscus syriacus* L. They are with good level of decoration and viability (Figure 5).

The consequence of sparse vegetation is an area that does not support certain environmental parameters (reducing air pollution and noise, pleasant stay in the area - less exposure to sunlight, the biological value of the space, etc.). Noise from surrounding traffics is present, especially during rush hour, also from a nearby stadium during match venues.

**a. Tree-line of *Fraxinus excelsior* L. in front of the "SPENS".**

**b. Tree-line of *Tilia platyphyllos* Scop. along the Street Maksim Gorki.**

**c. *Tilia platyphyllos* Scop. and *Betula verrucosa* Ehrh.**

**Figure 5: The view of sparse vegetation on the Square carica Milica.**

According to the survey, which was conducted in this area, 74% of the population uses the space exclusively for the purpose of passing, only 16% for the short-term staying in the area (about 5-30 minutes), while 10% of them stay there, whether it is a purpose business or residence. Is the area recognized as the square - almost 100% of respondents answered negatively.

As some of the future needs in the area, respondents viewed following: rest area (31%), exhibit space (26%), space for children to play (13%), space for recreation (7%) and for other purposes 8%.

## CONCLUSION

The space of the Square carica Milica has many advantages. It is well located, not far away from the city centre, very accessible, with acceptable size for forming the contents of a landscaped green area. It is located right next to a residential area, so the need for establishing the green area or space for rest is very evident. Also,

historical background of the site must not be neglected, which is just one more advantage of the space.

Any further intervention in the area should be directed towards its conservation, namely to preserve its environmental entities and any further revitalization or reconstruction, should carries the seal of the past. Vegetation is an indispensable element of any urban composition and, therefore, here it should have the role of breeding the area, its composition, but also to highlight the following ecological functions, in order make more comfortable and pleasant space for usage.

## REFERENCES

Antrop, M. 2004. "Landscape change and the urbanization process in Europe". *Landscape and Urban Planning*, 67, no.1–4(March): 9–26.

Cullen, G. 1995. *Concise Townscape*. New York, USA: Taylor&Francis group.

Đokić, V. 2009. *Urbana tipologija: Gradski trg u Srbiji*. Beograd: Arhitektonski fakultet, Univerzitet u Beogradu.

Ogrin, D. 2010. *Krajinska arhitektura*. Ljubljana: Univerza v Ljubljani, Biotehniška fakulteta, Oddelek za krajinsko arhitekturo.

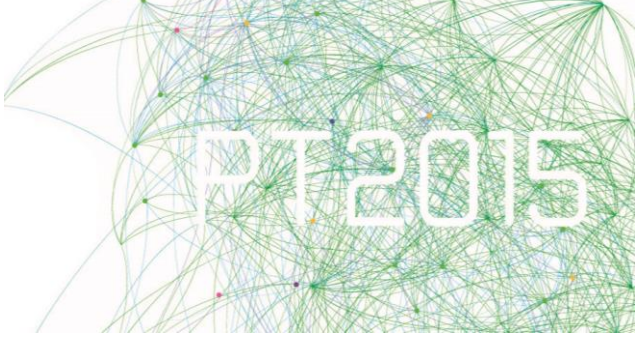
Sitte, C. 1965. *City planning according to artistic principles*. New York: Random House.

Tepavčević. B. 2008. *Trgovi u Vojvodini – morfogeneza, fizička struktura i funkcije*. Novi Sad: Fakultet tehničkih nauka.

Tišma, A, Ninić-Todorović, J, Ognjanov, V, Bajić, L, Kurjakov, A, Pajvančić, A, Lazović, R, Grujin, J, Mladenović, E, Čukanović, J. 2009. *Studija zelenih i rekreativnih površina u cilju izrade revizije Generalnog plana Novog Sada*. Novi Sad: Poljoprivredni fakultet, Univerzitet u Novom Sadu.

Vukićević, E. 1996. *Dekorativna dendrologija*. Beograd: Šumarski fakultet, Univerzitet u Beogradu.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# VARESE LIGURE: AN ITALIAN RURAL MUNICIPALITY WHICH HAS IMPLEMENTED AN EXEMPLARY MODEL OF SUSTAINABLE DEVELOPMENT

**Giovanni Sergi**[1]
Contract professor of Town Planning, DSA Polytechnic School - Genoa University, home and office strada del Cavallo 81 60019 Senigallia AN Italy, sergi.giovanni.pietro@gmail.com

**Carlo Berio**
Architect, Architectural and Town Planning Firm, distacco piazza Marsala 4/2 Genoa Italy, segreteria@studioberio.it

**Giulia Canton**
Junior Architect, via Piave 16 /1, 16040 Orero GE Italy, giulia_canton@yahoo.it

**Giacomo Crovo**
Junior Architect, piazza Roma 32/1, 16043 Chiavari GE Italy, giacomo.crovo@alice.it

## ABSTRACT

*The Municipality of Varese Ligure is located in Liguria with a territorial surface of 137 square kilometres and 2,091 inhabitants in 2013. Since the beginning of the 90s it has started a sustainable economic development and urban planning policy which has allowed to reach long-lasting goals as well as several acknowledgements at international level.*

*During the drafting of the new Master Plan in 1994 the Municipal Administration decided to give up a development programme focused on the protection and promotion of its environmental resources which cover one of the widest municipal areas in Liguria region and on a selected tourism.*

*The main results of this policy have been the following: stop of depopulation, independency through renewable energy, 1,800 ha of certified organic agriculture, the number of tourists has increased by three times, 140 new jobs, reduction of waste.*

*The sustainable economic development programme by the Municipal Administration is based on the support of certified organic agriculture and livestock farming, production of electricity without CO2 emissions. This production of clean energy takes place in a wind firm equipped with four wind turbines that produces 7 GWh/year, through the production of energy based on photovoltaic/solar systems and a hydroelectric plant built in 2006, which has*

[1] Corresponding author

*produced 5 kWh/year. The production of electricity through biomasses is currently studied because of the rich forest heritage in the area.*

*Varese Ligure has been one of the first Municipalities in Europe to obtain the environmental certification Iso 14001. Moreover, it has been received an award in Berlin in 2004 as the most virtuous rural Municipality in Europe. It has obtained the European Energy Awards and in Italy, the WWF has acknowledged the implementation of a sustainable development model.*

***Keywords**: rural municipality, sustainable development model, production of electricity from renewable sources, certified organic agriculture, master plan.*

## INTRODUCTION. THE ENVIRONMENTAL POLICY OF THE EUROPEAN UNION

Since the 70's the European Union has adopted more than 200 legislative acts to safeguard the environment. In 2050, the EU economy will have to be able to offer a high standard of living and at the same time guarantee a reduced impact on the environment.

Between 1990 and 2000 increase in ground that was made waterproof amounted to 1,000 square km per year. The European Commission has set the goal to reduce soil consumption in the EU to zero by 2050.

In 2012 in Italy 13% of the overall energy consumption and 28.2 % of electricity consumption came from renewable sources. The innovation outlook in the construction industry is quite clearly defined in EU countries. The EC Directive 31/2010 established that new buildings will have to be "neutral" in terms of energy consumption starting from 2019 as concerns public buildings and from 2012 as concerns private buildings.

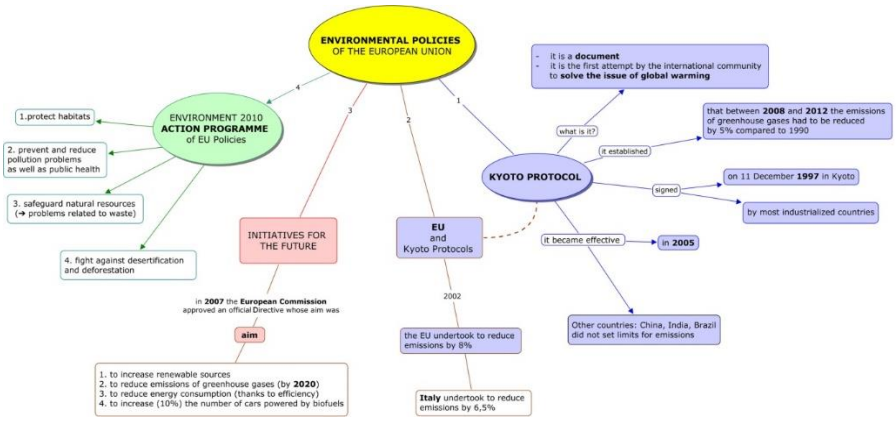
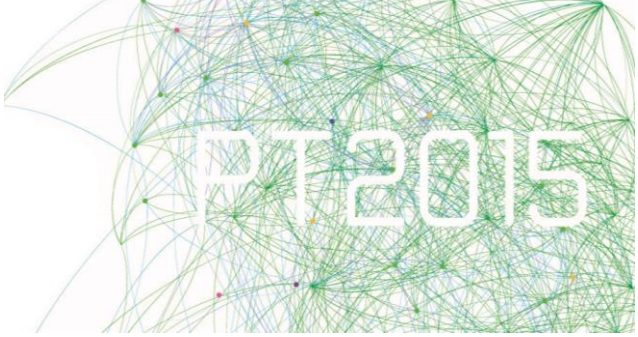



**Figure 1: the EU environmental policies.**
**(Source: European Commission, the EU environment policies, 2013).**




## THE PATH TOWARDS ENVIRONMENTAL SUSTAINABILITY FOLLOWED BY THE REGIONAL AUTHORITY OF LIGURIA

The Regional Operational Programme of Liguria POR 2007-2013 funded by the European Regional Development Fund gives a meaningful contribution to the development of an integrated sustainable energy policy, soil conservation and prevention of natural risks. Moreover, the priorities of POR are promoting urban sustainable development as well as protecting the natural and cultural heritage.

The Regional Rural Development Programme PSR 2007-2013 is a programme for the development of agriculture and rural economy as well as the improvement of the environment and quality of life in rural areas. The Law passed by the Regional Authority of Liguria no. 4/2014 includes regulations to boost agriculture and forestry as well as to safeguard rural areas. The Regional Authority has founded the "Banca regionale della terra" a Regional Bank in order to promote processes of land consolidation and reorganisation, recover agricultural or woodland areas that are abandoned, derelict or underutilised for cultivation purposes as well as promote environmental and land protection.

## TERRITORY, POPULATION AND PRODUCTIVE ACTIVITIES IN THE MUNICIPALITY OF VARESE LIGURE, PROVINCE OF LA SPEZIA

The municipal territory is the second largest territory in Liguria after the Municipality of Genoa covering an area of 13,759 hectares corresponding to 137.59 square kilometres. In 2013, it had a population of 2,091 inhabitants living in twenty-seven small villages. The main villages are Varese Ligure and S. Pietro Vara.

95% of the municipal territory is made up of non built-up areas. The built-up area of Varese Ligure is located on the bottom of the valley, along the Vara river. The other smaller and linear settlements are located either on the crests or at medium heights. The size and settlement of these small historical centres reflect an economic model based on farming and cattle breeding that has been subject to changes over the last century. These small historical centres were completely abandoned some years ago.

The utilization of soil can be divided into three categories: farming land, woodland which covers a meaningful part of this territory, moor areas.

Cultivated land is located on the plain at the bottom of the valley, on hillsides and in areas surrounding the historical centres.

**Figure 2: Varese Ligure, Fieschi square and its inhabitants. Photo by Canton Giulia and Crovo Giacomo, 2014.**

If we evaluate the data related to resident population in the Municipality of Varese Ligure collected during the census surveys from 1861 to 2011 by the Italian National Institute of Statistics, we find out that Varese Ligure was subject to emigration of its inhabitants for a long time. Over the past years this phenomenon has continued, even though it has been less meaningful. Between 1951 and 2011, Varese Ligure lost overall 3,758 inhabitants.

**Table 1: Demographic dynamics of the Municipality of Varese Ligure. Source: Italian National Institute of Statistics, Rome.**

| Year | Population | Index number |
|---|---|---|
| 1861 | 7,851 | 100 |
| 1871 | 8,063 | 103 |
| 1881 | 8,185 | 104 |
| 1901 | 7,154 | 91 |
| 1911 | 7,127 | 91 |
| 1921 | 7,158 | 91 |
| 1931 | 6,805 | 87 |
| 1936 | 6,762 | 86 |
| 1951 | 5,909 | 75 |
| 1961 | 4,710 | 60 |
| 1971 | 3,711 | 47 |
| 1981 | 3,118 | 40 |
| 1991 | 2,681 | 34 |
| 2001 | 2,350 | 30 |
| 2011 | 2,151 | 28 |
| | | |

**Agriculture and organic livestock production**

The Regional Authority of Liguria approved the Law no. 66/2009, which established districts and territories for organic production.

In 2014 the "Biodistretto Val di Vara-Valle del Biologico" district for organic production was established which also includes the Municipality of Varese Ligure.

In Varese Ligure there are more than 60 certified organic farms, on a surface of 1,800 hectares led by two cooperatives: San Pietro Vara and Casearia.

**Towards a sustainable development in the area of Varese Ligure. Production of electricity from renewable sources**

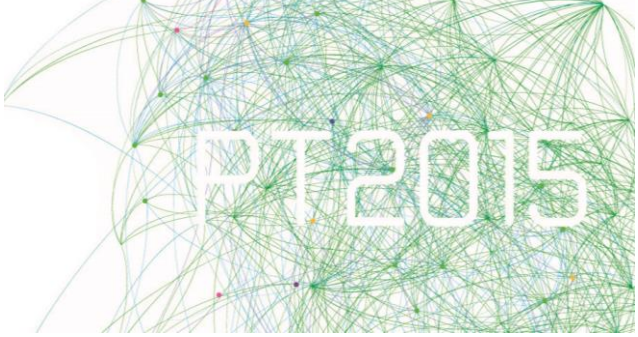
In Varese L. there are four photovoltaic plants on public buildings and several plants on private buildings.

In 2006 a hydroelectric power plant was built close to the water supply system of the principal village ensuring a total production of 5 kWh/per year.

The wind farm installed in 2002 and enhanced in 2006 is equipped with four wind turbines which ensure an overall power of 3,2 MW located at a height of 1,100 metres above sea level close to the Cappelletta pass.The wind farm achieves a production of 7 GWh/year which is five times higher than the energy need of the area of Varese Ligure. Thanks to the economic revenue coming from the company responsible for the plant, the Municipality can guarantee public services at reduced fees and a generally low taxation.

It is worth saying that Enel National Energy Agency laid the electric cables underground thus avoiding the construction of poles.

**Figure 3: The wind farm of Varese Ligure close to the Cappelletta pass. Photo by Canton Giulia and Crovo Giacomo, 2014.**




**Safeguard of biodiversity, management of municipal solid waste, water treatment**

The monitoring of various environmental elements in the territory of Varese Ligure shows a still untouched environment. Biodiversity here is safeguarded by the activities carried out by farms and livestock farms.

In the Municipality of Varese Ligure in 2014 waste collection reached 30.20% of the municipal solid waste production. The average in the province of La Spezia was 29.63% in 2014.

Today this area is supplied by the public sewage disposal works which conveys the effluents to the main village of Varese Ligure and to the second water treatment plant of S. Pietro Vara.

**Prizes and certifications**

The commitment of the Municipal Administration in favour of sustainable development since 1990 has been acknowledged with several prizes at national and international level.

In 1999 it was the first Municipality in Europe which obtained the environmental certification UNI EN ISO 14001. Some time ago, the EMAS registration was obtained according to the requirements of the EC Regulation 761/2001. Varese Ligure in 2004 received from the EU the prize "Promote 100" in Berlin, for the European Rural Municipality which has implemented the most complete and unique project for sustainable development. In 2005 it was the first Municipality in Europe which obtained the European certification European Energy Award, an award for the local authorities which contribute to a sustainable future through the efficient use and exploitation of renewable sources.

**Role of town planning in sustainable development. General Variance to the PRG (Master Plan)**

The Municipal Administration decided to develop the General Variance to the PRG before its expiration after ten PRG set two main objectives: upgrading of the local territory by reducing developable volumes through incentives and measures aiming at a reorganisation of settled areas years. The new PRG was fully in force in 1998.

The General Variance to the in Varese Ligure. The second objective was re-launching traditional farming activities. The potential of tourism-related activities was taken into account as a source of income in the high Vara Valley.

## The Detailed Plan for the historical centre

The main objectives of the Detailed Plan for the historical centre of Varese Ligure have been the recovery of the existing building heritage, safeguard of historical-environmental values and specifically, identification of effective solutions to the needs of residents in the ancient village.

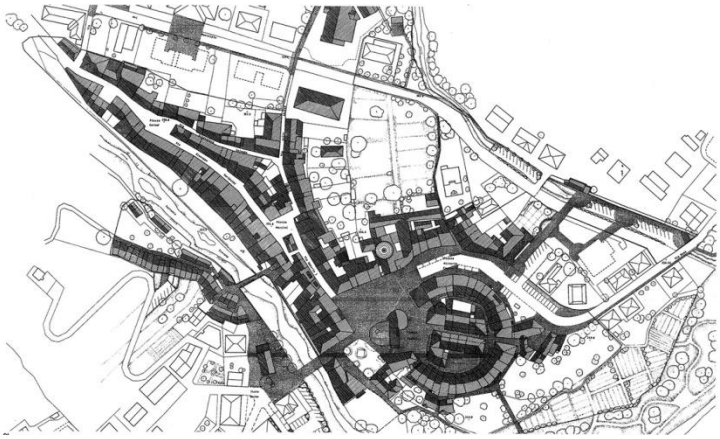


**Figure 4: The Detailed Plan for the historical centre of Varese Ligure. Designer Arch. Berio Carlo.**

The round hamlet dates back to the 14th century and is an example of hamlet built according to a design attributed to the Fieschi family. The buildings were round for defence purposes and all openings pointed at the internal side of the walls. The Plan for the historical centre pursued the following objectives: a) effective and suitable architectural recovery in order to ensure compliance with the types of buildings, constructions and historical heritage; b) improvement of comfort and convenience of homes through a slight increase in volumes and reorganisation.These measures aimed in the medium term at maintaining the current number of residents in the old village and restoring traditional handicraft and commercial activities. The Detailed Plan for the historical centre as been financed in 1992 through a financial programme POI Piano Organico di Intervento Regional Law no.25/87.

## Outcome of the policy for sustainable development carried out by the Municipal administration

Varese Ligure has implemented a model of rural development that combined environment, employment and business.
Over the past years, the Municipal administration has obtained the following results:
- it has slowed down the decline in population;
- it has developed renewable energy;
- it has developed organic farming and livestock production;

- it has developed sustainable tourism;
- according to estimates it has created 140 jobs;
- it has increased separate waste collection;
- several businesses have obtained ISO certification.

## CONCLUSIONS: HOW TO KEEP AND IMPROVE RESULTS

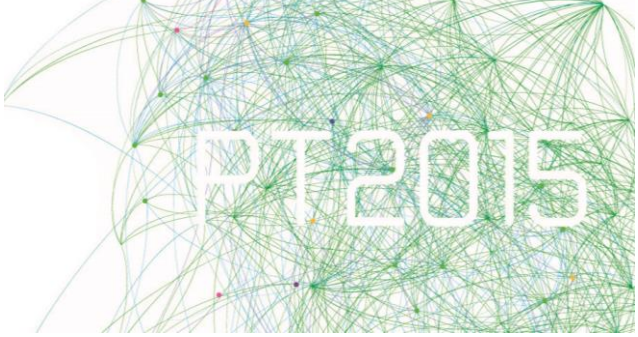
According to the Inea National Institute of Agricultural Economy data related to 2013, 214 organic certified farms were active in Liguria. Today in Varese Ligure there are 60 organic certified farms. The Regional Law no. 4/2014 focuses on the employment of young generations in agriculture and forestry by granting free use of state-owned areas according to established methods. Moreover, it aims at promoting the development of agroforestry companies as well as the establishment of new ones.

The second element of sustainable development is the production of renewable energy considering the meaningful results achieved in Varese Ligure. It seems likely to envisage the construction of small biomass power plants because of the great availability of combustible material in this area.

New investments to develop renewable energy may increase the availability of financial resources that the Municipal administration already gets from the wind farm as well as from other renewable sources. A part of these resources could be used to build an Experimental Station for Agriculture located in an area owned by the Municipality.

**Figure 5: The small old village of Montale in the Municipality of Varese Ligure. Photo by Tamburini Sauro.**

The development of tourism in a consistent way and promotion of small old villages seem likely by implementing two different methods. The first method is that one of local community distributed hotels. This type of accommodation is widespread because it is hard for businesses to buy properties within old villages




characterised by the splitting of real estates. This is why tourism operators have chosen multi-building accommodation within the same old village.

The second method which is probably more suitable for very small old villages in the area of Varese Ligure, like for example Montale, may be a type of company which includes owners who cannot manage their small split properties. According to this solution, the economic operator, after the basic investment, will allocate the income to each owner-partner who is part of the business based on his/her respective share.

The successful results are related to environmental and landscape protection, production of electricity from renewable sources, protection of historical building heritage, development of organic agriculture and stock farming, prevention of property speculation and mass tourism.

The unsatisfactory results are due to the difficulty of implementing an economic development to support a meaningful population growth. The decrease in the number of inhabitants has slowed down even if a trend towards decrease still remains in the Municipality of Varese Ligure. This trend is a feature in the Region Liguria as well as in Northern and Central Northern Italy.

## REFERENCES

Canton, G, and Crovo, G. 2014. *Varese Ligure: un modello di sviluppo sostenibile del territorio*. Dissertation, Department of Architectural Science Politechnical School-University of Genoa. Supervisor, Prof.Sergi Giovanni, Assistant supervisors: Prof. Bobbio Roberto and Arch. Berio Carlo.

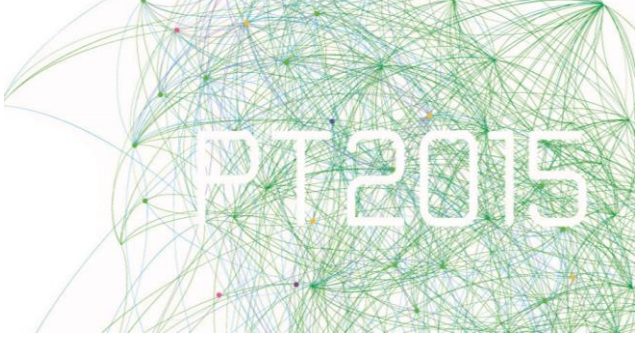
Lagomarsino, L, and Sergi, G. 2012. *Consumo di suolo: Politiche e piani per il contenimento della dispersione insediativa in Europa e in Italia*. Genoa: ECIG.

Municipality of Varese Ligure. 2008. *Dichiarazione Ambientale 2008-2011*.

Municipality of Varese Ligure. 1998. *Variante al Piano Regolatore Generale.* Appointed designer: Arch.Berio Carlo.

Municipality of Varese Ligure. 1992. *POI Piano Organico di Intervento. A financial programme for the Detailed Plan of Varese Ligure historical centre.* Appointed designer: Arch.Berio Carlo.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# CYBERPARKS CHALLENGES - NEW DIGITAL MEDIA FOR ATTRACTIVE URBAN OPEN SPACES

**Ina Šuklje Erjavec**[1]
MSc, landscape architecture, Urbanistični inštitut Republike Slovenije, Trnovski pristan 2, Ljubljana, Slovenija, ina.suklje-erjavec@uirs.si

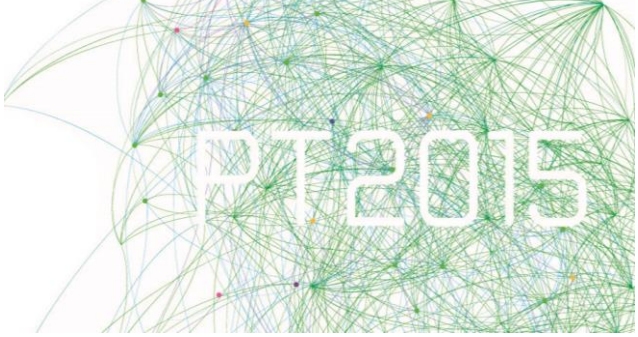
**Carlos Smaniotto Costa**
PhD, landscape architecture, Department of Urban Planning, Universidade Lusófona de Humanidades e Tecnologias, Lisbon, Portugal, smaniotto.costa@ulusofona.pt

## ABSTRACT

*In this paper we discuss how new digital media technologies (smart phones, tablets, Wi-Fi connections) are changing habits, expectations and motivations of urban open space users, why and how ICT development is challenging urban open space designers and vice versa, how new research, planning, and design approaches may challenge the future development of information and communication technologies. Presented information is based on first knowledge and experiences exchanges carried out within the European COST Action Project CyberParks (www.cost.eu/domains_actions/tud/Actions/TU1306) which provides a forum for cross-sector working with researchers, urban designers & developers, ICT experts, urban anthropologists and sociologists, creative industries experts and others, from 28 countries. The leading issue of CyberParks is how to use ICT to transform our cities into more human environment, rather than just more high-tech and to understand that "smartness" should be people friendly. Through the structure of the project work the importance of a comprehensive and trans-disciplinary development is introduced and justified. With examples from different cities key questions are discussed, such as: What are the aspects of quality and attractiveness of urban public space and what kind of added values and functions could new technologies provide? How could we use new ICT to enhance our understanding on the uses and users of urban public spaces?*

***Keywords**: mobile technology & urban open space, public space users, multidisciplinary approach, people friendly cities, CyberParks project.*

[1] Corresponding author

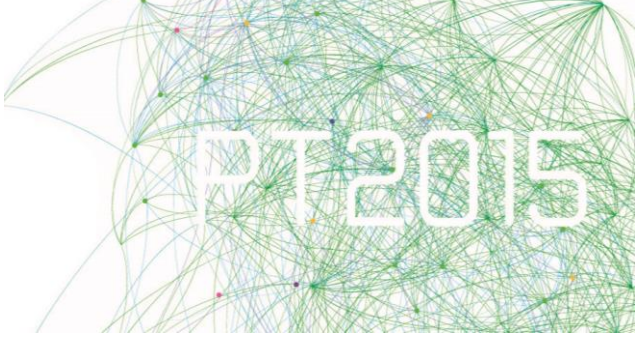



## INTRODUCTION

Urban open and green spaces are widely recognized as an important aspect of the quality of life and environment as well as sustainable and people friendly development of the cities. Many research works and projects explain in deep their importance and highlight their social, ecological, spatial and economic benefits, from a single as well as from a cumulative perspective (GreenKeys, 2008; Šuklje, 2010; Smaniotto, 2012, 2012a, 2014). But not only presence, distribution and accessibility of such places is important but as well their attractiveness and usability defined by their design and equipment (Šuklje 2010). If we look at the perhaps most complex type among contemporary public green spaces, the urban park, it is important to understand that it should fulfil a wide range of functions to become really part of the community. Usually within the urban fabric, an urban park plays an important role in forming the image of the neighbourhood or even the whole city, having good design quality with some symbolic and identifying features that make it clearly recognizable so it embodies a representative character. On the other hand, it should also serve as a green space for everyday use for different groups of citizens and visitors, fulfilling equivalently to their different needs and expectations, providing a good accessibility and welcoming atmosphere for all, not only in physical sense but also psychologically and sociologically. That means as well offering a possibility of choice and responding to time and change within. Different authors suggest that the role of urban park in contemporary and future cities should be re-thought and developed according to new lifestyles, values and attitudes (Tschumi, 1983; Thompson, 2002; Turner, 2004). However opinions go in different directions and are sometimes even conflicting. While some authors lay a great stress upon experiencing the nature while visiting an urban park (Thompson 2002, Kaplan& Kaplan 1989) or even put this aspect as mayor characteristic, others introduce a completely new views on the role of the urban parks with requests for a huge variety of different programmes and cultural activities to be placed into the park, replacing the traditional idea of the park with the new model of the "urban park-building" as in the Park de la La Villete (Tschumi 1983). What kind of changes is really needed is still the matter of research and discussion, but the common standpoint is that traditional ways of using and developing an urban park are not sufficient anymore. It's pointed out that people friendly urban parks should go beyond recreation (Turner, 2004) and be places for new needs and activities, new way of uses and experiences (Thompson, 2002).

## PERVASIVE SPACES – THE AMALGAMATION OF DIGITAL AND REAL SPACES

People are attracted to "wired way of life" more and more, using options offered by new technologies in their everyday life for work, education and leisure. This attitude also means that many times people prefer to stay indoors experiencing virtual reality and/or engage themselves in virtual community rather than real even when being outdoors. That is changing social behaviour and social interactions

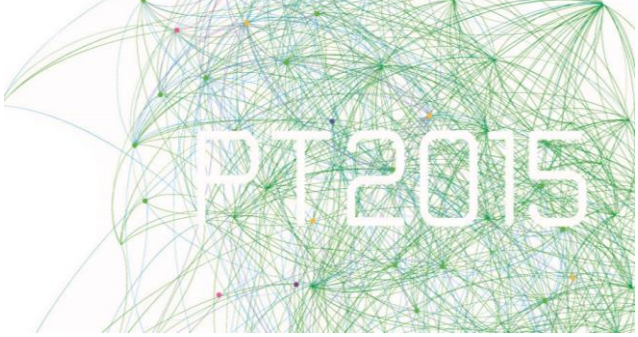



(Hampton et al., 2009), lifestyles and open questions of connections among the virtual city, crisis of public space, social polarisation and the access to computers and telematics (Graham &Auguri, 1997). Not going outdoors has negative aspects to health and wellbeing of people (Godbey, 2009) and to the urban place itself, its quality, vitality and safety. Interrelations between ICT and cities are mostly discussed within the technology-driven visions of "smart cities" and "smart mobility" but more and more authors emphasise the importance of other, more people oriented aspects linked to the use of new technologies. The idea of hybrid space as a real space mashed-up with mobile technology (Souza e Silva, 2006) is nowadays developed further, based on interaction between users, ICT and urban places to improve legibility of the cities (Bristol Legible City), their liveability and playfulness (Playable cites). New forms of integrating people into the urban design process find inspiration in creative play and urban games and so attract more people to engage and support them to be more involved (The Mobile City). The research of the connections between technology and biophilia (Thomas, 2013) is especially interesting and inspiring and demonstrate the importance of nature for people, even for imagining virtual space as a familiar physical ecology. Sue Thomas, writer, journalist and member of CyberParks identifies 'technobiophilia' as 'innate attraction to life and lifelike processes as they appear in technology', (Thomas 2013) and challenge us in her blog: "Can we capitalise on our new-found love of the wired life to encourage more people to go outside?" (Thomas, 2014).

In this regard, the questions tackled by CyberParks Project (COST TU1306), are highly relevant. It will increase the understanding how new digital technologies (smart phones, tablets, Wi-Fi connections, applications) are changing habits, expectations and motivations of urban open space users on one side, and how ICT development, can increase possibilities for new uses and elements or even types of urban open spaces, new ways of social interactions, participation and involvement. On the other hand, the project seeks as well as to develop and test new research methodologies for better understanding users and places and their interrelation, explore different topics related to future development of ICT for the purpose of recognition of values of open spaces, especially in the cities, contemporary and future lifestyles, needs and challenges to develop better urban open spaces and more inclusive and participatory cities.

## CHALLENGES OF NEW TECHNOLOGIES

Free wi-fi provision in public spaces is becoming a standard service enabling the accessibility to internet to all inhabitants. Several examples from different cities from all over the world (NYC, Lisbon, Barcelona, Curitiba, etc.), testify this as the most common new technology provision related to urban open spaces. Also new street furniture is being used to facilitate the use of this – as the "Intelligent Urban Furniture BLOCPARC in Paris or even the signs to inform users of the availability of free Wi-Fi. In Paris, six different kinds of intelligent street furniture are being already tested. This includes the *Digital Harbour*, a kind of open kiosk with a plant-



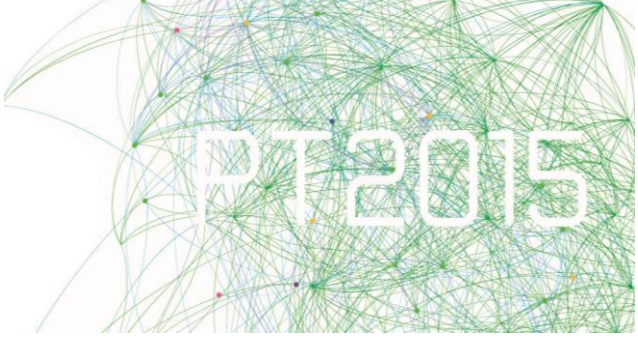

covered roof, equipped with swivel seats and table-tops designed for laptop computers. It offers free Wi-Fi connection and recharging points for electronic devices. Development of new technologies, applications and devices are also enabling a waste range of data collection, producing enormous databases that are mostly used for marketing purposes but could be also directed into more people friendly ways of use offering researchers, planners and designers better understanding of the place, people behaviour and their needs, values and motivations as well as problems and obstacles in relation to use of urban open space. Sensors and other devices not to control but to understand better to react, monitor the quality, changes, values, motivations. Nowadays there are different examples of the penetration of public spaces by ICT, be it applications for helping people to navigate through urban spaces, or be it the provision of Wi-Fi in parks. Many new technologies and applications that were developed for other purpose could be quite usable also for research and monitoring like sensors, data mining, google maps and similar. All such possibilities are challenging the urban designers, sociologists, health care professionals and others not to change the urban place into the technology–driven places but into more attractive, user friendly and interactive urban open spaces where new technologies are bringing added values.

**Introducing new ways of use**

Different ICT, sensors, APPs and games can be used as a part of urban open space program incorporated into urban furniture, screens and other elements or offered via free Wi-Fi to enable new ways of use attractive also to people with more "wired and indoor lifestyles". It is important to challenge them to go and be active outdoor as well and to offer new possibilities for all visitors to be engaged and creative in their real living outdoor environment. New ways of activities as "Geocaching", "Urban Games" can be developed further into more responsive and interactive environments, supporting different programs and events from cultural and artistic to educational, wellbeing and leisure. In Ljubljana for example the new urban park Severni mestni park – Navje was designed to attract wide range of people and offer the visitors also possibility to learn, experience and interact about culture and art, especially literature) through the innovative park elements "multi-media book portals" (Šuklje Erjavec et al, 2004-2010).

**Enhancing Publicness**

With the ability of ICT to enhance communication with (potential) users, creative participation and community empowerment ICT can be a tool for scenario simulations, and used for social reporting it can help to enhance the attractiveness and responsiveness of the public spaces, as users can share information, expose their opinions, needs and desires. GPS and other GIS supported devices can greatly inform about usage-spatial relationships. These pose a challenge for spatial planers to respond to creatively and holistically. ICT in public spaces may also bring threats




that should be taken into account like electronic aggression when ICT are used to conduct hostile acts. Such aspects, from the users' view in regard to their needs as well as from the designer's open research opportunities for meeting the social needs and public preferences.

**Reviving democracy of public space**

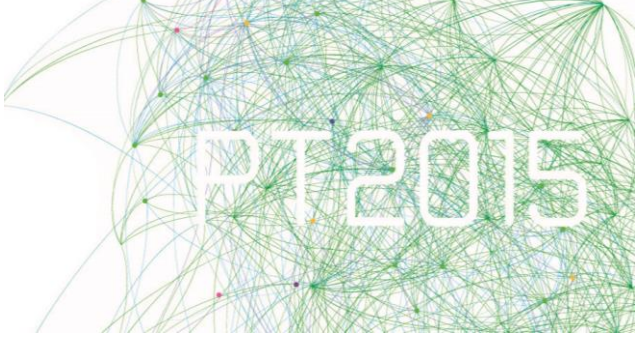
The actions that need public attention, such as demonstrations, strikes, sport events, or even carnivals, require precisely the prominence that public spaces can offer. These events require the immediacy of a live acting or the impact of the kinetic energy of a mass in motion. The Tahrir Square in Cairo, the Taksim Square in Istanbul became worldwide known in this context. The revolutionary movements of the so-called Arab Spring revolutions of early 2011 calling for more democracy and regime change were fostered by the use of modern means of communication. Internet, social media, blogs, twitter, etc. were important drivers (Storck, 2011) allowing a fast dissemination of information, ideas and even live and unofficial images of conflict areas.

**Deepen the understanding and knowledge**

New elements incorporating sensors and information may enable encourage people to learn about the immediate environment in real time and real place, to understand better its natural elements, features, processes, take care, contribute and share their knowledge and experience. Different apps for smart phones already support the identification of wildlife features, as for example Isoperla App Bird Song Id (isoperlaapps.com), which identifies bird species from songs picked out of the air using the device microphone or PlantNet App (plant.net.org) for plant identification. But such experiences could be also reached through in-place elements such smart furniture, interactive info points and similar.

**Enhancing options for participation and co-creation**

Besides new ways of meetings, socializing, sharing information, knowledge and ideas within urban open/green spaces, new technologies open possibilities for involvement, bottom up activities, cooperation and co-creation in the space itself or within the urban planning and design processes. Many artistic or advertising public space installations use new technologies to interact with public and challenge them to co-create the place as is possible to see in Playable Bristol proposals or in Lisbon Interactive Dancing Traffic Lights installation of Smart car brand (2014) that involved people as creators and observers at the same time.




**New design solutions and smart, interactive urban furniture**

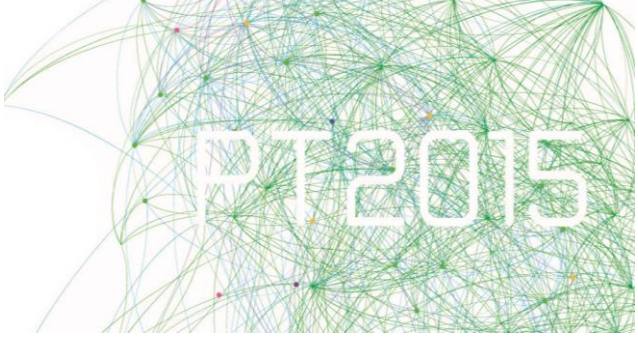
The biggest challenge for designers is to develop new elements or even new types of spaces using all this new possibilities and design innovative solutions that smart, interactive and permanent as well, structuring the place as other elements and features do. Quite a number of interesting urban space elements already exist as already mentioned "multi-media book portals" in Ljubljana that are designed in a way to function also without added value of new technologies or "Mobilier urbain intelligent" in Paris, and reactive light installation for the Osram Seven Screens at the Osram headquarter at Mittlerer Ring, Munich where for example the traffic on the street is tracked in real-time; each vehicle creates a spark which moves across the screens.

**Support for research**

New digital media is especially effective in gathering and analysing different data and information, monitoring and tracking. With appropriate adjustments that can be used also for research purposes to gather relevant information about behaviour, needs, preferences, motivations as well as opinions and suggestions of the users of urban open/green spaces to help professionals to understand better the way places are used by different people, to design and manage them better as well as to present better their importance to decision makers and society in general. An interactive research methodology example is the app "WAY CyberParks". Being developed within the project this app tracks users and their ways in public spaces, and as an interaction interface, as it allows through augmented reality display more information about the space and it elements, and as social reporting it enable users to give a feedback but also to provide information about problems, or warning about incidents.

## THE CHALLENGES FOR FUTURE DEVELOPMENT - CONCLUSIONS

In the paper the big variety of challenges new digital media represents for the future development of urban open spaces is presented, more to open this question in a more comprehensive way that to offer some final answers. For sure in the meantime new innovative ideas and technologies have emerged, challenge us further. The extremely fast development of digital technologies confronted to the permanency of the real place is thus maybe the biggest challenge of all. How to stay in line of real time but keep the quality of real place? How to achieve a good balance between temporary and permanent, between co-creation and management, between traditional and new? From my experience of Ljubljana "multi-media book portals" there is a strong need for smart management of urban open space involving also social and cultural management not only spatial. Successful examples as Playable city Bristol demonstrate that it is possible and really brings an important added value to the quality of life, space and attractiveness of the city.




## REFERENCES

COST TU1306 Cyberparks. http://cyberparks-project.eu/agora/.

Godbey G. 2009. Outdoor Recreation, Health, and Wellness. Understanding and Enhancing the Relationship. Resources for the Future (RFF RP 09-21).

Google. 2014. "Reactive sparks". Light installation in urban environment. Accessed October 9, 2014.http://www.markuslerner.com/projects/reactive_sparks/.

Google. 2015 "inhabitat"," Escale Numérique", Accessed February 22, 2015. http://inhabitat.com/escale-numerique-is-an-intelligent-free-green-roofed-wifi-station-in-paris/escale-numerique-mathieu-lehanneur-2/?extend=1.

Google. 2014. Playable city. http://www.watershed.co.uk/playablecity.

Google. 2014. "Interactive Dancing traffic lights" Accessed July 15, 2014. http://www.dezeen.com/2014/09/17/interactive-dancing-traffic-lights-installation-smart-car-lisbon/.

Graham, S.; Auguri, A. 1997. "Virtual Cities, Social Polarisation and the Crisis in Urban Public Space". Journal of Urban Technology, 4 (1): 19-52.

GreenKeys Project Team, 2008. GreenKeys @ Your City – A Guide for Urban Green Quality. IOER, Dresden. http://www.greenkeys-project.net/en/home.html.

Hampton, K.; Livio, O.; Sessions, L. 2009. 'The Social Life of Wireless Urban Spaces - Internet Use, Social Networks, and the Public Realm". Journal of Communication, 60 (4): 701–722. DOI: 10.1111/j.1460-2466.2010.01510.x.

Hampton, K. and Gupta, N. 2008."Community and Social Interaction in the Wireless City: Wi-Fi use in Public and Semi-Public Spaces". New Media & Society, 106.

Kaplan, R., Kaplan, S., 1989. Experience of Nature: A Psychological Perspective. Cambridge University Press, New York.

You are here. Publication of Bristol Legible City: http://www.city-id.com/assets/publications/bristol_you_are_here_city_id.pdf.

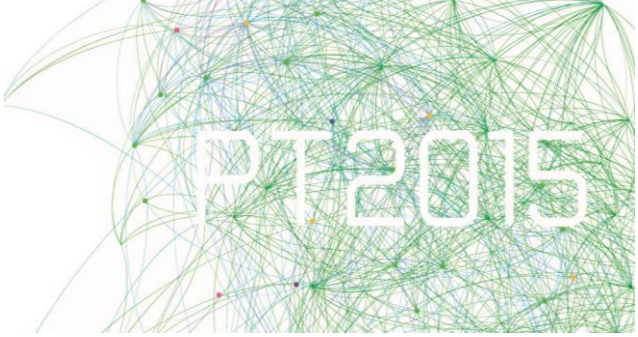
Smaniotto Costa, C. 2012. „Kommunikationstechnik im öffentlichen Raum - Beispiele für neue Interaktionen". Stadt und Grün, 11: 19-26.

Smaniotto Costa, C.; Steinmeier, G. 2012. "A caça ao tesouro ao ar livre. Geocaching, uma oportunidade de lazer em espaços verdes". Arquitextos, São Paulo. Accessed 07/04/2014. www.vitruvius.com.br/revistas/read/arquitextos/12.143/4332.

Smaniotto Costa, C. 2014. "Can we change processes in our cities? Reflections on the role of urban mobility in strengthening sustainable green infrastructures". Journal of Traffic and Logistics Engineering, 2, 2: 141-155.

Souza e Silva, A. 2006. "From cyber to hybrid: mobile technologies as interfaces of hybrid spaces". Space & Culture, 9 (3): 261-278.

Storck, M. 2011. 'The Role of Social Media in Political Mobilisation: a Case Study of the January 2011 Egyptian Uprising'. http://de.scribd.com/doc/132230246. Accessed 22/04/2014.




Šuklje Erjavec, I. 2010. Designing an urban park as a contemporary user-friendly place. In Human Cities - Celebrating Public Spac edited by GolicnikMarušić, B. & Nikšič, M. 39-51. Oostkamp: StichtingKunstboek.

Šuklje Erjavec , I. et al., 2004-2010. "Severni mestni park-Navje, Ljubljana". (different design project and implementation documentations).

THE MOBILE CITY Mobile Media and Urban Design. http://themobilecity.nl/.

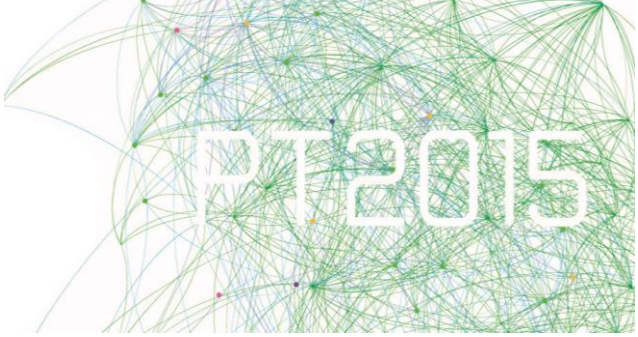
Thomas, S. 2013. Technobiophilia: Nature and Cyberspace. London: Bloomsbury.

Thomas, S. 2014. "Cyberparks will be intelligent spaces embedded with sensors and computers". http://theconversation.com/cyberparks-will-be-intelligent-spaces-embedded-with-sensors-and-computers-26837. Accessed 15/07/2014.

Thompson, C. W. 2002. Urban Open Space in the 21st Century. Landscape and Urban Planning. 60 (2): 59-72.

Turner, M. 2004. "Urban parks as partners in Youth Development. In "Beyond Recreation – A Broader view of Urban parks", 1-7. The Urban Institute, The Wallace Foundation.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# MEDIA ARCHITECTURE AND SUSTAINABLE ENVIRONMENT

**Jasna Čikić-Tovarović**[1]
PhD, Assistant Professor, University of Belgrade, Faculty of Architecture, Belgrade, Bulevar kralja Aleksandra 73/II, Serbia, cikic.tovarovic@gmail.com

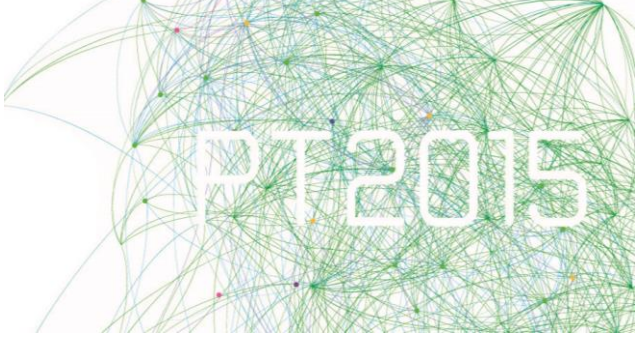
**Jelena Ivanović-Šekularac**
PhD, Associate Professor, University of Belgrade, Faculty of Architecture, Belgrade, Bulevar kralja Aleksandra 73/II, Serbia, jelenais@orion.rs

**Nenad Šekularac**
PhD, Associate Professor, University of Belgrade, Faculty of Architecture, Belgrade, Bulevar kralja Aleksandra 73/II, Serbia, nseki@orion.rs

## ABSTRACT

*Being the integral part of a building, street or infrastructure, media contents shape the appearance of modern cities and affect the way their inhabitants act. The objective of this paper is to analyze the forms of communication that make the media contents useful. The communication between mediafacades and their environment is achieved by applying various sources of artificial light and mechanical systems. There are numerous advantages regarding media facades and their impact on certain buildings, city areas and regions. However, these façades are regarded to be the result of great technological achievements in the field of architecture and other spheres; therefore, certain problems are inevitably come across. This paper deals with the challenges in the media architecture and its interaction with cities and people as well as the users of media objects. Sustainability, visual and light comfort, visual and light pollution in cities, exaggerated importance ascribed to the perception of information technologies and architectural marketing focused on 'healthy life in cities' are some of the topics included in this paper. One of the significant aspects that is to be considered carefully is appropriate 'positioning' of media contents within a city, since there is a potential problem of excessive application of media contents in urban environment. This paper explores the ways in which everyday functioning in a city (noise, street lights, etc.) can affect the audio-visual qualities of media facades. Also, this work presents the methods of integrating the principles of sustainable architecture in the field of media architecture. Whenever it is possible, the principle of energy efficiency should be included in media-architecture design of new structures and remodeling of some old structures. Environmentally-aware development and reductions in energy consumption are the most important goals*

[1] Corresponding author




*to be achieved in the field of media façade designs, regarding the phases of construction and media structures.*

***Keywords**: media architecture, media facades, light pollution, healthy places*

## INTRODUCTION

One of the most significant changes in the world of modern design and architecture is the appearance of new, hybrid forms of media and technology mixtures in order to introduce digital aspects into the physical world of architecture. Media facades, as a new form of architectural expression, were created in order to fulfill the needs of urban communication (Wirth, A. 2001). Media facades with artificial lights represent a new 'infrastructure' of modern cities and it 'makes our cities vibrant and our streets safer' and also leads to excessive illumination of modern cities and increase in energy consumption, since it is an inevitable part of all media facades. The contents and message of media facades are of great significance for promoting cultural and social values within a local community as well as for media architecture adaptability. There is a great number of issues to be dealt with regarding the media architecture sustainability in modern cities. Some of the most important ones are:

1. Cultural sustainability
2. Health sustainability ("light pollution")
3. Energy sustainability

## CULTURAL SUSTAINABILITY AND MEDIA FACADES

Architecture is a new medium for presenting the information regarding advertizing, culture and art, since it is regarded to be an easily available form of communication in modern cities. LevManovich[2]points out that cultural practice (texts, graphics, photographs, music and film) has been increasingly transferred to architecture through the digital forms by digital media in the sphere of media architecture.

Development of a city and culture of a community can be stimulated and improved through the existence of specific interactions within media architecture. Media facades are very important for the social sphere of the city development, considering their ability to inspire and renew social contacts and direct them toward the urban dialogues. Media facades can promote some positive local cultural and artistic values.

[2] LevManovich, in his works*Softvare Takes Command (2008), Soft Cinema: Navigating the Database(2005)* and *Language of New Media (2001))* offers a detailed analysis and history of the media.

One of the good examples of improving the social sphere can be crime prevention within the marginal city zones, where the interactive projects of dynamic illumination of media facades reveal the capacity of media architecture to create ”liveability, safety andvisibility ofcity streets.”[3]

On the other hand, the modern architecture is currently dealing with the challenges of mass culture elements – the forms of subculture within urban environments through media architecture. Repetition, homogenization, commercialization of cultural values and their reproductive character is very common, sine the elements of marketing easily affect the architectural media objects. Although media facades do not always imply the affirmative participation of the media into the architecture of a facility, it does not necessarily mean that media facades can be equated with the phenomenon of commercialization in architecture. There is a risk of exaggerated significance of information technologies and marketing in the field of architecture. Along with another risk, the perception of a structure through media contents only, it can seriously endanger the sustainability of media architecture.

In order to create a proper balance between commercial, marketing interests and importance of cultural motivation in the process of media architecture implementation, there are a few suggestions to be pointed out:

- Total integration of media contents, elements and facades;

- The communication that dominates the space surrounding a media façade should result from the latest technologies, urban and architectural space and active participation of the users through different social relations that are supposed to improve the existing ones;

- Contents and programming models are to be adapted to the function of the existing facility

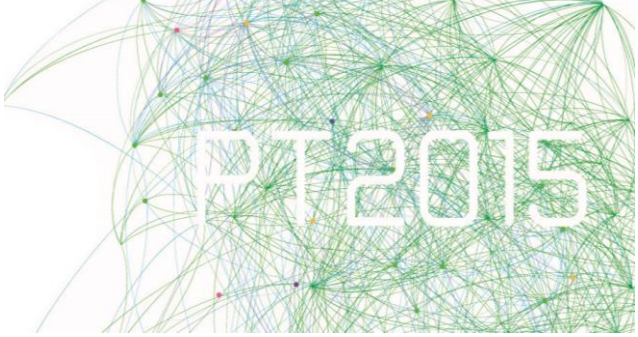
## HEALTH SUSTAINABILITY- LIGHT POLLUTION AND MEDIA FACADES

Too many facilities with dynamic illumination of media facades in some city areas have led to the excessive consumption of artifical light and ’light pollution’. There are various forms of the light pollution[4]and they are harmful for human health and environmental quality.[5]When it comes to electronic media facades this issue is of great importance, since these types of facades require larger sources of artificial lights. Therefore, some crucial aspects are to be taken into consideration.

[3] See I*nteractive lighting preventing crime through environmental design, Wellington, New Zealand* on *http://www.newscenter.philips.com/main/standard/news/backgrounders/2014/20141110-media-backgrounder-citypeoplelight-2014.wpd#.VRCVqPyG-uI.*

[4] See more details about definition and forms of light pollution at Djokic, L., pp. 133-140.

[5]See Effects on animal and human health and psychology, Steven Lockley, Harvard Medical School, CfDS handbook "Blinded by the Light?". Chapter 4, "Human health implications of light pollution".




The main issue is an apparent competitivenes of media contents within urban spaces as well as the feeling of being disoriented. This is especially visible at the cities of the Far East and the USA (Tokyo, Hong Kong, Las Vegas, etc.). These cities are endangered by chaotic media facades displaying commercial contents.

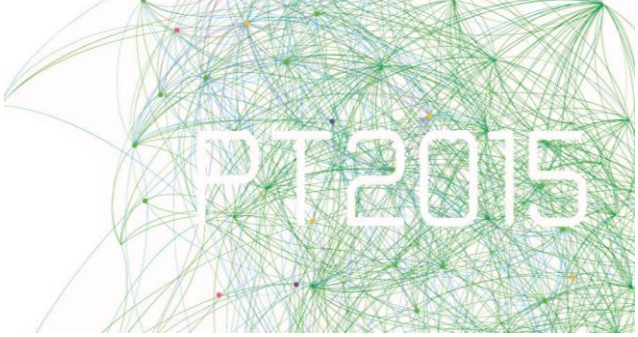
*Changeability and dynamics of artificial light* is very important for media architecture, especially for interactive media architecture. Dynamism in media architecture is based on the modern city dynamism. A proper, well-balanced, moderate dynamic process of illumination is good for our senses. Otherwise, it can initiate some negative psychological consequences. Excessive dynamism included in the media facade functioning can damage human health – it can especially be harmful for the people who are exposed to these types of sensations for a long period of time.

Changeability in light intensity of media facades and the application of a changeable colour spectrum, especially at night, can disrupt the factors of light comfort in the surroundings. Based on a wide variety of examples, it is apparent that the application of media facades is limited to certain urban environments only. They can be dominant in some central city zones, where business activities and trade represent the usual activities. Media facades are often designed in business and sports centres (stadiums), outside the city central zones, so that they do not disrupt the light comfort of the residential facilities.

If a media facade is inappropriately located, it can have a negative effect on the traffic flows in the city, thus endangering human health as well. Media facade must be easily perceived by pedestrians and other users of the city traffic. The European Union countries impose a specific regulation that controls and limits the application of mobile video presentations within public areas in the middle of an intensive traffic flow.

A special issue that requires attention is a potential risk for the users of interior areas, due to the reflection created by a part of media facade light. When it comes to light comfort aspects, it is necessary to control the intensity of light and neutralizing effects of the flash in accordance with the changeable conditions of media facades. The colour of light within media facades is regarded to be a significant parameter to consider in the light comfort aspect, because it affects a realistic perception of all the colours in the interior space. Therefore, it is an important segment to be taken into consideration so that the final result would be the creation of a healthy environment that meets psychological and aesthetic requirements.

Besides the light comfort and all its aspects, it is necessary to provide a visual comfort as well, that is – the connection between users and outdoor environment, an unobstructed view from the inside. Media facades should not be a barrier




disrupting this interaction. If so, there would be a feeling of seclusion and discomfort within the interior space.

In order to create a healthy environment and prevent some unfavourable effects of the artificial light involved in media facades, the following suggestions are to be followed:

The lights included in the media facade should not be directed toward the visible part of the sky;

City zones should be protected from light pollution; the implementation and location of media facades should be carefully selected and monitored within urban environments;

Visual sequences presented through these media facades should be a 'logical visual continuity', so that the whole building could be easily perceived as a unity; this is possible to be realized by applying the latest digital technologies and a specific type of media programming;

The light comfort of the surrounding facilities should also be provided by carefully selecting and locating the media contents within the facades of the facilities; or, a media façade could be applied to only those facades that are easily perceived;

The local regulations[6]on media facades should be imposed, just like the world's countries have been dealing with lately;

The location of media facades should be carefully chosen, taking into consideration the areas of roundabouts and traffic intersection known for intensive traffic flows;

The facades having the front projectors, the facade animation realized by raster graphics as well as the media facade having steel meshes with reflected lights inward, are to be applied only in certain cases – carefully chosen buildings, or/and at certain times of day, or/and under specific conditions (for a very short period of time, or using the flexible curtains, if possible).

**ENERGY SUSTAINABILITY AND MEDIA FACADES**

Energy efficiency in media architecture includes the planned and implemented measures in order to obtain the minimum electric energy consumption and analyze the application of renewable resources in the field of media facades.

[6] In June 2009, the *American Medical Association* developed a policy in support of control of light pollution. Since 2011 Croatia has applied the Law on Light Pollution, see at http://narodne-novine.nn.hr/clanci/sluzbeni/2011_10_114_2221.html.

Active systems of solar radiation involve the application of photovoltaic elements for accumulation, distribution, energy saving and then generating electric energy in order to use it for the purpose of building lighting. The main objective is to calculate the precise amount of electric energy required for media façade powering, using PV element within the facility itself. Such solutions are usually rather expensive and require enormous initial investments. Thus, the ratio of energy efficiency and investment optimization is currently unfavourable. In other words, saving energy is technically possible but it is still not cost-effective, since the period of cost-effective investments are too long, which is not correlated with warranty periods and PV system lifetime. It is of crucial importance to implement PV systems, whenever it is possible, in order to correspond to façades in all aspects (technical, aesthetic and functional).

PV elements can be integrated in media facades (Fig. 1.a-c)[7]:

- thin-layer, completely flexible, semi-transparent or non-transparent PV foils on transparent (curtain wall, windows, parapet glass or brisolei) or non-transparent façade zones.

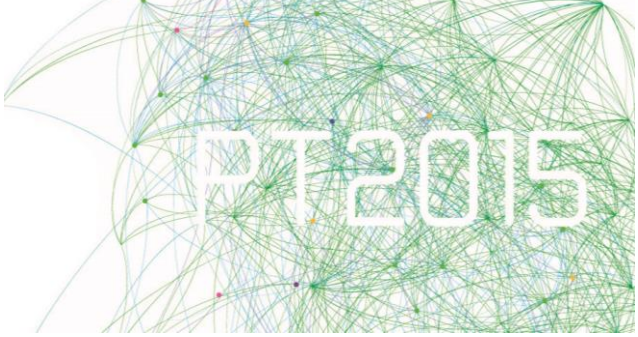
- lamella-like PV concentrator system integrated into the space between the panes of the insulating glass units offers the shading effect and direct protection from solar radiation

- PV modules in the areas of facades having an additional substructure for module support

**Figure 1.a: Greenpix, arch. Ove Arup, Beijing, China, 2008.**
**(Source: http://www.greenpix.org/).**
**Figure 1.b: Lamella-like PV concentrator system into glass.**
**(Source: http://www.onlyglass.de).**
**Figure 1.c: Solar display for a self-powered media façade, Linz, Austria.**
**(Source: http://www.domresearchlab.com/).**

Oliver Ebert (ag4 media façade GmbH) points out green media facades, regarding them to be a Corporative architecture innovation, the work of Corporative communication and social responsibility strategies. Green media facades are based on potential applications of renewable and energy-saving technologies, as well as

[7] INTEGRATING PHOTOVOLTAICS INTO MEDIA FACADES, Conference Proceedings of the 9th ENERGY FORUM, pp. 13.




on media contents that is to present a specific, social responsibility and awareness in relation to environment and local communities.

Besides the renewable solar energy needed for media façade functioning, there are other alternative sources that can be used as potential generators for operating mechanical-electronic media façades. Wind energy is also regarded as suitable, since it is used as an actuator of mechanical elements and it creates a constantly different dynamic perception of an architectural object in motion.

## CONCLUSION

Media technologies are being developed as an integral part of modern cities, and together with media architecture they shape the urban design and environmental quality. Although media facades are regarded as a significant potential of a modern city, the increasing number of these facades leads to various issues regarding the effects of media architecture on social and cultural development and energy resources and environmental protection from the light pollution. This paper includes the suggestions aimed at overcoming the obstacles of media façade implementation in a modern city and realizing the sustainable development of media architecture, while paying special attention to social responsibilities, health protection, safety and environmental quality.

## REFERENCES

Čikić Tovarović, J., Ivanović Šekularac J., Šekularac, N. 2014. *Integrating Photovoltaics Into Media Facades*, Conference Proceedings: 9th ENERGY FORUM - Advanced Building Skins, Bressanone, Italia, 28 -29 October 2014, pp. 13.

Čikić Tovarović, J. 2011. *Influence of New Technologies on Development of Modern Facades – Media Facades, and Possibilities of Remodeling Glass Facades in Belgrade*, Unpublished doctoral dissertation, University of Belgrade, Belgrade, Serbia.

Djokic, L. 2012., *The Illumination of Urban Elements and Space: Harmony through Masterplans*, Belgrade, The Faculty of Architecture; (*Osvetljenje urbanih elemenata i prostora: harmonija kroz masterplan*, Beograd:Arhitektonski fakultet) .

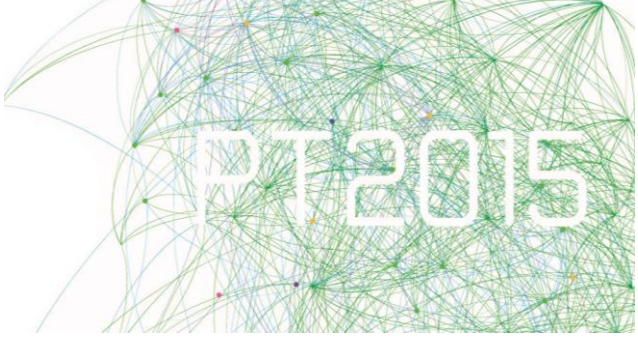
Pop, S., Tscherteu, G., Stalder, U., Struppek, M. 2012. *Urban Media Cultures.* Germany, Avedition.

Google. 2015. Accessed February 25, 2015.www.onlyglass.de.

Google. 2015. Accessed March22, 2015.www.sunways.eu.

Google. 2015. Accessed March 25, 2015.www.solpix.com.

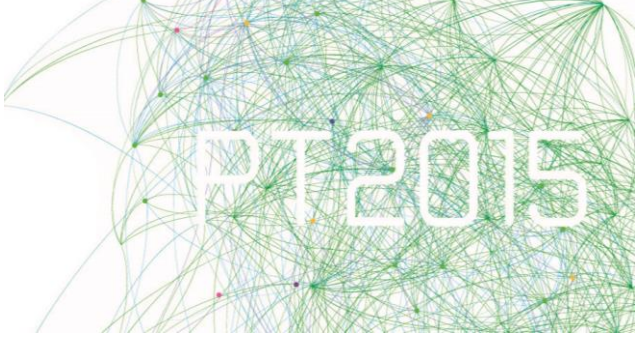
Google. 2015. Accessed April 7, 2015.http://www.domresearchlab.com/content/solar-display-self-powered-media-fa%C3%A7ade-linz-1.




Google. 2015. Accessed November 21, 2008.Wirth, Axel *On sinergies of electronic media and architecture* at http://netzsrannung.org/cat/servlet/CatServlet?cmd=netzkollektor&subCommand=showEntpy&fopward=&entryId=130292&section=&version=ppint&lang=de

Google. 2015. Accessed March 28, 2015.http://www.arup.com/Services/Lighting_Design.aspx

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# IMPLEMENTATION OF NORWEGIAN EXPERIENCE TO SLOVENIAN HOSPITAL SECTOR

**Alenka Temeljotov-Salaj**[1]
PhD, Associate Professor, Evropska pravna fakulteta, Slovenia, alenka.temeljotov-salaj@evro-pf.si

**Svein Bjoerberg**
Professor, Norwegian University for Science and Technology, Multiconsult Norway, svein.bjorberg@ntnu.no

**Simon Vrhunec**
General director, University Medical Centre, Ljubljana Slovenia, simon.vrhunec@kclj.si

**Andrej Baričič**
PhD, Senior Lecturer, Evropska pravna fakulteta, Slovenia, andrej.baricic@siol.net

## ABSTRACT

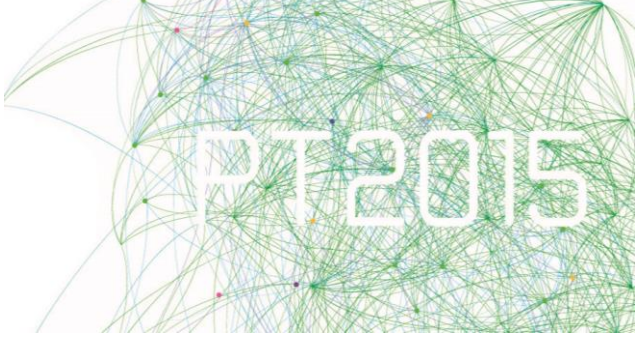
*In Slovenia, as in all nations, the specialist health care services represent the most costly of public sectors. Due to rapid changes in health treatment caused by development within technical and medical equipment, new organizational models etc, it is an increasing demand for development of competence and a clear role of Facility Management (FM), as well as a need to upgrade the hospital buildings portfolio. Effective management and transformation of the building portfolio in line with the development of the health care services is necessary.*

*In Norway a method of assessing buildings performance is developed and used on approximately 30 mill sqm of public buildings. The main objective of looking into the experiences from Norway is to see if it is possible to implement similar methods in Slovenian health sector. This could contribute to a more cost effective resource allocation in building portfolio management and FM, as well as further development of theories, development of innovative and efficient methods and tools to support strategic planning and strategic FM.*

*Methods used are literature review, workshops and presentation of case studies where quantitative methods have been used.*

*Based on these preliminary studies and discussions it seems possible to implement the experiences from Norway regarding innovative methods and tools for strategic property analyses and building evaluation in Slovenian health sector. If correct, this will result in a good understanding of the buildings' viability, with a main focus on sustainability, usability and adaptability. Implementing the Norwegian*

[1] Corresponding author




*tool 'MultiMap' into Slovenian hospital environment will give an overview of the performance of the building portfolio regarding technical condition, usability and adaptability. This information, together with future demands in health care, will give the platform for further strategic planning of future needs.*

***Keywords**: health sector, facility management, hospital, Norway, Slovenia.*

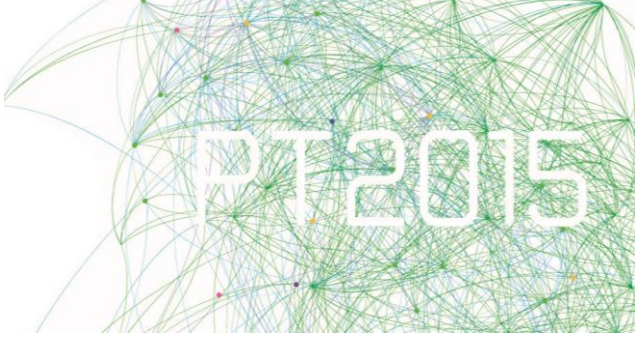
## INTRODUCTION

The health sector is one of the most costly sectors in all nations and the big question is how Facility Management (FM) can contribute to a more cost-effective health operation. Change, innovation and current pressures give demands for change and adaptation. Health campuses in many countries comprise both new build and retrofit. Existing buildings present a greater challenge due to lack of adaptation to current and future needs. A big part of the existing hospital buildings are outdated technically as well as functionally. The needs for investments are substantial to transform the facilities in order to satisfy future needs. But at the same time the economic resources are limited.

In Slovenia 1.222 billion EUR were allotted to the Specialist Health Care Service in 2010 (approx. 561 EUR per inhabitant). Out of this allotted budget approximately 51,25 million EUR is related investment and FM costs. Total income of all state owned hospitals in Slovenia for the year 2013 was 1.197 billion EUR. Approximately 1.050 billion EUR (88%) were payments for health services from national health insurance institute. Other 12% were income from other sources, mostly from private insurance companies for insurance for co-payments. Total costs of hospitals in the year 2013 were 1.237 billion EUR. In total costs there is also 46 million costs of amortisation included which must be by law spent exclusively for new equipment and facilities. By Slovenian regulation the obligation of state budget is for investments in hospitals. In 2013 there were 95,1 million EUR spent for investments from state budget.

The situation represents a challenge for the development of good FM strategy in the sector. It is important to develop: a coherent approach to the transfer of best practice of sustainability within the FM industry in health sector, based on evidence-based information; knowledge around the concept of adaptation and change in FM, and; benchmarking platform for FM decision making for strategic planning.

Larssen (2011) stated that for good property and facility management it is important to be oriented on buildings usability. She listed parameters which are relevant for buildings usability in the health sector, as: activities (performance of desired activities); capacity (related to activities); sufficient design (plan, room size and form, traffic area etc); equipment (including infrastructure and fixtures); Indoor environment, technical condition, adaptability and flexibility (physical,




economical, organizational), and; resource use, risk, security (all other aspects has a direct or indirect impact on this).

It is also important to provide transparent mechanism for communicating FM related information to the core healthcare business. The extraction of information about the huge hospital buildings portfolio should be the platform for decision making in the strategic planning process.

The research objective is to examine possibility to implement methods and tools which provide information needed to support strategic planning for the development of hospitals in Slovenia. This is essential for improvement of resource efficiency in the health sector by strengthening the interaction between health treatments and supporting services. The highest priority is to provide information that may, together with scenarios on core business trends, support the work with identifying future need for dimensions and types (content) of hospitals.

One of objectives is to see if MultiMap method, which is widely used for hospitals in Norway, can be applicable in Slovenian context. This method is a result of research project "Buildings and Property as a strategic means of effective health services" (Bjørberg et.al: 2005-2010) and PhD-study (Larssen, 2011). The challenge is to find out if the tool is useful for the biggest and most complex hospital in Slovenia 'University Medical Center in Ljubljana' (UMCLJ), with buildings mainly situated in the center of Ljubljana and few dislocated buildings. The buildings date from period 1898 to 2012.

## THE NORWEGIAN TOOL "MULTIMAP"

Development of MultiMap started back in 1998 in Norway based on Oslo municipality's need for an overview of technical and environmental condition, upgrading cost and technical value of the total building portfolio of approximately 4 mill sqm. MultiMap has since then been further developed and refined, especially in connection with the mentioned R&D projects.

MultiMap has been the driver in the ongoing work within strategic FM. It is a resource-efficient way of obtaining information for use at strategic level and is suitable for large building portfolios. Results provide general overview of the needs, possibilities, risks and limitations in the portfolio, to form the basis of any further/deeper analysis.

Data structure is based on the Norwegian Standards classification system for condition, costs, building elements and categories. NS 3424 "Condition Assessment of Construction Works" is the most central. It uses condition grades between 0 and 3. Condition grade 0 is equivalent to the best grade (new building), and condition grade 3 corresponds to the lowest rating.

MultiMap consists of several modules, such as Technical condition, Adaptability, Usability, Infrastructure and site etc, which totally give information of a building/-portfolio regarding the potential for future use (Figure 1).

Information is based on "constructive research" (Kasanen et. al, 1993, Lukka, 2003), which is a procedure to develop innovative "constructions" solving a concrete problem. In this context "Construction" is an abstract term describing what is going to be "constructed". Structured information from the hospital portfolio will be applied into the Usability / Adaptability matrix (The Viability Model - see table 1) and shape a direct overview of the status of the portfolio including, if chosen, technical condition, indoor climate etc.

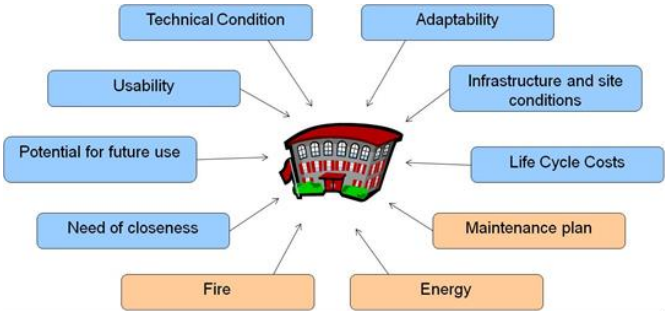
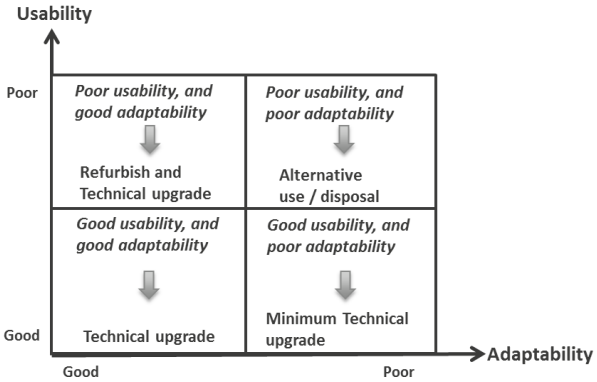
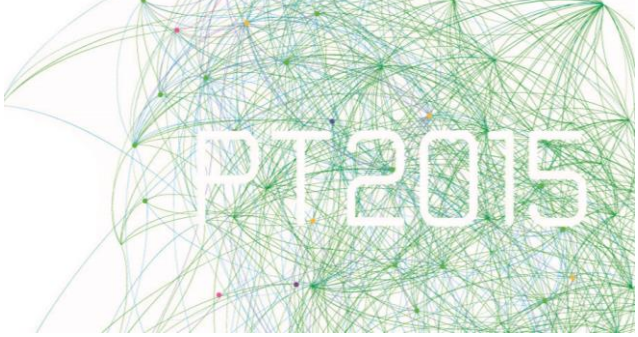



**Figure 1: Different modules in MultiMap (Ref.: Multiconsult).**

Also the module "Adaptability" has the condition structure from 0 to 3. Degree 0 is highest demand and degree 3 is the lowest. During the assessment the physical parameters are registered and given a performance degree according to medical function demands. When all parameters have been assessed, a performance profile can be compared with a set of demand profiles witch gives the answer on what kind of medical functions actually can take place in every floor.

**Table 1: The viability model (adapted from Larssen et al, 2004).**






The tool has been used for approximately 4,8 mill sqm (GFA) of hospital buildings in Norway and appr 1 mill sqm in Stockholm. In addition it has been used on appr 15 mill sqm of public buildings of other kinds, mainly education.

## IMPLEMENTATION APPROACH

The method is developed as generic, so it can be repeated over time and produce comparable results and it optimizes the relationship between detailing and the use of resources. The basic principle for the mapping building stock is to use the existing knowledge of people knowing the buildings and explanatory matrices and forms. Based on Norwegian experience a research for the implementation of gathering strategic data in Slovenia has started on following approach / steps:

1. *Establish cooperative partners*. It was concluded that the approach can give added value in the strategic planning within hospital sector.
2. *Form an organisation for the project implementation*. The main stakeholders should be presented in a steering committee, which should be responsible for overall input needed for the total analysis, including future trends and development in health sector.
3. *Clarify classification systems that are needed*. Slovenian classification system, based on Eurocode, should be implemented in different modules of the tools, including development of all the necessary helping matrixes.
4. *Training of people who should be responsible for the system in future*. This group should also be responsible for training (through special workshops) those who shall give information to the modules.
5. *Choose a pilot hospital as a starting case*. A pilot case should have a great variety of health functions and different buildings. An assessment should be based on: a/ Workshop with people at the hospital responsible for setting grades based on helping matrixes; b/ Assessment of grades as input to the database; c/ Make tables and other structured info out of the input; d/ Establish reports with results and suggested actions; e/ Make adjustments according to experience made.
6. *Establish a plan for assessment of the whole hospital sector in Slovenia*. This will include workshop at each hospital and further steps as for the pilot hospital.
7. *Summing up*. When all data is clarified a report for the whole hospital sector should be prepared. For this report it is crucial to use extracted data to make the best communication level as shown on picture 1.

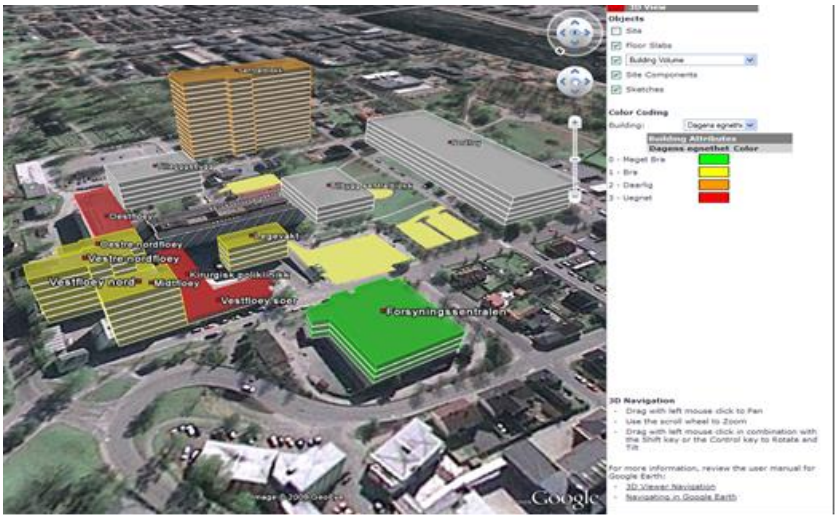



**Figure 2: Example on visualizing results (Ref Multiconsult).**

## CONCLUSIONS

Implementing "MultiMap" as a tool for gathering data for strategic planning in Slovenia has some challenges. But as a tool for gathering data, a better and more transparent way of communicating a huge amount of data is given, which makes a more firm platform for decisions in the strategic planning process for future development of hospital sector, and this is added value to the process itself.

Due to information, discussions and workshops throughout a period of six months the developed tools and methodology in Norway meet the criteria's that were defined as primary objectives. But a tool is just a tool, the result depends on how we choose to use it. The Norwegian methods and tools have been examined, and found to be a good way of getting structured data for strategic planning and development of future hospitals in Slovenia.

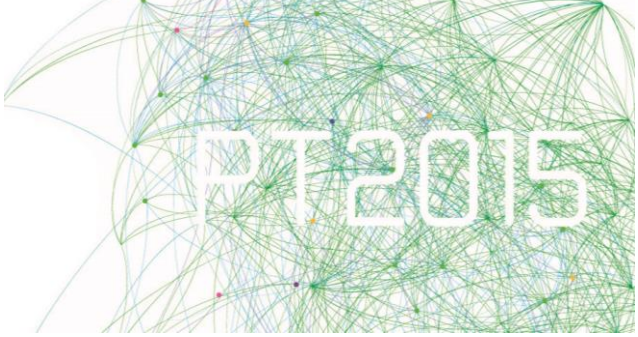
Experience so far proves that the methods and tools are relevant and useful for strategic planning and for early stages of feasibility studies. Further steps will be done to establish funding and then follow the 7 steps for implementation.

## REFERENCES

Bjørberg et. al: "*Buildings and Property as a strategic means of effective health services*" R&D project, Norway 2005 – 2010.

Larssen, A. K. 2011. *Buildings impact on Hospital Effectiveness*, Norway.

Kasanen et. al, Lukka. 2003 "Constructive research". Finland 1993.

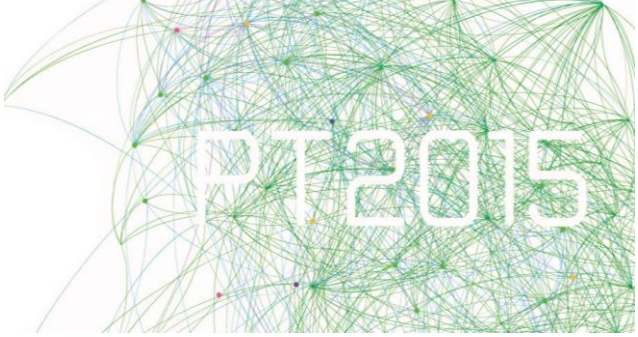



Larssen, A. K. and Bjørberg, S. 2004 Users needs / demands (functionality) and adaptability of buildings – a model and tool for evaluation of buildings. *The 12th CIB W70 Conference Proceedings. Hong Kong.*

Standard Norway (SN):

- NS 3424 " Condition Survey on Construction Works" 1995.
- NS 3451 "Table of Building Elements" 2009.
- NS 3453 "Specification on Building Costs" 1987.
- NS 3454 "Life Cycle Costs for Building and Civil Engineering Work" 2000.
- NS 3457 "Table for Building categories" 1995.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# TOWARDS OPEN, THERMODYNAMIC CITY P&T 2015

**Marija Bojović** [1]
PhD student, Teaching Assistant, University of Montenegro – Faculty of Architecture, bul.DžordžaVašingtona bb, 81000 Podgorica, Montenegro, trashandvaudeville@gmail.com

**Irena Rajković**
PhD student, Teaching Assistant, University of Montenegro – Faculty of Architecture, bul.DžordžaVašingtona bb, 81000 Podgorica, Montenegro, irena_arhi@yahoo.com

**Sanja Paunović Žarić**
PhD student, Teaching Assistant, University of Montenegro – Faculty of Architecture, bul.DžordžaVašingtona bb, 81000 Podgorica, Montenegro, paunovicsanja@gmail.com

## ABSTRACT

*Today, the space and the city represent valid resources for profit accumulation. Capitalism and its representatives have dominantly impoverished all the complexity of space, bringing it down to the market goods - measured by the market and not utility value. The cities are now experiencing fatal outcome of profit-driven management.*

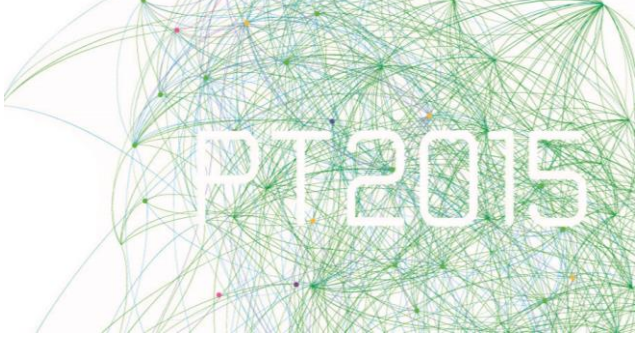
*The resource scarcity became evident at the end of the 20th century and it required optimization measures. Alarming climatic and demographic changes, fast economic cycles, and the profit-driven consumer society management require new solutions which would result with resilient cities, capable of surviving disturbing global transformations. Therefore it is necessary that 21st century urban planning reaches fundamental reform.*

*This paper argues necessity of the improved science of the city, which would consider the urban phenomenon in total, instead of limiting itself to particular, local studies. The city is complex, dynamic, self-adaptive entity. From a thermodynamic perspective, it represents open system, in constant exchange with its environment.*

*The primary objective of the following paper is to apply the logic of natural sciences and the theory of open systems in particular to the city, in order to try to define general framework for better understanding cities and their metabolism. The paper suggests possible pathways for achieving different, more sustainable, urban planning, which would eventually ensure better future of our cities and society in general.*

***Keywords**: city, open system, sustainable urban planning, thermodynamics.*

[1] Corresponding author




## INTRODUCTION

In the mid-sixties of the twentieth century tradition in art gets abandoned and artists started requiring greater involvement of audience, leaving their work unfinished and left to partial interpretation of the User. Artist decides to leave the arrangement of certain parts to the audience or to chance, not giving them a single definitive solution, but a multitude of possible answers.

Umberto Eco calls such a work of art *open* (Eco, 1962) and highlights its importance both for the long-term historical usefulness of its concept of openness, but also because of the extraordinary way in which it anticipates two main topics in the theory of art from the mid-sixties onwards - insistence on the element of multiplication, plurality or polysemy in art, and emphasis on the role of the user, interpretation and feedback reaction as an interactive process between the user and the work.

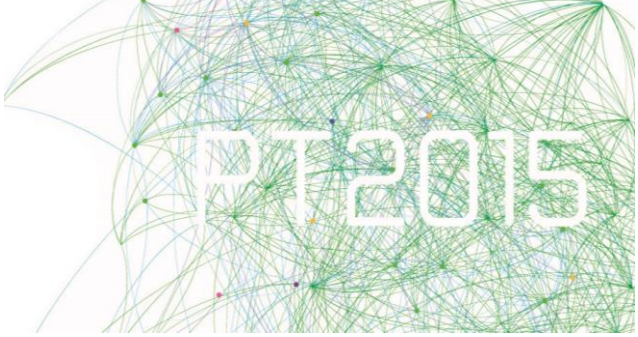
Modern art has radically changed the relationship between artist and audience, as it required greater participation, but it is not on the social aspect that this paper particularly insists. The paper attempts to correlate open form of a work of art, therefore the City as well as an artistic and human creation, with open systems in natural sciences, which would further imply that their logic of functioning is, if not the same, then very similar.

Why I think that insisting on an open city is important at all? Today, when we live under the imperative of sustainability, which is the only known concept, it would be important to note that the behaviour in accordance with nature of things is the only true sustainability. In modern art the transition of sixties of the last century relatively naturally occurred - open works were not the only art that has been created, but they were the only adequate one.

## CITY AS AN OPEN SYSTEM

An open system is a system that is in constant interaction with its surrounding. The interaction can take the form of exchange of information, energy, material transfers into or out of the borders of the system. In contrast to a closed and isolated system which neither exchanges energy and matter nor information with the outside world, borders of an open system are amorphous, permeable and constantly changing. To maintain itself, the system must share resources with the surrounding. In social sciences, an open system exchanges matter, energy, people, capital and information.

In his book *Landscapes of change* Sanford Kwinter gives his definition of an open system - evolving system that supports the flow of energy. Since the supply of energy and the information is continuous, the system is dynamic - simultaneously in constant transformation locally and in dynamic balance globally.




Bringing cities in connection with open systems has a simple stronghold - the city is alive, dynamic, and growing organism, which constantly interacts with its surrounding. Insisting on the city as an open system has the ambition to apply the logic of science to open systems and the City, which would, I believe, result in new and fresher guidelines for its smarter and more sustainable operation, i.e. for different urban planning.

The city is a complex dynamic entity. This makes it necessary to consider it as such, if we strive for sustainable urban planning. Static structures - physical environment of the city - buildings, streets, and infrastructure are only the scene for dynamic phenomena and countless co-evolutionary processes.

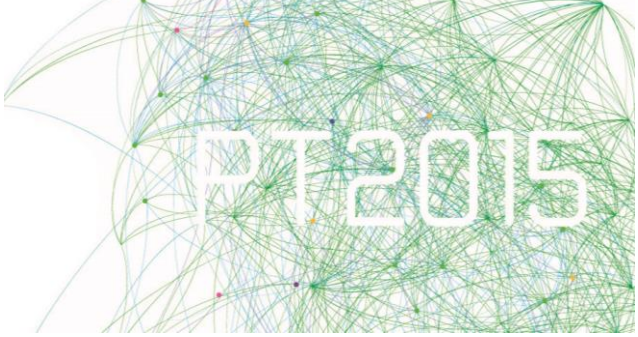
## CITY AS A THERMODYNAMIC SYSTEM

From a thermodynamic perspective, cities are open systems that continually import and export energy and matter through its borders. Export is always more chaotic than import, due to irreversible internal processes - dispersion of energy. If we draw an analogy with ecosystems, urban metabolism may represent intake, transport and storage of operating substances on city locations, as well as their transformation (from matter into energy).

Thermodynamics is not the only available *tool* for exploring issues of resources necessary for the city, but provides important insights into what makes cities unsustainable. The laws of thermodynamics, applied to urban issues, can provide guidance for optimization of urban metabolism. Although in the past few years, there is a considerable number of scientific papers dealing with precisely this issue, it is still not clear how thermodynamics can give a precise answer, quantitatively, and how actually can it offer successful scientific framework for understanding cities and their evolution.

The city imports resources - raw materials, fuel, and food, processes them and exports waste, almost irrespective of the consequences for the environment. Since we are talking about the planet where half a population is urbanized, the consequences of such negligence and inefficiency in terms of resources are alarming. If we add the fact that in the next twenty years the growth of population of more than 50% is expected, the future does not look promising. From all of the above, a better understanding of urban metabolism represents a compulsory assignment, in order to optimize the behaviour of cities and prevent negative scenarios.

According to Ilya Prigogine, a Belgian chemist and Nobel Laureate, *in the city, i.e. in a living system, we have different types of functional order. In order to maintain the thermodynamic theory for this type of structure we must show actually that imbalance is a source of order* (Pulselli, 2006). Irreversible processes can lead to




new types of dynamic states of matter which Prigogine calls dissipative structures (Prigogine, 1977).

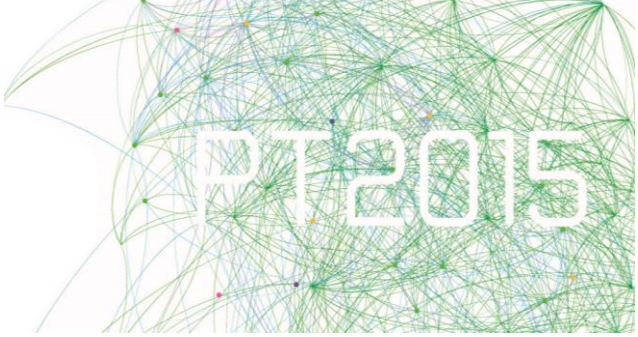
This and similar theories are more often applied to living systems, but also include disciplines relating to social behaviour, human settlements and dynamic phenomenon. The concept of dissipative structures Prigogine represents in order to generally describe the behaviour of such systems. According to him, dissipative structures are thermodynamic systems, open for energy and matter; they are self-organized towards high levels of complexity and organization (Pulselli, 2006). Characteristics of such structures are as follows:

- they are open and living systems;
- they try to avoid the state of thermodynamic balance, keeping themselves as far away from that state;
- they are self-organized due to the fluxes of matter and energy that they receive from the external environment and from a system with different energy and temperature;
- they are maintained in a stable condition at the higher levels of order and complexity;
- they strive towards minimum entropy;
- they absorb negentropy (negative entropy) from the external environment, thus structuring and evolving on the basis of these interactions.

The city, as such a structure, according to Prigogine, absorbs high quality energy fluxes and matter from the external environment, while radiating the heat and waste into the external environment. From the aspect of entropy, this means that the city tends to its decrease (absorbs negative entropy). Dashes of resources are creating order in dissipative structures, therefore in the city as well, keeping it regulated over time.

Entropy of the system is, in our case, a clear measure of the level of disorder within the system. It is a clear indication of towards what the City strives. Self-adaptive systems tend to increase regulation of the system by reaching and maintaining a higher level of organization. According to Prigogine, variation of entropy depends both on its production within the system, and on the variation of entropy due to exchange with the external environment. Entropy increases when the system is isolated and interacts only with itself and within itself.

Order in the city leads actually towards a relationship with the external environment, absorption of negentropy, which further leads towards a decrease in entropy of the system and introduction of order.




Self-adaptive open system – the City – decreases entropy of the system by increasing the order within that system, by self-organization.

## CONCLUSIONS REGARDING THE THERMODYNAMIC CITY

After observing the city through the lens of science, in the present case from the aspect of thermodynamics, it is necessary to carry out constructive conclusions, which can give us new directions in sustainable city planning. From all the foregoing, we can say:

- That the City is irrevocably an open system, structure that functions according to regularities of the open system. Therefore, any approach to urban planning that insists on an isolated city, self-sufficiency and closed borders is wrong and after some time fatal;

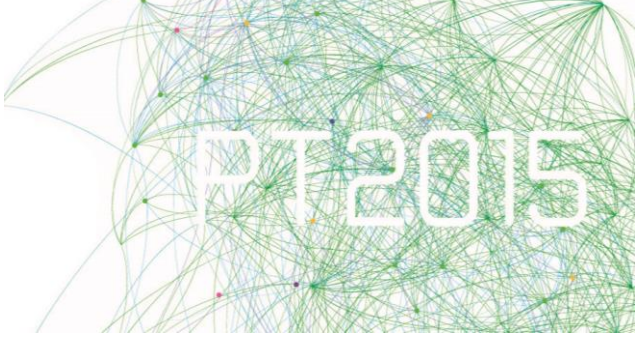
- That the open thermodynamic system, and therefore the City, is the most stable when entropy of the system is minimal, suggesting that the concept of the City as an isolated complex is totally unsustainable. The City should be autonomous, but not self-sufficient. It is and must be viewed as a hub of a more complex network, a part of a larger system, from which it receives the necessary negative entropy that maintains it in a regulated state;

- The City is a self-organizing and self-adapting system and it reaches its order through the chaos, although it may sound paradoxical. Prigogine, by exploring issues of transitional phase of the system in imbalance, came to an unexpected result – that chaos actually leads to order.[2] When the distance from balance increases, the system starts to oscillate. In the case when the system is infinite – which was of crucial importance for this paper – the system receives long-term spatial order. The long-term spatial order is exactly towards what the City strive.

If we want sustainable cities, we have to accept that they function according to their internal laws and that permanent stable condition results from seemingly chaotic behaviour at all levels. The current planning practice ignores the essence of the logic of urban metabolism, trying to *tame* it with the system of externally imposed rules.

We know now that, as far away from balance this City is, the more stable it is. Guidelines for development should correspond to the *wild* and *rebellious* nature of the city - they should represent a flexible network of opportunities, which has an

[2] The author refers here to Prigogine's results of the study, stated in a lecture when receiving the Nobel Prize – one would expect that chemical inelastic collisions together with diffusion would lead to a chaotic behavior, but he showed instead that near the critical state, we have long range chemical correlations and the system acts as a whole, inspite of the short range character of interactions.




infinite number of possible solutions. Urban planners are required to have a greater level of commitment to predict an elastic scenario.

It is not excluded that, for achieving these objectives, by implementing a set of necessary measures, a different social system is required, away from the high degree of control and fixation, the system which allows oscillations within the society and eventually leads to achieving long-term stability.

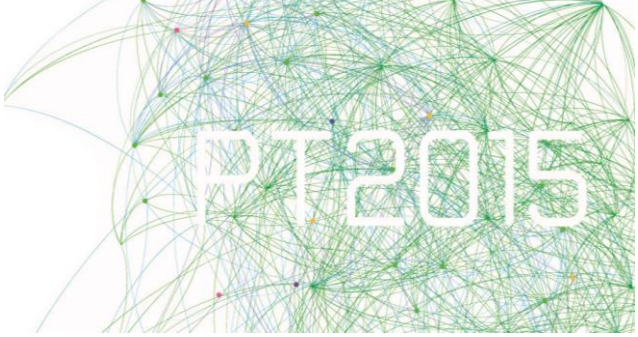
## SUSTAINABLE, OPEN CITY – SOCIAL AND POLITICAL ASPECTS

Since we are talking about guidelines for sustainable city planning, socio-political aspect is an inseparable part of the overall strategy. It can be said that it is even the most important aspect, because in order to have more sustainable and smarter cities the same decision-making system is necessary.

The art of city planning is significantly in a downtrend since the mid-twentieth century. We are witnessing a paradox - today's urban planners have a whole set of technological capabilities, some of which are almost unimaginable, but they are not using their potentials. Possible cause of this is over-determination, of both visual forms of the city, as well as its social function. Technologies that make an experiment possible are subordinated to the regime of power, which actually only wants order and control. What is missing to a modern urban planning is a sense of time - we have to accept that the City is a process, that its image changes during use and we must be prepared that our predictions often do not have to be correct.

Insisting on urban zoning in the twentieth century disabled local innovations and spontaneous growth of cities, freezing them in time. The result of these predeterminations is a fragile, brittle city. Today's urban units have a much shorter lifetime than the inherited urban tissue. By changing the purpose, the building must be destroyed instead of just adapted to the new purpose - over-determination of form and function leads to a pronounced sensitivity, non-resistance and fragility of the urban environment. The average life span of new collective residential buildings in the UK is now forty years, and of the new New York skylines only thirty-five. Although the average disinterested participant this fact does not have to look directly related to energy consumption, we know that the construction industry is very demanding consumer and that demolition due to rebuilding is at least justified undertaking as regards the energy.

We may at first glance think that the Brittle City as such in fact stimulates urban growth [Sennett 2006], since the old is very efficiently replaced by the new. The growth of urban complexes is actually much more complex phenomenon than just a replacement of what existed previously, it actually requires a dialogue between past and present, and it is a matter of evolution rather than erasure. The principle is accurate both socially, as well as architecturally. Scratch of a pen of urban planners is not enough, dialogue takes time to develop. The way we are building




cities today –by segregating functions, sweeping sense of space through zoning and regulation - leaves communities no time and space necessary for development. Brittle City is a symptom, and represents an image of society as a closed system. A closed system is a conception that broke state socialism in the twentieth century and gave the form to bureaucratic capitalism. This view of society has two main attributes - balance and integration. According to Lefebvre, management of space by the State represents the logic of continuity, fixed, which brings destruction and self-destruction with it (Lefebvre, 1968).

Every technological progress at the time of its creation represents interference and usurpation in a larger system. The same happens in an urban environment, provided that modern urbanism is trying to preclude those dysfunctions with a bunch of rules and regulations that should keep under control architectural, social, economic and historical context. This closed system reveals the horror of disorder that bureaucrats of the twentieth century feel.

## RIGHT TO THE CITY INSTEAD OF CONCLUSION

In the old sixties, Lefebvre argued that the primary human desire is to produce its own space – to live, work and in the end – total space – the City. Under the statement that citizens have a right to their city we mean the right to participate in its design and power over the processes of urbanization, in fundamental and radical sense. Since their conception, the cities were formed through geographical and social concentration of profits and therefore urbanization has always been a class phenomenon, and control of profit has always been entrusted to a selected minority.

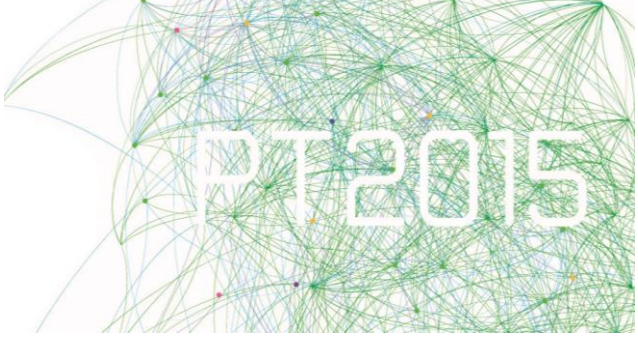
The right to the City would imply a greater, more democratic, control of creation and use of profits. Since the urban process is the most important channel of using profit, the right to the city would imply greater control of its use precisely through urbanization.

In the late sixties of the last century Lefebvre followers gathered around the revue Utopia, begin *Money of Urbanism*[3] with a quote of Corbusier on urbanization which is not spending money, but making money, accompanied by the text with very interesting illustrations – that the capitalist city, as a product of the capitalist system of accumulation and exchange, is in service of the power of money and its honourable representatives.

The result of the urge to engage capital which leads to an increase of cities without end and the concept, regardless of the social, political or environmental consequences is quite visible in our region.

Since (all of a sudden) we want sustainable, smarter and more resilient cities, it is clear that we need fundamental reform of their planning. Rethinking the cities of

[3] L'argent de l'urbanisme




the future must be integral – it must consolidate all aspects but it also must dominantly be led by the fact that the City belongs to the Citizens.

Only the open City, which is well thought-out and planned as such, is sufficiently resilient and flexible to accept changes over time, without fatal consequences for the space. And we know that sustainable planning is the planning which provides for the use of space in a manner that leaves it improved for future generations.

## REFERENCES

Eco, U. 1962. *Opera aperta: Foma e indeterminazione nelle poetiche contemporanee.* Milano: Tascabili Bompiani.

Kwinter, S, Boccioni, U. 1992. *Landscapes of Change: Boccioni's "Stati d'animo" as a General Theory of Model.* Cambridge: The MIT Press.

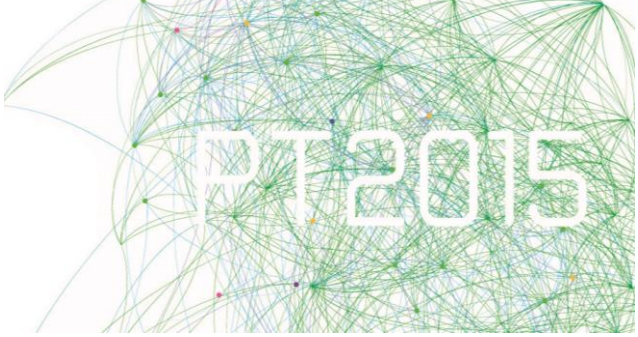
Lefebvre, H. 1968. *Le droit a la ville.* Paris: Editions Anthropos.

Prigogine, I. 1977. *Time, structures and fluctuations*. Nobel Lecture.

Pulselli, R M. 2006. *Non equilibrium thermodynamics and the city: a new approach to urban studies*[pdf]. Accessed January 10, 2015. http://www.ncbi.nlm.nih.gov/pubmed/17172207.

Sennett, R. 2006. *The Open City.* [pdf]. Accessed January 30, 2012. http://downloads.lsecities.net/0_downloads/Berlin_Richard_Sennett_2006-The_Open_City.pdf.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# INTERWEAVING OF BANJALUKA'S URBAN AND RURAL LANDSCAPES

**Dijana Simonović**
PhD, Assistant Professor, Faculty of Architecture, Civil Engineering and Geodesy, University of Banja Luka; S. Stepanovića 77/3, Banja Luka, Republic of Srpska, Bosnia and Herzegovina; dsimonovic@aggfbl.org

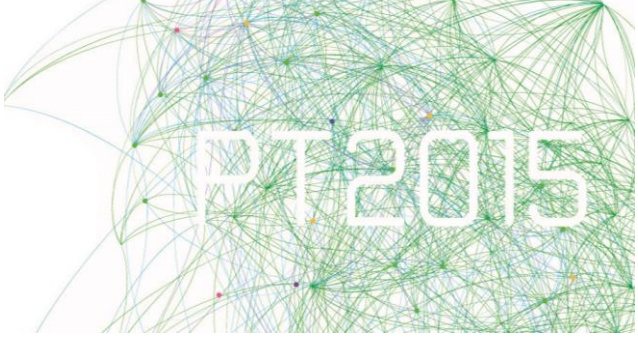
## ABSTRACT

*This paper points out the changes observed in the rural surroundings of Banja Luka City (Republic of Srpska, Bosnia and Herzegovina), recognised as a form of 'spillover' of concrete features of place identity to the spatial identity of the adjacent villages, from urban to rural areas. Manifestations of these changes are 'readable' in the rural landscape encompassing the City of Banja Luka. The paper also considers a different type of change in the city suburbs, which has taken place through the territorial linkage of the city with the adjacent places, to form new linear urban-rural conurbations. It explores the underlying causes of these changes and research opportunities for rehabilitation and improvement of spatial identity through landscape regulation. Also examined are the effects on the landscape produced over the past twenty years and how they relate to the applied regulation strategies, as well as their impact on spatial identity, both rural and urban.*

***Keywords**: urban landscape, rural surroundings, urban-rural continuum, place identity, regulation strategies.*

## INTRODUCTION

The premiss underlying this paper is that Banja Luka represents an instance of a landscape city (Симоновић, 2010), whose urban landscape has been regulated following a particular model which can be considered open or adaptive. (Симоновић, 2014, 2) The term 'landscape city' refers to those cities that grew and were planned and designed according to principles which met stringent criteria, in terms of both how the existing natural landscape was treated and striking a balance between the constructed and the natural, within the urban landscape as a whole. Banja Luka formed its character as a landscape city in a dynamic process of alternation of a series of regulation models, or spatial design models and guided urban development, as conforming to concrete ruling paradigms or ideologies of physical space/land use. It was due to frequent and abrupt changes to the local circumstances (historical, political, social, economic and natural) that these models transformed or stayed conceptually truncated. What remained the same to the end of the 20th century was the continuous presence of the landscape concept in



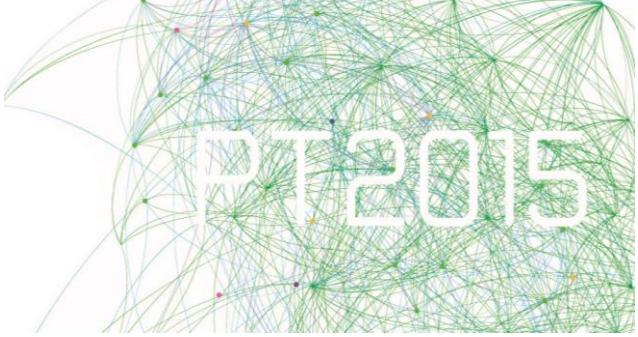

planning and designing the area of Banja Luka, with implications for its urban identity. (Симоновић, 2014, 9)

Major changes have taken place in the urban landscape of Banja Luka City, as observed in the last twenty years: the balance between its built and natural structure has been disturbed, its green structure has been jeopardised, while its previously formed character and urban identity as a landscape city are now beyond recognition. Research findings show that this urban landscape transformation is a direct result of the implementation of the model of urban regulation provisionally called the 'free market strategy'. This strategy opposes to the concept of landscape that of marketising space, of making it a mere asset, and territorialising power, whose implementation has put at risk the basic elements of Banja Luka's identity as a landscape city. (Симоновић, 2014, 297)

This paper points out the changes as observed in Banja Luka's rural surroundings, recognised as a kind of 'spillover', the rubbing off of specific characteristics of its place identity on the spatial identity of the adjacent rural settlements, from the urban to the rural environment. At the same time, these once rural environments have seen the birth of a new urban landscape and the imposition of a new spatial order, whose emergence or implementation have developed, or rather rehabilitated, some of the key elements based on which Banja Luka was categorised as a landscape city, which have been lost and no longer remain in the city's urban core. Also considered are other types of changes in the boundary zone or along the city perimeter, resulting from the city territory joining the territory of other adjacent settlements and/or villages. Manifestations of these changes are 'readable' in a new peculiar linear conurban or urban-rural form. The interrelational connection of these various forms, fabric and structures as observed in the transforming urban landscape of Banja Luka points to and necessitates an integral approach to how to consider and treat Banja Luka's urban landscape, which this paper recommends as relevant for observing the city in a spatially integral and structurally and visually comprehensive manner, by interconnecting the forms of its parts and the city as a whole.

## MULTIPLE LANDSCAPE TRANSFORMATIONS

In considering the impact of regulation on the most recent transformations of Banja Luka's urban landscape, this research focuses on two discrete developments as characteristic of a single process, Lefebvre's 'implosion-explosion', understood as the emergence of new dynamic urban landscape forms and structures found inside the 'original' urban landscape of a city, and new forms found outside its boundaries, along the perimeter and in its rural or natural surroundings, both merged with the social and natural context of the city. Several terms are used in research and professional literature to denote this new kind of urban space: conurbation, urbanised rural areas, peri-urban areas, pseudo-urban space, urban-rural continuum, etc. (Милић 2002, 65; www.periurban14.org) As such, this space




is characterised by dynamism, spontaneous emergence and sprawl, as well as lack of planning control and action. It emerges when two traditionally different types of constructed space overlap or merge, while characterised by different densities, land use, intended use of space, levels of utility network development/availability, and lifestyles. (Милић 2002, 66) This process results in a peculiar urban form which is 'neither rural nor urban', or is 'both urban and rural' (Ралевић, Симоновић 2000, 113), a phenomenon which remains insufficiently researched by the local urbanism theory.

An examination of the complex and multifarious transformations of Banja Luka's urban landscape reveals the basic distinctive features of the processes taking place: 1) there has been a conspicuous linear sprawl northwards, with new urban landscape extending mainly across low-lying ground, along the road to Laktaši and Gradiška (following the course of the Vrbas River), as well as to the northwest, with intensified construction along the road to Prijedor, and the northeast, including the townlets of Vrbanja and Čelinac, in the direction of Kotor-Varoš (partly along the Vrbanja River); 2) Banja Luka has sprawled across the hilly and mountainous ground of its southwest and west hinterland, i.e. neighbourhoods Lauš, Čokori and along the road to Bronzani Majdan.

This new urban-rural form has developed into three distinct morphospatial types: a) residential neighbourhoods, with the majority constructions being single-family free-standing houses on reduced farm plots; b) mixed neighbourhoods, with high-concentration production, storage and service facilities/businesses located along a main road and residential structures in the back, with single-family free-standing houses on reduced construction lots, created by fragmenting former farmland; and c) special mixed neighbourhoods, with a high concentration of residential, farming, production, storage and service facilities and businesses along a main road, created through fragmentation of former farm plots into small-sized plots intended for residential purposes and larger construction plots intended for commerical use.

Considered for the needs of this research are the differences between these new specific types of settlements or neighbourhoods bordering 'between towns and villages' in terms of their creation, evolution and condition. The criteria applied are those used to investigate the relations between those urban landscape characteristics that are representative of Banja Luka's permanent identity features and the implemented model of general regulation of its urban landscape in the period under consideration. (Симоновић, 2014) Changes to the quality and quantity of the green structure of Banja Luka's outskirts and rural surroundings have taken place as a trend of functional transformation of farmland and woodland into construction land, and the construction of residential, service, storage and production facilities. This has gradually led to the development of the new conurban form, continuously connected to the city core with which it has merged, resulting in changes to the form and structure of the urban landscape of the city. Concurrently, the space of the city's industrial zones, previously intended for these uses, has become derelict and is not used as space suitable for business and investment. (Simonović, Novaković, Vujičić, 2011, 444)

Three related processes take place simultaneously: a) increase in the building density in the city core, b) transformation of green areas in the city core and of farmland along the perimeter into construction land, and c) inadequate use, falling into disuse and dereliction of the existing spatial resources of industrial zones. Along with the urban landscape undergoing morphospatial transformation (figure 1), there have been particular sociocultural and organisational-functional changes in the neighbourhoods themselves, resulting from the urban and rural merging, with a range of implications for the characteristics of the local urban identity. These peculiar elements or characteristics are noticed if the phenomenon is regarded from the aspect of the following triadic relation, landscape-regulation-identity: (Симоновић, 2014, 295)

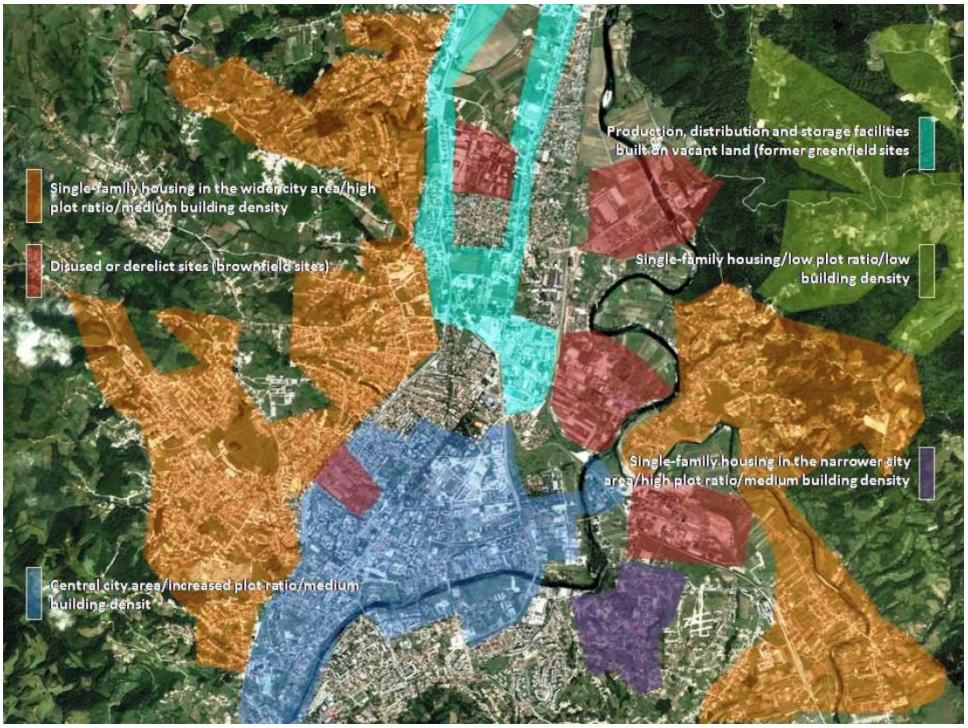
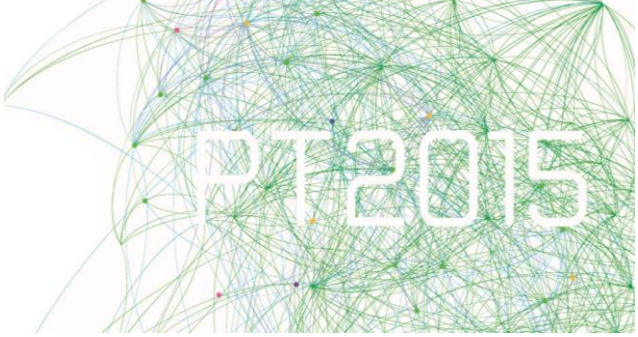



**Figure 1: Banja Luka urban landscape distribution according to endangerment level.**

a) Changes are the most extensive in areas between the city and adjacent villages, in zones where construction land is less costly (previously farmland, whose use has been legally changed in the meantime), beyond the 'reach' of planning regulation or in places to which no intermunicipal/intercity regulation instruments apply, where new hybrid settlements rose – both rural and urban, or neither urban nor rural – to which residents and economic actors 'import' patterns as adopted in their former environments (initially, urban patterns dominate; after the population has settled, rural patterns are increasingly introduced and prevail).




b) The population of these new hybrid urban-rural settlements mostly arrived during and after the 1992-1995 civil war, mainly from rural environments, although not exclusively, but surely from places or areas that were at different levels of economic development. The settlements formed through a process of concentration of people who were previously residents of the same area, former neighbours or relatives, i.e., people with shared or similar backgrounds, who initially accepted the governing rules of physical regulation of the original settlement (with plots and houses orderly lined up along a major road, in geometric order as typical of cities), only to introduce, with the passing of time, the 'old' rules and patterns of use and division of land and organisation of space, those they respected in their former environments. The share of the unemployed in the total number of the settled population is high, with a negligible percentage of farmers, craftsmen and other service providers, and a small percentage of people employed in the city or the conurbation area.

c) These peculiar urban satellites are characterised by dependence and incompleteness; they lack wholeness/integrity, public and common spaces, and are both isolated from and dependent on the city. (Ралевић, Симоновић 2000, 123-126) In line with the previously stated peculiarities and distinct organisational-functional, ambient-structural and sociocultural characteristics of these settlements, compared to the narrow city area, they are perceived as satellite habitation forms with a special character and identity, evolving in parallel with their own transformation.

For all the three sets of reasons stated above, the connection of the inhabitants of these areas with Banja Luka's central city area – its population, culture patterns and participation in identity building – is very weak, and they largely stay 'invisible' both for the population of the urban area of Banja Luka and the city and republic administration, with the exception of school children and college/university students, who enjoy a greater degree of social inclusion/openness. While these settlements undoubtedly possess authentic identity characteristics, they lack in spatial integrity and functional independence as relative to Banja Luka, and their identity may thus not be regarded separately from the identity of the city. Even more than that: as shown by the findings of a previously conducted axiological study of the quality of urban landscape properties as characteristic of the identity of Banja Luka as a landscape city, (Симоновић, 2010) on which are grounded the key premises of this research, the process of development of urban identity is an inherent one, with the accompanying phenomena such as 'spillover', 'import' and 'transfer' of the key elements of identity from the city core to the satellite settlements, very much like a set of communicating vessels.

The process of depopulation of rural areas in the Banja Luka region intensified after the Second World War, in parallel with its urbanisation and industrialisation. The movement of rural populations to urban environments was the result of political decisions favouring the spatial and territorial growth of industrially developed urban areas, for the purpose of creating a working class, or a working

collectivity, for which standards and norms were set regarding spatial use, planning and design, also based on political estimates and decisions. These two processes may be followed in parallel with the process of construction of holiday homes in the rural surroundings of the city, to the end of the civil war in Bosnia and Herzegovina and the beginning of the transformation of the political system of the country.

In terms of identity implications, the building of a great number of holiday homes/settlements in the rural surroundings of Banja Luka is indicative of the mentality of those of its inhabitants with a heightened need for occasional retreats to nature and for growing vegetables, fruit and flowers, which was impossible in multi-family residential blocks and neighbourhoods. This mixed and divided lifestyle, which included two places of living, a flat and a house with a garden, reveals the identity roots of former rural populations; at the same time, they were an expression of the new identity of industrial and administrative workers and the military – the middle class in general, with almost identical lifestyles and models of use of space, which included the need to reach the standards of extended stays/ part-time residence in holiday homes (which most often turned into permanent homes once their owners went into retirement).

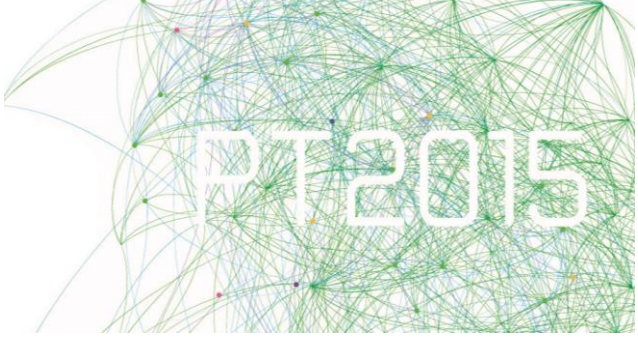
## CONCLUSIONS

The conclusions of these considerations may be reduced to the stance that the key to all future actions expected to resolve the issue of identity crisis in the current circumstances of the prevailing trend of globalising and marketising space lies in urban landscape regulation. (Pozo, 2014) In the widest sense, the process would impose the new 'old' spatial order, by integrally treating the urban and rural parts of the widest city territory; in a narrower sense, it would re-introduce urban regulation in the form of construction codes or books of statutes applicable to specific cities, towns or villages, adapted to the local environment and circumstances, which would contain not only axiological and normative standards, but also those relative to traditions and customs, as well as measures of 'accomplishment'. This would help reaffirm the peculiar model of open urban landscape regulation, which developed in the process of urban growth of the City of Banja Luka, as previously concluded, as based on the landscape concept, now highly at risk.

## REFERENCES

del Pozo, C. 2014. „Landscape oriented urban strategies". In: *STRATEGIES FOR THE POST-SPECULATIVE CITIES*. Eds. Juan Arana Giralt and Teresa Franchini Alonso, 85-92. Madrid: University San Pablo CEU.

Милић, Владимир. 2002. „Псеудоурбани простор између села и града: трендови у Републици Српској". У: *Зборник љетње школе урбанизма Шипово 2002*, 65-73. Бањалука: Урбанистички завод Републике Српске.




*Peri-urban.* 2014. Sidney, Australia. Accessed February 23, 2015. www.periurban14.org https://awa.sharefile.com/download.aspx?id=34e0ba19bea54bb5

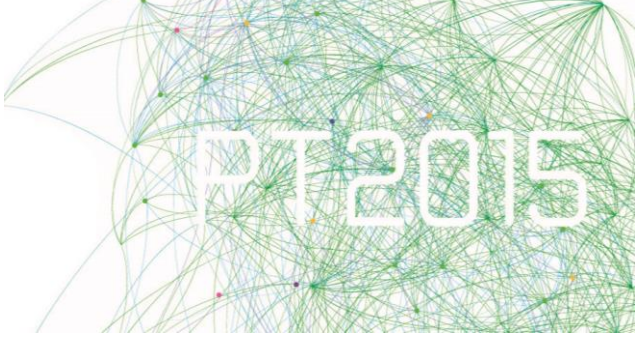
Ралевић, М. и Симоновић, Д. 2000. „Савремена урбана насеља између села и града.“ У: *Зборник радова III Летње школе урбанизма Шипово 2000*, 113-131. Бањалука: Урбанистички завод Републике Српске.

Симоновић, Д. 2010. *Пејзажни градови: поређење развоја урбаног идентитета Бањалуке и Граца.* Бањалука: Архитектонско-грађевински факултет Универзитета у Бањалуци.

Симоновић, Д. 2014. „Истраживање могућности обнове и унапређења урбаног идентитета Бањалуке као пејзажног града путем урбанистичке регулације“, докторска дисертација. Бањалука: Архитектонско-грађевинско-геодетски факултет Универзитета у Бањој Луци.

Simonović, D., Novaković, N., Vujičić, T. 2011. „Towards a strategy of regeneration of urban landscape: brownfields as a strategic resource“. In *Proceedings of I International Conference ECOLOGY OF URBAN AREAS*, 439-449. Zrenjanin: Faculty of technical sciences „Mihajlo Pupin“.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# AN APPLICATION OF THE "ENVIRONMENTAL ISLAND": A PRESCRIPTIVE TOOL TO CREATE HEALTHIER URBAN ENVIRONMENTS

**Lucia Martincigh**[1]
Professor, Architect, Department of Architecture, Roma Tre University, via Madonna dei Monti 40, Rome, Italy, lucia.martincigh@uniroma3.it

**Cecilia De Marinis**
PhD, Research Assistant, Architect, Department of Architecture, Roma Tre University, via Madonna dei Monti 40, Rome, Italy, arch.ceciliademarinis@gmail.com

**Janet Hetman**
PhD, Research Assistant, Architect, Department of Architecture, Roma Tre University, via Madonna dei Monti 40, Rome, Italy, janet.hetman@uniroma3.it

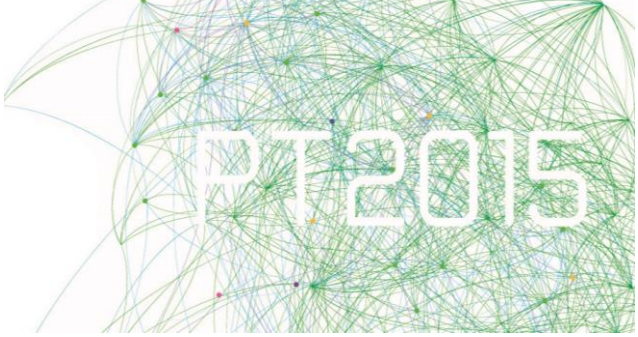
## ABSTRACT

*The Department of Architecture of Roma Tre University and Piattaforma Testaccio, a group of inhabitant and stakeholder associations, both based in the same district: Testaccio, cooperate since 2013 in order to enhance its urban environment and quality of life. The main issue of this collaboration has been a study on the possibility of implementing a prescriptive tool applicable in residential areas: the "Environmental Island", aimed at improving both sustainability and liveability of urban spaces. The students of the course "City & Environment", together with their teaching staff, were called to identify problems and propose solutions, considering also the inhabitants' expectations presented by the associations. It is important to underline that in this case the designers are also users, frequenting daily the area. Testaccio is a historical district characterized by an elderly population, due both to the aging phenomenon and the permanence of the early families.*

*To keep people in good health and decrease their stress, the World Health Organization recommends 30 minutes of walking per day and specific limits for acoustic levels, considering that in big cities noise is an important cause of stress as much as chaotic traffic. To keep older people mobile, it is important to create an urban environment that facilitates their walking, is comfortable and is not threatened by the heat island effect.*

*The analyses, run according to European methodologies, highlighted the areas with the highest level of air and noise pollution, mainly caused by vehicular through traffic but also by some night traffic, due to the presence of many activities.*

[1] Corresponding author




*Possible actions were identified in order to reduce traffic, noise and air pollution, featuring, on the one hand, the redesign of traffic patterns and streets, on the other hand, some technological devices reducing both particulate and noise.*

***Keywords:*** *healthy places, environmental island, air and noise pollution, heat island, urban design.*

## INTRODUCTION

The Department of Architecture of Roma Tre University, with its broad spectrum of disciplines, aims at developing innovation in architecture and at supporting students, researchers and professors in their study and experimentation activities. Therefore, research fulfils multiple aims, steering towards both basic issues, with educational and methodological character, and pilot studies, pointing to the applied aspects. The Department has recently moved to Testaccio, a historical, famous, working class district of the city, where Piattaforma Testaccio, a local association of dwellers, is very active. Its main initiatives, aimed at the enhancement of the site, are taken in the field of mobility, energy, historical heritage. The collaboration between Piattaforma Testaccio and the Department of Architecture on the "Environmental Island" pilot project represents for both an important experience.

## THE DISTRICT OF TESTACCIO IN ROME

Testaccio district is located in a central area of the city of Rome. It is delimited by the Tiber river, Via Marmorata, a congested urban road, and the Aurelian roman walls. The neighbourhood is a typical eighteenth-century residential area, built following the construction of the city slaughterhouse, gradually characterized by social housing and developed on a regular square grid (Franco, 1998). A number of court-buildings distinguish such grid. The inner space of the courts, that are often uncrossable, is very lived in by the inhabitants, as are the outer public spaces. The neighbourhood is also a city pole of attraction in terms of culture and entertainment, hosting a large number of people and not only dwellers. The presence of so many people, during day and night, requires urban spaces meeting, in a congruent way, the different needs of users and dwellers. Inhabitants care a lot for the space in which they live and this aspect makes easier the process of improvement.

## THE "ENVIRONMENTAL ISLAND": METHODOLOGY OF APPLICATION

The "Environmental Island" is a prescriptive tool, considered in the Italian legislation on Urban Traffic Plans and described as an urban zone located in mainly residential areas (Ministero dei Lavori Pubblici, 1995). Mentioning the "pedestrian network continuity", it allows to consider pedestrians as the core of the mobility planning and to give them priority, to reduce private vehicles circulation, to control car speed levels by different devices, for increasing safety and accessibility for the most vulnerable users (Ferone, 1998; Dipartimento Mobilità e Trasporti di Roma Capitale, 2015). In the course of "City & Environment"2, students together with researchers and professors applied the methodology developed in previous research works in order to identify and delimit the environmental island (Fleury and Laursen, 2002). This is an urban texture easily identified by ideal or actual boundaries, characterized by inner local streets and surrounded by main roads, that has a dimension easily walkable and presents, beside all the everyday facilities, also some environmental, architectural and historical features or attraction poles giving identity to the zone and satisfying daily life dwellers' requirements (Martincigh, 2012). Various hypotheses were proposed and assessed to choose the one to deepen in the following project.

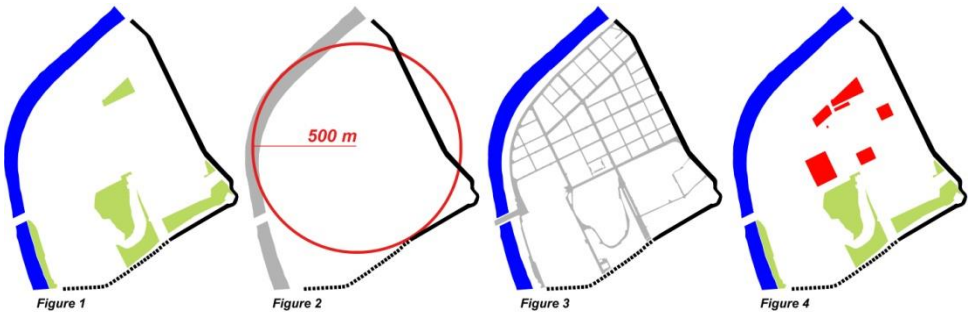
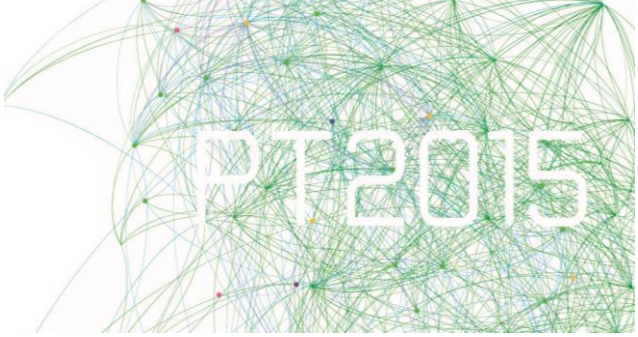



**Figure 1: the ideal or real boundaries; Figure 2: the 500 m radius; Figure 3: the road system; Figure 4: the everyday life facilities.**

The second step of the work faced the analysis of the district urban environment, and its performances, and of the dwellers' requirements. The compatibility analysis between performances and requirements, helps to detect problems to be solved and values to be enhanced, and then to define appropriate actions for a sustainable upgrading, in relation to liveability as a whole and in particular to accessibility, safety, comfort and attractiveness (Martincigh, 2002). In this case too, analysis is based on methodologies developed, applied and tested in previous European and national research experiences, which provide indications both on the assessment of

[2] The course is taught by Prof. Lucia Martincigh during the 2th year of the Urban Design MSc, at the Department of Architecture of Roma Tre University. The Department has a BSc+MSc programme, constituted by a single 3 year BSc and by three different 2 years MSc, for a 5 years programme in total.




the situation and the definition of intervention strategies, up to the proposal of design solutions (Rauhala et al., 2003; Martincigh, 2011).

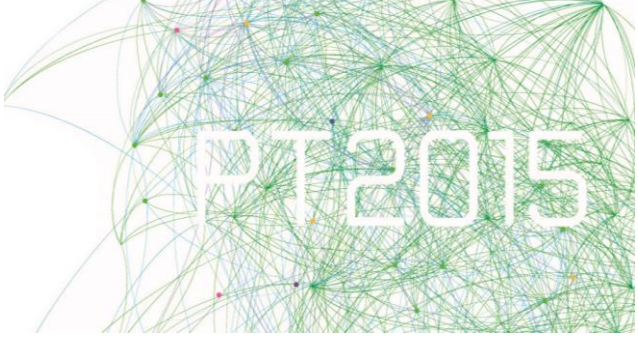
The project aims at eliminating through traffic and at organizing inner traffic, using innovative devices to reduce vehicular speed (30 km/h) and flow, in order to promote not motorized modes: walking and biking. It aims also at designing continuous pedestrian and biking networks, with comfortable and appropriate spaces and facilities for walking/biking and sojourning; finally at devising solutions that make the street environment comfortable and unpolluted (Martincigh, 2008).

As third step of the project, solutions and measures were proposed and designed as a sample of what could be made when drawing up a final design, if the town municipality programmed and realized an upgrading project [3].

## "ENVIRONMENTAL" AREA AND HEALTH

Italy, in comparison with other European countries, has a growing phenomenon of aging population, and it is the second country, after Germany, for ageing index. Reading the census data from 1961 to the present, in Italy the ageing index increased from 38,9 to 151,4 (ISTAT, 2014); it is also expected to grow further. The main reason is a significant decline in mortality, resulting in an increase in life expectancy at birth. Roma has an index of 144,4, and Testaccio is characterized by an elderly population, due both to the aging phenomenon and the permanence of the early families. Older people are more vulnerable, therefore they need good environmental conditions; to keep them in good health, World Health Organization recommends 30 minutes of walking per day (World Health Organization, 2010) and specific limits for acoustic levels, considering that noise, in big cities, is an important cause of stress as much as chaotic traffic (World Health Organization, 1999 and 2009). To keep older people mobile, it is important to create an urban environment that facilitates their walking, is comfortable and is not threatened by the heat island effect. Many studies claim that urban heat islands have a significant impact on the health of the urban areas' population (Alcoforado and Andrade, 2008). In particular, alarming effects on mortality of the elderly and very elderly population were found. Unfortunately, some events take us to support the argument set out above. Europe, in the summer of 2003, reached very high temperatures, even a few degrees above 40°C (Costanzi, 2005). The result was an increased mortality during the first two weeks of August, and Italy was not immune. Indeed in urban areas, warmer than adjacent rural ones, the air high temperature

[3] Martincigh, L. and Urbani, L.: *WP7: Solutions Report*, "PROMPT – new means to PROmote Pedestrian Traffic in cities". Coordinator: Kari Rauhala. VTT Building and Transport, Helsinki (2000-2004) http://prompt.vtt.fi




accelerates the photochemical reactions producing ozone at ground, or smog, that constitutes an additional threat to health, especially of the most vulnerable people: children and elderly.

Major causes for the Urban Heat Islands are the reduction of free land surfaces, wetlands, permeable and vegetate areas; buildings and roads transformed them into impervious and dry surfaces. The consequence is a greater absorption of solar energy and a decreased evaporative cooling. In addition to residual heat, the vehicular traffic, congested and too fast, generates air and noise pollution too.

## ANALYSIS OF THE DISTRICT IN ORDER TO OBTAIN THE MAIN PROBLEMS

The analyses of the district, made by students and university staff and run according to European methodologies, concern mainly air and noise pollution, in relation to vehicular through traffic to the vehicular speeds.

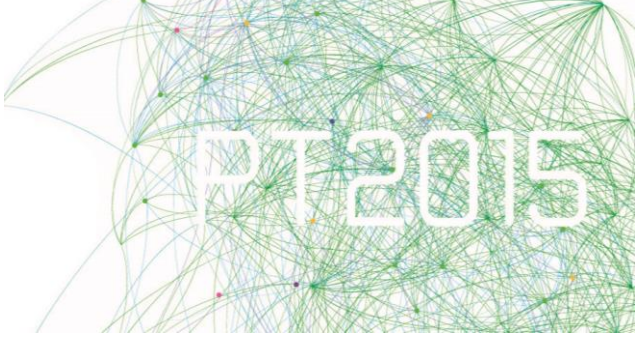
First of all, the traffic flows are used as indirect indicator of the pollution levels in the area. The traffic flows were computed as Average Annual Daily Traffic (AADT), according to the guidelines defined in the European research PROMPT4. This method can be used when no reliable direct measurements are available as regards air pollution levels in an area. Measures are taken by recording vehicles passing through a road by automatic or manual survey procedures, computing on an hour basis (vehic/h). The average of vehicular flows has been calculated in different days and in different time slots. In addition to this, also the pedestrians' flows have been evaluated, in order to define which relation there is between pedestrian and vehicular flows and to verify if pedestrians walk in the most polluted streets. It is also possible to measure the air pollution directly, as it was done in the European research ESCAPE5, also in the city of Rome. This measure is made through monitoring stations located throughout the territory, which collected data about the concentration of pollutants. The collected data are used to formulate maps available online presenting the spatial distribution of pollution.

The analysis of the vehicular speeds is another indirect way to obtain data about air pollution. Speeds are surveyed according to methods defined in previous European research works[6]. The first method is the quantification of the "spot speed", within speed ranges that are defined on the basis of the speed considered

[4] Olaussen Ryeng, E., Ovstedal, L. R., *Draft Instructions for assessing Comfort* and *WP3: Pedestrian Comfort Synthesis Report*. PROMPT–new means to PROmote Pedestrian Traffic in cities. Coordinator: Kari Rauhala. VTT Building and Transport, Helsinki (2000-2004) http://prompt.vtt.fi

[5] ESCAPE (European Study of Cohorts for Air Pollution Effects) is a European project that investigates long-term effects on human health of exposure to air pollution.

[6] Leden, L. WP2: Safety Synthesis Report. PROMPT–new means to PROmote Pedestrian Traffic in cities. Coordinator: Kari Rauhala. VTT Building and Transport, Helsinki (2000-2004) http://prompt.vtt.fi




as safer: 30 Km/h. The car speed should be detected preferably by using suitable systems (autovelox, reference line, chronometers etc.) and recording a number of passings sufficient to build a stable figure. The second method is the technique of "the pursuit" that is driving along the chosen roads, tailing after other vehicles in normal transit and verifying the speed on the tachimeter. Data collected by both methods can be reported on a map in which streets are classified in different ranges of speed. The analysis of traffic flows and vehicular speeds gives indirect information about noise pollution too (Martincigh, 2009).

To collect more precise data on acoustic conditions in the streets, it is required a special equipment: a phonometer. Spot sample measures were taken in most of the roads of the district; sound sources were analyzed by various parameters: permanent and temporary sources, punctual, linear or area ones. The sound intensity sources (dB) were reported on maps (Bianchi and Carratù, 2007). Finally an evaluation dividing sound sources in acoustic references and disturbance was made (Martincigh, 2009).

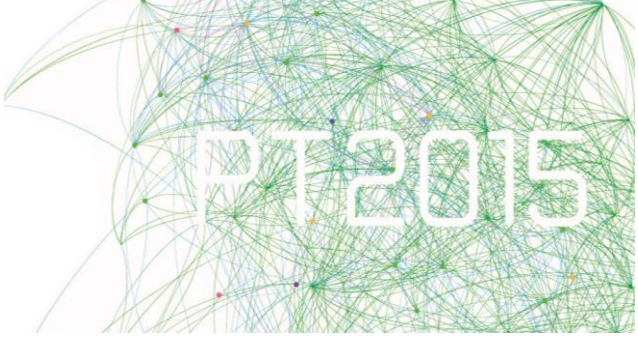
Outdoor security in the district is another performance that is very important for elderly people. Since it is known that it depends also on the presence of activities and lively spots, an analysis was made surveying the presence of people, of night and day activities, of lit and transparent frontiers to detect the "eyes and ears" of the district (Lopez, 2003; Martincigh, 2009).

## CONCLUSION: STRATEGIES AND SOLUTIONS FOR THE "ENVIRONMENTAL AREA" IN TESTACCIO DISTRICT

The outcomes of the study carried out in the course "City & Environment" concern innovative and interesting solutions, in order to reduce traffic flow and speed and, as consequence, noise and air pollution.

First of all, to force drivers to give more attention and to reduce the vehicular speed, several devices that affect indirectly the behaviors of the drivers are defined: the shared spaces, that integrate vehicular and pedestrian flows in the same space; the raised crossing, in which the street level is flush to the pavements; the roundabout, designed to avoid a straight visibility in order to have drivers reducing the speed where pedestrians cross; the chicane, that is an artificial extra turn in a street; the Berlin cushion, that is a slight elevation of the central part of the street, visible from a distance by drivers (Sanz Alduan, 1996; Martincigh, 2011).

In order to improve the microclimate of the urban environment some other devices were defined: wet swales, providing moderate pollutants removal, were located at the edges of the parking areas; green walls, located along the pavements to reduce both pollution and air temperature, thus improving comfort; they are indeed useful also to provide shadow for people walking or seating (Bellomo, 2003; Mazzotta, 2007) .




In conclusion, it appears evident that in order to ensure liveability in urban residential areas, it is necessary to start regular processes of investigation and evaluation of the general problems and to intervene by applying prescriptive tools such as the "Environmental Island", which provides guidance on strategies to adopt and design to draw.

## REFERENCES

Alcoforado, M.J., Andrade, E. 2008. "Global Warming and the Urban Heat Island" In: Marzluff, J.M. et al. (eds.). *Urban Ecology*. Springer US.

Berlund, B., Lindwall, T., Schwela, D. H. (ed). 1999. *Guidelines for Community Noise*. Geneve: WHO.

Bellomo, A. 2003. *Pareti verdi*. Napoli: Sistemi Editoriali.

Bianchi, F; Carratù, R. 2007. *L'acustica in architettura*. Novara: Città Studi Edizioni.

Costanzi, C. 2005. "Green areas and the quality of life of elderly people" in: Werquin, A. C. et al. (eds). *Cost Action C11 - Final Report: Green structure and urban planning*. Luxemburg: European Communties.

Ferone, P. 1998. "Isole ambientali e attrezzature urbane" in: De Luca, M., Astarita, V. (ed.). *I Piani Urbani del Traffico*. Milano: Franco Angeli editore.

Franco, G. 1998. *Il Mattatoio di Testaccio a Roma. Costruzioni e trasformazioni del complesso dismesso*. Roma: Edizioni Librerie Dedalo.

Fleury, D. (ed.). 2002. *Cost Action C6 - Final Report: A city for pedestrians, policy-making and implementation*. Luxemburg: European Communties.

Istat. 2014. *Italia in cifre*. Roma: Istat.

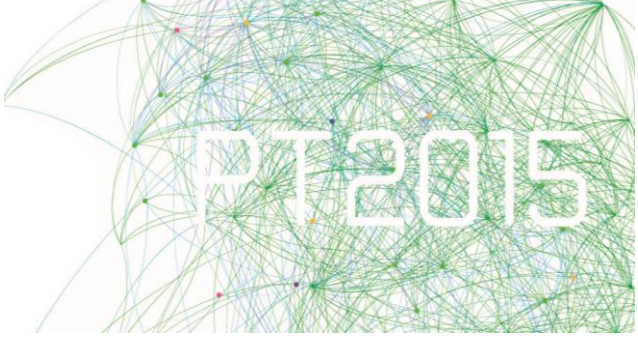
Fleury, D, Laursen, J G. 2002 "Urban network modeling" in: Fleury, D., (ed). 2002. *Cost Action C6 - Final Report: A city for pedestrians, policy-making and implementation*. Luxemburg: European Communties.

Lopez, T.G. 2003. *Influence of the public-private border configuration on pedestrian behavior. The case of the city of Madrid*. PhD Thesis, La Escuela Técnica Superior de Arquitectura de Madrid, Spain.

Martincigh, L. 2012. *Strumenti di intervento per la riqualificazione urbana*. Roma: Gangemi Editore.

Martincigh, L. 2011. *Mobilità e qualità della vita nella terza età. Indicazioni di intervento per agevolare la fruizione dell'ambiente urbano - Mobility and Quality of life for senior citizens. Indications to improve the use of the urban environment*. Roma: DEI.

Martincigh, L. 2009. *La mobilità sostenibile: un toolbox per la valutazione dei progetti/Sustainable mobility: a toolbox for design assessment*. Roma: DEI.




Martincigh, L. 2008. "Linee guida per il progetto della mobilità" in: Amirante, M. I. (ed.). *Effetto città stare vs transitare. La riqualificazione dell'area dismessa di Napoli Est*. Firenze: Alinea.

Martincigh, L. 2002 "Urban quality and design for pedestrians" in: Fleury, D., (ed). 2002. *Cost Action C6 - Final Report: A city for pedestrians, policy-making and implementation*. Luxemburg: European Communties.

Mazzotta, A. 2007. *L'acqua: materia per l'immagine del paesaggio costruito. Indicazioni manualistiche tra sostenibilità e "sensibilità".* Firenze: Alinea Editrice

Ministero LLPP. *Direttive per la redazione, adozione ed attuazione dei piani urbani per il traffico*. Gazzetta Ufficiale n. 146, 24 giugno 1995. Roma: Ministero di Grazia e Giustizia.

Rauhala, K. et al. 2003. *New means to PROMote Pedestrian Traffic in cities – Summary of the PROMPT projects and results*. Rome: Di Virgilio.

Sanz Alduan, A. 1996. *Calmar el trafico*. Madrid: Centro de Publicaciones Secretaria General Tecnica Ministero de Obras Publicas, Transportes y Medio Ambiente.

World Health Organization. 2010. *Global recommendations on physical activity for health*. Geneva: WHO Press.

World Health Organization Europe. 2009. *Night Noise Guidelines for Europe*. Copenhagen: WHO Regional Office for Europe.

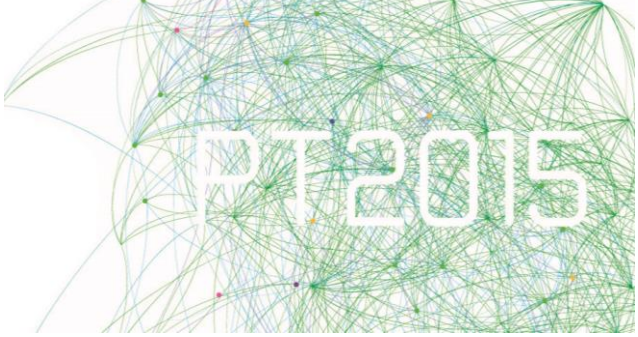
Administration deeds:

Dipartimento Mobilità e Trasporti di Roma Capitale. 2015. *Piano Generale del Traffico Urbano di Roma Capitale dalle Regole ai Sistemi*. Delibera Assemblea Capitolina n. 21 del 16 aprile 2015.

Internet source:

www.romariasalute.it
www.escapeproject.eu
www.Istat.it

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# DEVELOPMENT OF PUBLIC SQUARES IN NORTH WESTERN EUROPEAN CITY CENTRES

**Bob Giddings**[1]
PhD, Professor, Chair of Architecture and Urban Design, Department of Architecture and the Built Environment, Northumbria University, Ellison Building, Ellison Place, Newcastle upon Tyne, NE1 8ST, UK bob.giddings@northumbria.ac.uk

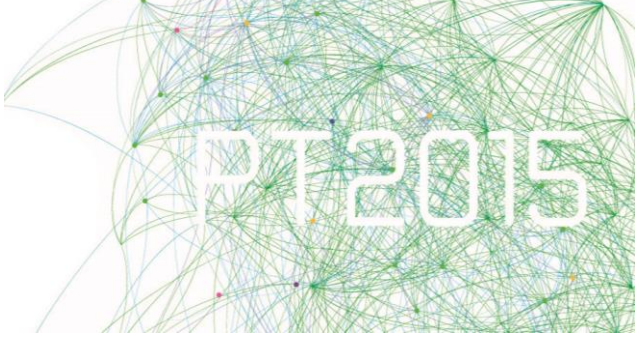
**James Charlton**
PhD, Lecturer, Department of Architecture and the Built Environment, Northumbria University, Ellison Building, Ellison Place, Newcastle upon Tyne, NE1 8ST, UK j.charlton@northumbria.ac.uk

## ABSTRACT

*Ever since cities became developed, public space has been a contested realm. As the 20th Century progressed, privatisation exacerbated this situation. As an urban form, squares had been at the apex of the public space hierarchy but as their traditional uses declined, city managements started to debate their purpose. As vehicles in cities increased, many just became car parks while others looked abandoned and unloved. Private enterprise was offering indoor shopping malls and entertainment venues, and local authorities were content to hand over large areas of their city centres for these developments. However, democratic communities need urban public space, if only as places of assembly that are not controlled by private interests. Fortunately, by the beginning of the 21st Century, central governments started to realise that cities were for people and not motor cars, and poor air quality due to exhaust fumes was particularly highlighted. The new policy was to return the city centre to the pedestrian. In the latter part of the 20th Century, the research for this paper, focussed on locational and geometric criteria for what appeared to be successful squares. However, the only way to test them was to actually build a square, but local authorities pointed to the potential lack of use and adverse climates. In 2008, work started on computer simulation of microclimates and pedestrian movement, which demonstrated that comfortable and useful squares could be created. Initially, it was intended to produce a design tool for practitioners, but the enormous computer power needed to run the software rendered this approach impractical. Research is now underway to combine the virtual city model and building information modelling to produce layers of data on the Newcastle City Model that will enable proposals for designs of buildings and spaces to be tested in terms of their effects on microclimate and pedestrian movement patterns.*

***Keywords**: urban public space, squares, microclimate, software.*

[1] Corresponding author




**THE DECLINE IN PUBLIC SQUARES**

Urban space has always been the place for the community rather than the individual and therefore public rather than private in nature. They were places where the framework of society was formulated, and where economic activity thrived. A common theme among urban pioneers is that the popularity of particular cities is derived, at least in part, from space that is defined by buildings rather than the commercial 20th Century model in which buildings are seen as artefacts dropped into space (Alexander, 1987). Squares are special urban spaces, provided for the benefit of the public. However, Krier (1979) articulates a general feeling that towards the end of the 20th Century, public squares had become synonymous with empty spaces. The loss of symbolism in particular, was greatly lamented by Giedion (1962). The empty spaces were often filled with vehicles. The loss of the city squares as places for citizens, seemed to hasten the commodifying of cities in which they were viewed merely as commercial and retail opportunities; and the downgrading of the public realm by privatisation (Giddings *et al*, 2005).

**THE IMPORTANCE AND RE-INTRODUCTION OF PUBLIC SQUARES**

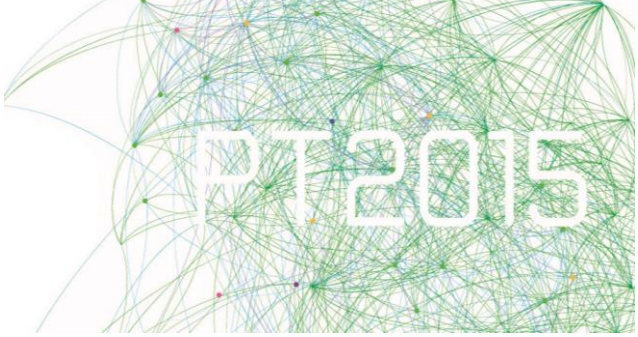
Lack of public space is an insidious expression of a lack of democracy. In the past, public squares were invested with symbolic power that could evoke pride and public interaction. City design requires networks of properly conceived streets and squares – introducing pedestrians to symbolic buildings, culture, entertainment as well as commercial activity. The re-introduction of public squares needs to be viewed as part of reversing the erosion of the public sector and the public realm, and reclaiming city centres from private interests for the benefit of communities (Mattson, 1999).

## A Framework for the Design of Squares

A study was undertaken to establish a framework included criteria for the three dimensional geometry of squares. It was based on academic literature from Sitte (1889) to Tibbalds (1990), and tested in numerous squares in North Western European Cities. However, the restriction was that although it was possible to analyse existing popular squares and produce a framework (see Table 1); the notion that a square designed to those criteria would be successful, had to be taken on trust.

**Table 1: Frame of Reference for Geometric Criteria.**

| **dimensions** | **length to width** | **length to height** | **width to height** | **perimeter** | **number of openings** | **%tage of perimeter** |
|---|---|---|---|---|---|---|
| small: 30x12<br>avge: 70x50<br>90x35<br>max: 100x70<br>120x50 | 1.1 to 3.0:1 | 1.4 to 8.0:1 | 0.8 to 3.0:1 | 75-335 | 2-5 | 8%-28% |
| Giddings (1996) all dimensions in metres | | | | | | |




A second study by Charlton (2011) validated the framework for geometric criteria with data from five exemplar squares (see Table 2). However, this study identified from the expanding literature that appropriate microclimate (see Table 3) and pedestrian movement are the most significant factors in design of a square.

**Table 2: Results from Five Exemplar Squares Northern European Cities.**

| city | dimensions | length to width | length to height | width to height | perimeter | number of openings | % tage |
|---|---|---|---|---|---|---|---|
| Birmingham | 70 x 60 | 1.2:1 | 3.5:1 | 2.0:1 | 254 | 5 | 23 |
| Bruges | 70 x 45 | 1.5:1 | 5.2:1 | 2.3:1 | 230 | 3 | 9 |
| Hague | 70 x 30-40 | 2.0:1 | 6.0:1 | 2.7:1 | 207 | 4 | 12 |
| Bonn | 70 x 25-50 | 1.9:1 | 3.5:1 | 1.1:1 | 220 | 3 | 14 |
| Paris | 100 x 45 | 2.2:1 | 3.2:1 | 2.2:1 | 286 | 4 | 18 |
| Charlton (2011) all dimensions in metres | | | | | | | |

**Table 3: Microclimatic Criteria for Squares in Northern Europe.**

| Temperature $^0$C | Wind in miles per hour (mph) | Noise dbA |
|---|---|---|
| 13 - 24<br><br>eg Gehl (2006) | 0-8 - no noticeable pedestrian discomfort<br>eg Cooper Marcus and Francis (1997) | 65 – maximum at night to avoid sleep disturbance<br>eg Sacre (1993) |

The primary differences between northern and southern Europe are that in the north, it is not usual for the climate to produce temperatures of over 24$^0$C; whereas uncomfortable winds speeds of over 8mph are commonplace. Thus the objective is to design squares that provide temperatures of more than 13$^0$C, on as many occasions as possible, while minimising the number of days that the wind exceeds 8mph, and noise 65dbA. The other major part of the research is modelling pedestrian movement. In order to avoid the claims that squares will remain empty spaces, some form of pedestrian simulation would be required.

## Software Modelling

A comparative analysis of microclimatic and pedestrian movement software was undertaken (Charlton et al, 2008) and the following were selected as the most accurate and compatible for the analysis and holistic design of public squares. A fundamental criterion was the need for three dimensional simulation. There are a number of well-established simulation software systems that can only operate in two dimensions. Thus, the software shown in Table 3 was selected.

**Table 4: Microclimate, Pedestrian movement and selected software.**

| | | |
|---|---|---|
| **Microclimate** | **thermal comfort** | TownScope |
| | **wind analysis** | Star – CCM+ |
| | **noise mapping** | Cadna A |
| **Pedestrian Movement** | | Legion Studio with Legion 3D |

In order to test the microclimate in an existing square compared with the climate; and to evaluate the accuracy of the software, the exemplar Chamberlain Square in Birmingham was selected. For simplicity, the measurement of temperature, wind and noise; and their simulation with the software outlined above, were undertaken on a single day (see Table 4).

**Table 5: Measures of Climate, Microclimate and Simulation for Chamberlain Square.**

| **Microclimate – sample 26 May 2009** | | | |
|---|---|---|---|
| measure | average climate in Birmingham (1) | average microclimate in square (2) | simulated with software |
| temperature | $13^0$C | $18^0$C | $18^0$C (3) |
| wind | 15mph | 6mph | 6mph |
| noise | not applicable | 60dbA | 60.5dbA |

Notes:
1. average climate in Birmingham on 26 May 2009 (http://www.meteoarchive.com)
2. average measurements from 7 locations in the square - morning, mid-day and evening
3. data from the simulation includes a solar access pattern throughout the day

The results show that on the sample day, Chamberlain Square enjoyed a more comfortable microclimate than the natural climate in Birmingham. The temperature in the square was raised by $5^0$C and the wind reduced by 9mph. The simulated values are comparable to those measured. Thus, there is confidence that the simulated values produced for future designs of public squares, will be realised in practice. Data from Birmingham City Council regarding pedestrian movement, established the two-dimensional plot on Figure 1, which was used to validate the 3D simulation.

**Figure 1: Pedestrian Movement in Chamberlain Square and 3D Simulation.**

## Proposed Library Square Newcastle upon Tyne

Six architects and landscape architects in the city were invited to submit designs for the square. They all ignored the Framework for Geometric Criteria that was sent to them, and produced designs of huge variation in size and enclosure. The designs were evaluated with the software and the results showed undesirable microclimate and pedestrian movement in nearly all cases. The research team

designed its own proposal based on the Framework, and the results are shown on Figure 2 and Table 5.

**Figure 2: Design for Library Square: existing and proposed.**

**Table 6: Climate and Microclimate Simulations.**

| **dates** | 21 March | 21 June | 21 Sept | 21 Dec |
|---|---|---|---|---|
| **existing** | | | | |
| temperature | 11ºC | 17 ºC | 17 ºC | 7 ºC |
| wind | 5mph | 7mph | 19mph | 10mph |
| noise | 72 dbA | | | |
| **proposed** | | | | |
| temperature | 14.5 ºC | 21.5 ºC | 20 ºC | 9 ºC |
| wind | 1.5mph | 4mph | 9mph | 4mph |
| noise | 53bdA | | | |

## THE VISION

This research has proved that software can be used to predict solar access and thermal comfort, wind speed and movement, noise, and pedestrian movement for proposed public squares at design stage. However, the study revealed that none of the software is well developed and the simulation takes considerable computer power. Thus, significant programming work would be required before a design tool could be available. An alternative would be to utilise the virtual city models that are becoming common-place in British and other European cities (see Figure 3). Currently, these are based on virtual reality, but layers of building information modelling (BIM) could be added to produce a database of climatic information and existing pedestrian movement in three-dimensional form. To date, BIM has only been used in building design. The intention is that designers will be able to log onto the appropriate city model, and insert their designs. The building information modelling database will then be able to predict the microclimatic conditions and pedestrian movement. In this way, different locations and geometric configurations could be tested until the optimum solution is achieved. The detailed design of subspaces has not been part of the research so far; but landscaping, vegetation, seating, public art, lighting, canopies, umbrellas etc., could be added to the model

and their effects on microclimate and pedestrian activity simulated. High levels of pedestrian activity are usually desirable, provided there is not overcrowding; so that there are still places to rest and linger, and there are no pressure points at entrances and exits to the squares.

**Figure 3: Newcastle upon Tyne Virtual City Model.**

## CONCLUSION

This paper outlines the reasons for the decline of public squares in European city centres, analyses why they are important and why they should be re-introduced. Previous studies are summarised and it is shown that the Framework developed for the design of new squares is still valid. However, there has been inactivity in progressing the criteria beyond geometric parameters due to the lack of tools. Software is now becoming available that can simulate microclimatic conditions and pedestrian movement. Future studies are identified and these include The Vision in which virtual city models, however they are produced, will not only be able to show the proposed design of these squares but also provide simulated data on the microclimate and pedestrian movement that will result from them.

## REFERENCES

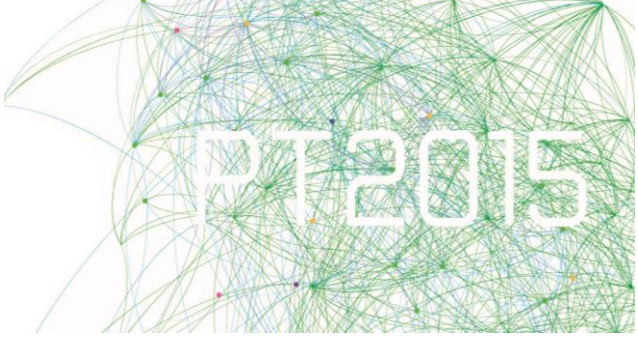
Alexander, C. 1987. *A New Theory of Urban Design.* New York: OUP.

Charlton, J., Giddings, B. and Horne, M. 2008. 'A survey of computer software for the urban design process.' In*: Proceedings of the 9th Conference on Design Decision Support Systems*, Eindhoven.

Charlton, J. 2011. *Holistic Design of City Centre Squares*. PhD thesis. Northumbria University, Newcastle upon Tyne.

Cooper Marcus, C. and Francis, C. (eds.) 1997. *People Places: Design Guidelines for Urban Open Space,* 2nd ed. New York: John Wiley and Sons Inc.

Gehl, J. 2006. *Life Between Buildings – Using Public Space*, 6th ed. Copenhagen: The Danish Architectural Press.




Giddings, B. 1996. 'Towards the urban restoration of Newcastle upon Tyne'. *Urban Design International* 1(3): 265-281.

Giddings, B., Hopwood B., Mellor, M. and O'Brien, G. 2005) 'Back to the City: a route for urban sustainability'. In: M. Jenks and N. Dempsey (eds.) *Future Forms and Design for Sustainable Cities*. Oxford: Architectural Press, pp. 13-30.

Giedion, S. 1962. *Space, Time, Architecture*, Cambridge: Harvard University Press.

Krier, R. 1979. *Urban Space,* New York: Rizzoli Publications Inc.

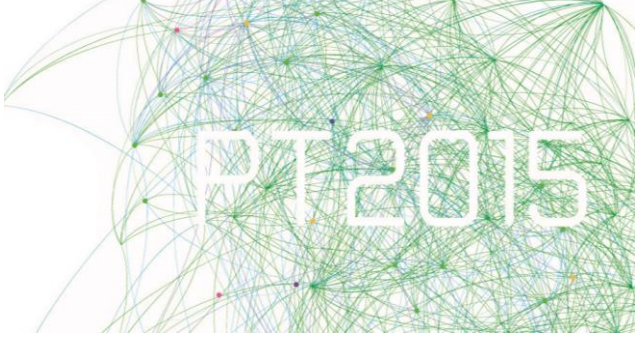
Mattson, K. 1999. *Reclaiming and remaking public space: towards an architecture for American democracy*. National Civic Renewal 88(2): 133-144.

Sacre, P. 1993. 'Environmental Acoustics'. In: D. Templeton (ed.) *Acoustics in the Built Environment*. Oxford: Butterworth-Heinemann, 7-33.

Sitte, C. 1889. *City Planning According to Artistic Principles*, 1986. New York: Rizzoli.

Tibbalds, F. 1990. *City of Birmingham: city centre design strategy*. Birmingham: UDS.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# MUSIC AND SOUND AS A TOOL INTO DESIGNING HEALTHIER ENVIRONMENT

**Anja Kostanjšak**[1]
PhD student, University of Zagreb, Faculty of Architecture, Kačićeva 26, 10000 Zagreb, anja.kostanjsak@gmail.com

**Morana Pap**
PhD student, University of Zagreb, Faculty of Architecture, Kačićeva 26, 10000 Zagreb, morana.pap@arhitekt.hr

**Tena Lazarević**
Master student, Studio for Immediate Spaces, Sandberg Instituut, Fred. Roeskestraat 98 1076 ED Amsterdam, contact@tenalazarevic.net

## ABSTRACT

*Music reaches us, it touches us to the heart. To understand music, oneself should understand space, because without space, there is no sound, therefore no music, at least not as we perceive it.*

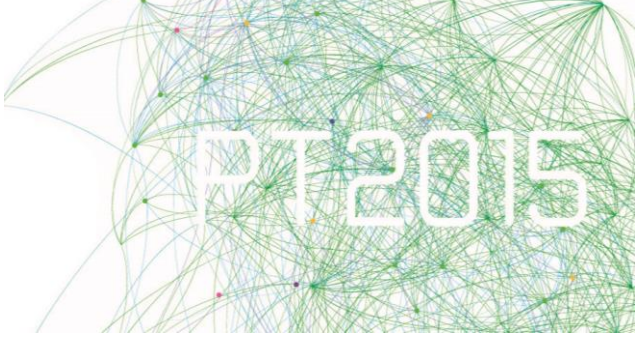
*In dependence of the surface, sound wave collides and reverberates from it, giving us more information than just sound itself. By the way sound echoes in the space we perceive it as cold, cosy, spacious, narrow, etc., and in that way it makes an impression on our subconscious level. We can feel anxious, happy, fearful, or even irritable.*

*It is well known that music may improve quality of life and wellbeing, but also has different effects on body functions, such as increase or decrease of heart rate, its variability. Music emphasis and rhythmic phrases can be tracked consistently by physiological variables.*

*In dependence of oneself and his belonging lifestyle, different sounds and music have different effect on individual wellbeing. Our brain autonomic responses (ABR) are synchronized with sounds and music surrounding us. Following the sound piece our brain corresponds within the changes inside the piece itself, and by the way sound travels through architectural space it enhances its experiences on perceiver.*

*Mental and physical wellbeing is affected by the places in which we live, work and play. We have to design spaces for all senses and be aware of new digital age in which we are living and presence of new available technologies. This technologies*

[1] Corresponding author




*can be an add-on in design process and existing architecture. Our aim is to make architects become aware of influence of sound in the space they are designing, and its impact on health and wellbeing of beneficiary, and also on procreation of healthy environment.*

*Can architecture be a living organism, which changes following the atmosphere around beneficiary and sounds surrounding them?*

***Keywords**: sound, healthy environment, new technologies, hearer, ABR (autonomic brain responses).*

## INTRODUCTION

Importance of space and thereby architecture in persons everyday life and health are a topic which nowadays increasingly attracts our attention. Through history many thinkers and later scientist and researchers found the importance of space around them on human wellbeing (for example Socratic house, Vitruvius in his *De architectura*[2], CIAM and Le Corbusier upon hours of daylight in quarters of living space, and so on).

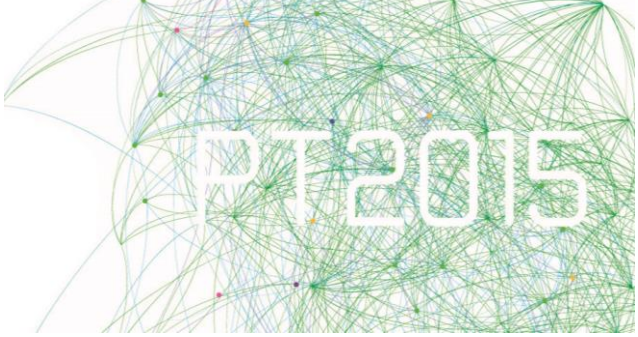
Design of buildings and community altogether affect our health and wellbeing. Through many case studies and examples, such as Intersections: Health and the Built Environment, different organizations are trying to provide, in a way, a road map for architects, planners and designers to be able to positively impact health outcomes through the thoughtful design of housing developments and other aspects of the built environment.

With increasing frequency in rise of chronic diseases like obesity, as well as associated healthcare costs, healthy design elements add value to projects and solve pressing problems.

## GLOBAL HEALTH SITUATION

Nowadays more and more people are prone to health problems regarding chronic diseases and obesity. Our health is affected by many aspects surrounding us, such as the foods we eat, waters we drink, air we breathe, or capability to move around the city with bike or by foot. Also, our choices and behaviours as well as genetics, availability of health care, transportation, housing, education, income, and the way environment perceives health, and promotes it.

[2] Or *De architectura libri decem*, translated *On architecture*, published as *Ten Books on Architecture*, in Croatian translated as *Deset knjiga o arhitekturi*




**Chronicle Diseases and Obesity**

Chronic diseases now outrun infectious diseases in almost every global region, with the exception of Africa, but even there rates are rising. These diseases take two-thirds of lives worldwide. According to some assumptions by the year 2030, chronic diseases rates will increase by nearly 50 percent, claiming the lives of approximately 52 million people. Number one cause of death today, worldwide, is ischemic heart disease, caused in part by high cholesterol and diabetes. As a result of public health efforts to curb infectious diseases, global populations are also aging. And with notion of all this, with certainty we can say that urban populations will face and already faces grooving environmental threats, and through changes in our lifestyle, seen as physical inactivity and other unhealthy habits that come through means such as food, alcohol and tobacco.

Hand in hand with chronic diseases comes obesity. Obesity affects one in ten adults worldwide. High obesity rates are associated to chronic and often lethal conditions, including coronary heart disease, type 2 diabetes, and certain cancers. Obesity is caused by aspects of our lifestyle, such as the consumption of unhealthy or excessive amounts of food and a lack of activity.

**Mental Disorders**

With today speed of life and the form of the work that people are doing, we are more and more prone to mental problems such as depression[3]. Dysphoria threatens humans more every day. Lifestyle that counts lack of sleep, long working hours combined with unhealthy foods we consume comes as the icing on the cake.

**Destroyers of Health Today**

Today, many different trends and aspects influence our health, majority of them in poor form. High rate of urbanization, aging of populations, environment (through global greenhouse gas emissions), climate changes (rise of the sea level), and surely our lifestyle. When we combine all this aspects and trends together we can see the problems rising in health of populations.

[3] "Depression is a common mental disorder, characterized by sadness, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, feelings of tiredness and poor concentration. It can be long lasting or recurrent, substantially impairing a person's ability to function at work or school, or cope with daily life. At its most severe, depression can lead to suicide. When mild, depression can be treated without medicines but, when moderate or severe, people may need medication and professional talking treatments. Non-specialists can reliably diagnose and treat depression as part of primary health care. Specialist care is needed for a small proportion of people with complicated depression or those who do not respond to first-line treatments. Depression often starts at a young age. It affects women more often than men, and unemployed people are also at high risk." taken from World Health Organisation (WHO)

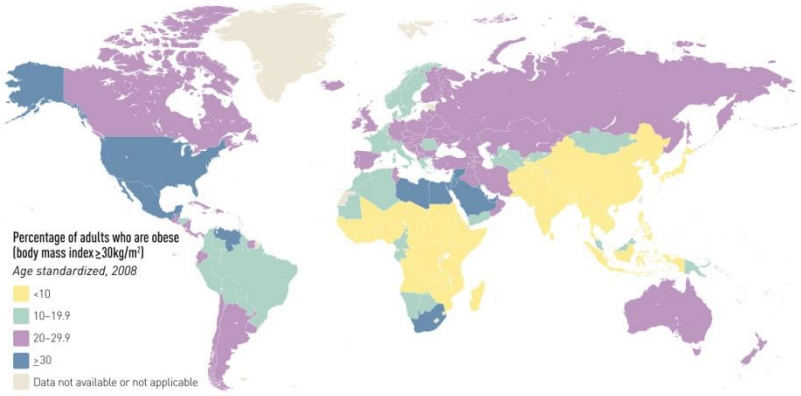



**Figure 1: World Obesity Chart - source Urban Land Institute.**

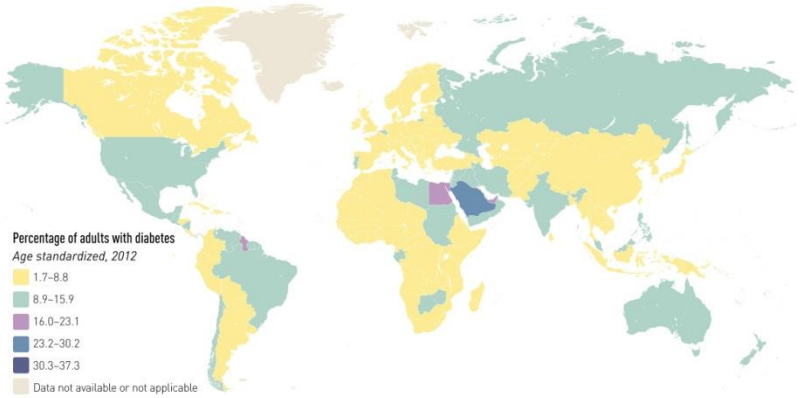



**Figure 2: World Diabetes Chart – source Urban Land Institute.**

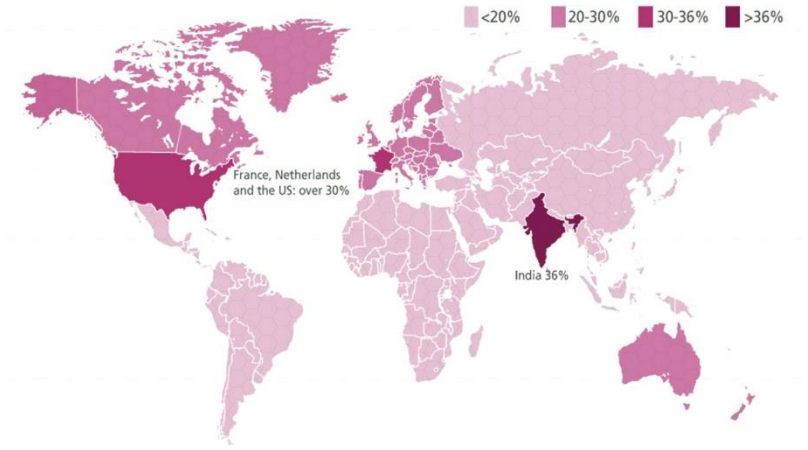
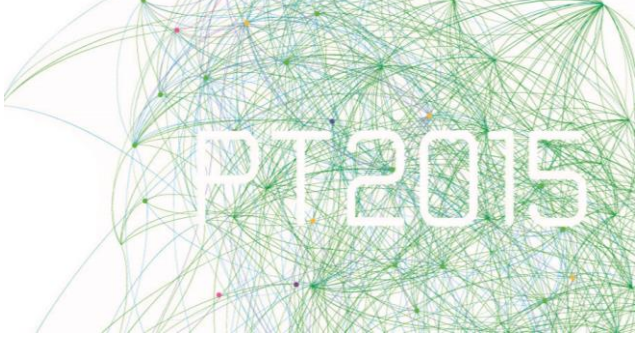



**Figure 3: World Major Depressive Episode (MDE) Chart – source Healthline.**




**Diseases, Music Therapy and Sound Healing**

Through different researches it has been proven that music therapy, to certain extent responds well with almost all known diseases. Different sound techniques of music therapy benefit divergent disorders. Some creative interventions such as usage of drumming help in control of chronic pain, asthma, boost the immune system, reduce tension, stress, anxiety and dysphoria releasing negativity and healing emotional trauma. Singing therapy on the other hand helps in conditions such as stroke, Alzheimer's, Parkinson's and multiple sclerosis. This therapy has its special usage in treating people that are unable to speak, but somehow are able to sing. Receptive interventions in these ways awaken our creativity and help in healing personal relationships and personality disorder. Vibro acoustic therapies help with autism, asthma, cystic fibrosis and several other disorders.

Sound healing and music therapy in a way are very similar, but sound healing focuses only on the frequencies of sound, preferably than indulge in any therapeutic process. Basic theory behind sound healing is that brain waves become accustomed to specific frequencies, which change the chemistry and output of the neurotransmitters serotonin and dopamine in the brain. There was a study in 1982 on sound healing that showed how this type of modality increase mental health, and reduce anxiety (this was particularly proven by the study).

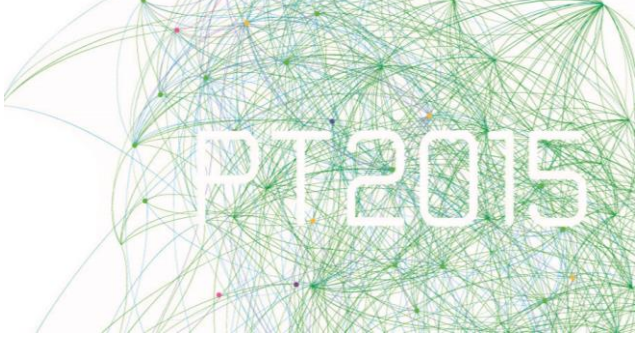
## EMPHASIS ON SOUND IN ARCHITECTURE AND TECHNOLOGIES

Space around us is perceived through five senses. We see, smell, feel, taste and hear different situations surrounding us. Most basic way of perceiving our surrounding is through the sense of sight. Other senses contribute in smaller amount than sight, only in particular situations, they have higher amount of usage, such as when the perceiver is blind. In common situations, they are perceived as subtle viewers and data collectors of our surroundings, but their effect on humans is on deeper levels, in subconscious realm of our mind.

**Sound and Design in Architecture**

Sound is complex because there are many countervailing influences. The most powerful sound there is, is music.

Why are sound and music an emerging focus in 3D design today? Because it starts with our health and then aspires to architecture. Today, spaces meant to help us hear better are seen as more productive, comfortable and safe. Still they are rare. And why is it so? Maybe the answer can be found in the thoughts and explanations of Julian Treasure, a sound consultant whose TED talks have raised awareness of "sound health." He says that architects don't really get paid for the aural health benefits of their design. It's time "to start designing for our ears." he implores,




because our increasingly noisy world is bad for us. Another interesting thinking we can see in a book by Tyler Gray and Joel Beckerman, entitled *The Sonic Boom: How Sound Transforms the Way We Think, Feel and Buy*. In this book it is shown how "to use sound as a rich storytelling strategy" to influence audiences, gain competitive advantage and express a brand's core mission.

From this we can conclude that we have to raise sound in our consciousness and transform our relationship with sound. If we start to listen consciously, we can take control of the sound around us and it will be good for our health, our productivity etc. If we do that we move to a state which some nowadays like to say and think will be sound living in the world.

**Acoustic Issues and Aural Experience**

Involving and coordinating of sound and acoustic issues are very important in today's design process. In this way we can avoid uncomfortable and sometimes painful aural sensations. The paper *Acoustics and Sound Systems* in Architectural Design, indicates just mentioned. It emphasizes that acousticians should be a part of design team in the early stage of design process. In other words it is important that acoustics is well thought out and coordinate in architectural design from the beginning. The result we want to achieve is that the sound spectrum remains clear.

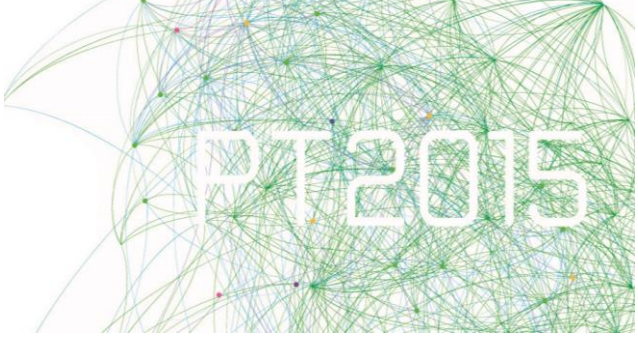
Author of the mentioned paper above sets/offers design tips to achieve best architectural acoustics within a space. Principles/design tips for achieving best aural experience are the following: to watch over sound reflections, carefully select acoustical treatment, when necessary diminish echoes, noise control, to keep objects or other obstructions out of the way, get good pattern control, question of disturbed sound system, and so on.

These principles, with perhaps slight differences, but the main match, can be found in a number of different sources and literature. In the end, it is important to make sure that the architectural acoustics match the architectural function and aesthetic value of a particular project.

**Sound and Technology**

Today we live in a digital world. We must be aware of the presence and availability of new technologies. Perhaps more importantly, we need to understand on which levels this technology has influence, what it has changed and is changing still and how to use it in optimal way.

More precisely, in order to explain current research topic, this technology can be an add-on in design process and maybe even existing architecture in which we don't forget to think about the relation: space-sound-health.




More architects are today using building information modeling (BIM), and other specialized software tools to study acoustics earlier in the building design process. This gives the complete design team an insight on proper and beneficial soundscapes. Some digital tools now offer sound visualization and quantifiable evidence of acoustic problems. These advances also presage even closer ties between the world of sound(s) and the world of buildings and public spaces.

"With these design approaches, we'll see a much stronger connection between the fields of architecture and music. We can now perceive our sonic environment just as well as our visual environment, which is beginning to allow us to build and adapt spaces with specified input from artists or composers on how they would like to control both music and noise."[4]

One result will be a better alliance between architects and the performing arts world, experts predict and better listening for all.

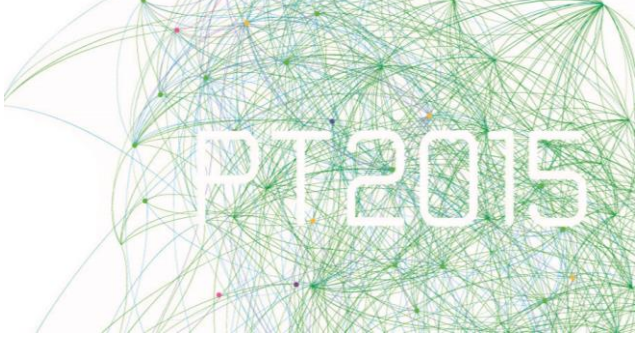
**Key Notes and New Approach**

Sound cannot be seen and therefore it is often neglected at design and build stages, or when the focus is the physical structure. The key to good acoustic design is to remember that once people arrive to use the space, sound matters. It matters because we cannot ignore that sound is affecting us all the time in four major ways: physiological, psychological, cognitively and behaviourally.[5] Creating a good looking but noisy environment is akin to building. Some can say it is a leaky building because it looks good in the beginning but the attraction quickly wears off. It is time to point the way towards a multi-sensory architecture which facilitates a sense of belonging and integration.

Integrating three key areas in acoustic design will deliver a place that will achieve key acoustical comfort needs for the users of that space. These three key areas are: human element, design and acoustic treatment.[6] The human element of acoustics is difficult to design for because most interactions are spontaneous. Design and acoustic treatment can be achieved through planning and zoning of spaces.[7]

We must start to think different! Why not reverse the thing and instead of the model that we have developed, which allows us to start at the top and look at the drivers of sound, analyse the soundscape and then predict outcomes by starting at the bottom, and say what outcomes do we want, and then design a soundscape to have a desired effect?

[4] quote by architect Andrew Franz, who collaborates often with performing arts groups
[5] explanation can be found in TED Talk by Julian Treasure: *The 4 ways sound affects us*
[6] U.S. General Services Administration. (2012). Sound Matters: How to achieve acoustic comfort in the contemporary office. Washington, DC: U.S. General Services Administration
[7] Microsoft Wellington is a great example of workplace zoning where basic acoustic principles and aids have been adopted.




## CASE STUDIES - WITH SOUND TOWARD HUMAN WELL BEING

It is a matter of fact that everything surrounding us, including our own bodies is made of energy vibrating at various frequencies. Important question to ask yourself can this diversity of sound frequencies affect our psychic realm? Can we be said based upon a sound emitted in our surrounding? Answer is simple, they can. Through many different experiments it has been demonstrated that frequencies do affect the physical world, some of these experiments is science of Cymatics and water memory. The science of Cymatics illustrates that when sound frequencies move through a particular medium such as water, air or sand, it directly alters the vibration of matter.

Also, numerous studies in the field of modern medicine has measured and confirmed the practice of sound therapy as a mean for promotion of healing and reducing of stress. Cells in our bodies has their own vibrations, cycles, our nerves transmit at a frequency of 1,000 cycles per second to the heart and its 70 beats per minute. These inter rhythms placed upon as by nature allow our bodies to respond to sound vibrations.

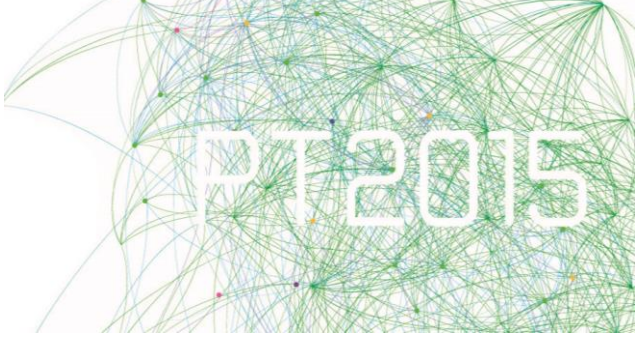
Some of numerous examples of case studies in the field of architecture demonstrate how we can create environment and spaces that encourage human wellbeing ambiance through the means of sound. Some of the examples are: the New York Life Insurance Company Building, Microsoft Wellington, Liminal-Organ of Corti, Waterfalls and green walls in the cities, and so on. Through all this cases, and many other, we see approach towards healthier environment and architecture that surrounds people and tend towards their wellbeing.

## CONCLUSIONS

Sound travels around us in waves, different frequencies, and in its passage through our surroundings its affects us. Depending on the coating of surface from which the sound wave is reflected our sound can be shallow, muffled, with echo and so on. In ways the sound collides with surfaces, and the way we perceive it, arouses different sensations in individual. Some sounds affect as on deep subconscious levels, and while not knowing it changes our mood, and in dependence of persons mental health and amiabilities, person can become dysphoric, anxious, depressed, and other similar conditions.

In today life, where everything is accelerated, and people don't have a time to stop and consider their wellbeing, we as architects should help them consider themselves more. Sound cannot exist in a spaceless place, and we as the “sculptors of space” should take task of space and sound within it in our hands.

Depending on individual susceptibility towards mental disorders sound can encourage healing or disorder. Because of these notion architect should design




spaces with a thought of sound within it. For normal healthy human, dripping of water in plumbing system can be only annoying, but to someone who is prone to mental disorders it could be a start of more severe state, than just annoyance. Same as light influences depression, or to be correct lack of it, sound does the same. The main difference is that light is more tangible than sound, at least we can see it. Sound is more profound, it is in absolute backstage, and without you knowing it affects you.

"Today, architects and engineers the world over have come to recognize proper acoustics as necessary in the modern types of building construction. The importance of sound control and noise reduction, together with the great benefits in health and happiness which it gives to the human race, is something now generally accepted."[8]

## REFERENCES

TED. 2009. "The 4 Ways Sound Affects Us". Talks. Last modified July. Accessed March 27, 2015. https://www.ted.com/talks/julian_treasure_the_4_ways_sound_affects_us

TED. 2012. "Why Architects Need to Use Their Ears". Talks. Last modified June. Accessed March 29, 2015.
http://www.ted.com/talks/julian_treasure_why_architects_need_to_use_their_ears

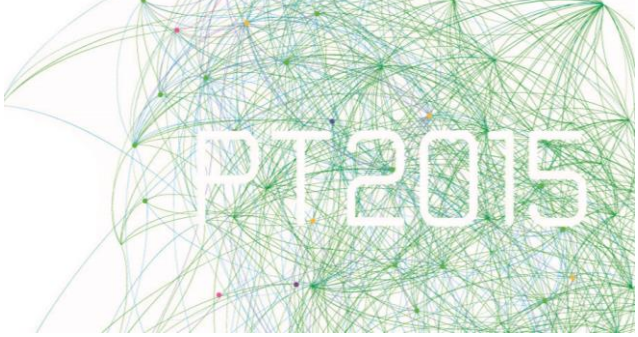
The Door of Perception. 2013. "Bringing Matter to Life with Sound". Cymatics. Last modified November 30. Accessed April 13, 2015.
http://doorofperception.com/2013/11/cymatics/

Thompson, Emily. 2004. "Acoustic Materials and Modern Acoustics circa 1929: The New York Life Insurance Company Building." In The Soundscape of Modernity – Architectural Acoustics and the Culture of Listening in America, 1900-1933. 38-49. Cambridge, MA: The MIT Press.

Urban Land Institute. 2013. *Intersections: Health and the Built Environment*. Washington, D.C.: Urban Land Institute.

[8] Absorbex Acoustical Corrective for Sound Control and Noise Re- duction' (sales pamphlet, Thermax Corp., 1932)

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# DESIGNING PARKING STRUCTURES IN SERVICE OF PUBLIC HEALTH

**Tanja Trkulja**[1]
PhD student, University of Belgrade, Faculty of Architecture; Senior Teaching Assistant, University of Banja Luka, Faculty of Architecture, Civil Engineering and Geodesy, Stepe Stepanovića 77/III, 78000 Banja Luka, Bosnia and Herzegovina, ttrkulja@aggfbl.org

**Tijana Vujičić**
PhD student, University of Belgrade, Faculty of Architecture; Senior Teaching Assistant, University of Banja Luka, Faculty of Architecture, Civil Engineering and Geodesy, Stepe Stepanovića 77/III, 78000 Banja Luka, Bosnia and Herzegovina, tvujicic@aggfbl.org

## ABSTRACT

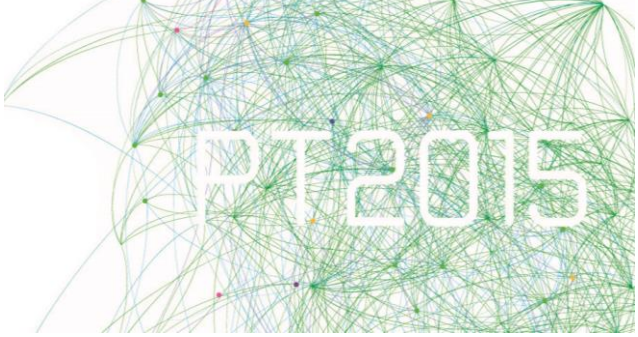
*Urban places and urban planning and architectural designing processes, which are influencing their forming process, are progressively taking part in defining of the public health level. Therefore, the context and characteristics of built and social environments, which are considered to be the key initiators of public well-being processes and not just their background, could be seen as central features of public health. It is evident that parking in the city invades the public space and its planning should be regulated by a parking distribution policy that would take improvement of public health and quality of life into account. However, in the absence of such policy, it is necessary to deliberate architectural and urban forms for modeling of public parking garages and associated facilities, i.e. to reflect on the relationship between parking areas and public open spaces. Therefore, this article explores urbanism and architectural models for development of parking zones on example of a parking lot located within the Banja Luka city (Bosnia and Herzegovina) central zone, which include organization of public city spaces at similar locations. The main goal is improvement of parking zones in terms of creating public spaces of higher quality. In that way parking zones would develop into public urban spaces that would improve the level of public health and quality of life.*

***Keywords****: parking structure, public open places, public health, social interaction.*

## INTRODUCTION

Researchers and practitioners have identified as a serious impediment to addressing health disparities the disconnection between public health and urban planning and architectural designing, particularly in cities. However, in the early 1980s

[1] Corresponding author




academics and activists around the world met with the idea of reconnecting these two areas. The World Health Organization, Office for Europe, in 1986 created the Healthy Cities Project, which goal was to build a network of cities and towns committed to public health and development of a healthy city plan (Corburn, 2009).

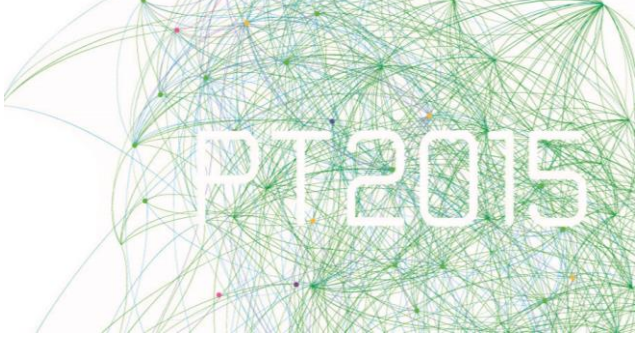
A result of the modern urban planning process is not only the physical matrix of the city, but healthy population as well. City planning and physical and natural structures designing certainly have an impact on psychological and physical health of its inhabitants. Air pollution as well has to be taken into account when developing urban processes. Traffic is certainly one of the air pollutants that has a negative impact on pedestrian safety as well. Pedestrian conflicts with motor vehicles are one of the leading causes of injuries in urban areas (Chu, Thorne, Guite, 2004). Also, starting in the 1950s and 1960s, many European cities found their once vibrant public plazas and boulevards encroached upon by vehicular parking (Kodransky, Hermann, 2011). Local European governments allowed vehicles to park at no cost on public squares, on sidewalks and nearly anywhere a car could fit (Gehl, Gemzoe, 2006). After decades of unfettered accommodation to cars within the densest and most visited parts of the city many local administrations developed more stringent parking regulations. City authorities eventually realized that extensive traffic, air pollution, various city noises, cars parked everywhere, etc., where all factors which were leading towards the public life degradation (Kodransky, Hermann, 2011). Therefore, the European Union has initiated a series of policy initiatives to reduce the negative impacts of traffic (Pasaoglu, et al., 2012).

Public space is what defines a character of a city and its value. Constructing comprehensive, healthy, functional, and productive cities is perhaps the greatest challenge that humanity is facing today. Healthy public spaces represent a springboard for community revitalization processes and a vital component of successful cities that helps establishing a sense of community, civic identity and culture (Project for Public Spaces Inc., 2012).

Areas allocated for car parking could represent a kind of a public space with a specific use: an area for gatherings and social interaction. However, not all parking lots are the same. Different types of parking lots require different interventions so their position as a public space would be increased. Parking lots may differ in their surroundings, size, property value and relationship to context (Mayer, 2005). Therefore, this paper explores the urban-architectural models for transformation of parking zones into public urban spaces, by offering patterns for their spatial organization with the aim of improving public health and quality of life.

## PARKING DISTRIBUTION POLICY

Every time we take a car out for a trip, our journey will inevitably involve the use of parking spaces. That is the reason why having a regulated parking is the best




way to control the car use. Average driver uses between 2 and 5 parking places a day, and each parking lot occupies area between 15 and 30 $m^2$. Drivers often spend a lot of time searching for a place to park, thus contributing to traffic congestion. Having a public health – oriented parking distribution policy would significantly enhance general traffic and parking. Number of available parking lots in a city largely depends on the public policy: number of public spaces to be transformed into parking lots or used for other purposes is ultimately a political decision (Kodransky, Hermann, 2011).

Parking distribution policy should represent the following criteria: public parking supply, parking distribution, functional, ecological, aesthetic and social influencing factors. Public parking supply and parking distribution is affected by spatial distribution of parking supply and demand, which refers to price management, parking supply and parking locations in order to enhance the quality of an urban environment (Young, Beaton, Satgunarajah, 2010).

Over the last few decades the number of European cities that are changing their parking policies has been on the rise. A growing number of their citizens are examining whether dedicating scarce public space to car parking was a wise social policy (Kodransky, Hermann, 2011). All this has led to changes in transport policy, which were mostly consisted of: maintaining or reducing overall traffic volume, improvement and expansion of public transportation systems, better legal provisions for pedestrians and cyclists, control over land use, and promotion of the walking trend and interest in environmental damages caused by traffic (Goodwin, 1998).

Kodransky and Hermann (2011), in their paper, give an overview of successful European parking practices. For example, in majority of big cities in France there are underground parking garages built in order for public squares, that were once overwhelmed by parked cars, to be revitalized. Zurich and Copenhagen are giving parking spaces back to the pedestrians, also they have very strict policies for parking in the urban core. In the Dutch city of Breda, a canal was restored to the old waterfront with pedestrian promenade, and it was originally drained so an underground parking garage with an overpass above it would be built. The impact of these new solutions is impressive: revitalized and thriving town centers, significant reductions in private car trips, reductions in air pollution and generally improved quality of life.

## CASE STUDY ANALYSIS: PARKING LOT LOCATED WITHIN THE BANJA LUKA CITY CENTRAL ZONE (BOSNIA AND HERZEGOVINA)

Public space is simultaneously a built environment and a social setting. Analyzing its functional, ecological, social and aesthetic qualities could improve the understanding of the relationship between spatial forms and social interaction.

These spatial form qualities are examined on example of the parking lot located within the Banja Luka city central zone by studying its transformational models.

Banja Luka is the largest city of the Republic of Srpska, one of two entities in Bosnia and Herzegovina. Even the Banja Luka Master Plan from 1975 highlighted the problem of vehicles parked in the city central zone that culminated in a huge traffic volume. At that time, in this part of the city, there were almost no equipped parking lots, so the stationary vehicles were occupying areas intended for active transportation, sidewalks and green areas. The proposal for Banja Luka Master Plan 2008-2020 (2009) sets specific goals and tasks in the traffic domain, which, inter alia, refers to construction of public parking garages around the perimeter of the city, one at each entrance to the central city zone, thus encouraging for car journeys to end in one of them (Figure 1, left).


**Figure 1: Position of parking garages planned for construction around the Banja Luka city center perimeter (left) (Source: Authors based on the Proposal for Banja Luka Master Plan 2008-2020, 2009) and position (left) and images of the selected parking lot (right). (Source: Dakić, 2010).**

The chosen parking lot is located in the central city area and has 234 parking spaces (Figure 1, right). In this area, the Regulatory Plan anticipates construction with maximum construction percentage of 70% with number of floors P+4. However, the southern part of the parking lot is in the vicinity of the city park and the city square, so it could be seen as a potentially interesting area for expansion of the public open spaces zone.

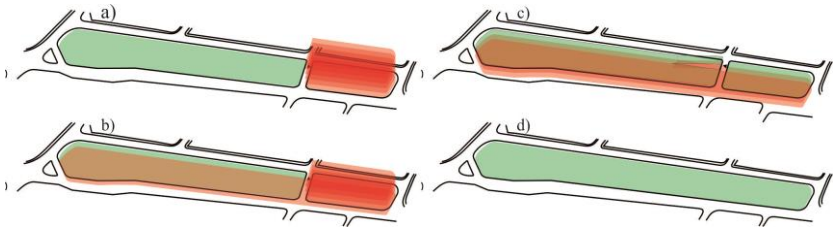



**Figure 2: Urbanism transformation models of the selected parking lot.**

Urbanism and architectural models of transformation of parking lots into public spaces were studied for purpose of improvement of the public health, social cohesion and social interaction. The urbanism approach resulted in four models

(Figure 2): a) 2/3 of the parking lot area is a public space and 1/3 of it is an overground parking garage, b) 2/3 of the parking lot area is a public space and 1/3 of it is an overground parking garage with fewer levels and an underground parking section, c) the parking lot area becomes a public space with an underground parking garage below it, and d) the parking lot area becomes a public space and the parking zone is transferred to a neighboring parking garage with capacity of 384 parking spaces (Figure 1, left).

In the context of the architectural designing field, public spaces could be developed even within a facility of a parking garage, as follows: a) on the surface: horizontally across the entire level (ground floor) or vertically in a separate annex of a building, b) linearly: horizontally on the ground level or vertically through the floors of the building, and c) dotted around the building depending on the functional needs, collimation lines, lightning, etc. (Figure 3).

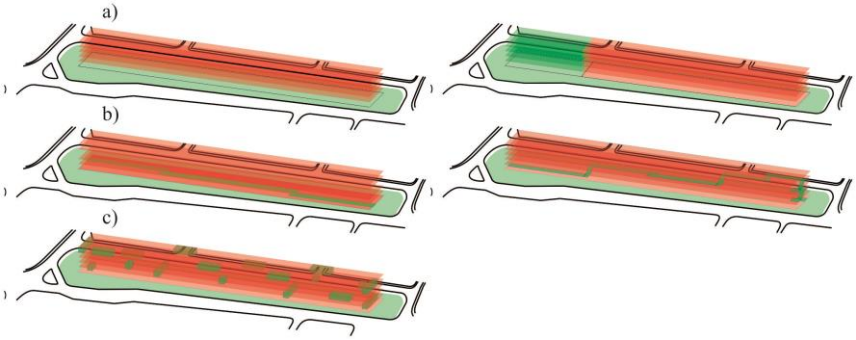



**Figure 3: Architectural transformation models of the selected parking lot.**

All transformation models represent an improvement of the parking lot zone in terms of creation of superior public spaces. From functional and social perspective, they facilitate introduction of new services that would attract new customers to the area, they enable social cohesion and social interaction and improve the social image of the city. From ecological and aesthetic perspective, transformation models enable introduction of green areas and facades that help reduction of CO2 emissions and create a visually pleasanter space. This way, parking zones would develop into superior urban public spaces that would improve public health and quality of life.

## CONCLUSION

High prices of the land in the central city zones influence the relocation of parking lots from these zones to peripheral parking garages and introduction of more attractive public services in their place. However, if general relocation of parking from the city center is not possible, it is necessary to strive for its integration with the public city services, but in the way that pedestrians become dominant users of

these areas, not cars. This research shows that it is possible to define urbanism and architectural transformation models of parking structures in service of public health, which could be regarded as recommendations for planning and designing. This paper presents several models that escalate in reference to the exploitation value, i.e. frequency and locations of parking lots and public spaces. All models improve the parking lot zones by transforming them into superior urban public spaces which improve public health and quality of life.

## REFERENCES

*Banja Luka urbanistički plan-sinteza*. 1975. Banja Luka: Urbanistički zavod.

Chu, A., Thorne, A., and Guite, H. 2004. „The impact of mental well-being of the urban and physical environment: An assessment of the evidence.“ *Journal of Mental Health Promotion* 3, no. 2: 17–32.

Corburn, J. 2009. *Toward the Healthy City: People, Places, and the Politics of Urban Planning*. Cambridge: The MIT Press.

Dakić, T. 2010. *Analiza saobracajnog sistema Banje Luke i preporuke za njegovo poboljsanje*. Banja Luka: Centar za životnu sredinu.

Gehl, J., and Gemzoe, L. 2006. *New City Life*. Copenhagen: The Danish Architectural Press.

Goodwin, P. 1998. „Unintended effects of transport policies.“ In: *Transport Policy and the Environment*, edited by David Banister, 114-129. New York: Routledge.

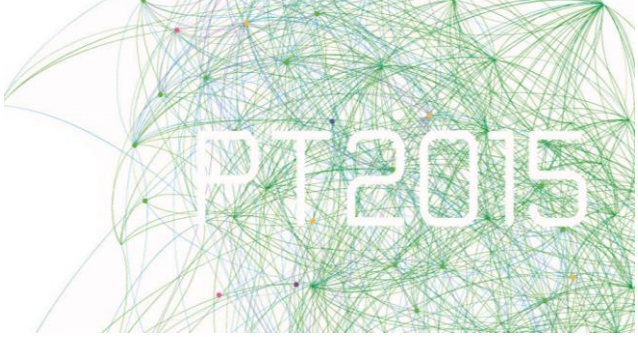
Kodransky, M., and Hermann, G. 2011. *Europe's Parking U-Turn: From Accommodation to Regulation*. New York: Institute for Transportation & Development Policy.

Mayer, M. R. 2005. *Parking lots-an investigation of public space in the contemporary American city*. A Thesis presented to The Academic Faculty, Georgia Institute of Technology for the Degree Master of Science in Architecture.

Pasaoglu, G., Fiorello, D., Martino, A., Scarcella, G., Alemanno, A., Zubaryeva, A., Thiel, C. 2012. *Driving and parking patterns of European car drivers - a mobility survey*. JRC Scientific and policy reports. European Commission: Joint Research Centre, Institute for Institute for Energy and Transport.

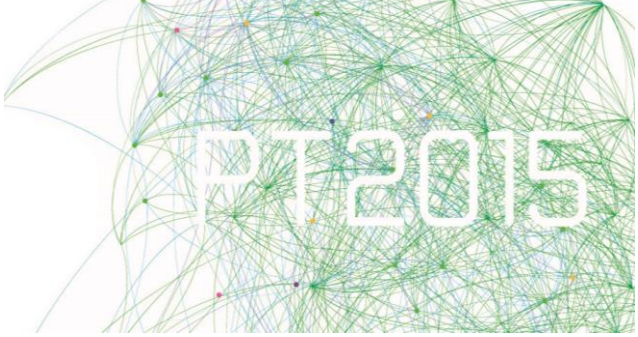
*Prijedlog Urbanističkog plana Banja Luke 2008-2020. godine*. 2009. Banja Luka: Urbanistički zavod Republike Srpske a.d.

Project for Public Spaces, Inc. 2012. *Placemaking and the Future of Cities.* Produced under the auspices of the UN-HABITAT Sustainable Urban Development Network (SUD-Net) with funding from the United Nations Federal Credit Union.




Young, W., Beaton, D., and Satgunarajah, S. 2010. „An analysis of the spatial distribution of parking supply policy and demand.“ *Australasian Transport Research Forum (ATRF)*, 33: 1-13.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# DESIGNING THE WORKING ENVIRONMENT WHEN PLANNING BUSINESS ZONES

**Gregor Čok**
PhD, Assistant, University of Ljubljana, Faculty of Architecture, Zoisova 12, SI-1000 Ljubljana, Slovenia, gregor.cok@fa.uni-lj.si

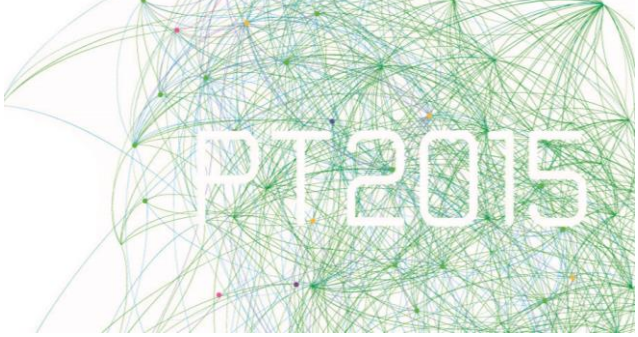
## ABSTRACT

*In the past twenty years, within the framework of stimulating economic development, Slovenia formed numerous Business zones which guaranteed spatial condition for organizing modern entrepreneurship. Their planning principally went in two directions, firstly by modifying traditional small business and industrial parks, and other economic areas, and secondly by forming new zones in new locations. In both cases the managers of the zones – by forming and selling internal plots of land and buildings – predominantly followed the economic effects of the real estate investments.*

*With the purpose of guaranteeing the right conditions for placing a broad spectrum of economic entities in those zones, very flexible conditions were defined regarding the programme and spatial design of individual buildings. The regulation criteria for urban design and architectural solutions, and consequentially the conditions for forming the working environment as a complex visual and psychophysical environment, were reduced to a minimum in accordance with the applicable spatial legislation. The environments formed that way are not stimulating – not visually, organisationally, or programme wise – and do not contribute to the general productivity of employees. The overall appeal of the zone as a whole is reduced and does not attract new entrepreneurs.*

*By using a suitable alternative approach which includes planning the zone in a broader sense and stresses individual structural elements of the zone (internal public space, natural light in the work environment, green elements, programme diversity, quality building design etc.), it is possible to influence the psychophysical mood of the employees and consequentially increase their productivity. A quality designed Business zone (in all the parameters) has a greater economic effect, and its offer can be competitive in the current international market.*

***Keywords**: working environment, business zones, regulation criteria, quality design.*




## INTRODUCTION

Business zones have a twofold significance in the spatial planning process. Primarily, they are economic development generators with direct economic impacts (Kavaš, Koman, 2003), while, on the other hand, zones are evident spatial phenomena, i.e. extensive built-up areas with various impacts on the environment. In any case, from the viewpoint of employees, business zones are workplace locations, i.e. land, buildings and external arrangements making up complex working environments where the employees spend a significant portion of their active day (Tartara, 2011). In this sense, zone planning is also planning of working conditions (Evans, Mitchell McCoy, 1998) with all the parameters affecting the individual's physically and visually perceived environment.

In the past, the business zones in Slovenia were created for various reasons. Under several spatial development strategies, we developed a network of various types of zones serving as a special structural instrument for political and socio-developmental regulations for placement of businesses in the physical space. Within the zones, real-estate investment companies were motivated by maximizing the return on investment by setting-up and selling land and buildings for business use, while the enterprise sector found there the space for its operations. The zones were planned within the limits set by applicable spatial legislation, mostly in the form of modest, strongly rationalised urban and architectural design. Today, the result of the process in the Slovenian territory is seen in the relatively large number of zones (approx. 380 zones of various types and sizes, from 2 ha to 90 ha), which can be divided into two groups. The first group comprises the former industrial, commercial and storage zones (locations from spatial plans prior to 1991), which in the new economic conditions responded to the needs of the business sector. The second group consists of newly established zones (after 1992 and more intensively after 2002) of two dimensions. Smaller zones were established to meet the immediate needs of the local entrepreneurship (adhering to the principle: a zone to each municipality), while larger zones were established to market the developed land for a wide range of programmes, and also as an instrument for attracting foreign direct investment (particularly greenfield FDI).

Common to most zones is that in drafting spatial acts, the planners, at the investor's request, defined technologically rational urban solutions but rather vague (flexible) programmatic and project conditions, allowing for the construction of buildings of various contents, shapes, and sizes. Indeed, the "working environment quality" itself was not raised as a special spatial component. The design of the individual workplace characteristics was postponed to the last stage of planning (as part of the project for acquiring a building permit (PGD)) where, based on several

Regulations, only the minimum technical requirements in dimensioning workplaces for a given activity were considered (Figures 1, 2).

There are very few good practice examples where the workplace is designed to meet all the principles of sustainability, stimulating the employees in both physiological and psychological sense, and hence encouraging higher productivity (e.g. the Akrapovič complex, Ivančna Gorica). Improving the working environment quality is also the focus of the European Healthy Workplaces Campaign 2014-2015; it draws attention to the current issues of the modern society and provides guidelines to remedy the situation.

The working environment characteristics in the project sense are laid down by various applicable labour laws, which are, in principle, focused on fundamental physiological elements. In this context the following questions are considered:
– What planning actions can impact the design of a high-quality working environment, and which structural elements can be included in the early stages of zone design as part of spatial implementing acts? As part of the study, we used the descriptive method to test five characteristic cases of implementing acts for business zones, and tried to identify the contents that indirectly or directly affect the design of the working environment.

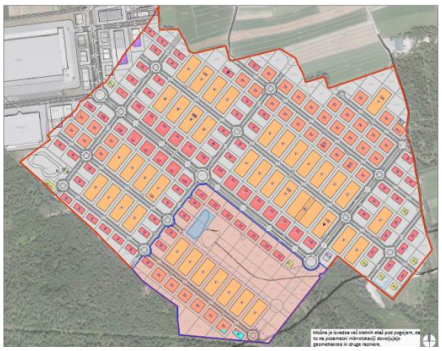
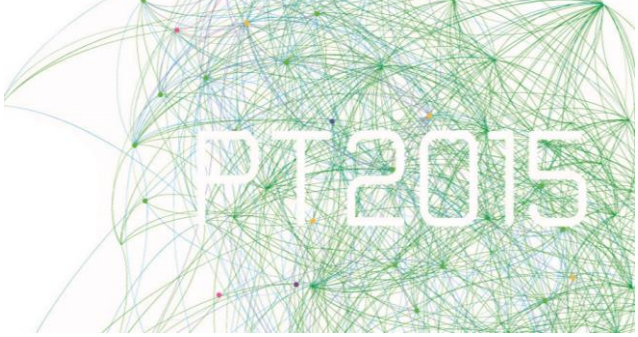


**Figure 1: Komenda business zone (left) as a distinctly regulated spatial design (potential for setting up an appropriate working environment).**
**Figure 2: The Kanižarica business zone (right), organic structure with vague regulatory actions (and, as a result, a confusing working environment).**

## WORKING ENVIRONMENT CHARACTERISTICS

Similarly to the living environment, the creation of the working environment means creating conditions that can meet the individual's psychophysical requirements (Grawitch, Trares, Kohler, 2007). We refer to the wide range of features of the perceived environment to which our bodies are responding with the different senses. Three parameter groups, which form a complex working environment, are crucial to the process: physiological parameters (temperature, light, sound, etc.), psychological parameters (visual: the interior, the exterior,

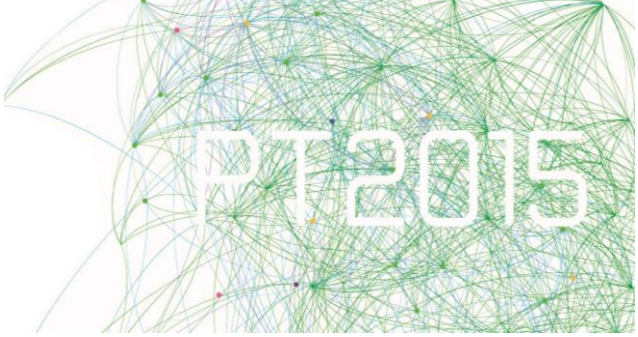



visual art elements, etc.) and sociological parameters (social environment: workplace integration and participation). The working environment topic is well studied in various disciplines (Tartara, 2011). Many studies prove that work satisfaction and psychological well-being of the employees is directly linked to the workplace architecture (Briner, 2000). In this discussion, the parameters that directly originate in the concept of designing a zone as a whole are of particular importance (location, contents, functional design, etc.) and the conditions for the basic regulation of the individual buildings (shape, outline, configuration of the building envelope, etc.).

## ENERGY PERFORMANCE AND OTHER SUSTAINABLE PLANNING PRINCIPLES

In design of buildings following sustainable planning principles, modern technologies are becoming increasingly important (responsive building envelopes, smart systems for installation control, etc.) to ensure good energy performance, by replacing the natural environmental elements at the same time (artificial light, air conditioning, etc.). In this context, we talk about the external and internal environments, and the building envelope (façade envelope) as an interface between indoor and exterior environments. Analytically, the interior environment can be divided into sub-environments. Košir (2011) distinguishes between five fundamental sub-environments: thermal, visual (light, illumination), olfactory, acoustic, and ergonomic sub-environments. By regulating the physical parameters of these environments we directly affect the user's responsiveness in space (workplace), by trying to create the individual components of the so-called environmental comfort (Tartara, 2011) distinguishes between physical, functional, and psychological comfort). This is a two-way regulation: by regulating the building envelope (façade openings, transparency, orientation depending on solar exposure, size and shape of the building volume, etc.) and by using integrated technological systems and installations. In recent years, the energy performance of buildings has been promoted as the fundamental value, while other characteristics of the internal environment play a subordinate role. As part of sustainable planning principles, we also need to consider other sustainable aspects. The recently adopted German Sustainable Construction Guidelines (Leitfaden Nachhaltiges Bauen, 2011) specifically identify the visual component as a specific sustainable quality. The guidelines define a group of visual criteria for evaluating the visual quality of buildings (e.g. stimulating interior design or exclusively technologically designed work space). In this sense, the physical or at least the visual link of the interior and the exterior is important as it can increase the perceived workplace space (Čok, 2014).

In business zone design, we can indirectly or directly affect some of the fundamental urban design and architectural elements that make up the working environment. The appropriate definition of the "project conditions", in the form of norms, provisions and recommendations in drafting spatial implementing acts, can




improve the quality of working conditions, raise productivity, and improve the general satisfaction of all participants.

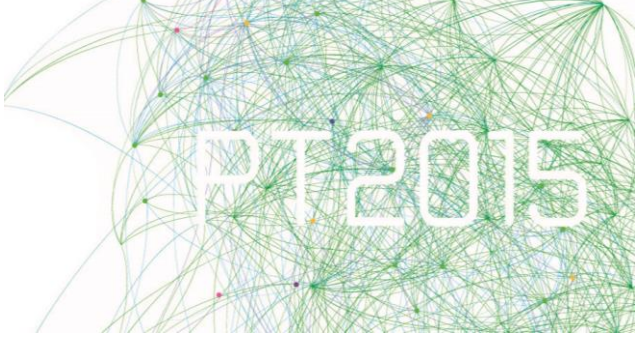
In the framework of the study we analysed 5 business zone projects ((1) Ivančna Gorica, (2) Mačkovec Novo mesto, (3) Lucija, (4) Cikava Novo mesto, (5) Dobrepolje). Using the descriptive method the following issues were addressed:
– which parts of the spatial planning document define the working environment parameters (and, if any, what those parameters are),
– which conditions for designing buildings and the exterior indirectly or directly influence the individual parameters (Table 1).

**Table 1: Working environment parameters, which can be affected in the business zone design.**

| | **Stransko polje commercial zone (Ivančna Gorica)** | **Mačkovec-1 business and service zone (Novo mesto)** | **Lucija commercial zone (Portorož – Lucija)** | **Cikava business and industrial zone (Novo mesto)** | **Predstruge commercial zone Dobrepolje** |
|---|---|---|---|---|---|
| Implementing act | Municipal Detailed Spatial Plan (OPPN) | Local Detailed Plan (OLN) | Development Plan (ZN) | Spatial Implementation Conditions (PIP) | Development Plan (ZN) |
| Construction development concept | flexible – area for building development | flexible – area for building development | structure design | flexible – area for building development | structure design |
| definition of term "working environment" | No | No | No | No | No |
| potential for good working environment quality, rating (1–5) | zone level: 3<br>building level: 3 | zone level: 5<br>building level: 4 | zone level: 2<br>building level: 3 | zone level: 4<br>building level: 3 | zone level: 2<br>building level: 3 |

We found the following:
– None of the projects specifically defined the working environment as a "project or qualitative term" (with the exception of parking spaces for employees),
– Vague regulation instruments are in place in the form of fundamental conditions for the programmatic design of the zone, land subdivision and conditions for (external) building design, with mostly indirect impact on the working environment,
– The concept of designing individual buildings, in the form of an "area for development of buildings", as defined by the building line and the building ratio, without further attention to outline, shape and building orientation (this mostly applies to recent implementing spatial planning documents (PIAs) for business zones), is a poor starting point for shaping a good-quality working environment,
– All detailed working environment parameters are not included in the business zone's PIA, but rather they are left to the partial initiative of the individual investor and the building designer at the PGD level.

By valuating the individual characteristics of the analysed spatial acts and based on some good practice examples we find that by using an appropriate planning approach and by integrating the individual regulatory provisions in the graphic and



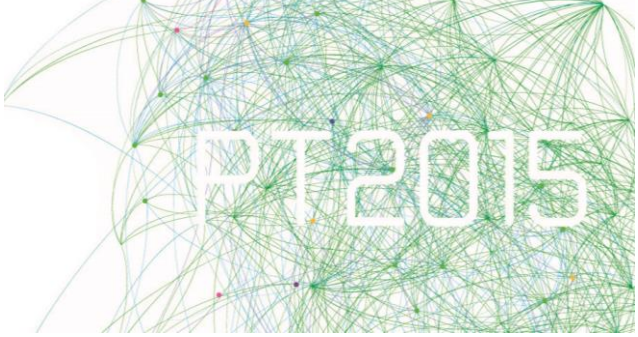

textual parts of the implementing act we can, to some extent, affect the individual parameters of the working environment. In continuation, we present the actions (Table 2), which can – at the level of zone a whole, and the building level – contribute to a good quality working environment in 10 key parameters:

**Physiological parameters**

1. The regulation of the natural light in a workplace can be defined as part of PIAs with the provisions defining the share of glazing of the façade envelope, roof shape, and building orientation to benefit from favourable solar exposure or shading.
2. The thermal regulation at the zone level cannot be affected, while at the building level this is achieved through the provisions regarding the configuration and orientation of the building.
3. The level of sound (noise) can be significantly affected within the activities allowed in the zone and an appropriate concept design defining transport infrastructure, noise barriers, and building orientation itself.
4. Similarly to sound, the emissions (smell) can be significantly affected by the range of activities that are acceptable to other stakeholders, and with appropriate allocation within the zone – sectoral zone division and a system of placing ecological islands and landfills (the level of zone concept as a whole).
5. Working environment ergonomics at the building level is the subject of PGD. Regarding the design of external areas, we have a certain impact on the planning of public spaces and service facilities.
6. The workplace–home distance is important in terms of the time spent by the employees. Great distances or routes through condensed urban centres cause additional fatigue and nervousness. This parameter can be greatly affected at the planning level where the zone macro location and its gravity area are selected, i.e. into which the potential employees gravitate. Most zones in Slovenia are located in the relative vicinity of urban centres, while, recently, some zones have been placed far in the hinterland due to lower land prices.

**Psychological parameters**

7. Building interior design is mostly in the domain of the investor and the planner. The individual architectural elements and, as a result, the concept of the interiors and the views to the outside can be affected by building design conditions which consist of the following: proportion of glazing and façade envelope structure, division of buildings to business and production parts, consideration of the required building line, shape and orientation of building volumes, and organisation of external surfaces (green and public green spaces, and others); And exceptionally also by the range of allowed materials and colours of the building envelope.
8. The design of the exteriors is more subject to designing the zone as a whole. In this context, the prescribed proportions of public spaces and other external arrangements, urban facilities, programmatic diversity, etc., are important. The problem of most Slovenian business zones is that investors avoid these kinds of




arrangements. New, bigger zones with joint management and good quality regulation plan have a considerable advantage.
9. Privacy in the workplace is the result of the appropriate layout and the technological or business process in a building. At the zone level, we can define rest areas (structures or outdoor arrangements), for repeated daily relaxation of the individual or group. This category also includes accompanying activities (parks, accommodation and food service activities, smoking areas, etc.).

### Sociological parameters

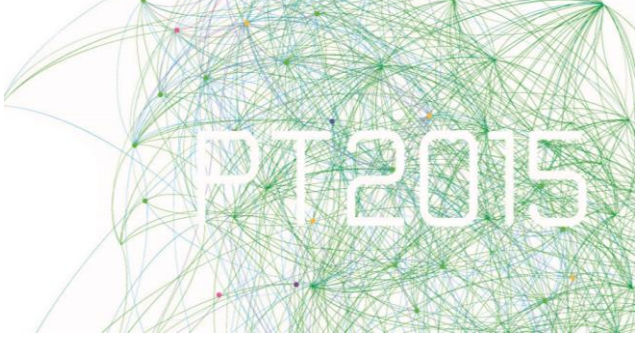
10. The individual's integration into the work team and the wider working environment is highly individualistic. With the specified concept of zone design as a whole (e.g. (a) central concept; common public areas and meeting places, (b) network concept; system of unconnected blocks on building land, etc.) we can direct employment flows and create meeting points, or vice versa, increase the distance and isolate them. The same approach applies at the level of the design of individual buildings.

**Table 2: Ten working environment parameters, which can be affected in the business zone design.**

| | **Physiological parameters** | | | | | | **Psychological parameters** | | | **Sociological parameters** |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1<br>light | 2<br>heat | 3<br>sound | 4<br>smell | 5<br>ergonomics | 6<br>work–home distance | 7<br>the interior, cityscape | 8<br>the exterior | 9<br>privacy | 10<br>participation and integration |
| | | | | | | | | | | |
| **A** - zone level | ● | - | ● | ● | o | ● | - | ● | o | ● |
| **B** - building level | o | o | - | - | - | - | o | o | - | o |
| ● significant impact, partial impact, - no impact | | | | | | | | | | |

## CONCLUSIONS

Zone planning and, consequently, working environment planning is carried out at three levels: (a) the planning level by selecting the appropriate location, (b) the zone concept level where many parameters are qualitatively defined in terms of programmatic diversity, structural design of development and public spaces, and (c) at the level of an individual building, which can be affected by regulating the individual architectural elements. In the future, greater emphasis should be placed on the following:
– ensuring programmatic diversity of zones as distinctly technological areas,
– increasing the share of public and green public spaces as co-creators of a stimulating working environment of the zone as a whole and, at the same time, of social interaction areas,




– architectural solutions of individual buildings of better quality, where the shift from the strict technology of the work process to the individual's needs is necessary,
– more pleasant design (materials, colours, green elements, illumination).
The final quality of the working environment, despite the well-defined starting points in relevant spatial documents, is mostly affected by the level of interest of the entrepreneur who is well familiar with the work process, and the psychological profile of the employees.

## REFERENCES

Briner, R. 2000. "Relationships between work environments, psychological environments and psychological well-being." *Occupationalm medicine*, no.50 (July): 299-303.

Čok, G. 2014. "Načela održive gradnje u oblikovanju životnog prostora : vizualna udobnost kao odrenica održive kvalitete = Principles of sustainable construction when designing a living environment : visual comfort as an element of sustainable quality." *Holon*, no. 4 (Januar): 58-88.

Evans, G. W., Mitchell McCoy, J. .1998. »When buildings don't work: the role of architecture in human health.« *Journal of Environmental Psychology* 18, no. 1 (March): 85-94.

Grawitch, M. J.; Trares, S.; Kohler, J. M. 2007. "Healthy workplace practices and employee outcomes." *International Journal of Stress Management* 14, no. 3 (August): 275-293.

Healthy Workplaces Manage Stress - Evropska kampanija Zdravo delovno okolje 2014-2015. Accessed April 10, 2015. https://www.healthy-workplaces.eu/en/campaign-material/introducing-the-campaign-guide/campaign-guide.

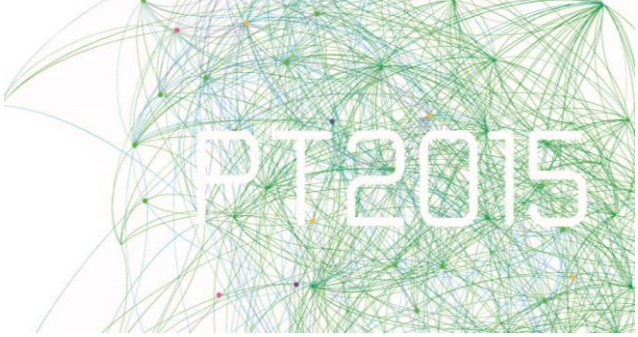
Kavaš, D. and Koman, K. 2003. "The role and status of regional and industrial policy in Slovenia". In *From old industries to new regions : policies for structural transformations in accession countries, (Schriftenreihe des Institutes für Technologie- und Regionalpolitik der Joanneum Research, Bd 1), edited by* Steiner Michael, 157-177. Graz: Leykam.

Košir, M.. 2011. »Regulacija notranjega okolja z uravnavanjem stavbnega ovoja.« AR 2011/1: 19-28.

Leitfaden Nachhaltiges Bauen - Smernica za trajnostno gradnjo. 2013. Ljubljana. Inženirska zbornica Slovenije.

Tartara, M. 2011. *Povezanost delovnega okolja z delovnim zadovoljstvom in psihološkim blagostanjem.* Diplomska naloga. Univerza v Ljubljani. Filozofska fakulteta.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# FOUR PARADIGMS FOR THE VENETO REGION'S CENTRAL AREA

**Enrico Anguillari**
PhD, Architect, Venice-Italy, enrico.anguillari@gmail.com

## ABSTRACT

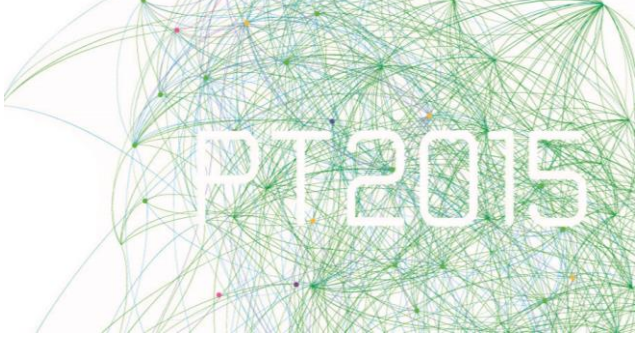
*Recent literature on the crisis that cities and territories are undergoing is rapidly on the rise, in reference to issues such as hydrogeological calamities, a "weariness of living", the arrest of economic growth and social inequalities. This paper presents some of the current thinking on the central area of the Veneto Region. It focuses on the themes, issues, and spatial planning strategies that are useful to the construction of a possible "urban agenda" aimed at expanding prospects, in fields of planning and socially, on the future of the city-territory; and it questions some of the subject's commonly accepted axioms.*

***Keywords****: urban sprawl, city-territory, isotropy, recycle, social cohesion.*

## INTRODUCTION

For those interested in the form of the contemporary city, the central area of the Veneto Region represents a paradigmatic case of study. Its structure, on one side, inverts the normal relations between the full and void spaces of the compact city, and, on the other, it reveals more articulate and complex realities than those presented by some of the common dichotic narrations: urban-rural, industrial-agricultural, workers-peasants, etc. The large-scale density of the region's infrastructural layout, as connected to the system of the area's waterways, as well as its roadways - dating back to ancient roman land reclamation -, has given form to an extremely versatile landscape that is almost entirely accessible, habitable and cultivable. In adapting to this structure, the central area of Veneto has thus taken the form of the city-territory (Piccinato, Quilici, Tafuri, 1962); a horizontal city rich in agricultural areas mixed with a host of small-scale activities of production, industries, districts and enterprise networks. A patchwork metropolis (Neutelings, 1989) was thus formed making way for the possibility of an isotropic use of space that allowed for a number of very different "things", uses and economies to coexist and even cross-breed; as in the case of factory metal workers, metal-mezzadri who, in their spare time, also worked the fields. This is one symbol of the economic miracle of Italy's northeast (Bernardi, 2009).

At the same time, this very form resisted against the systems and tools of consolidated planning approaches, thereby preventing any connected seaming of

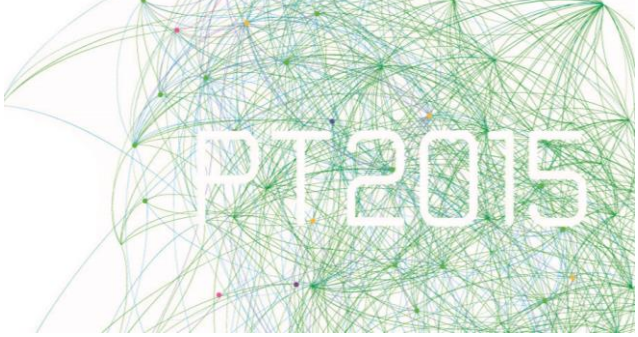



the area's different parts. Over the past two decades, there have been tenacious attempts to consolidate a "different" design approach for the area; one that is capable of bringing out the distinct traces of this latent city (Munarin, Tosi, 2000). Furthermore, there have been repeated questions regarding the opportunity to insert policies that address urban sprawl within the Regional-level planning agenda. However, these attempts were overshadowed by more prevalent interests in the politics of major infrastructure projects and regulatory reforms in the Urban Planning field, which consigned the territorial government to local municipal administrations and the construction sector (Lanzani, 2014).

Nevertheless, there are still valid reasons to continue the discussion and provide further reflection on this theme. One important reason is that, today, more than ever, there are obvious negative effects on the welfare of citizens and the economic development of an area that is complicated to live in, difficult to maintain, poorly functioning, destabilized and fragile (Giannotti, Viganò, 2012). A second reason is that we are facing an epochal change of the very context in which we live and work; one that is linked to a structural and radical halt of a long period of uninterrupted income growth.

«Whenever the structure of the economy and society changes [...] the urban question comes to the forefront», wrote Bernardo Secchi in his book La città dei ricchi e la città dei poveri (The city of the rich, the city of the poor, 2013). This change opens up to problems that all urban models, even given their diversity, will have to face in the near future. It is these problems that, when presented together, raise a "new urban question". «Social inequalities and their leading to obvious forms of spatial injustice, along with the consequences of climate change and problems connected to the idea of mobility as a part of rights of citizenship, represent one of the most important aspects of that question» (Secchi, 2013).

This paper aims to give an account of the current thinking on the central area of the Veneto, supplemented by the ongoing discussions, debate and research that it generated. The hypothesis is that the following contributions brought forth are all essential to the construction of a new agenda for the city-territory. The first discourse concerns *isotropy* and its project, i.e., the capability of reading and planning in areas that are spatially lacking in structure, where directions or prevailing hierarchies are not immediately recognizable. The second discourse regards *recycling*, intended as the possibility to re-enter the resources and the refuse produced by natural processes of birth and aging into a new cycle of life, as we can with the abandonment of urban materials, territories and spaces (Marini, Santangelo, 2013). The third discourse regards the relationship between innovation, development and social cohesion. And finally, the fourth addresses the idea of a territory that can once again become a major production area, while also, at the same time, becoming a place of widespread quality and attentive care.




## THE PROJECT OF ISOTROPY

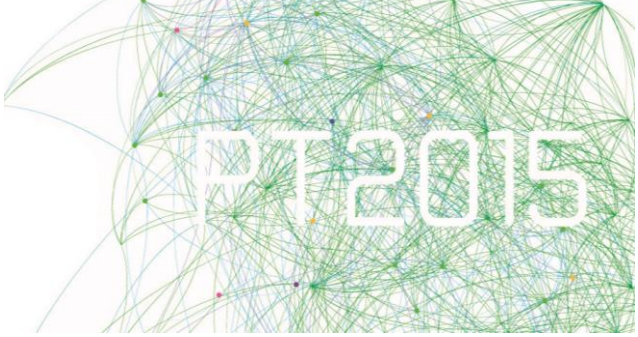
Isotropy is the physical property by which an object or substance presents the same physical characteristics or gives place to a given phenomenon that holds the same values in all directions. For the central area of the Veneto, isotropy is used to describe that part of the region's morphological condition lacking hierarchy, with its horizontality and dispersion (Viganò, 2008).

Starting from the 1970's, the underlying project that held, and still holds, a steadfast commitment in the Veneto was based on a strong selection of project-interventions and on the idea that large-scale infrastructure automatically leads to modernity, development and improvements in the spatial quality of an area's settlements. To adopt the idea of isotropy as a project instead means to uphold the belief that if the city-territory is to increasingly organize itself by limiting its permeability and widespread connectivity, it could lose enormous potential, both ecologically and environmentally, as well as in terms of mobility. For example, in following the area's waterways, as with surveys of other basic infrastructure systems, we are led to consider the Region's overall operation and its dynamics that strongly impact valleys, plains and lagoons. This leads to inscribing the territory's construction processes within more ample representations of the landscape. It brings us to pay more careful attention to distinct places and marginal areas, which allows us to reformulate views on traditional themes of planning and urban design in regard to settlements, systems of production, as well as the forms and spaces of welfare (Munarin, Tosi, 2014).

Dealing with the theme of isotropy also sheds light on the ambivalent nature of the territory: as a "common resource" it is also the source of "common risks", the management of which, project planning cannot do without (Giannotti, Viganò, 2012; Anguillari, 2013). The dispersion of settlements - outside of collective regional planning schemes and shared visions of development - has produced expansion, land consumption, and a dispersal of the values of an urban core and its surrounding landscape. This mechanism has dotted the region with autistic fragments in the name of convenience and individual interest, completely lacking a viable culture of project-design and administration that is capable of upholding community values. The project of isotropy overturns the very meaning of development and growth in affirming the significance of continuity - with space, networks of mobility, water, ecological values, landscape networks - through its capacity to give a different orientation to the role of institutions and their responsibilities in regard to a significant and necessary revision of their cognitive, technical, operational and communicative tools.

## RECYCLING

In shrinking territories, such as those of the Veneto, it is essential to reformulate a strategy of growth that opposes generic tendencies towards a cyclical return to



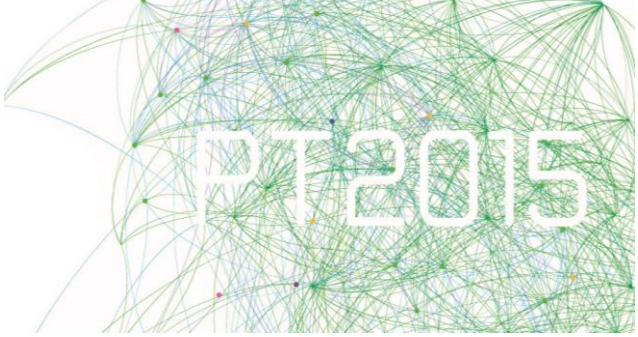

patterns of expansion (Russo, 2014). Development, in such contexts, means a regeneration of systems and materials, which have exhausted their role and their function, and are to be reconceived within more innovative living spaces and environments.

Recycling here is intended as a project oriented towards interpreting the current transition; one that can give back a different world, which will however have to operate by introducing into a new cycle the excesses of residual areas and spaces that the city-region has produced, including: landslides, flood damage, the ever frequent flooding of small streams, serious forms of ground pollution, abandonment of agricultural areas, landfills, infrastructure, landscapes, buildings, and the neglect of important historical and artistic heritage, roofless sheds to reduce taxation (Materi, 2014), excessive degrees of land impermeabilization, vacant buildings and the concurrent lack of housing for large sections of the population, schools and other dilapidated public facilities lacking maintenance, as well as a legacy of public works that were started and never completed.

Recycling thus means to optimize such resources, which means to lessen the impact of economic growth on the environment and non-renewable resources. For the future of the city-territory, this implies the prospect of cities' growth as a possible cure for their structures and systems, by mobilizing renewal, regeneration and innovations for the use of open spaces and landscapes. Valid examples of this are the practices of urban agriculture or, conversely, strategies aimed at the clean-up of entire portions of the territory (Shannon, 2008); the reclaiming of abandoned lands in the experience of Detroit (Waldheim, Santos-Munne, 2001) or of large urban areas in decline (Oswalt, 2005). In this sense, shrinking territories are called to re-imagine their future development through innovative forms of social creativity in order to conceive of new economies and new ecologies for the construction of forms of cohabitation that are supported by a rational and responsible use of resources.

## INNOVATION, DEVELOPMENT AND SOCIAL COHESION

Growth was always considered a specific quality of Western countries, in the sense of providing for increasing amounts of goods and services per capita in the world and particularly in economic markets. Since the 1970s, municipalities and economic operators throughout the central area of the Veneto promoted policies that were in favour of strengthening provisions for services and infrastructure in the area's various "poles of urban development", thus increasing their functions and roles while also conferring qualities and traits of "urbanity" to smaller towns that still retained a rural nature. The entire territory was affected by non-linear and fragmented processes, often without any coordination of project-intervention, resulting in numerous dysfunctions and an overall "weariness of living" (Munarin, Tosi, 2014). Within such a framework, innovation then meant to increase the efficiency of land management. This partly explains the centrality and focus in




current regional policies on the theme of smart cities and territories, as a watchword of innovation leaning towards an integrated use of information technology and the environment at the service of the city administration and the territory, from mobility to a rational use of energy resources.

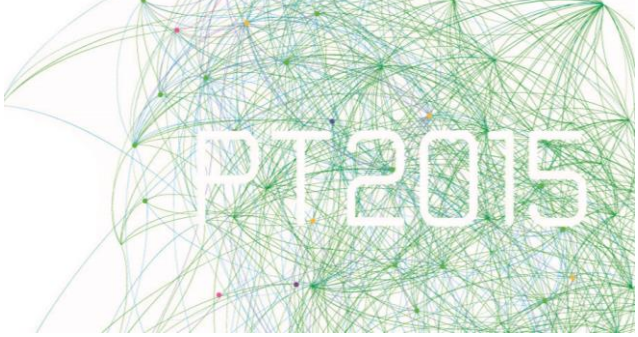
In regard to these questions, the idea of dispersion seems to provide opportunities that the compact city does not offer. For its variety and incompleteness, the dispersion model allows for a glimpse of the possible reaches of innovation and development that are greater than those of many large urban concentrations (Fondazione Impresa, 2012). This in turn leads us to think that the future of such territories could guarantee entire economies a greater resilience than large concentrations of areas of production. Therefore, the recourse to a wide range of renewable energy, a more intelligent re-usage of gray energy deposited in the city and the territory, the development of complementary techniques in the policies of recycling and a re-conception of mobility programs, have all become very promising fields of study and research.

Nonetheless, considering the fact that cities and territories react, or are partly constructed through a myriad of project-interventions and thinkable micro-changes, - almost as if through a form of "open-source urbanism" (Sassen, 2011) - , it becomes evident that the technological path cannot be sufficient on its own. It is instead necessary to combine innovation with a different approach to development; one that is both social and cultural, while also being supported and powered by renewed values of inclusion, openness and cooperation. Therefore, the model of growth to which the city-territory should aspire can no longer head toward a mere quantitative expansion, but rather lean in on innovation and creativity. It needs to take care of people and the environment in which they live, in their entirety.

## URBS IN HORTO

The city and the region, as a result of either spontaneous processes or of projects and policies - particularly spatial policies -, are the archive and deposits of what the different "urban issues" have produced over time. Following a continuously slow process of cumulative selection, cities and territories give back to later periods everything that is preserved, changed and transformed, in ritualizing the past, as well as everything that, by contrast, is destroyed and replaced with something else (Corboz, 1983). This huge collection of materials can only continue to be a vital support to the future of the city-territory as well as to the questions it poses today, in light of issues such as the environment, mobility and social inequalities.

The production capacity itself of the city-territory is related to this set of materials. It is therefore necessary to carefully assess the new opportunities that can arise from the territory's formation and evaluate if transitions within that landscape can be facilitated by a more varied and widespread "productivity" of small and medium




dimensions, rather than by larger concentrations of production; for example, with the development of an agriculture of proximity proving more effective in solving the problems of area's care and maintenance than large-scale intensive production aimed at the international market. Instead of conceiving of a plan for large-scale works - often interrupted due to lack of funds -, it may be worth thinking of an ample project-plan for small-scale, spread-out work projects that are connected to the maintenance and protection of the overall apparatus of the territory.

The image of *Urbs in Horto*, although a motto for the city of Chicago, effectively describes the idea of the city-territory as a widespread and capillary "productive garden" in which many of the buildings and industrial platforms of small and medium-sized enterprises of northeast Italy are situated; an idea of a territory that can be both a large production area as well as a place of environmental quality and widespread care; an idea of management that is different from an exact perpetuation of "goods", directed instead at the enhancement and transformation of hybrid spaces and unusual combinations that typically define the space of urban sprawl.

## CONCLUSIONS

The topics addressed in this paper are intended to introduce an urban and regional agenda for the central area of the Veneto Region in light of the research, debates, and discussions of which it has been the subject in recent years.

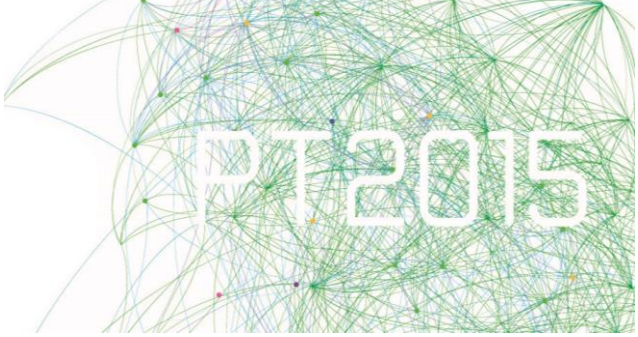
These investigations show a line of continuity with the experience of planning in Italy, where the themes of the environment, landscape and ecology intersect in a new perspective that goes beyond the limits of sectoral approach in the professional field, and act more as a background for resilient project-planning that is capable of adapting to the limits and potential of the territory in question.

Although the questions addressed certainly provide only a partial set of priorities to be pursued, they perhaps also shed some light on a drafted perspective upon which to build a work program aimed at re-launching a different idea of growth and development that can build the instruments and knowledge to:

> affirm the centrality of the city-territory as a place of relationships and integration of social, ecological and environmental values for the continuity of our landscapes;

> demand a renewed sensitivity to limit the depletion of non-renewable resources, most importantly soil and water;

> selectively examine the existing territory to regenerate and recycle the fabric of its structures and its abandoned landscapes;




> understand growth as prosperity, that is, as the ability to be happy, to achieve a physical, moral and social development which replaces the mostly individualistic models of consumer society with a community perspective that can enhance social capital and public goods.

## REFERENCES

Anguillari, E. 2013. "Veneto 2100: living with water." In *Living Landscape - Landscape for Living. Policies, Practices, Images*, edited by Camilla Perrone, Planum. The Journal of Urbanism, no. 27, vol. II.

Bernardi, U. 2009. "L'eredità del metalmezzadro nel Veneto agropolitano", In *Ruritalia. La rivincita delle campagne*, edited by Corrado Barberis, 299-312. Roma: Donzelli editore.

Corboz, A. 1983. "The Land as Palimpsest", *Diogenes* 31, no. 121: 12-34.

Fondazione Impresa, (edited by). 2012. "La nuova crisi del 2012-2013: prospettive per il Veneto e il Nord Est", *Veneto e Nordest*, no. 36: 9-29.

Giannotti, E. and Viganò, P. (edited by). 2012. *Our common risk. Scenarios for the diffuse city*. Milano: et. Al.

Lanzani, A. 2014. "Per una politica nazionale della città e del territorio". In *Città tra sviluppo e declino. Un'agenda urbana per l'Italia*, edited by Antonio G. Calafati, 49-73. Roma: Donzelli editore.

Marini, S and Santangelo, V. (edited by). 2013. *Re-Cycle Italy 02. New life cycles for architecture of city and landscape*. Rimini: Aracne editrice.

Materi, N. 2014. "L'ultimo atto della crisi: capannoni scoperchiati per pagare meno tasse", *Il Giornale*, 07/07/2014.

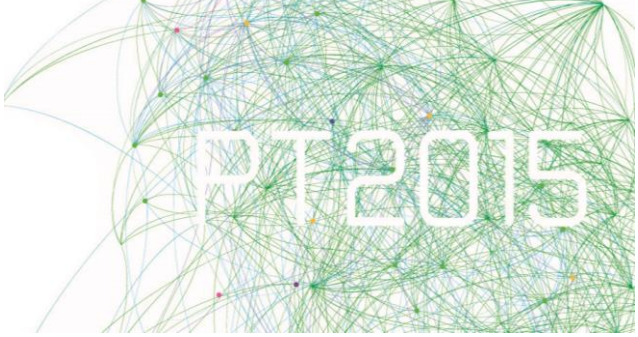
Munarin, S and Tosi, M.C. 2001. *Tracce di città. Esplorazioni di un territorio abitato: l'area veneta*, Milano: Franco Angeli.

Munarin, S and Tosi, M.C. 2014. *Welfare Space. On the role of Welfare State Policies in the Costruction of the Contemporary City*. Trento: ListLab.

Neutelings, W. J. 1989. "Patchwork Metropolis", *de Architect*, no. 36.

Oswalt, P. (edited by). 2005, *Shrinking Cities: International Research, Volume 1*. Ostfildern-Ruit: Hatje Cantz Verlag.

Piccinato, G., Quilici, V. and Tafuri, M.. 1962. "La città territorio: verso una nuova dimensione", *Casabella-continuità*, no. 270: 16-25.




Russo, M. 2014, "Un'urbanistica senza crescita?". In: *Urbanistica per una diversa crescita. Progettare il territorio contemporaneo*, edited by Michelangelo Russo, XV-XXX. Roma: Donzelli editore.

Sassen, S, 2011, "Open Source Urbanism", *The New City Reader: A Newspaper Of Public Space*, no. 15.

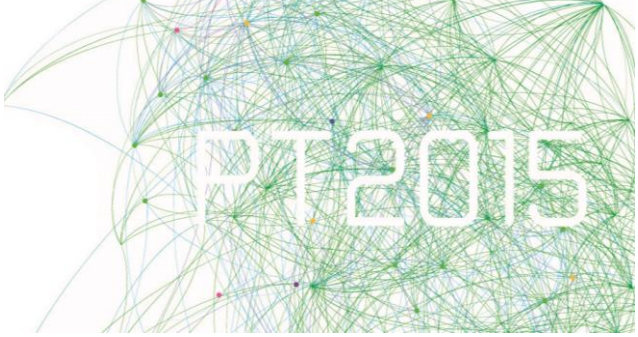
Secchi, B. 2013. *La città dei ricchi e la città dei poveri*. Bari: Editori Laterza.

Shannon, K, De Meulder, B. and d'Auria, V., Gosseye, J. (edited by) 2008. *Water Urbanism*. Amsterdam: SUN.

Viganò, P. 2008. "Water and Asphalt. The Projection of Isotropy in the Metropolitan Region of Venice", *Architectural Design* 78, no. 1 (January/February): 34–9.

Waldheim, C. and Santos-Munne, M.. 2001. "Decamping Detroit". In *Stalking Detroit*, edited by Georgia Daskalakis, Charles Waldheim and Jason Young, 104-21. Barcelona: ACTAR.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# MUNICIPALITY POLICY AS KEY FACTOR FOR THE ROLE OF ARCHITECTURE AND TECHNOLOGY IN PUBLIC HEALTH

**Dejan Vasović**[1]
PhD candidate, Assistant, University of Belgrade, Faculty of Architecture, Bul. kralja Aleksandra 73/II, Belgrade, Serbia, d.vasovic@arh.bg.ac.rs

**Nataša Ćuković Ignjatović**
PhD candidate, Assistant Professor, University of Belgrade, Faculty of Architecture, Bul. kralja Aleksandra 73/II, Belgrade, Serbia, natasa@arh.bg.ac.rs

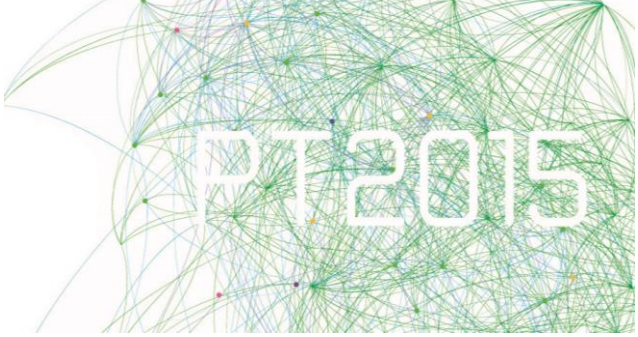
**Dušan Ignjatović**
PhD candidate, Assistant Professor, University of Belgrade, Faculty of Architecture, Bul. kralja Aleksandra 73/II, Belgrade, Serbia, ignjatovic.dusan@arh.bg.ac.rs

## ABSTRACT

*The construction of the so-called "social infrastructure" (kindergartens, schools, health centres, hospitals), which is the basis for a "public health" in a broader sense, in many countries is led by the administration (state and municipal). The quality of the built environment largely depends on the quality of financier, in this case embodied in some kind of state/municipal authorities, committees and civil servants. In this paper, an example of the application of up to date high-tech design methods and technologies in the design and construction of public buildings is presented. Belgrade public buildings designed and constructed in the period 2009 – 2013, is shown. The first five projects for construction of energy efficient kindergartens (up to passive house standard) with the use of renewable energy sources and realised through architectural competition, were considered as a passing fad, but such a practice has become standard procedure for the design of the other public buildings, and even the only option for the construction project of 1400 social apartments in Borča. The paper presents these projects, and, in particular, highlights the necessary processes and procedures established to ensure that these projects would be implemented.*

***Keywords**: municipality policy, energy efficiency, architectural competition, healthy places.*

[1] Corresponding author




## INTRODUCTION

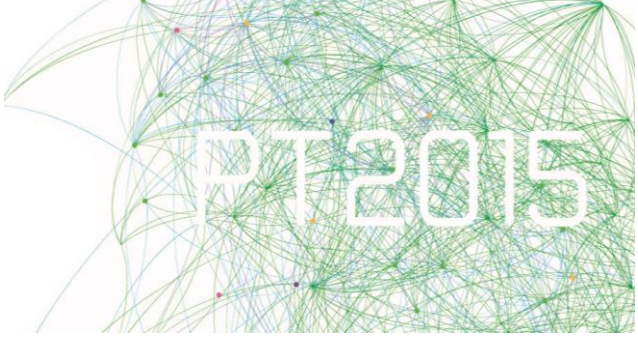
World Health Organization defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 1948). In the broader sense, it means that social well-being is one of the key elements of people's health. Even more, in UNDP study "Stuck in the Past" (UNDP, 2004) it was clearly stated that if the Serbian society wanted to develop, decrease of energy consumption would be mandatory.

City of Belgrade spends around 30% of the energy produced in Serbia (Belgrade's Energy Sector Development Strategy, 2008). Therefore, the decrease of the energy consumption in Belgrade is crucial both for the citizens, and for the City Municipality. However, as the price of the energy sources is subsidised by the Government, there is no economical motivation for the rational usage of the energy or for the application of the renewable energy sources. For that reason, it is the mission of the local authority to be a leader in the energy saving process: on one side, to reduce its own expanses for the energy sources, and on the other to start the development of the energy saving industry (education of financiers, architects, engineers, constructors, supervisors, final users ...). These tasks imply the change of the many administrative bodies which is always a big challenge.

## DEFINING OF THE MUNICIPALITY POLICY

The main goal was to improve the design, construction and management of the public buildings, to lower their energy consumption in exploitation and to use renewable energy sources for this lowered energy needs. Having in mind some failed attempts, a decision was made to start more projects in different fields simultaneously. University, professional associations, public companies, interested private companies, relevant city secretariats, agencies and municipalities – they all had their representatives included. To avoid partition and segregation, the projects were linked by the mutually dependent goals, and teams' members took different roles in different projects. Special attention was made to ensure equal presence of the members of the City authority and other contributors in different projects. In that way, one participant could reach more different results, one project would be finished and other one started, the projects which did not progress were put on hold temporarily, while the same participants remained active in other on-going projects. This organisation brought on higher activity of the employees in the city authorities and different ideas how to improve the system itself. The very system started to change itself.

A very important decision was made to acquire all the design solutions through the public competition with more equal rewards, and to have the entries and results published. In this way, all the participants, and not only those rewarded, became the promoters of new ideas.




## STUDIES AND SURVEY OF CURRENT STATE

City of Belgrade (Directorate for Energy) provided yet in 2003/2004 energy efficiency studies made for 20 kindergartens and schools ("EnPlus"), projects "Energy revitalisation and comfort optimisation", with the exact outcomes such as economic analysis of measures, recommendations of possible scenarios of energy recovery with precise information about the investment vs. benefit, but nothing had ever been realised due to lack of interest. However, Directorate for Energy continued the activities by making following studies of the housing, hydro potential, and Energy information system:

### Atlas of the Energy Characteristic of the Building Envelopes in Belgrade

The study was made by Faculty of Architecture, University of Belgrade in 2012. Atlas made the identification, classification, architectural and thermo-visual analysis of the performance of the building envelopes, suggested the measures to be undertaken accompanied by financial estimation of the costs for 30 typical building in Belgrade. The buildings made in the period before the first thermal protection regulations, mostly during 60-ties and 70-ties (even during 80-ties) have the biggest savings potential. The possible savings, which include all measures, are around 50% of the current consumption.

### Detailed Research on Sub-Geothermal Water Resources of Belgrade – Potential, Usage Possibilities and Energy Evaluation

The study was made by Faculty of Mining and Geology, University of Belgrade in 2012. The subject of the Study is sub-geothermal energy with low enthalpy, which can be used in heat pumps, with the depth of 200-300 meters, for the defined temperature range 9-30°C. The conclusion of the study is that one third of the thermal needs of the buildings attached to the central heating system can be obtained by using available sub-geothermal thermal energy. According to general calculation, total available thermal power for Belgrade is around 1.5 MW.

### Cadastre of the Geothermal Wells in the Territory of the City of Belgrade and Forming of the Geothermal Information Database

This is the first classification of the information of this type and it covers collection of all available data related to existing geothermal wells in the territory of the City of Belgrade (number of exploitation wells that are or can be used for the heating/cooling needs of the buildings; current number of geothermal energy users). This conceptual approach enables the forming of the base for the sustainable usage and management of the hydro-geothermal resources in the City territory.

**Research on Wind Energy Potential and Identification of the Most Favourable Locations for the Wind Power Plants in the Territory of City of Belgrade**

The research was made by School of Electrical Engineering, University of Belgrade, and it is an indicative city/regional study made after one-year-measurement in three referential locations (height of 35-63 m). The possibility of development of the wind power plant with the power of more than 3 MW was analysed and there were eight established micro-locations in the broader City territory on the right side of the Danube, with the optimal possibility of usage of the south-east and north-west winds (net usage coefficient of the 25 do 30% capacity on yearly basis, estimated installed power around 110MW).

**Informational System of the Energy of City of Belgrade (ISEB)**

Implantation of the Informational system of the energy should continuously monitor the energy flows in the territory of Belgrade, so that data analysis might prevent supply disturbances, enable planning and disposal of the energy, define measurements for the loss reduction, influence growth of the energy efficiency, optimise the consumption of all forms of energy and minimise the environment pollution.

## REALISED PROJECTS

By Major's decision, City of Belgrade decided to adopt energy efficiency (EE) measures and use renewable energy sources (RES) through construction of new buildings. The first occasion was the construction of five new kindergartens with passive house standard (less than 15kWh/m$^2$ for heating). Design briefs were acquired through public architectural competition initialised in 2010, when the participants were clearly (for the first time in Serbia) asked to use EE measures and RES. Public competition and following main design completion were used to encourage and educate the professionals to adopt EE and RES knowledge.

**Figure 1: Kindergarten "Tesla – Science for Life" in Block 67, New Belgrade. Design: DVA STUDIO. Photo: D. Vasović.**

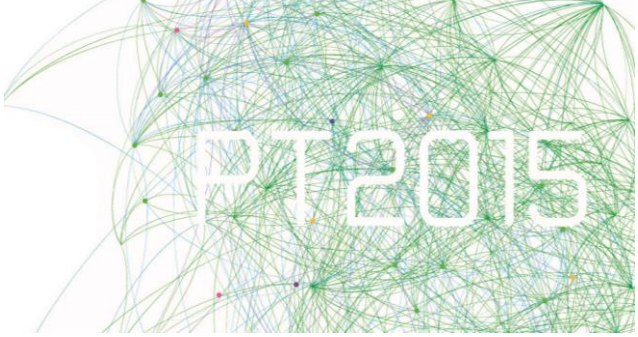
The first one of those kindergartens was opened in Bežanijska kosa (block 12) in May 2012, and the second one in University City (Block 67) in October 2013. The

Kindergarten in Block 67 was awarded with the Grand Prix of 36th Salon of Architecture in 2014. Kindergartens in Stubline (near Obrenovac) and in Bežanija (block 61) were opened in the beginning of 2015, while the construction of the fifth kindergarten in Voždovac (settlement Banjica) shall soon be launched. The project development defined the usage of different RES for each of five kindergartens (sub-geothermal water, geo probes, photovoltaic and water heating solar collectors, in order to reduce to the minimum the costs for heating, cooling and hot water preparation. The cost for energy consumption for these buildings is less than 1 euro cent/$m^2$. For the first time, there are directions for measurements and verification of the energy consumption defined in the project documentation.

**Figure 2: Kindergarten "Dragan Laković" in Block 61, New Belgrade. Design: AGM. Photo: D. Vasović.**

There is a small solar power plant in kindergarten in Bežanijska kosa, which should supply the electric power to the EPS (Serbian Electric Power Company) not just for pure economic reasons, but also as a role model (7 photovoltaic panels, 3.2 kW installed power). The construction of this kindergarten was the first opportunity for City administration to pass all the procedures for conditions, agreements and approvals, and also for setting-up of the privileged electric energy supplier to sell the electricity per "feed-in" prices. All five kindergartens and social building "Predah", are subsidised by Republic of Serbia in 4.7% of the total value of the construction of the building, in the RES part - for the works and installations, and thermal exchange.

Successes in kindergarten construction caused the "competition" in application of EE and RES measures in other public buildings. In the end of 2014, "Predah", a new social building for the temporary and occasional accommodation of children with autism was opened in Shakespeare's street. There are two compact EE buildings with whole day stay accommodation for the children, kitchen and administration. The buildings use similar EE measures as the five kindergartens: usage of RES for heating and cooling (underground water wells, heat pumps), solar system for the hot water (also for the kitchen and laundry) is combined with the usage of natural gas.




## ONGOING PROJECTS

The biggest EE and RES usage should be future social housing project in Ovča settlement in Belgrade. Design briefs were also acquired through public architectural competition. What makes the project unique is the fact that master plan united seven different rewarded designs. Total number of 965 social apartments and solidarity apartments were designed to be constructed in four phases. In total, around 70.000 $m^2$ of the apartments and 1.800$m^2$ of social and commercial usage, were designed. Preparatory works of the first phase (65 social and 185 apartments of Solidarity Fond) started. The project competes for the funding at European Committee, as aimed to accommodate internal refugees from KC Krnjača. The negotiations for the financial support of the second phase (235 apartments) are pending – Central European Bank might finance it from the Regional housing programme. The main challenge was a complete lack of infrastructure, except roads. Due to lack of sewage installation, there is a need for the wastewater treatment plant, due to lack of the heating system and gas pipeline, the thermal energy for this low energy consumption buildings should be produced in hydrothermal RES sources available at the site (during the summer, underground water will be used as technical water for the greenery). Along with low consumption of electrical energy for the heat pumps, these measures will enable remarkable savings for the apartment users and for the City of Belgrade. Energy and economy efficiency of the buildings are made possible through combination of the passive measures in urban and architectural design and usage of the low temperature energy distribution system – floor heating in the apartments. Along with the significant thermal insulation, both in the facades and roofs, PVC windows should be made of six-chamber profiles with low emission cover, double glazing and argon filling.

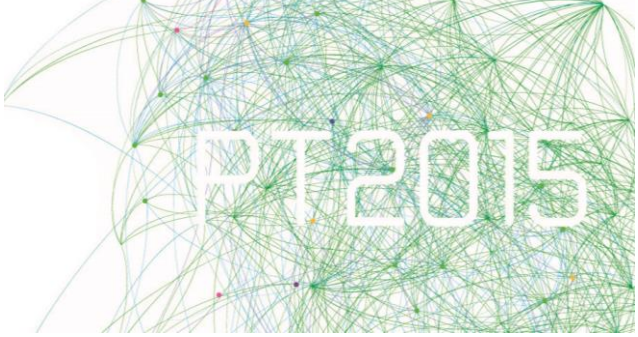
## CONCLUSIONS

Introduction of high-tech projects in public works is always challenging because of to inertia, complicated procedures, and already established routine. It is not only the building process that is challenging, but the operation time even more. Therefore, it is very important to spread the knowledge and information about new technologies to different levels.

## REFERENCES

Corburn, J. 2009. *Toward the healthy city: people, places, and the politics of urban planning*. MIT Press.

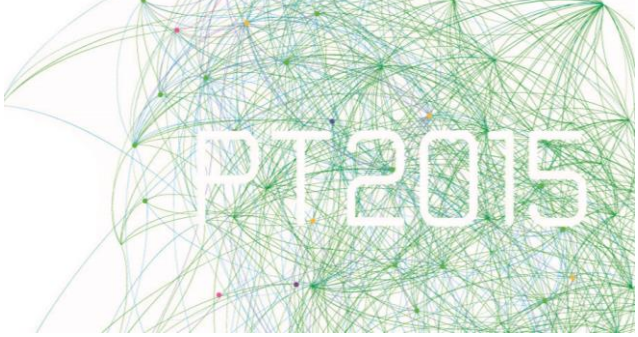
Prindle, B. et al. 2007. *The twin pillars of sustainable energy: synergies between energy efficiency and renewable energy technology and policy*. Washington, DC: American Council for an Energy-Efficient Economy.




UNDP Country Office of Serbia and Montenegro. 2004. *Stuck in the past – Energy, Environment and Poverty in Serbia and Montenegro.* UNDP Serbia and Montenegro.

Vasović, D. and Radulović, G. 2013. "Energetska efikasnost: Primer grada Beograda", *Polis* 6, no. 6 (December): 39–45.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# INDUSTRIAL HERITAGE IN ALBANIA AND THE OPPORTUNITIES FOR REGENERATION AND ADAPTIVE RE-USE

**Florian Nepravishta**
PhD, Associate Professor, Polytechnic University of Tirana, Faculty of Architecture and Urbanism, Albania, florian.nepravishta@fau.edu.al

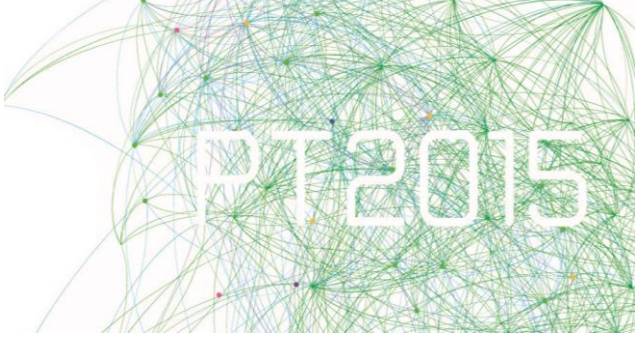
## ABSTRACT

*The industry as one of the sectors of economic development in Albania has been one of the main engines of growth in the period of communism. After the 1990s, industrial areas suffered major structural changes that were associated with the closure of many economic activities especially the industries that failed to resist to the new market economy. Inappropriate industrialization caused many environmental problems. Abandoned industrial heritage areas have been transformed into centers of urban degradation. These areas need sustainable regeneration to recall their importance for the community, but in a way not to lose their use. The purpose of this paper is to assess industrial heritage areas, to develop a clear picture of the existing situation, as well as the potentials and possibilities for their regeneration. It deals with the typological analysis and morphological development of industrial facilities, the extent of their damage and disconnection with the urban structure of the city. It analyzes three case study proposals of industrial brownfield regeneration and adaptive re-use that aim the protection of historical heritage, as well as the sustainable development of these areas. It is argued that regeneration and adaptive re-use of industrial facilities are seen as an opportunity and a new tendency to turn attraction to this heritage.*

***Keywords:*** *industrial heritage, brownfield regeneration, adaptive re-use, sustainable development.*

## INTRODUCTION

Albania has inherited some industrial facilities, which have functioned until the beginning of 1990, period of changing economic and political system, which already have lost their productive destination, a result of technical and economic factors, in front of the regional free market competitiveness. Although industrial heritage is an important proof of the economic, social and architectural development of the country, nowadays this heritage is forgotten and in risks of extinction.

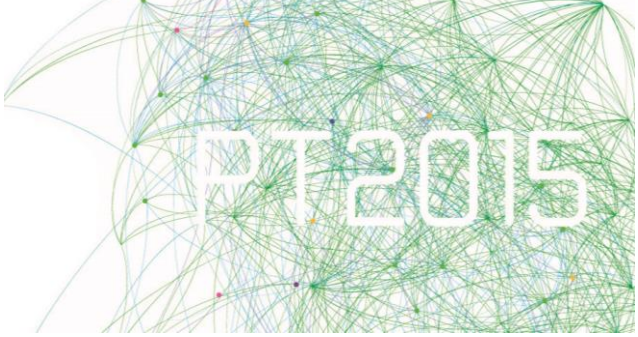



## HISTORICAL BACKGROUND OF INDUSTRIAL DEVELOPMENT IN ALBANIA

During the second half of the nineteenth century, Albania was characterized by economic growth in the shape of small craft workshops of artisanal character. Promote to free economic competition, locally between local artisans or on the European scale, was born the need to set up the first workshops based on technical manufacturing more advanced than that of craft workshops. Development of industrial processes in Albania has launched at the 70s of XIX century. The beginning of first elements of motor industry coincided with the period of performance of the second phase of industrialization of European countries (Frashëri et. al., 1976). The process of industrialization was expanded further in the beginning XX century and especially during the World War II and the occupation of Albania by Italian fascists, who invested for their interests by increasing the number of industrial enterprises in the country (Grup Autorësh, 1976).

The rapid industrial development, Albania had after the release of the country by the Nazi fascists and the establishment of the communist regime. Like any other sector in the country, the industry was involved in a centralized planned economy and run by state policies. After 1950, began the industrialization of the country through five years plans. In 70s, the development of light industry shifted in the development of the heavy industry with the support of China of Mao Tse-tung. Heavy industry and its massive development were characterized by the construction of the largest industrial complexes (Civici, 2012). During the five years plans for economic development, industrialization and urbanization took place concurrently. The construction of new factories and industrial complexes built were accompanied by the relocation of urban population in the former urban centers and the newly build industrial cities. The planning, design and construction of industrial facilities involved the most advanced intellectual and human resources of the time. Innovative structural systems, materials, special prefabrication systems were used. In the period 1980-1990, the decreases industrial economic development of the country was recorded prior to the levels of economic growth.

The collapse of the communist system in the early 90th hardens slowly production in almost all industrial facilities in the country. The industrial sector was a self-skeleton of its former, beyond any technological standard and competitive in a free market economy (Parangoni, 2010). After the 1992 economic reforms were undertaken to include industrial working facilities in a market economy. In this stage began the privatization of the large former industrial complexes, which were dissolved in separate production units. Various factors, including lack of proper training management, lack of financial capital, the incorrect application of contractual agreements, leaving passive mineral resources have brought degradation of industrial activity. By the last decade until today, the country's industrial heritage has lost its primary manufacturer destination. The transition to the inefficient privatization has reduced the opportunity for investment in




manufacturing. Facilities are left abandoned by increasing the opportunity for increasing the degree of degradation, environmental pollution, and to their complete destruction.

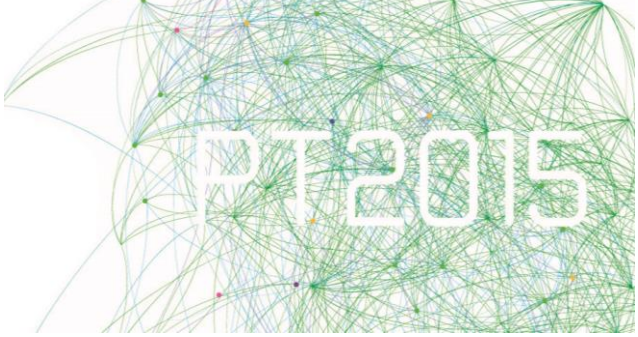
Economic analyzes carried out show that the country has potential for sustainable intervention in these industrial structures, to restore the primary function for which they were built, or their adaptation to new functions, suitable in areas where they are.

**PROBLEM OF INDUSTRIAL HERITAGE REGENERATION OF ALBANIA**

The transformation which the economy of Albania, after 90s, has been going through the restructuring of its industry and reorganization of its production, have resulted in a large number of unused, abandoned and neglected industrial brownfield sites, some of which are also in environmentally unsustainable condition. Industrial facilities built during the period of socialism until 1990 have the following common features (Nepravishta, 2013):

- They were established on the outskirts of cities, but with the rapid urbanization occurring after the 90s, these structures remain within the urban area.
- They constitute a group of buildings linked or not with each other, sometimes built with various construction technologies and materials.
- Standardization was one of the key elements that were used for saving and to increase efficiency in construction.
- After 70s in the construction was used the reinforced concrete skeleton and later use of pre-strained elements.
- Are designed and built without with minimum standards of comfort (no heating, lack of thermal insulation).
- They were subject to a higher level use and abuse compared with other buildings, and maintenance standards have been low.
- High level of pollution. Sometimes are used and harmful building materials like asbestos, lead, etc.
- Systems are fully amortized.

The majority of inherited industrial sites, previously developed as a built space nowadays, are evidently inefficiently used, but they have the potential for urban renewal and sustainable development. The majority of the sites that possess significant values and re-vitalizing possibilities are mostly owned by government institutions (Parangoni, 2010). Nowadays, the phenomenon of industrial heritage that marched the social and economic development of Albania has not been sufficiently explored or they're potential carefully evaluated; no official definition and classification are in use, and no formal approach to this rather complex problem is used by the national and local authorities.




## INDUSTRIAL HERITAGE AND SUSTAINABLE REGENERATION

Conservation of industrial artifacts and technologies began in Europe and the US in the 1950s and focused on the archeological preservation of the relics of the industrial revolution (Wang & Jiang, 2007). Industrial heritage regeneration has been the focus of the urban debate, both theoretical and practical, since the 1980's. A number of European countries and cities began the process of rebuilding and revitalizing their brownfield sites at different times in the past, while countries of the former Eastern Bloc have dealt with the problem of brownfield regeneration only since 2000. (Đukić et al. 2014)

According to the Nizhny Tagil Charter, industrial heritage refers to the remains of an industrial culture that possess historical, technological, social, architectural and scientific value. These sites describe and exhibit industrial histories, industrialism and the universal value of engineering, design, and planning. In principle, the Charter advocates 'preservation in situ' and thus, it recommends re-use that respects the functional integrity and offers psychological stability for local communities (TICCIH, 2003).

RESCUE defines sustainable regeneration of degraded areas such as process management, rehabilitation and return to profitable use in such a way as to ensure the attainment and continued satisfaction of human needs for generations present and future about environmental sensitivity, economic stability, strong and institutionally acceptable by society, and in a balanced way within a specific regional context (RESCUE, 2003). Significantly, this concern of sustaining local cultural contexts and transforming obsolete spaces into viable places within industrial heritage conservation connects itself with urban regeneration, which basically seeks historic, aesthetic and economic elevation of degenerated areas (Choa & Shin, 2014).

## VALORIZATION AND ADAPTIVE RE-USE OF INDUSTRIAL HERITAGE SITES

Industrial heritage is a relatively new compared to other cultural heritage objects. Social consensus on acknowledging industrial spaces as heritage sites are not yet widely reached while they are under the pressure of remodeling, demolition and redevelopment (Choa & Shin, 2014). The first step toward the reactivation of this resource concerns in Albania is the formulation of a national strategy for the regeneration of industrial heritage, as an alternative to a society that continuously grows and heavily depletes its natural resources. For this it is necessary:

1. Registering an listing of industrial properties,
2. Identifying, inventorying and evaluating the condition of industrial properties,
3. Classification, assessment o f their development potential,
4. Regeneration and adaptive re-use.

Adequate evaluation and planning processes, expert advice, and appropriate funding are required to facilitate good intentions of conservation (Pearson & Sullivan, 1995). Public initiatives and governmental intervention, which could coordinate financial resources and long-term management planning, are required for sustainable maintenance (Choa & Shin, 2014). Regeneration of industrial heritage has sought to find a way that obsolete industrial buildings and sites without damaging the embedded cultural and historical significance can be preserved and accommodate new socio-economic demands. In this respect, adaptive re-use has been regarded as one of the desirable conservation options, which could maintain physical forms and pursue their continuous utilization in a cost-effective way (Bullen & Love, 2010; Nepravishta, 2013; Yildirim & Turan, 2012; Yung & Chan, 2012). Re-use and regeneration of obsolete industrial spaces has been discussed and practiced as a new method for changing negative images of declining areas, promoting public participation in conservation and boosting regional development (Andrei, 2010; Hospers, 2002; Mansfeld, 1992; Olgethorpe, 1987; Pretes, 2002; Ronchetta&Trisciuglio, 2008; Tagliaferri, 2006; Wang, 2009).

In contrast to the dwellings and commercial facilities, adaptive re-use of industrial facilities was less common in Albania. Reuse of industrial facilities for other purposes has not been as numerous as in other buildings. It is because the size, condition and structural composition, in many cases, were not suited to adapt to other functions. Mainly existing industrial facilities are reused for a new industrial function, and some of these structures were reused as small workshops, offices, shopping centers, housing for the homeless people. Economic problems and technological backwardness have to inherit physically depreciated and outdated industrial buildings that have lost their functions. Regeneration and adaptive re-use of this property is a possible option for preservation of this heritage, but this is dependent on the financial and legal factors. Today, some of local government policies tends to encourage the regeneration of industrial areas (e.g. the adaptive re-use of the former Auto-tractors Factory in Tirana for social housing, etc.), since it is one of the interventions that have positive effects on sustainable urban development.

Some industrial heritage sites can be used for the same purpose, and other can change the use to other ones. In question is the feasibility of the intervention were economic one is the most important. New functions and usages might better reinforce heritage values and promote future sustainability. Adaptive re-use can foster the economic regeneration of industrial areas by creating and establishing cultural values of obsolete spaces and their social recognition and viability of the heritage sites. The question of which functions can best convey social memories embedded in such spaces emerges as an important issue. For these reasons a set of assessments has to be done in different phases of an adaptive re-use project (Fig. 1).

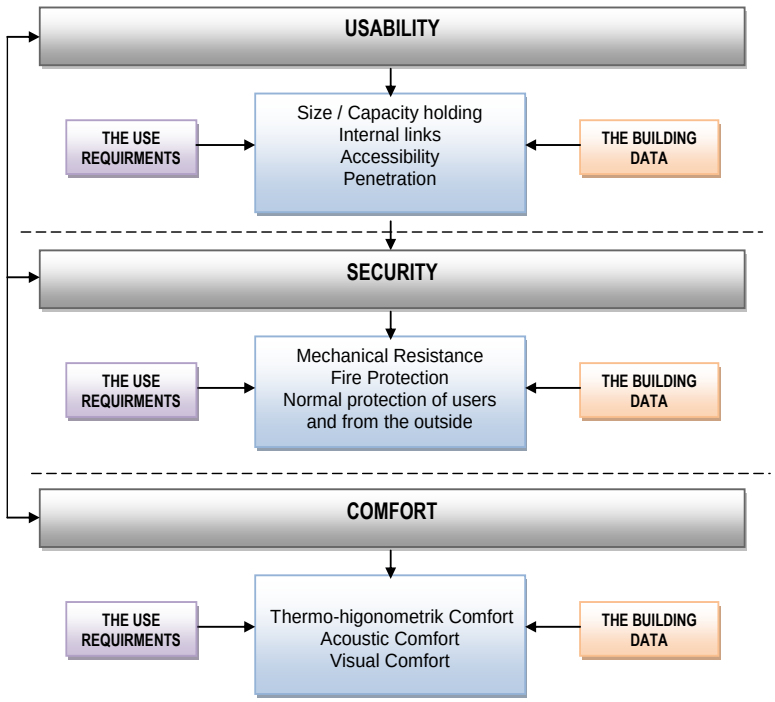



**Figure 1: Comparison of functional requirements in relation to the building data (Nepravishta, 2013).**

## CASE STUDIES: PROPOSAL FOR INDUSTRIAL REGENERATION AND ADAPTIVE RE-USE

### Former iron-nickel extraction and processing factory Guri i Kuq, Pogradec

Industrial complex of extraction and processing of iron-nickel was built with Chinese support in the years 1976-1980. The area interacts as a full-cycle industry, starting with the extraction of iron in the tunnels of the mine and 16 processing facilities of the industrial complex. It was used for 15 years for producing Ferro-nickel. Since 1992, the complex is abandoned and is going to the buildings physical degradation. The slope of the terrain favored the land sliding, bringing soil inside the facilities, and therefore damaging of retaining structures. The iron ore, stored for years in the shape of industrial stocks of thousands of tones, is a major pollution problem of soil, groundwater in the surrounding area.

For this reason, it is necessary to propose a future transforming of the area and integrated with the city, to bring back the memory of the community, as one of the most populated areas of the former time. Identification of the current state of the Guri Kuq area was essential for finding ways to regenerate it. In this regard, the

activities that are proposed to be incorporated, for the preservation of the identity of existing buildings and site are recreational, social and cultural character, for the tourism and economic development of the area supported by advanced technology that are capable to provide a high quality environment (Fig. 2).

**Figure 2:** ***Existing situation and adaptive re-use for youth center; hotel and spa. Source: DAU archive.***

## Former factory for extraction and processing of iron mineral in Përrenjas

The industrial city of Përrenjas was established in 1961 with the construction of the iron processing plant. It was built according to a well-defined plan and the creation of all ancillary elements of the city Geology and Mining in 1963, hospital workers, workers' houses and cultural buildings. After the bankruptcy and closure of the industrial activity since 1992, the industrial facilities remain unusable and are deteriorated. The industrial dumps are turned to an environmental threat, because they are located too close to the inhabited area.

Intervention in this industrial area is efficient because the physical condition of the facilities is good, in general because the structure of the buildings has resisted in time. One possible option is to restore the original function, but the restoration of the mine creates environmental problems because it is very close to the inhabited area. Proximity to the urban area will be defined the strategy for the regeneration of the contaminated area. Adaptive re-use of existing structures in public facilities like cultural feature, social and educational would be appropriate solution by bringing local economic development, employment, education and youth activity (Fig. 3).

**Figure 3:** ***Existing situation and adaptive re-use for social activities. Source: DAU archive.***

## Industrial area of the Thermo Power Plant in Fier

In the period 1960-80, city of Fier turns into one of the most important industrial centers of the country. The industrial zone of chemical and energetic complex is positioned on the southern edge of the city. It has provided great opportunities for employment and development of the city and the entire region. Thermo Power Plant was built in 1966 with the help of China and Czechoslovakia. Building typology represents a grouping based on two units, manufacturing facilities; administration and maintenance facilities. In a general plan, this industrial area conceived as a very flexible and with good morphological development.

Since 2007 TPP of Fier was not in function as the entire industrial complex. The current technical condition leaves much to be desired; over 90% of the equipment does not function. The industrial complex represents degradation of facilities and disposition to the creation hazardous areas and with high content of harmful substances. In general conclusion, this area has lost compactness to work as a whole.

Despite numerous claims that are a result of the drop, the area offers the potential and real value, which can be exploited for various purposes. Among the values that represent this area, we can mention the presence of a regular orthogonal network, placement of objects and roads, significant surface and strategic positioning against national road network. Sustainable adaptation of the industrial zone would consist in the realization of some poles with different functions of incubators with research laboratories in the field of sustainable energy and agribusiness (Fig. 4).

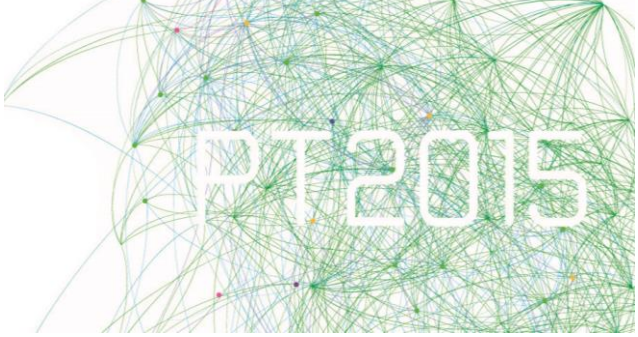
**Figure 4:** ***Existing situation and adaptive re-use for science incubators. Source: DAU archive.***

## CONCLUSIONS

The social, cultural, environmental and economic potential inherent to some of the industrial heritage sites in the main industrial cities of Albania indicates their importance for the urban community and points out the necessity for their regeneration. These abandoned and disused sites represent an exceptional strategic reserve of space and urban resource. Industrial heritage reactivation is an economical solution that supports sustainable urban development based on more efficient exploitation of urban spatial resources.

The assessment system can be applied by heritage institutions (Institute of Cultural Monuments) to suit the needs of the industrial heritage preservation in the wider context of Albanian to better manage the entire built heritage resource. Preservation of industrial heritage, as a key strand of the country's history, could be part not only of cultural institutions but need to be very important part of local and the national planning policy.

The analysis of three case studies noted that despite political factors, economics and technology that led to their breakthrough, has brings to the conclusion that such industrial areas offer great potential and opportunities for adaptive re-use. These potential and development opportunities compared with different needs and concerns of the site and surrounding areas, such as pollution, degradation, informality, and backwardness, can be translated into possible practical solutions. It can be seen as a new opportunity for return to function not only of these abandoned areas but also for the overall economic and social development of region.




## REFERENCES

Andrei, R. 2010. Industrial building conversion the poaching of an already poached reality. Bulletin of the Polytechnic Institute of Jassy, 52, 157-164.

Bullen, P. A., & Love, P. 2010. The rhetoric of adaptive re-use or reality of demolition: view from the field. Cities, 27(4), 215-224.

Đukić, A., Simonović, D., Vujičić, T. 2014. BrownInfo. Toward a Methodological Framework for Brownfield Database Development, Banjaluka, November, p. 6.

Frashëri K. et. al. 1976 "Zhvillimi ekonomik dhe shoqëror i shqipërisë gjatë shek. XIX - fillimi i shek. XX**".** Historia e Shqipërisë, Vëllimi II, Akademia e Shkencave të R.P.S të Shqipërisë, Instituti i Historisë, 1976.

Autorësh, G. 1976 "Historia e Shqipërisë", Vëllimi III, Akademia e Shkencave të R.P.S të Shqipërisë, Instituti i Historisë, 1976.

Hospers, G.2002. Industrial heritage tourism and regional restructuring in the European Union. European Planning Studies, 10, 398-404.

Mansfeld, Y. 1992. Industrial landscapes as positive settings for tourism development.Geo Journal, 28, 457-463.

Choa, M., Shin, S. 2014. Conservation or economization? Industrial heritage conservation in Incheon, Korea. Habitat International 41 (2014) 69-76.

Nepravishta, F. 2012 "Rehabilitimi dhe Adaptimi i Ndërtesave". Monografi. Publishing house Pegi, Tiranë.

Olgethorpe, M. 1987. Tourism and industrial Scotland. Tourism Management, 8(3), 268-271.

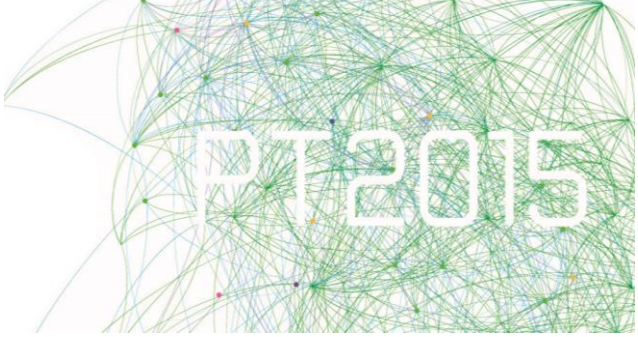
Pearson, M., & Sullivan, S. 1995. Looking after heritage places: The basics of heritage planning for managers, landowners and administrators. Carlton: Melbourne University Press.

Pretes, M. 2002. Touring mines and mining tourists. Annals of Tourism Research, 29(2), 439-456.

Ronchetta, C., Trisciuglio, M., 2008. Progettare per il Patrimonio Industriale. Celid, Giugno 2008.

Tagliaferri, M. 2006 Industrial Chic- Reconverting Spaces. Edizioni Gribaudo srl. Arti Grafiche DIAL-Mondovi (CN-Italy).

Yildirim, M., & Turan, G. 2012. Sustainable development in historic areas: adaptive re-use challenges in traditional houses in Sanliurfa, Turkey. Habitat International, 36, 493-503.




Yung, E., & Chan, E. 2012. Implementation challenges to the adaptive re-use of heritage buildings: towards the goals of sustainable, low carbon cities. Habitat International, 36(3), 1-10.

Wang, J. 2009. "Art in capital": shaping distinctiveness in a culture-led urban regeneration project in Red Town, Shanghai. Cities, 26(6), 318-330.

Wang, J., & Jiang, N. 2007. Conservation and adaptive-reuse of historical industrial building in China in the post-industrial era. Frontiers of Architecture and Civil Engineering in China, 1(4), 481- 490.

Internet source:

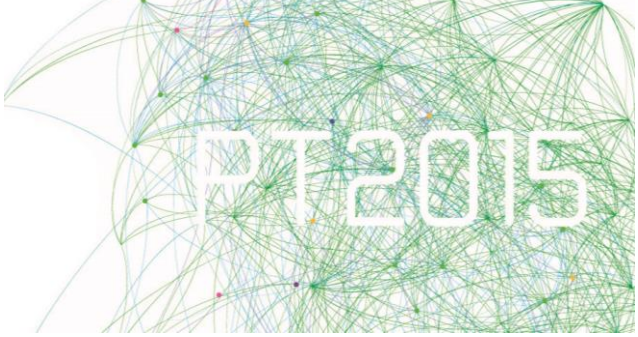
Civici, A., (2012). Ekonomia shqiptare gjatë regjimit komunist 1945-1990, Available: www.monitor.al.

Parangoni Ilir 2010. Assessment of Industrial Heritage in Central Albania. The Albanian Heritage Foundation – Report, November 2010. Available www.albanianheritage.net

RESCUE Consortium 2003. Analytical Sustainability Framework in the Context of Brownfield Regeneration in France, Germany, Poland and the UK, Final report of Work Package 1. Available: www.rescue-europe.com

TICCIH, 2003. Nizhny Tagil Charter TICCIH XII International Congress, July 2003. Available: http://international.icomos.org/18thapril/ 2006/nizhny-tagil-charter-e.pdf.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# THE POSSIBILITIES OF THE APPLICATION OF THE CONCEPT OF HEALTHY CITY IN ILLEGAL SETTLEMENTS IN SERBIA

**Branislav Antonić**[1]
Assistant scientific researcher and PhD student, Faculty of Architecture, University of Belgrade, Bulevar kralja Aleksandra 73/2, Belgrade, Serbia, antonic83@gmail.com

**Biserka Mitrović**
Assistant Professor, Faculty of Architecture, University of Belgrade,
Bulevar kralja Aleksandra 73/2, Belgrade, Serbia, biserkamitrovic@gmail.com

## ABSTRACT

*The importance of healthy life has become important issue in cotemporary settlements in last decades. Thereby the meaning of "health" has been transformed from strictly sectorial view to a wider interpretation, being used in the context of local community and city development. This broader prospect has resulted in the creation of healthy city concept as a recognisable theoretical concept, based on the striving for healthy environment and good quality of life.*

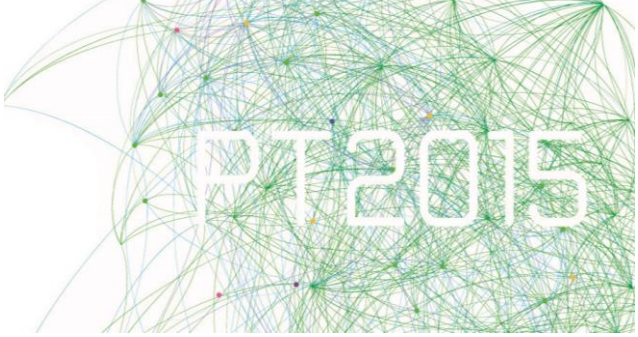
*Globally, communities face pressing health challenges related to the built environment, so the awareness about the need to make the link between human health and development has grown, as well as the urge of establishing the concept for a healthy city. While the framework and general goals are being recognised internationally, the local adjustments and characteristics, related to the national and regional context, have not yet been made.*

*Further, special challenge is how to approach to less developed communities and areas in developing countries in transition, such as Serbia. Even bigger challenge is to examine and test the possibilities of the application of the healthy city concept for the illegal settlements in Serbia. In such settlements, which lack basic infrastructure, amenities and services, the need for improving the quality of life is even bigger. This paper aims to contribute to the advance of practice and policy for healthy places and cities, by defining a local sensitive approach for the informal areas in Serbia.*[2]

***Keywords**: healthy places, quality of life, illegal settlements, application.*

[1] Corresponding author

[2] This paper is done as a part of research project "Research and systematization of housing development in Serbia, in the context of globalization and European integrations, with the aim of housing quality and standard improvement" (TR 036034), financed by Ministry of education and science of Serbia.




## INTRODUCTION

The concept of healthy city is one of known hybrid theoretical concepts in urbanism, which connects this discipline with public health. Thereby, the meaning of public health is becoming wider today, far away from initial coverage. Cotemporary definition includes also the feature of the dependency of the health of population from the conditions and commodity of communal life and environment (WHO, 2012). This relation between public health and space has been crucial for the creation of the concept. Therefore, the concept strives to develop healthy cities, where both healthy environment and good quality of life would be significant (Edwards &Tsouros, 2008, p. 3).

The importance of the formation of healthy cities is especially visible in developed part of the World. Current conditions of life here enable mentioned "extension" of the focus to urban issues which are related to public health. Europe is good example among global regions. The implementation of the measures, proposed by the concept, is one of main pillars of World Health Organization[3] in Europe.

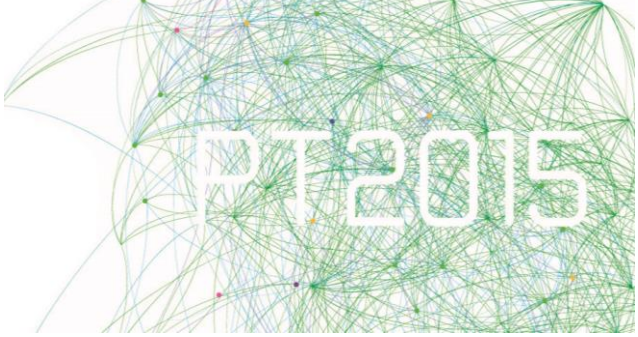
But, Europe isn't a "monolith", so there are many local variations. Hence, it is special challenge how to introduce and implement the concept of healthy city in less developed communities and areas in European countries in transition, such as Serbia. Transition has especially shaken up the most vulnerable communities in country, such as illegal settlements around major cities in Serbia (Tsenkova, 2012). Inherited lack of basic infrastructure, amenities and services in these settlements has been even increased by transitional conditions. In accordance to this, the need for improving the quality of life and public health is quite noticeable in these places.

Considering previous, illegal settlements in Serbia are very suitable "polygon" for the possibilities of the implementation of the concept of healthy city "in situ". Huge illegal settlements around Belgrade are certainly the most triggering areas in Serbia for such analysis. Their main characteristics will be analysed by the concept propositions in this paper. The aspiration of the paper is the contribution to the advance of practice and policy for healthy places and cities. The paper should be also understood as a one step in the development of theoretical framework for the upgrading of illegal settlements in Serbia.

## THE MAIN ELEMENTS OF THE CONCEPT OF HEALTHY CITY

The concept of healthy city was mentioned first time in 1986 (Awofeso, 2003). So, it is relatively modern concept. As well as many modern theoretical concepts, it isn't easy to define the concept of healthy city, because its hybridness makes it more complex. The most obvious - the concept is certainly related to general

[3] Hereinafter: WHO.




improvement of public health[4] as a constant process, including essential functions and services (WHO, 1999, p. v). This is probably main reason why WHO accents than the concept is more familiar with process than outcome. Therefore, some experts compare the meaning of healthy city with a city with vivid life or active city (Edwards and Tsouros, 2008, pp. 1-6). Further, this means that healthy city is (WHO Europe, 2010):

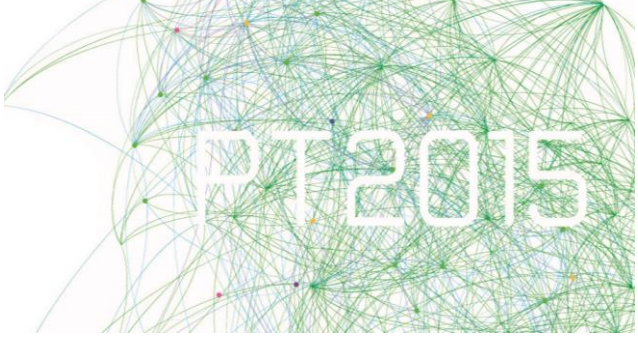
- Healthy city is not one that has achieved a particular health status;
- It is conscious of health and striving to improve it. Thus any city can be a healthy city, regardless of its current health status;
- The requirements are: a commitment to health and a process and structure to achieve it;
- A healthy city is one that continually creates and improves its physical and social environments and expands the community resources that enable people to mutually support each other in performing all the functions of life and developing to their maximum potential.

But, widely-organized "definition" is certainly inappropriate for concrete implementations. Thus, regional offices of WHO works on locally-based policies of healthy cities, as well as closer concepts and themes. For example, WHO Europe recommends a basic model for a healthy city in related region, which based on "strong movement for public health at the local level" (WHO Europe, 2010). Fundamental spatial-oriented elements of the model are included in three main urban themes: caring and supportive environments, healthy living and healthy urban design (WHO Europe, 2009, pp. 1-3). They can be elaborated through following principles (WHO Europe, 2010):

1. High-qualitative, secure and stable physical environment;
2. The accessibility of basic needs (food, water, shelter, income, safety and work) for all the people in community;
3. A diverse, vital and innovative economy;
4. Connectedness with the past - cultural and biological heritage of place;
5. An optimum level of appropriate public health and sickness care services, accessible to all.

In order to strengthen the implementation of the concept in Europe, WHO/Europe has developed specific approach, known as HEALTH21 policy framework. This approach includes 21 targets (WHO, 1999, pp. 3-4). They are created in "idealistic form"[5], so the achievement of them can be considered as a "permanent duty". WHO/Europe has developed a variety of guidance documents as tools for the implementation of the concept.

[4] Thereby, public health should be understood as a set of preventing actions of human-health protection by the promotion of healthy behaviours, communities and environments.
[5] For example, one of the targets is: equity in health, or closing the health gap within countries.




## THE APPLICATION OF THE CONCEPT IN THE CASE OF ILLEGAL SETTLEMENT IN BELGRADE, SERBIA

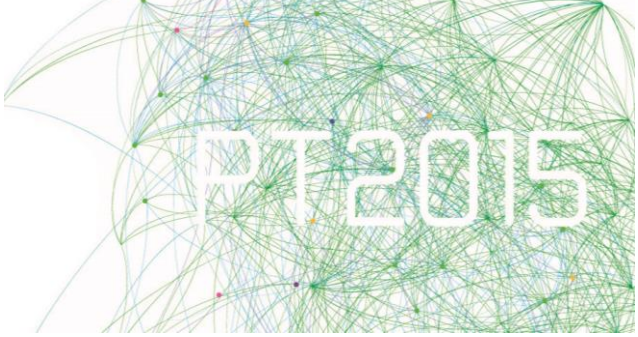
Recognising the fact that the concept of healthy city is strongly related to general improvement of public health, it can be concluded that it should be especially implemented in the places with obvious lack of it. In European context this is the situation with illegal settlements in South East Europe. Majority of illegal settlements is situated in peri-urban areas of main cities in SE Europe. This process is accelerated during transitional period of post-socialistic transformation (Tsenkova, 2010, pp. 6).

Illegal settlements around Serbian capital Belgrade are certainly good example for such research. Besides inherited "tradition" of illegal building from socialist period and harsh transitional circumstances, the growth of illegal settlements around Belgrade has been also significantly caused by wars and refuges' influx (Mitrović, Ralević, Antonić, 2014, p. 72-73). Although exact figures about illegal settlement are scarce, it is estimated that are more than 150.000 units, which occupy circa 44% of the total housing area in Belgrade (Simeuncevic Radulovic, Mitrovic, Ralevic, Djurovic, 2013). Hence, illegal settlements are so significant, that they cannot be skipped in any policy of Belgrade development.

Illegal settlements in Belgrade keep both general and specific characteristics of illegal and informal building in SE Europe. These characteristics are (TPIB, 2001-09):

**Table 1: Main characteristics of illegal settlements of Belgrade, Serbia.**

| No | Characteristic - Crucial meaning and description |
|---|---|
| C1 | POSITION - The largest informal settlements of Belgrade are situated at the North Eastern and Southern outskirts of Belgrade, as well as on the left Danube riverbank, expanding to the north |
| C2 | DENSITY - Surprisingly, there is still a decent share of green areas. The concentration of buildings is the highest along the main traffic corridors |
| C3 | "URBAN" FUNCTIONS - Dominant land use is for residential areas (approximately 90% are Single-family detached homes), but there is significant share of non-residential land use, concentrated along the main traffic corridors |
| C4 | TRAFFIC NETWORK is irregular and insufficient. In the future, street regulation could be very difficult since it would cause massive demolishing of houses |
| C5 | OTHER INFRASTRUCTURE - Except the electrical network the infrastructure mostly does not exist. |
| C6 | URBAN STRUCTURE of such housing areas is irregular and spontaneous |
| C7 | PUBLIC SERVICES - One of the main problems about informal settlements' land use structure is lack of public spaces and services |
| C8 | PUBLIC PERCEPTION - Informal housing areas in Belgrade are mostly perceived as impersonal and disharmonized residential area, being neither quite urban, nor rural settlements. |




## ANALYSIS

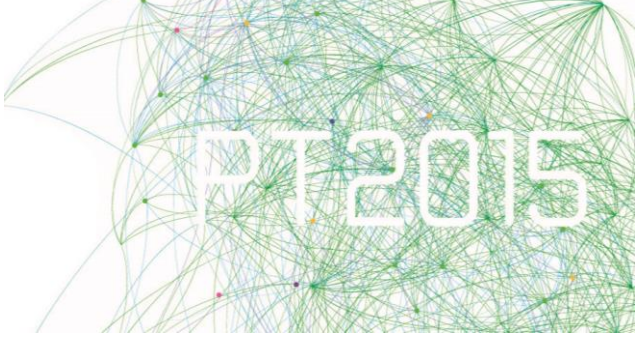
**Table 2: The possibilities of the implementation of "European model" of healthy city in Europe in illegal settlements of Belgrade, Serbia.**

| The principles of the concept of healthy city | Targeted characteristics | Possibilities of implementation - Settlements' improvement |
|---|---|---|
| 1. high-qualitative, secure and stable physical environment | C1, C2, C6, C7 | • Stable land and middle density enable physical security<br>• The use of current greenery and new public services as focal points for high-qualitative and secure environment |
| 2. the accessibility of basic needs (food, water, shelter, income, safety and work) for all the people in community | C1, C4, C5 | • The regulation of traffic network and the introduction of other infrastructure can be led simultaneously<br>• The position of the settlements is usually near to main traffic corridors, which simplify "home-work" transport connection |
| 3. a diverse, vital and innovative economy | C3, C8 | • The development of the part of settlements along the main corridors with commercial facilities as a "driving force" for local economy<br>• The use of "urban-rural" facilities as a gain for local economy |
| 4. connectedness with the past - cultural and biological heritage of place | C2, C8 | • The preservation of greenery in order to keep natural heritage of place<br>• The preservation of "urban-rural" element as a cultural uniqueness |
| 5. an optimum level of appropriate public health and sickness care services, accessible to all | C2, C3, C4 | • Current unbuilt land enables possible location of health services and other public facilities<br>• The preservation of green areas as a prevention for good healthy conditions<br>• The vicinity of main transport corridors as a possibility for fast sickness care service |

## CONCLUSION

This concise analysis tried to present the possibilities of the implementation of the concept of healthy city in unique context of illegal settlements in Belgrade, Serbia. The use of so-called "European model" of the healthy city narrowes the analysis to specific themes for European cities. This approach enables the clear connection of the concept with main characteristics of illegal settlements. This can be seen by the analysis in the table, where every principle of the concept can be match with appropriate characteristics of illegal settlements in Belgrade.

Further, used method in the analysis also gives the opportunity to form the list of particular actions in space of illegal settlements as possibilities for the implementation of every observed principle of concept. Therefore, it enables simple relations from theoretical foundation to implementation in reality.




Finally, the analysis also points that the problems with public health in illegal settlements in Belgrade and, generally, in SE Europe are very visible. Thus, the forming of particular approach and related documents for such settlements should be important step for future implementation of the concept in Europe.

## REFERENCES

Awofeso, N. 2003. "The Healthy Cities approach - reflections on a framework for improving global health". *Bulletin of the World Health Organization*. 81, no. 3 (January).

De Leeuw, E., Tsouros, A. , Dyakova, M. and Green, G. 2014. *Healthy cities: Promoting health and equity – evidence for local policy and practice*. WHO Europe. Accessed April 15, 2015.

Edwards, P. and Tsouros, A. 2008. *A Healthy City is an Active City: A Physical Activity Planning Guide*. Copenhagen: WHO Europe.

Mitrović, B., Ralević, M., Antonić B. 2014. "The Illegal Settlements in Belgrade VS Taming City: Growth Case Study of Belgrade", In *Proceedings of International Academic Conference on Places and Technologies*, edited by E. Vaništa Lazarević, A. Krstić-Furundžić, A. Đukić and M. Vukmirović, 71-77. Belgrade: Faculty of Architecture.

Simeuncevic Radulovic, S., Mitrovic, B., Ralevic, M., Djurovic, M. 2013. "Informal Growth of Housing in Belgrade under the Impact of Transition to Global Economy", *Planum - The Journal of Urbanism*, n.26, vol. 1/13, 1-13.

Town Planning Institute of Belgrade - TPIB, 2001-2009, *Master plan of Belgrade 2021*, Belgrade: TPIB.

Tsenkova, S. 2012. *Urban Planning and Informal Cities in Southeast Europe*. Accessed April 8, 2015.

Tsenkova, S. 2010. "Informal settlements in post-communist cities: Diversity factors and patterns". Urbani izziv 21, no. 2 (December), 2010: 5–15.

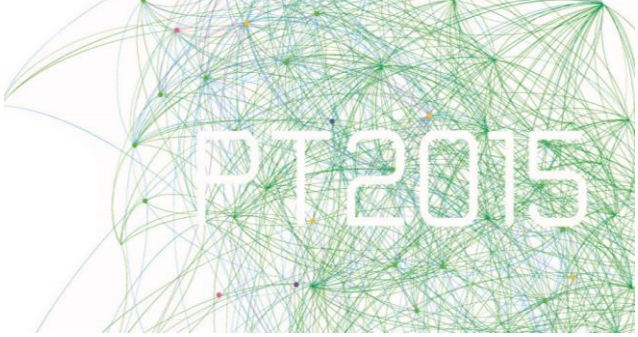
World Health Organization - WHO. 1999. *Health21: the health for all policy framework for the WHO European Region*. Accessed April 15, 2015.

World Health Organization - WHO. 2012. "Public Health." Glossary of globalization, trade and health terms. Accessed April 8, 2015. http://www.who.int/trade/glossary/ story076/en/.

World Health Organization Europe - WHO Europe. 2009. "Zagreb Declaration for Healthy Cities". Accessed April 15, 2015.

World Health Organization Europe - WHO Europe. 2010. "What is a healthy city?". Accessed April 15, 2015. http://www.euro.who.int/en/health-topics/environment-and-health/urban-health/activities/healthy-cities/who-european-healthy-cities-network/what-is-a-healthy-city.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# URBAN REGENERATION AS A TOOL FOR POPULATION HEALTH IMPROVEMENT

**Filip Petrović**
PhD student, Teaching Assistant, University of Belgrade, Faculty of Architecture, Bulevar kralja Aleksandra 73/II, sevenarh@gmail.com

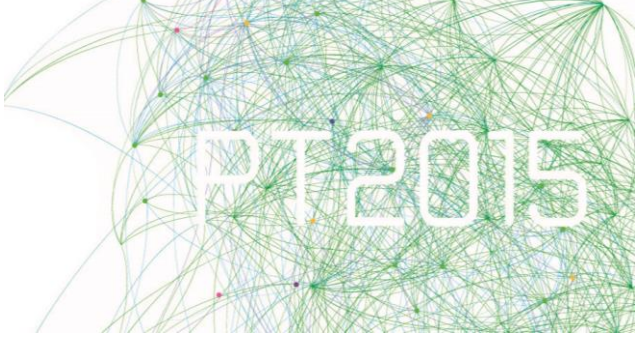
## ABSTRACT

*Poor health is associated with poorer living circumstances (Ellaway et al., 2012) and there is therefore, a logical expectation that housing improvements and area regeneration in disadvantaged urban areas will improve health and reduce social inequalities in health (Kearns et al., 2009; WHO Commission on Social Determinants of Health, 2008). Urban regeneration can thus be considered a public health intervention whereby improvements in health and wellbeing are stated as specific aims of regeneration strategies (Beck et al., 2010). Regeneration in most cases includes a range of activities that potentially may improve the interlinked realities of household, dwelling, community and neighbourhood environment in urban areas, thereby impacting on many of the social determinants of health (Dahlgren and Whitehead, 2007). However, to date the evidence that regeneration activities achieve these health benefits is limited or weak and any health effects are small (Jacobs et al., 2010). Evidence for long-term effects and the mechanisms by which different interventions or combinations of interventions might lead to positive health outcomes tend also to be rare (Jacobs et al., 2010). There are also concerns that regeneration activities may have unintended consequences of social disruption and displacement through gentrification (Lindberg et al., 2010). This paper therefore collects information and evidence of urban regeneration projects in a systematic way, both from historic urban regeneration projects and new modern models of regeneration, analysing and evaluating them from population health impact perspective. Paper concludes with recommendations of necessary future aims and methods to implement in urban regeneration projects as to achieve improvements in population health and health equality.*

***Keywords**: urban regeneration, population health, effect, improvement, gentrification.*

## WHERE WE LIVE MATTERS FOR OUR HEALTH

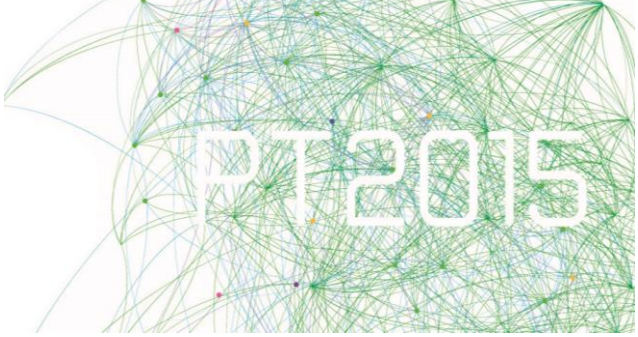
Poor health is associated with poorer living circumstances (Ellaway et al., 2012) and there is therefore, a logical expectation that housing improvements and area regeneration in disadvantaged urban areas will improve health and reduce social inequalities in health (Kearns et al., 2009; WHO Commission on Social




Determinants of Health, 2008). Where we live is essential for our daily lives. For most people, home is a place of safety, security and shelter, where families come together. Housing generally represents family's greatest single expense, and, for homeowners, their greatest source of wealth. Given its importance, it is not surprising that factors related to housing have the potential to help or harm our health in different ways. This paper briefly examine many ways in which housing and neighbourhoods can affect our health and recommend strategies to improve population health through healthier homes and healthier neighbours, achieved by urban regeneration projects. Urban regeneration can thus be considered a public health intervention whereby improvements in health and wellbeing are stated as specific aims of regeneration strategies

## CHANGING THE PHYSICAL, ECONOMIC AND SOCIAL ENVIRONMENT

Urban regeneration is primarily concerned with regenerating cities and early/inner ring suburbs facing periods of decline due to compounding and intersecting pressures (in its widest sense: social, economic, cultural, physical) through policies and programmes. An urban regeneration project is typically a partnership undertaken by local and / or central government, the local community and sometimes private developers (Johnson, Gregory, Pratt & Watts, 2000). Regeneration in most cases includes a range of activities that potentially may improve the interlinked realities of household, dwelling, community and neighbourhood environment in urban areas, thereby impacting on many of the social determinants of health. The historical and theoretical underpinnings of urban regeneration have their genesis in the spirit of modernity at the turn of the late nineteenth century. Urban regeneration has been known under many different names in different countries and different times such as: Slum Clearance, Reconstruction, Revitalisation, Urban Renewal and increasingly Urban Renaissance. With each of these names come different public policy objectives and aims. The re-development or rehabilitation of "depressed" urban areas has often been justified and executed as a means of improving housing and environmental conditions (Gibson & Langstaff, 1981). The term "slum clearance" and the symptoms of "urban decay", poor housing, social and environmental conditions, have been the main focus of many urban renewal initiatives, especially in post-war England (Gibson & Langstaff, 1981). Today, urban regeneration embodies physical development and also economic objectives, such as stimulating investment and employment, as well as social objectives, such as alleviating the problems caused by poverty and disadvantage (Fitzpatrick et al., 1995). Most conceptions of urban regeneration hold that physical, economic, social and health problems are entwined and that regeneration will not be sustainable unless all aspects are tackled.



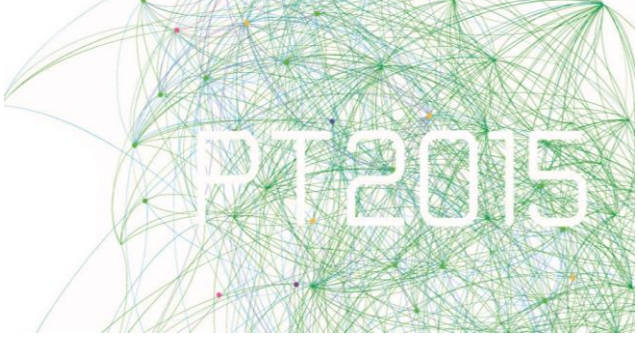

## PLACE AND HEALTH

Health is affected by how we feel about a place. Opportunities for social interaction in a local neighbourhood are key for developing good health. A simple facility like a small café or landscaped garden with seating can be an important meeting place and the focus of community life, such as the Plaza common in Latin and Hispanic cultures (Low, 2000). Within the urban environment, urban design and planning can influence health, for example, the creation of better health by walking, running or cycling to destinations, rather than travelling by car or induce poor health as a result of low-density development or urban sprawl which has been associated with a number of adverse health, social welfare and ecological conditions (Knox, 2003).

Observed differences in health impact between places have traditionally been attributed to one of the two possible explanations: compositional and contextual. The first explanation is that differences in health impact between places are a result of the differences in the characteristics of people who live in these places (a compositional explanation). Often tied to this explanation is the fact that lower individual socio-economic status is associated with poorer health outcomes. The other explanation is that differences in health between places are due to differences in the characteristics of these places (a contextual explanation). This explanation is given when differences cannot be explained by individual factors. Kawachi and Berkman (2003) argue that this distinction is somewhat artificial due to evidence of the interrelationship between people and places. People create places and places create people. It is generally recognised within the literature that concentrations of disadvantage in certain areas within cities is the result of a complex mix of social, spatial, economic and political forces, and that the local neighbourhood is important in shaping these processes (Skifter Andersen 2003). This spatial segregation is not a simple result of social inequality, but of the interaction between social and spatial processes that simultaneously create both social and spatial inequality (Skifter Andersen 2003). Place is, therefore, important. Hence the focus on places and place-based interventions in current urban renewal projects.

Although commonly known that certain places have better health impact than others, still many health promotion projects and public health polices only focus on individuals. Focus should be, instead of changing behaviours, to use urban regeneration to remake city areas by improving social and physical environment. Used in conjunction with behavioural approaches, urban regeneration would aim to improve the aspects of the urban environment more health promoting. For example, urban regeneration projects could aim to improve the availability, quality and prices of healthy food, improve the accessibility to sports grounds and green spaces, aim to lower crime and improve primary health services.

The physical and social characteristics of the urban environment are intertwined. MacIntyre and Ellaway (2000) suggest a link between social interaction, place and health and argue that socially constructed features of the built environment or in their terminology “local opportunity structures” contribute to an individual’s and community’s health and well-being. By this, MacIntyre and Ellaway (1999) argue



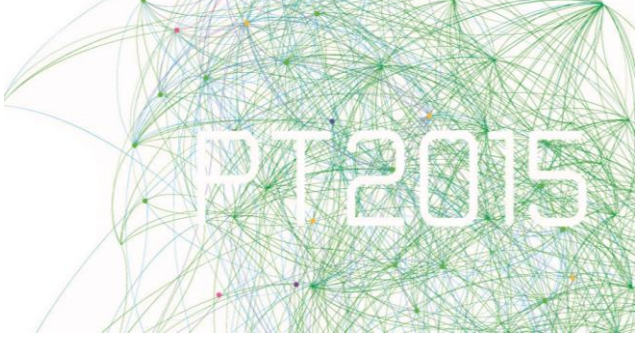

that citizen civic engagement with urban or environmental design and urban planning can influence social relations and facilitate social capital and encourage place making. Places where people can build and maintain social interaction and relationships are essential to encourage social inclusion and encourage health development, as is lacking of them essential for social exclusion.The creation of places where a community can meet and interact with each other has been termed "third places": places in communities that are not domestic or commercial environments (Oldenburg, 1997). Macintyre S and Ellaway A. (2000) found that third places were important for participants in their study. Third places were used as important meeting places to establish or maintain loose social ties and networks. Their research also suggested that people felt it was important for their health to have places in their local area, outside of their home, that enabled people to mix socially (Macintyre S & Ellaway A., 2000).

Collaboration between urban designers and planners, through urban regeneration projects, holds much promise as a method of health promotion and encouraging participation among people. Recent developments in social policy and urban planning have highlighted the role of spatial policy and the use of space as a significant dimension in social exclusion and associated negative health outcomes (Beck et al., 2010). The concentration of urban poor in the least advantaged neighbourhoods, not a new social phenomena, means that citie can become spatially segregated along social class lines. Residential segregation is a form of spatial exclusion that is heavily influenced by social factors. Social scientists have termed these areas as "ghettos" which have a politicised meaning (see Hannerz, 1969). Spatial exclusion is often experienced by those facing multiple disadvantage. For example, indigenous people in many countries face great health inequalities compared to other ethnics groups and are increasingly segregated within urban environments.

As the title states, this paper examines the positive and negative health implications for urban regeneration, examining health and social effects on housing improvements, mental health and economic impacts on participants' health outcomes within them.

**Housing improvements**

Housing improvement has been a central initiative to create better health in areas experiencing urban decline. Urban regeneration programs rarely operate at the micro process level, and significant changes in health are likely to occur only over a relatively long period. Despite this fact, there have been many studies that have shown that health and social well-being are influenced by housing improvement. In a systematic review of forty-five intervention studies of the health impact of housing improvement from 1887 to 2007 Thomson, Thomas, Sellstrom and Petticrew (2009), identified improvements in general respiratory and mental health following warmth improvement measures, but these health improvements were varied across studies. Thomson et al. (2009) also noted varied health impacts were reported following housing led urban regeneration especially in the developed



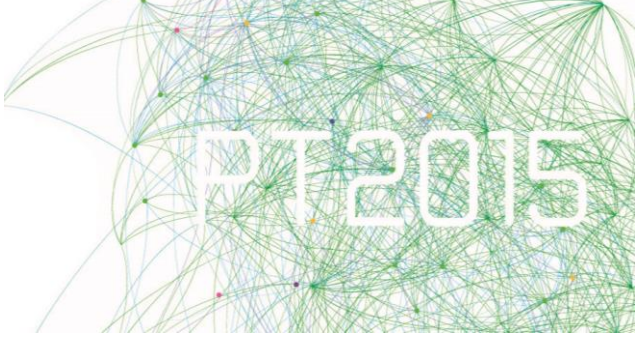

world, such as the United Kingdom, United States of America, Western Europe and Australia. This review suggests that housing improvements can generate health improvements and that there is little evidence of detrimental health impacts. Also, research into housing improvements outlines some negative outcomes associated with housing renewal projects. The Forest Gate and Plaistow Sustainable Communities Project carried out in London, England, showed that the negative effects of housing improvements and health were mainly the result of risks due to disruption, pollution and accident hazards from the building works (Curtis & Cave, 2002). The residents in this project also expressed dissatisfaction with the fact that the housing improvements were unable to help everyone currently living in the program area (Curtis & Cave, 2002). The Forest Gate and Plaistow Sustainable Communities Project highlights that health benefits from urban regeneration might be selective and uneven in the populations in which projects are implemented. Other studies have shown that housing improvement can have adverse effects on residents because of increased rents. For example in Stepney, England rents increased by 14.8 percent, which affected a household's ability to buy adequate food, and became a barrier to employment opportunities (Ambrose, 2000 cited in Thomson, Petticrew & Douglas 2003). Such negative aspects of housing improvements can also influence other health factors such as mental health.

**Mental health**

Mental health is greatly impacted by housing improvements and urban regeneration projects. Studies by Green and Gilbertson (1999) found positive improvement to self-reported mental health one month to five years after the housing were completed. These positive health improvements were related to improvements to physical aspects of housing, such as improvements to windows, bathrooms, fencing of semi-private space, the closing of alleyways, traffic calming and improved child playground facilities (Curtis, Cave & Coutts, 2002). Psychosocial changes associated with these improvements were found to: reduce anxiety and depression, improve self-esteem, reduce fear of crime and create a greater perceived "friendliness" of the area (Curtis et al., 2002). However, a longitudinal study of an urban regeneration project in South Manchester, England found no improvement over time in mental health for those in the area undergoing urban regeneration (Huxley et al., 2004). This study found that the urban regeneration initiatives may have had little impact on mental health because it failed to address the concerns of local residents, and failed to remove restricted opportunities, a variable closely related to mental health (Huxley et al., 2004).

**Economic factor**

Inherent with mental and physical health are economic issues which have various health implications for urban regeneration projects. Vast majority of urban regeneration and economic initiatives are often solely focused on unemployment and training patterns. There is a growing body of research showing that unemployment, insecure employment and work that offers low social support to

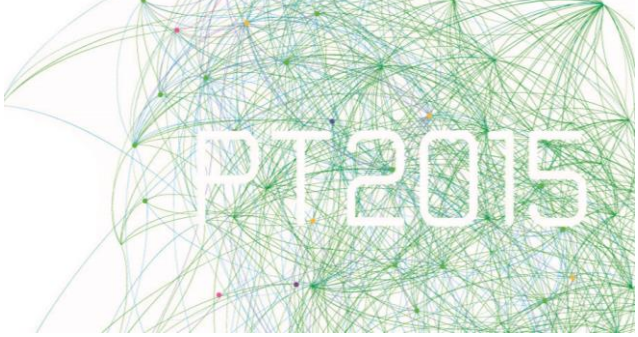



workers' and high ratios of effort to reward, are associated with poor health outcomes (Curtis et al., 2002). The negative material effects associated with unemployment and/ or insecure employment include low income, poverty, low standards of quality of life, poor housing and poor health determinants (Curtis et al., 2002). Negative mental health effects associated with urban regeneration projects, such as unemployment, are seen after the completion of the project. Unemployment can influence a person's health by contributing to greater uncertainty, lack of choices and control in life, disruption of life plans and negative social stigma (Curtis et al., 2002). Curtis et al. (2002) also mention that there is little evidence so far that urban regeneration creates changes to neighbourhood economic conditions. The authors also suggest that individual participation in schemes to improve employability is unlikely to have positive effects on the health of those who are disadvantaged in the labour market (Curtis et al., 2002).

Economic focus in urban regeneration projects do not always produce employment benefits to the people of targeted area. Often, new employees are ,,imported" from outside the targeted area, preventing local people from competing for new jobs in order to create an environment, where positive health outcomes are possible. Therefore, economic regeneration programmes, made through inter-sectoral solutions, need to include the creation of employment opportunities within disadvantaged neighbourhoods, and strategies that aim to build links between excluded areas and the wider labour market in order to create the opportunities for health development (Gordon, 2000).

## A TOOL FOR POPULATION HEALTH IMPROVEMENT

Changes to the built and social environment through urban regeneration can provide changes to the determinants of health. The relationship between place and health in reference to urban regeneration suggests that local physical amenities and resources were closely associated with social relationships and symbolic meaning (Forrest & Kearns, 1999). For example, communities that experience urban decline where small local shops were closed lost not only access to retail outlets, but also access to the shopkeepers who were often key community stakeholders and leaders (MacIntyre & Ellaway, 2003). Places within communities are important sites of social interaction. When public services, such as banks or post offices closed, residents suffered not only from poorer quality services but also felt that the removal of these services indicated a lack of interest in or support for the neighbourhood from service providers (MacIntyre & Ellaway, 2003). Social factors such as crime and violence could hasten or trigger the closure of shops, banks and post offices. The prevalence of delinquency and vandalism can be influenced by physical features, such as empty or abandoned properties, bad or inadequate street lighting (MacIntyre & Ellaway, 2003). Urban regeneration projects that focus interventions on physical development through improvements to environmental design and lay-out can influence patterns of social interaction. Thus, changing features of the built environment to include the provision of improved physical amenities such as street lighting, street cleaning, shops and



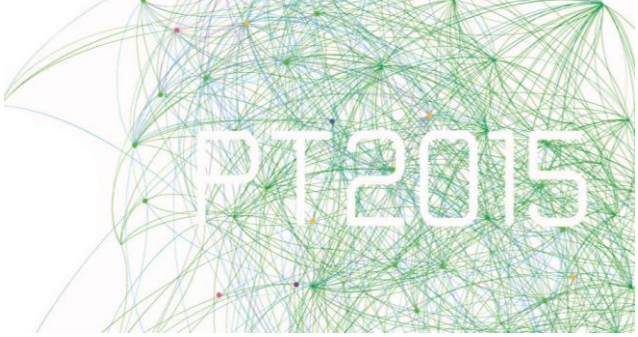

banks, may help to facilitate the regeneration of social interaction and a "feel good" sense about a place (MacIntyre & Ellaway, 2003).

## CONCLUSION

Urban regeneration projects need to focus on physical features of the environment shared by all residents in a locality, for example air, water quality, decent housing, secure employment, and safe play areas for children. Urban regeneration projects also need to focus on services in the community that provide support for people in their daily lives, such as education, transportation, street cleaning, street lighting and policing. The socio-cultural features of a locality, including the political, economic, ethnic and religious history and the degree of social integration also have to be addressed for the urban regeneration of an area to be successful as an intervention. If urban regeneration is to enhance and mitigate social inequalities in health, it needs to implement policies that concentrate on the following initiatives:

- **Main focus for urban regeneration should be public health issues of people and places.** Urban regeneration policies should be focused toward people and places, as the exclusive targeting of the most deprived areas will not help materially and socially disadvantaged people or households living in slightly better off areas. Exclusive targeting of individuals in either health education programmes or income redistribution often does not address geographical and social variations in employment, education, or land use.

- **A holistic view of urban regeneration is essential for giving equal attention to all aspects of the environment.** Urban regeneration policies should be directed towards the physical and social environments. Urban regeneration policies that solely focus on physical inputs or have not involved local people or considered patterns of social relations, and cultural values in to urban regeneration projects have often failed. Equally, community development policies that only focus on the social environment may ignore important aspects of the physical environment, such as street lighting, and third places. So it is therefore important for planning regulations to place importance on green spaces, safe play areas and community facilities that encourage interaction and sustainable uses.
- **Implementing use of health impact assessment as a factor in decision making.** Central and local government, private and local voluntary services should be encouraged to undertake health impact assessments especially in relation to the analysis of health inequalities (through an understanding of the broad views of the determinants of health) on all polices and plans that might have an impact on the health of the local areas. There is general agreement within the literature that poorer people have poorer health, in part because they live in places and spaces that can be damaging to their health (Macintyre S & Ellaway A., 2000) It is therefore critical that urban regeneration should be seen as a public health intervention, enhancing the social determinants of




health through the organized efforts of society and healthy public policy and practice.

## REFERENCES

Beck, S.A, Hanlon, P.W., Tannahill, C.E., Crawford, F.A., Ogilvie, R.M. & Kearns, A.J. 2010. How will area regeneration impact on health? Learning from the GoWell study, Public Health, 124 (3), pp. 125–130.

Curtis, S., Cave, B., & Coutts, A. 2002. Is urban regeneration good for health: Perceptions and theories of the health impacts of urban change. Environment and Planning C: Government and Policy, 20(4), 517–534.

Dahlgren, G. & Whitehead, M. 2007. European Strategies for Tackling Social Inequities in Health: Levelling Up. Part 2, WHO Regional Office for Europe, Copenhagen.

Ellaway, A., Benzeval, M., Green, M., Leyland, A. & Macintyre, S. 2012. 'Getting sicker quicker': does living in a more deprived neighbourhood mean your health deteriorates faster? Health Place, 18, pp. 132–13.

Fitzpatrick, S., Hastings, A., & Kintrea, K. 1995. Including young people in urban regeneration: a lot to learn? Bristol, UK: The Polity Press.

Gibson, M., & Langstaff, M. 1981. An introduction to urban renewal. London, UK: Hutchinson Publishers.

Gordon, I.R. 2000. Targeting a Leaky Bucket: the case against localised employment creation, New Economy, 6, 4, 199-203.

Green, G., & Gilbertson, J. 1999. Housing, poverty and health: The impact of housing investment on the health and quality of life of low income residents. Open House International, 24(1), 41–53.

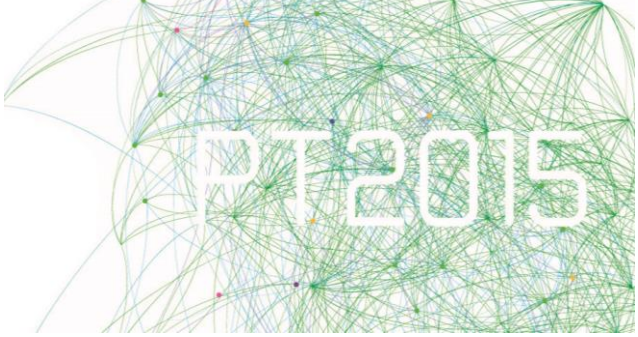
Hannerz, U. 1969. Soulside. New York, USA: Columbia University Press.

Huxley, P., Evans, S., Leese, M., Gately, C., Rogers, A., Thomas, R., & Robson, B. 2004. Urban regeneration and mental health. Social Psychiatry and Psychiatric Epidemiology, 39(4), 280– 285.

Jacobs, D.E., Brown, M.J., Baeder, A. et al. .2010. A systematic review of housing interventions and health: introduction, methods, and summary findings, J. Public Health Manage. Pract., 16 (5 Suppl.), pp. S5–S10.

Johnson, R., Gregory, P., Pratt, G., & Watts, M. 2000. The dictionary of human geography (4th ed.). Oxford, UK: Blackwell Publishers.

Kawachi, I. & Berkman, L. 2003. Neighbourhoods and health (pp. 20–42). Oxford, UK: Oxford University Press.




Kearns, A., Tannahill, C. & Bond, L. 2009. Regeneration and health: conceptualising the connections, J. Urban Regen. Renewal, 3, pp. 56–76.

Knox, S. 2003. Planning as a public health issue. Urban policy and research, 21(4), 317–319.

Lindberg, R., Shenassa, E., Acevedo-Garcia, D., Popkin, S, Villaveces, A. & Morley, R. 2010. Housing interventions at the neighborhood-level and health: a review of the evidence, J. Public Health Manage. Pract., 16 (5S), pp. S42–S50.

Low, S. 2000. On the plaza: The politics of public space and culture. Austin, USA: University of Texas Press.

Macintyre S, Ellaway A. 2000. Ecological approaches: rediscovering the role of the physical and social environment. In Berkman L, Kawachi I, eds. *Social epidemiology*. New York: Oxford University Press, pp. 332–48.

Macintyre, S., & Ellaway, A. 1999. Local opportunity structures, social capital and social inequalities in health: what can central and local government do? Health Promotion Journal of Australia, 9(3), 165–170.

Oldenburg, R. 1989. The Great Good Place. New York: Paragon House.

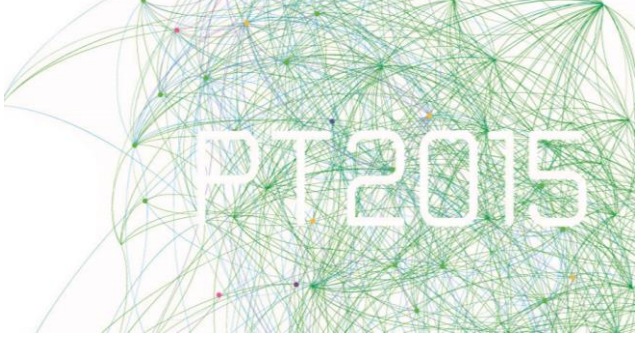
Skifter Andersen, H. 2003. Urban Sores: On the interaction between segregation, urban decay and deprived neighbourhoods. Aldershot: Ashgate.

Thomson, H., Petticrew, M., & Douglas, M. 2003. Health impact assessment of housing improvements: Incorporating research evidence. Journal of Epidemiology and Community Health, 57(1), 11–16.

Thomson, H., Thomas, S., Sellstrom, E., & Petticrew, M. 2009. The health impacts of housing improvement: A systematic review of intervention studies from 1887–2007. American Journal of Public Health, 99(S3), S681–S692.

WHO Commission on Social Determinants of Health. 2008. Closing the Gap in a Generation: Health Equity through Action on the Social Determinants of Health, World Health Organization, Geneva.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# URBANIZATION OF METROPOLITAN AREAS – THE IMPORTANCE OF NEW SPATIAL DATA ANALYSIS TOOLS

**Hanna Obracht-Prondzynska**
PhD candidate, Gdansk University of Technology, Faculty of Architecture, Department of Urban Design and Regional Planning, G. Narutowicza 11/12, 80-233 Gdansk
Pomeranian Office for Regional Planning, Gradowa 11, 80-802 Gdansk
haniaop@gmail.com

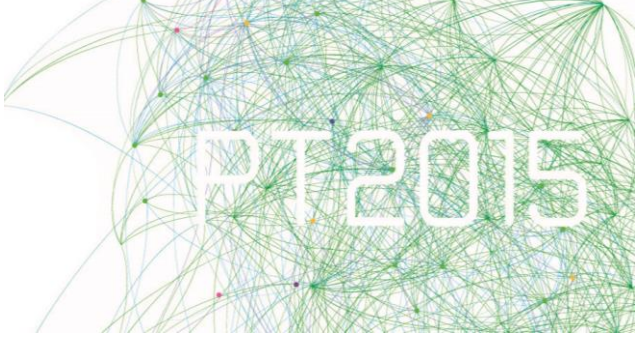
## ABSTRACT

*Nowadays, a rapid development of metropolises is connected with the pressure on urbanizing, which leads to a sharp increase in developed areas as well as urbanized areas. As this trend becomes more dynamic, cities sprawl beyond their administrative boundaries, causing spatial disintegration and hindering sustainable development of a given area. Increased dispersion of residential area results in extensive and chaotic spatial development, stimulated by numerous real estate investments on buildable areas that are not adapted to the current demographic projections. Consequently, it is difficult to provide technical infrastructure systems and ensure an unlimited access to public services.*

*However, changes in law have led to the creation of national databases of topographic objects, under the EU provisions and the INSPIRE directive, which helped increase the scope and specificity of currently conducted spatial analyses, at the same time enabling a precise identification of areas that should be subject to further urbanization as well as areas which are characterized by the lack of access to technical infrastructure and basic social infrastructure – the two deciding factors when it comes to the quality of life and the costs borne by the country and the residents.*

*The aim of the following paper is to discuss new possibilities and ways of managing sustainable development of a metropolitan area, on the example of Gdańsk and its surrounding area, which is put under the pressure of urbanization, covers services of supra-regional importance and encompasses economic activity that is directly or indirectly connected with the sea. The analysis will be performed from the level of regional planning and current works on the Spatial Development Plan for Metropolitan Area.*

***Keywords****: Gdańsk, metropolitan area, suburbanization, spatial analyses.*

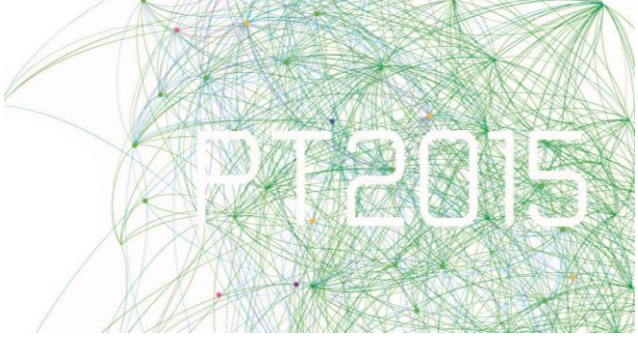



## THE ROLE OF METROPOLITAN AREAS

Currently, the process of metropolitanization is believed to be a dominant factor which shapes the settlement system seen from various perspectives, at the local and global scale. Metropolitanization started a long time ago, but it has begun to grow in significance and gain new functions as a result of the changing conditions, connected with the development of technical civilization and the globalization of socio-economic phenomena (Korzeniak, 2014: 15). Therefore, it is necessary to search for new forms of organization solutions for multifunctional, vast metropolitan areas that are currently developing. In Poland, the largest cities, including Gdańsk and its surrounding area, were the first to encounter obstacles to the development, which resulted from a non-compatibility of the existing territorial and administrative structures to the nascent needs and challenges. A metropolis should be developed in a sustainable way and the whole process should not contribute to the intensification of disproportionality within a given region. On the contrary, it should become a driving force for other, less developed areas. On a regional scale, the major task of the sustainable development is striving towards the multifunctionality of a region and establishing strong connections between its urban settlements and the urban core with its surrounding area. This, however, requires undertaking specific actions that will aim at bestowing complementary functions upon particular urban settlements. Currently progressing process of metropolitanization differs from the earlier processes of suburbanization and is related with a rapidly growing significance of big urban layouts as well as a departure from the hierarchical organization of space, a concept introduced by Christaller. It also changes relations between a metropolitan city and the whole region, which necessitates the introduction of a new method for the territorial division of labor (Danilewicz, 2014: 82).

## SUBURBANIZATION IN POLISH

According to the Central Statistical Office and the national census, the urban population in Poland decreased from 61.2% of total in 2002 to 59.4% of total in 2011. At the same time, the rural population increased by 2.4%. These changes were to a large extent triggered by migrations from big urban settlements to the suburbs, which are classified as administratively separated rural areas (Kajdanek, 2012: 17). The collection of data which illustrate the phenomena of suburban migration and construction development, aggregated at the communal level, distorts the actual reality. Much as the scale of suburbanization encompasses almost the entire suburban communes in the direct neighborhood of the urban core, the further from the urban core we get, the process becomes more insular and is less perceptible on the basis of statistical indicators (Kajdanek, 2012: 11). Therefore, there is a need for spatial analyses to be conducted on the level of geodesic precincts or even specific structures, to determine their economic and infrastructural condition as well as landscape attractiveness. Suburbanization, which results from the lack of stability in terms of area planning and area utilizability, leads to the escalation of problems with the localization of public




utility investments. This, however, is a direct consequence of unreasonably large settlement areas, included in some local area plans. For example, it is practically impossible to coordinate and prepare building lands with utility infrastructure on a building area whose development yield is 10 times greater than the current number of residents (Śleszyński, 2014: 18). Currently, the process of suburbanization consists of numerous independent construction-related decisions and chaotically-erected houses, whose individualism in architectural design as well as random localization on various land lots, of different shapes and sizes, intensify the spatial chaos which, given the lack of any strategy for managing metropolitan areas, leads to changes in the landscape and other irreversible implications (Kajdanek, 2012: 224).

## METROPOLITAN AREA OF GDAŃSK

Not every highly urbanized area is a metropolitan area. The metropolitan character of a given area depends on locally existing socio-economic functions which affect the whole region, country and international relations (Czyż, 2009: 450). Gdańsk is a city which only aspires to become a metropolitan center and whose spatial policy will be stipulated in the area development plan that is currently being prepared.

### Delimitation of the metropolitan area

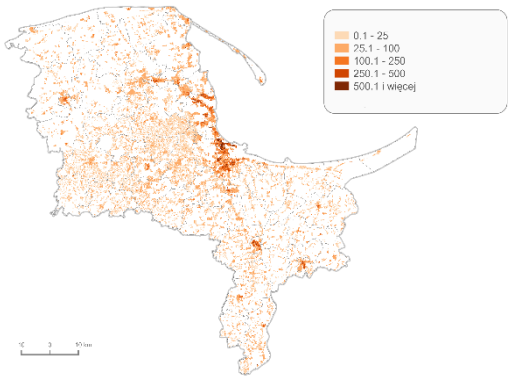
Delineating the boundaries of metropolitan areas is a separate, but still crucial issue. Establishing a well-defined boundary of a metropolitan area, on which the activities related with the spatial development policies of particular regions will be concentrated, may lead to such dangerous phenomena as growing disparities within a given region and, at the same time, peripheralization of the local government units.

Poland's National Spatial Development Concept, which determines functional areas, defines metropolitan area as the area of a big city and its functionally linked direct surrounding[1]. More specific criteria were proposed in the Draft Ordinance of the Minister of Infrastructure and Development, concerning specific conditions for the identification of functional areas and their boundaries. The boundaries established on the basis of these conditions are different from those identified in the currently binding Pomeranian Spatial Development Plan. They also differ from the boundaries formed through the establishment of the Gdańsk Metropolitan Area, an association of Pomeranian communes located in the neighborhood of the metropolis, and from the boundaries determined by the EU policy connected with

[1] Pursuant to Art. 39, section 3, item 4 of the Act of 27 March 2003 on Spatial Planning and Development (consolidated text: Dz.U. of 2015, item 199), the boundaries and spatial development principles of functional areas of supra-regional and regional importance are determined by the voivodeship spatial development plans.

Integrated Territorial Investments, a funding instrument that fosters initiatives aimed at strengthening urban agglomerations.

## Suburbanization in metropolitan area




**Map 1: Population density on areas of dispersed residential development, centered around the urban core.**

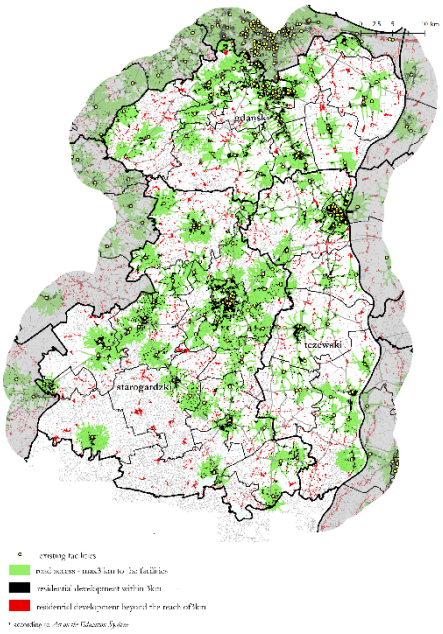
**(Source: Map prepared by the Pomeranian Office for Regional Planning on the basis of the Database of Topographic Objects.)**

The greatest increase in the number of residents can be observed in suburban communes, which are centered around the metropolis, and in cities belonging to the functional zone of the metropolis, which form a distinctive "chain" around Tricity. Over the past 16 years, there was a 2-fold increase in the number of people living in suburban communes, the so-called "bedroom communities," with a predominance of single-family dwellings surrounding the metropolitan center. Single-family dwellings started to appear more often also in rural, suburban communes, especially in towns that were located near the boundaries of the cities. Residential development of particular towns not only illustrates the process of "escaping" the city, but also shows the influence of the city on suburban regions (including their land development tendencies, lifestyle, etc.), thus giving rise to numerous questions regarding the city limits (Turzyński, 2014). Intensive development of multi-family residential units in the aforesaid towns causes the administrative boundaries, but also rural-urban boundaries, to blur. Because of functional connections and the origin of new residents, the mental boundary of the central city is constantly changing. However, dispersed development combined with low population density (map 1) may cause the aforementioned problems with infrastructure investments as well as financial repercussions.

## QUALITY OF LIFE AROUND THE METROPOLIS

Polish metropolitan class has no historical roots. Therefore, it is important to create an offer of public services, available in the nearest vicinity, which will help establish a sense of identity and integrity with one's place of residence. Striving towards the sustainable development of a metropolitan area consists mainly in improving the quality of life of its residents in all urban settlements. When evaluating living conditions, one should analyze the accessibility to basic social

infrastructure, including one of the most fundamental facilities which is the kindergarten. At the same time, it should be noted that pursuant to the amendments to the Act on the Education System, if the distance to the nearest preschool facility is more than 3 km, local authorities shall provide free transport to a child which is subject to compulsory preschool education[2]. Determining minimum distance is crucial when it comes to improving the quality of life of the local residents, but it also helps analyze the developmental disparities within a given metropolitan area, which encompasses urban settlements with great access to basic infrastructure and urban settlements with poor access to basic infrastructure. At the same time, such factors as the pace of development in the vicinity of a metropolis and positive growth rate may quickly deteriorate the situation and result in a shortage of kindergarten places. However, in a similar time slot, the urban core might experience a contrary phenomenon, whereby depopulating areas will have to deal with a surplus of places in preschool facilities. By analyzing maps which illustrate the accessibility to various facilities, it can be observed that the more intense the suburbanization and the greater the dispersion of the development, the bigger the problems with the accessibility to basic social infrastructure (map 2). Such an analysis may help attract the attention of local government units to problematic areas and their economic status and stimulate undertaking specific actions, pursuant to the Act on the Education System.



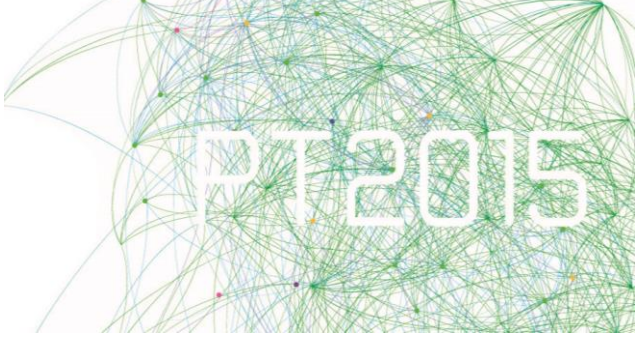

**Map 2: Analysis of spatial accessibility to preschool facilities in selected Poviats of the Gdańsk Metropolitan Area, as of May 2014.**

***(Source: Compiled by: Hanna Obracht-Prondzyńska, Jakub Olech, on the basis of: Regional Information System for the Pomeranian Voivodeship, data from surveys conducted by Pomerenian Office for Regional Planning and Database of Topographic Objects - residential development).***

## TOOLS FOR MANAGING METROPOLITAN AREA DEVELOPMENT

Population growth is accompanied by an increase in the territorial range of a given metropolis, mainly as a result of its suburbanization. Chaotic and dispersed development means greater expenses when it comes to the construction and exploitation of sewerage systems, water supply networks, gas networks, heating networks, power grids, telecommunications networks, street networks and lighting systems. In the case of power grids and

[2] Applies to five year old children, one year before entering primary school. (Art. 14, section 1a, Art. 14. section 3, Act on the Education System).

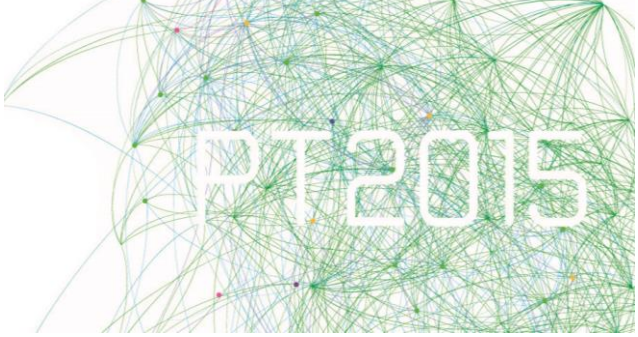



heating networks, the costs of exploitation include not only maintenance, but also losses in the distribution systems. What is more, highly dispersed development requires maintaining an unreasonably great number of small schools, kindergartens or health centers, where unit costs are higher than in bigger facilities (Śleszyński, 2014: 17). In this context, it is important to mention the Act of 4 March 2010 on the Infrastructure for Spatial Information, which is a Polish transposition of the Inspire directive. The Act provides a free access to a wide range of data from public records, compiled by the units which work in industries that are closely related with spatial planning, to institutions that deal with planning documentation. Public records are more and more often vectorized, so that it is possible to obtain data from the Geodetic Register of Public Utilities Network, kept by the Geodetic and Cartographic Documentation Center of a given Poviat, and conduct a detailed analysis concerning the accessibility to basic media. In juxtaposition with the map of population density in developed areas, presented above, it is possible to identify areas which are currently non-developed and estimate the cost of infrastructure construction. This should become a guideline for the local government units of a given metropolitan area, which prepare spatial development studies of Polish communes and identify areas to be developed. Such an analysis will help identify areas that are prepared for investments, where there is already some degree of residential development, and whose vicinities can be identified as a place for a further residential development and the creation of compact urban structures.

The aforementioned analysis can be performed owing to the Database of Topographic Objects, prepared by the Central Geodetic and Cartographic Documentation Center, which, similarly to the Land and Property Register, is not bound by the number of residents. Consequently, each analysis might be erroneous. On the national level, there are projects which combine official registers with spatial databases as well as databases that include information regarding the permanent residence of local residents (Białousz, Ostrowicka, 2013: 167-170). This will help determine spatial policy on a more fairly basis, especially in metropolitan areas where the dynamics of ongoing changes requires more detailed and in-depth analysis and consequent planning decisions.

## CONCLUSIONS

Numerous communes will bear costs connected with the acquisition of land for roads and the construction of technical infrastructure on areas that will never be developed, as a result of repeatedly overestimated actual land use requirements for residential housing, and on areas that are extensively developed (Śleszyński, 2014: 15). Spatial analyses based on new tools, such as those using GIS software, will help identify financial implications of the current, uninhibited development of suburbanization. The collection of such data on the metropolitan level will help lay down the guidelines for the communes that are located within the functional influence of the urban center. A proper development of a metropolitan area is connected with integrated strategic management and planning. A coherent vision




of the whole area, which transcends the boundaries of the local government units and focuses on functional connections, is of primary importance for achieving a coherent development policy (Danielewicz, 2013: 137).

**REFERENCES**

Act of 27 March 2003 on Spatial Planning and Development (consolidated text: Dz.U. of 2015, item 199).

Act of 5 June 1998 on the Regional Government (consolidated text: Dz.U. 1998 no. 91 item 576).

Act of 6 September 2001 on Access to public information (consolidated text: Dz.U. 2001 no. 112 item 1198).

Act of 7 September 1991 on the Education System (consolidated text: Dz.U. 1991 no. 95 item 425).

Antoń, M., Rogocz, M., Romasiuk, I., Tisler, B., Turzyński M. 2014. „Analizy urbanistyczno- funkcjonalne gdańskiego obszaru metropolitalnego, cz. I. osadnictwo" in *Gdańskie zeszyty urbanistyczne*, ed. Turzyński, Marcin. Gdańsk: Biuro Rozwoju Gdańska.

Białousz, S., Ostrowicka, N. 2013. „Bazy Danych tematycznych" in *Informacja przestrzenna dla samorządów terytorialnych*, ed. Białousz, Stanisław. 163-182. Warszawa: Oficyna Wydawnicza Politechniki Warszawskiej.

Danilewicz, J. 2013. *Zarządzanie obszarami metropolitalnymi wobec globalnych procesów urbanizacji*. Łódź: Wydawnictwo Uniwersytetu Łódzkiego.

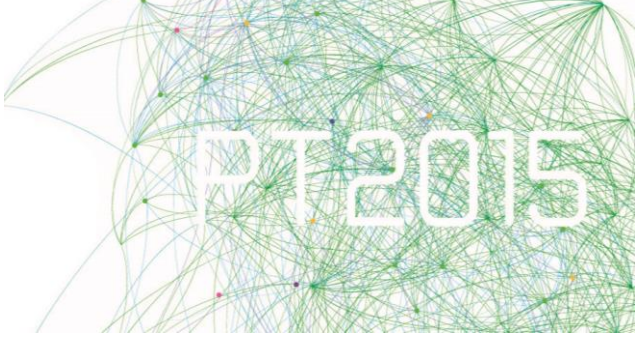
Kajdanek, K. 2012. *Suburbanizacja po polsku*. Kraków: NOMOS.

*Koncepcja Przestrzennego Zagospodarowania Kraju*. 2012. Warszwa: Ministerstwo Rozwoju Regionalnego.

Korzeniak, G. 2014. *Małe i średnie miasta w policentrycznym rozwoju Polski*. Kraków: Instytut Rozwoju Miast.

Kowalewski, A., Mordasewicz, J., Osiatyński, J., Regulski, J., Stępień, J., Śleszyński, P. „Społeczne koszty niekontrolowanej urbanizacji w Polsce – wybrane fragmenty raportu" in Samorząd Terytorialny 4/2014.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# AQUAPONICS BASED ARTIFICIAL BIOSPHERE INCLUDED IN ARCHITECTURE: FROM MITIGATION OF NEGATIVE IMPACTS TO POSITIVE ADDED VALUES OF URBAN SPATIAL STRUCTURES ON LOCAL, REGIONAL AND GLOBAL SCALE

**Piotr Marek Smolnicki**
PhD candidate, Gdansk University of Technology, Faculty of Architecture, Department of Urban and Regional Planning, Narutowicza 11/12 Gdansk, Poland,
piotr.smolnicki@pg.gda.pl

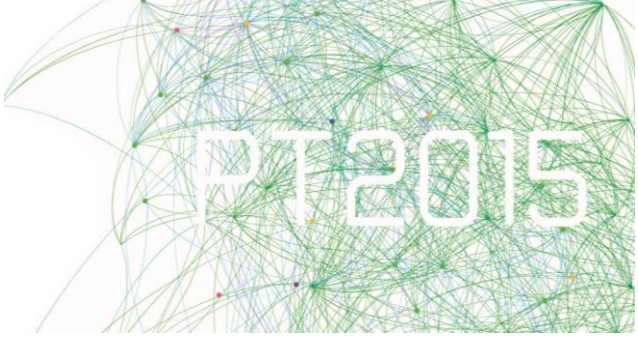
## ABSTRACT

*Technologies may appear faster than spatial planning can afford it. Although applying new technologies solve particular problems, it may also create new ones. Many negative consequences of implementing new technologies are visible after years or decades – they accumulate until the need of solving them. According to The Hannover Principles (McDonough & Braungart 2013) one should, by example not think about reducing but about eliminating negative impacts. Did we learn life-cycle management from this since 1992, and implement it correctly? Can we predict and eliminate negative side effects? Could we add a positive value to the neighbourhood?*

*In this paper author will scrutinize selected applications of modern and contemporary techniques and technologies influencing shaping of spatial structures and will emphasize their side effects in terms of urban, regional and global "health".*

*Author will propose contemporary local intervention and investment possibilities on creating self-sustaining neighbourhoods and buildings. Its background will be a new vision of architecture and spatial structures that include ideas inspired from biosphere, e.g.: retrieving and capturing or circulation of $CO_2$ and nutrients. Author will present a concept based on aquaponics gardening that could be adapted to existing buildings and new designs. The concept design will not only reduce and eliminate emissions but also could have a positive impact on citizens' health and the whole city and its surrounding.*

***Keywords**: mitigation and eliminating of negative emissions, nutrient circulation in biosphere, urban aquaponics based food production, added value spatial structures.*



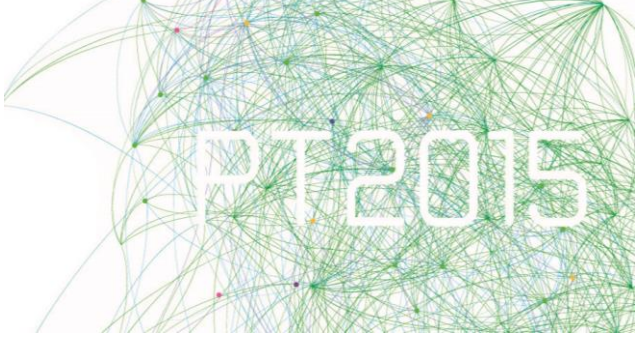

## INTRODUCTION

Recently it's frequent to cite data showing that for the first time in history more than half of the Earth's population is living in the cities. This is literally the reason for proofing importance of cities' impact on the rest of the World. Even during some cities are shrinking, in 2030 around half of the World population will live in gigalopolises, area of each one will increase three times. By 2050, the urban population is expected to increase to 64 – 69 % of world population (IPCC 2014, pp. 25 (43)). This will have a huge impact on their surrounding regions as, comparing to traditional cities, their hinterlands. From the down of history cities were dependent of their hinterland production (Frey & Yaneske 2007, p. 82). Urban population growth was forced by development of agricultural methods and technologies and the hinterland size was time-depended of goods transportation and selling, and coming back (Frey & Yaneske 2007, pp. 83–4). According to Frey and Yaneske, achieving balance between city and its hinterland could be possible probably only due to population control, so the hinterland capacity would be enough for desired population (Frey & Yaneske 2007, p. 120).

In 1992 were introduced the Hannover Principles which present universal sustainable way of thinking and doing, to mention: recognizing interdependence, design decisions consequences, totally eliminating the element of waste or relying on natural energy [and matter] flows[1] (McDonough & Braungart 2013, Loc. 176). After years of using a term *Reduce-Reuse-Recycle*, it was proposed a new concept of *Upcycling*[2] which can be reached by adding value to used/useless product so the potential waste is no longer waste but a useful thing. Moreover, we should keep in mind, that we focus too literally on plans, model codes, transportation modes, building appearance, economic and population specifics, and summary indicators of how land is currently used (Wolfe 2013, 123). Considering implementation of new technologies and innovations, first we have to describe all their impacts: positive, controversial and negative (Smolnicki 2015, pp. 73–4). Next is to know not only how to reduce controversial/negative impacts but how to eliminate/reverse them. The third step is to propose solutions with added value of positive impacts on the city, region, and hence in the global scale. Let's imagine the built environment realizing the concept of upcycling beginning from bottom-up local interventions and investments like everyday human behaviours and every possible modernized or new building.

[1] The Hannover Priciples are: *„1. Insist on the right of humanity and nature to coexist in a healthy, supportive, diverse, and sustainable condition. 2. Recognize interdependence. 3. Respect relationships between spirit and matter. 4. Accept responsibility for the consequences of design decisions upon human well-being, the viability of natural systems, and their right to coexist. 5. Create safe objects of long-term value. 6. Eliminate the concept of waste. 7. Rely on natural energy flows. 8. Understand the limitations of design. 9. Seek constant improvement by the sharing of knowledge"* McDonough and Braungart (2013, Loc. 176).

[2] *„The goal of the upcycle is a delightfully diverse, safe, healthy, and just world with clean air, water, soil, and power - economically, equitably, ecologically, and elegantly enjoyed"* McDonough and Braungart (2013, Loc. 212).



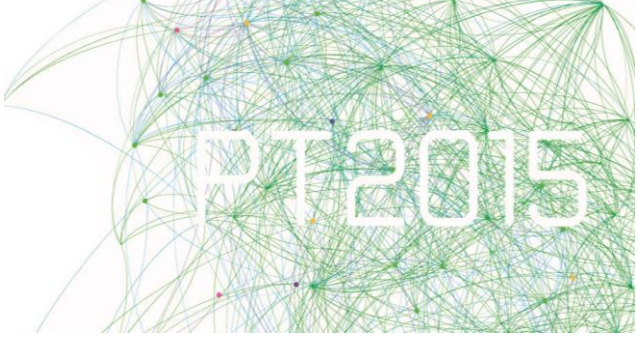

## THE COMPLEXITY OF THE PROBLEM[3]

The number of walk journeys and walked distances were falling at least since second half of 20-th century (Tolley 2003, p. 180). In Poland 2/3 of households have cars and the amount is rising (Czapiński 2013, p. 66). It depends not only of mobility need but also materialistic reasons (Czapiński 2013, p. 254) and it has obvious health and social consequences like obesity or social alienation. There are few ways to meet the needs of mobility: transportation systems development, shaping spatial structures providing spatial proximity and destinations concentration; and ICT development which reduce the need of mobility (Sołtys 2008, pp. 87–8). When urban structure functions are mixed, particular needs can be meet in the home neighbourhood and any additional utility needs only small amount of extra travel time (Maat, in Maat 2009, p. 36). This can be improved by promotion of local produce, where cities' hinterlands, urban agriculture or crafts has the biggest possibility of positive influences. For example, accessibility to fresh food is an element of locally oriented well served and regularly supplied neighbourhood and contributes to a higher quality of life (ITDP 2014, p. 23).

Barry Schwartz's Paradox of Choice theory claims that people don't want anymore bigger choice, but exactly what they want (Brown 2013, p. 134). Advertisement is creating artificial needs. That means the global market and a market with local products are in opposition. Planning for both seems to be irrational and may be like Aaron Wildavsky stated: *"If planning is everything, maybe it's nothing" (Wildavsky 1973; Sanches & Afzalan 2014)*? One can ask about economy but it should coexist with environmental protection, because it is an economic opportunity (Vella 2014). It is already proofed that Internet (online shopping) had little or no effect on per capita sales – it just killed much of local retail (Davidow 2015).

According to Girardet and Mendonca research, average food travels 2,414-4,023 kilometres before eating (Brown & Sovacool 2011, pp. 33–5). Traditional food production used less energy than its equivalent of produced food calories. Today it is estimated 2:1 in corn or tomato up too 99:1 in case of lamb meet (Brown & Sovacool 2011, pp. 36–7). Land around the city has bigger value when developed (suburbanized) and the city is more and more dependent of cheaper land, not only outside of local areas but also in far countries (Frey & Yaneske 2007, pp. 86–7). Its negative impacts come not only from food transportation but also irrational land use of whole countries. Moreover, if developing countries will reach a level of developed countries we would need few more Earths to feed global population. To mention, the number of people is growing rapidly. According to research of Chambers (et al.) future agriculture will have a significant influence on reduction of biodiversity (Frey & Yaneske 2007, p. 114). Sir Ken Robinson in his famous TED speech said that we need to switch from industrial-like [modern] productive

[3] Author get interested in the topic of the complex problem of sustainability during his final project in the field of urban planning (2012).




linear mode to agriculture-like [traditional] organic mode, creating good condition for development (Robinson 2014, 14'30"). According to Vaclav Smil, few-fold cropping development was reached by 150-fold increase in energy consumption, due to bigger machines, fertilizers, packaging and so (Brown & Sovacool 2011, p. 36).

According to Global Footprint[4] Network, in 2050 people will consume 100 per cent more than Earth's regenerative capacity (2004). That means the global population can not grow for ever. According to Smith's (et al.) research, the European Union footprint is exceeded four times and according to Sustainable London Trust (1996) the City's footprint is 125 times bigger than its own surface area (eds Jenks, Williams & Burton 2000, p. 2). Future population growth is dependent of improving agricultural technologies and farming techniques (Frey & Yaneske 2007, p. 6). Agriculture is strongly connected with enormous use of water. For example according to WHA and UNEP data (2010) to produce an apple it is needed as much as 70 litres of water (Brown & Sovacool 2011, p. 49). Another needed resource, considered as non-renewable is land. About quarter of anthropogenic greenhouse gas emissions come from deforestation (for agricultural use) and other agricultural emissions (IPCC 2014, pp. 24 (42)). It is due to pasture and cropland to grow animal feed, deforestation and conversion of forests or enteric fermentation by ruminants - cow farting (Brown & Sovacool 2011, pp. 37–40).

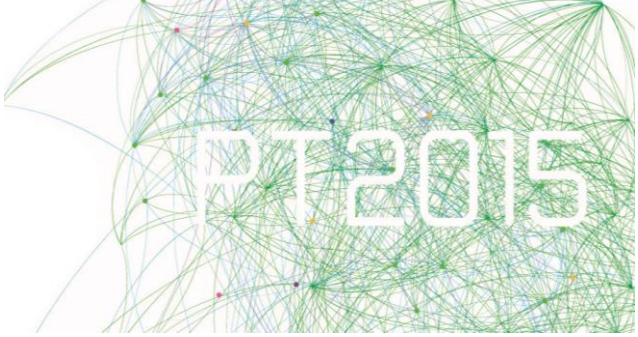
There are many more problems to solve that could be mentioned in our complex world but above examples are more than enough reasons to light that it is already too late for any mitigation of negative aspects – it is the time to eliminate them and create solutions with positive added values!

## ENVIRONMENTALLY ADDED VALUE BUILDINGS

It is said that buildings cannot return anything of value to the biosphere (Armstrong 2012, 135). But it is not only theoretically possible to create artificial biospheres[5] (Frey & Yaneske 2007, p. 117). Any process in closed systems of nutrient circulation does not have a problem of waste and pollution because these by-products are building-up another processes (Nowacki 2014, p. 196). Very efficient loop of nutrient circulation can be obtained by the use of aquaponics gardening. This ancient technique combines aquaculture and hydroponics. It allows to avoid chemical fertilizers, doesn't need soil, and recycles water (Stout 2013, p. XV).

Modern aquaponics gardening is getting popular as small-scale interventions or independent investments as part of urban agriculture/farming focused on local food

[4] Ecological/carbon footprint is: *"a measure of the exclusive total amount of carbon dioxide emissions that is directly and indirectly caused by an activity or is accumulated over the life stages of a product"* Wiedmann and Minx (2008, p. 4) – to mention only one of many definitions.
[5] The example is the Eden Project, a monumental palm house inside late Cornish china clay pit in Cornwall, England, designed by Grimshaw & Partners Davies (2001, p. 40).




produce. What if we think about aquaponics as the element of self-sustaining neighbourhoods and buildings as shown on the diagram on Figure 1 Researched by Henrique Sánchez in his thesis, aquaponics can be used for aquaculture wastewater treatment and human urine treatment (2014). Structure isolation from external factors allow human emissions like heat and CO2 to be used to stimulate photosynthesis process. In return we get fresh air/water and faster food produce. Air heat recovery can be extended to wastewater heat recovery, and installation combined with building can be a part of building's thermal insulation (located for example on the roof) preventing it from summer overheating and winter chilling. In return the aquaponics garden can function all over the year, and combining it with micro hydro power plant[6] it can use sun energy 24 hours per day (using special energy efficient LED lightning to stimulate photosynthesis). And hence the kinetic energy allows to produce electricity on demand, for example when clouds appear. Moreover, the micro hydro power plant can be combined with a heat pump so water in the previously well insulated top and bottom containers can store heat for later use, for example for warming and chilling building interiors. Chemical photovoltaics can be replaced by algae based photovoltaics to eliminate non-recyclable toxic waste. The innovations here are not particular technologies but their applications at the city scale as mentioned by Michael Easter and Gary Stix (2014, 379).

## CONCLUSIONS

To solve complex problems it is needed to use complex solutions. Buildings added value to the environment could be reached depending of structure scale and investment complexity. It is worth to notice that: purifying and treating water; refreshing and oxidizing air; heat recuperation; thermal and UV insulation etc., are the elements already existing in biosphere, just to mention predators taking up heat collected from the sun by stones. Wide spread of these ideas could have a global scale positive impact by reducing green house gases emissions or more efficient land use. It could be achieved by eliminating of: agricultural emissions and chemical fertilizers pollutions; agricultural land use; agriculture or domestic water use; deforestation and biodiversity lose; food transportation pollutions; far distance car addicted shopping need etc. And last but not least, it will improve general urban and human health by promoting of locality, and hence a natural mobility and social contacts. As it is assigned to Patrick Geddes, he said circa a 100 years ago, we have to think globally and act locally.

[6] Author proposed a district scale micro hydro power plant in his master final project (2012). The idea of water use was further mentioned in his first paper during first year of doctoral studies (2014).

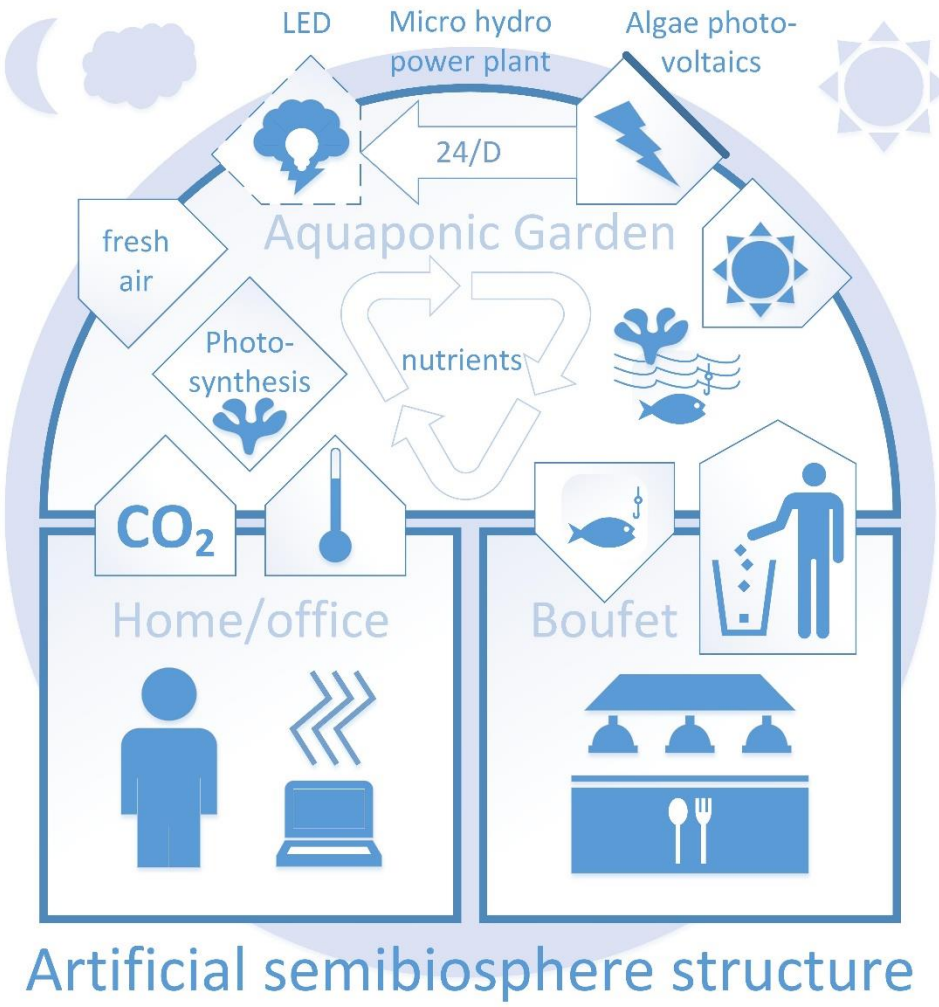
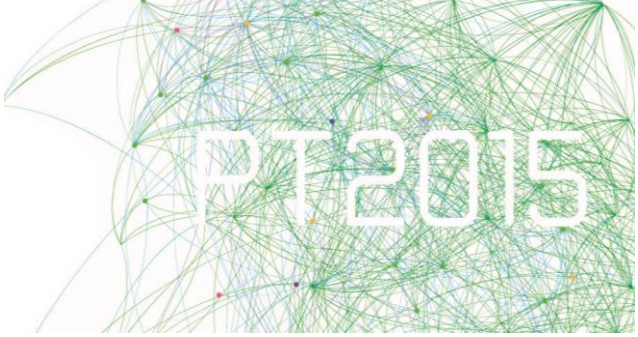



**Figure 1: Mixed-use urban structure simplified scheme of an artificial semi-biosphere based on aquaponics. Image by Piotr Marek Smolnicki.**

## REFERENCES

Armstrong, R. 2012. *Living architecture: How synthetic biology can remake our cities and reshape our lives*, Ted Conferences, New York.

Brown, MA & Sovacool, BK. 2011. *Climate change and global energy security: Technology and policy options*, MIT Press, Cambridge, Mass.




Brandeis A (ed.). 2014. 'Potentials of water usage in urban neighbourhood structures', in *Proceedings of the 50th ISOCARP Congress*, 50th ISOCARP International Planning Congress Urban Transformations - Cities and Water, Gdynia, Poland, 23-26 September 2014, ISOCARP, pp. 941–9.

Brown, T. 2013. *Zmiana przez design: Jak design thinking zmienia organizacje i pobudza innowacyjność* (Change by design: how design thinking transforms organizations and inspires innovation), Seria Wydawnicza Projektowanie Komunikacji, Wydawnictwo Libron - Filip Lohner, Wrocław.

Czapiński, J. 2013. *Diagnoza społeczna 2013: Warunki i jakość życia polaków*, Główne wyniki i wnioski (PL) no. 4, 7th edn, H Król, Warszawa, viewed 8 June 2014.

Czubenko M & Tatara M (eds). 2015. 'The influence of modern technologies on spatial structures', in *PhD Interdisciplinary Journal: Special Issue*, BioTech Conference, BIOTech Conference 2014, 2 vols, vol. 2, Gdansk University of Technology Press, Gdańsk, pp. 67–75.

Davidow, WH. 2015. *The Internet Has Been a Colossal Economic Disappointment*, viewed 31 March 2015, <https://hbr.org/2015/03/the-internet-has-been-a-colossal-economic-disappointment#signin>.

Davies, C. 2001. 'Eden Regained', *The Architectural Review*, no. 1254.

Easter, M & Stix, G. 2014. (Originally published: Scientific American Online 2012.), 'Street Talk', in Scientific American Editors (ed.), *Designing the Urban Future: Smart Cities* (English), [Kindle Edition], Scientific American, a division of Nature America, Inc., 319–470.

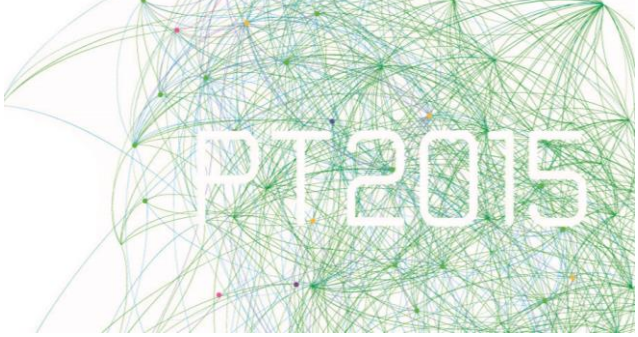
Frey, H & Yaneske, P. 2007. *Visions of sustainability: Cities and regions*, Taylor & Francis, London.

Global Footprint Network 2004, *The Living Planet Report 2004* (en), Switzerland, <http://www.footprintnetwork.org/gfn_sub.php?content=1pr2004>.

Intergovernmental Panel on Climate Change 2014. 'Summary for Policymakers', in O Edenhofer, R Pichs-Madruga, Y Sokona, E Farahani, S Kadner, K Seyboth, A Adler, I Baum, S Brunner, P Eickemeier, B Kriemann, J Savolainen, S Schlömer, C von Stechov, T Zwickel & JC Minx (eds), *Climate change 2014: Mitigation of climate change*, Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Jenks, M, Williams, K & Burton, E (eds). 2000. *Achieving sustainable urban form*, E. & K. N. Spon, London.

Maat, K. 2009. 'Land use and travel behaviour: Expected effects from the perspective of utility theory and activity-based theories', in K Maat, *Built environment and car travel:*




*Analyses of interdependencies* (Text in English; summaries in English and Dutch), Sustainable urban areas, vol. 29, IOS Press, Delft University Press, Delft, pp. 27–47.

McDonough, W & Braungart, M. 2013. *The Upcycle: Beyond sustainability - Designing for abundance*, North Point Press, a division of Farrar, Straus and Giroux, New York, viewed 13 February 2014.

Nowacki, Ł. 2014. 'Zielony dach krok po kroku: Poradnik realizacji', in U Majchrowska (ed.), *Miasto zielone z natury: Poradnik dobrych praktyk*, Miasto zielone z natury, Agencja Create Event, Chojna, pp. 174–98.

Robinson, K. 2014. *Bring on the learning revolution!*

Sanches, TW & Afzalan, N. 2014. 'Mapping the Knowledge Domain of Planning', Association of Collegiate Schools of Planning 54th Annual Conference, Philadelphia, PA, November 2, 2014, viewed 18 April 2015, <https://tomsanchez.files.wordpress.com/2014/10/sanchezafzalan.pdf>.

Sánchez, Henrique Junior Aiveca. 2014. 'Aquaponics and its potential aquaculture wastewater treatment and human urine treatment', Master thesis, Universidade Nova de Lisboa.

Smolnicki, PM. 2012. 'Pruszcz 2020+: The conceptual study of the city development and modifications' (Pruszcz 2020+. Studium koncepcyjne rozwoju i przeksztalcen miasta), Master final project, Gdansk University of Technology, Gdańsk.

Sołtys, J. 2008. *Metody planowania strategicznego gmin z uwzględnieniem aspektów przestrzennych i rozwoju zrównoważonego* (Summary in English), Monografie / Politechnika Gdańska, vol. 87, Wydawn. Politechniki Gdańskiej, Gdańsk.

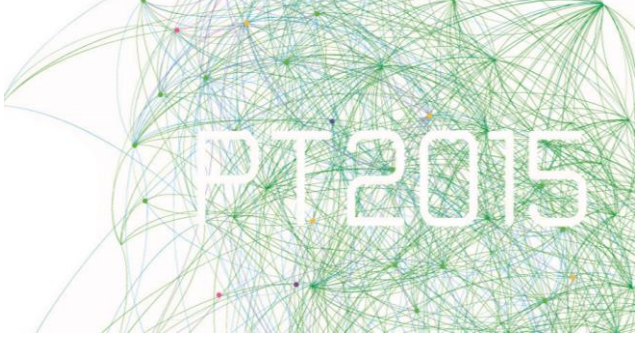
Stout, M. 2013. *The complete idiot's guide to aquaponic gardening*, Alpha Books, Indianapolis, IN.

*TOD Standard: v2.1* 2014, Nowy Jork, viewed 9 June 2014.

Tolley, R. 2003. 'Ubiquitous, Everyday Walking and Cycling: The Acid Test of a Sustainable Transport Policy', in I Docherty & J Shaw (eds), *A new deal for transport?: The UK's struggle with the sustainable transport agenda*, RGS-IBG book series, Blackwell Pub., Malden, MA, pp. 178–97.

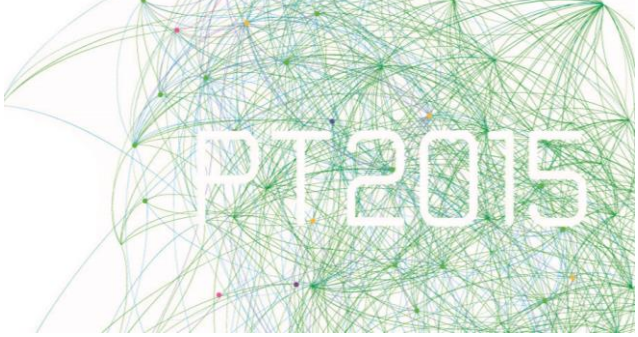
Vella, K. 2014. 'Europe at the crossroads: the challenge of environmental sustainability', European Environmental Bureau, Brussels, viewed 30 January 2015, <http://www.iucn.org/news_homepage/all_news_by_region/news_from_europe/>.

Wiedmann, T & Minx, JC. 2008. 'A Definition of 'Carbon Footprint'', in CC Pertsova (ed.), *Ecological Economics Research Trends: Chapter 1*, Nova Science Publishers, Hauppauge NY, USA, pp. 1–11.




Wolfe, CR. 2013. *Urbanism Without Effort: Reconnecting with First Principles of the City* (English), (Island Press E-ssentials) [Kindle Edition], Island Press, Washington, DC, <http%3A//www.amazon.com/Urbanism-Without-Effort-Island-E-ssentials-ebook/dp/B00CGRHBN4?SubscriptionId=AKIAJEOIHAJER6RL7KQQ&tag=ws&linkCode=xm2&camp=2025&creative=165953&creativeASIN=B00CGRHBN4>.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# INSTITUTIONAL CHALLENGES IN THE URBAN PLANNING WATER SENSITIVE PLACES

**Višnja Sretović Brković**[1]
PhD student, Research Assistant, Faculty of Architecture, University of Belgrade, Serbia; visnja_sretovic@yahoo.com

**Matija Brković**
PhD student, Researcher and Architect, Faculty of Architecture, University of Belgrade, Serbia; matija0brkovic@gmail.com

## ABSTRACT

*Last few years cities in Serbia witnessed a number of problems with small urban streams and an inappropriate sewer systems. Traditional approach of solving these problems, using underground pipes and concrete revetments, is inefficient and expensive. Instead, it is increasingly becoming common to use "soft" approach based on the natural processes and use of the existing landscape elements and plants for water treatment. Thus, water becomes the featured element in the urban landscape, the new resource for the creation of public green spaces and improvement of community health.*

*Planning the city zones surrounding small urban streams and old sewer systems became challenging, as the number of experts from different fields, stakeholders and citizens that should be involved grew. If such approach is to succeed, it is critical to create appropriate institutional framework.*

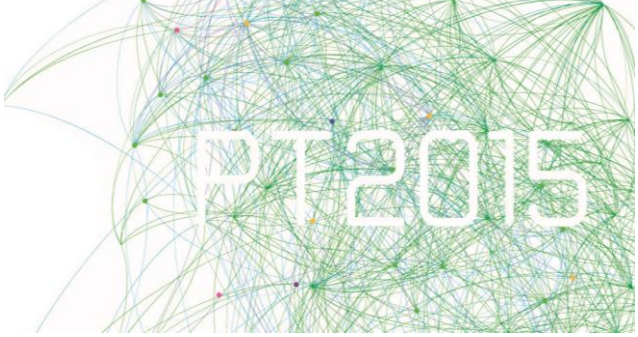
*In this paper we are exploring appropriate institutional arrangement for planning of these zones. We are basing our research on the already proven and successful examples from Europe. Finally, we are discussing the institutional constrains and opportunities for implementation of these arrangements in Serbia, taking into account the specific Serbian context, in order to make cities in Serbia more water sensitive.*

***Keywords**: water, soft approach, institutional framework, urban planning, Serbia.*

## INTRODUCTION

City zones situated around small city watercourses and deteriorated sewer systems, often flooded and polluted, became a commonplace in Serbian cities. Resulting from inadequate care and changes in city dynamics – rapid development and

[1] Corresponding author




changes in the market intensified by global issues such as the climate change – they now pose as a serious challenge to the future development of cities.

These zones are usually located in city centers and, due to their position, amount of vacant space and open areas, they present a significant potential for improving the quality of life in central city areas.

Renewal of these areas is a very current issue in Serbia. The modern „soft" approach – return to the natural processes and naturalized problem-solving – is a method increasingly in use due to its comprehensiveness, but it requires a special approach to planning. A range of new, innovative, complex multidisciplinary projects needs to be integrated into existing plans. There have already been attempts, pilot projects, which have either lost many important and innovative characteristics during the planning process, or have not been implemented at all. This is why the main issue is how to go about the planning in order for plans to truly be implemented.

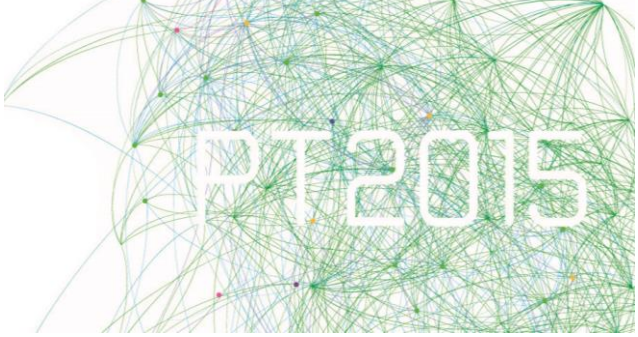
## CHARACTERISTICS OF PLANNING THE CITIES' WATER SENSITIVE PLACES

The modern approach to river revitalization and addressing the problem of rainwater drainage completely changes the concept of regeneration of these areas. Devastated zones with polluted rivers that flood the surrounding areas, deteriorated sewer systems, cultural and industrial heritage, and often low quality residential areas needs to be planned for and turned into the lively and holistically functioning city zones.

Rainwater is not considered a waste, but a resource present in the environment. Water is becoming the central element of the urban environment and important social and aesthetic factor. It can be used for recreational areas, which become new gathering places and contribute to the character of the environment they are situated in. In addition, small decentralized open systems for collection and purification of water use existing plants and landscape elements. They are alive and unpredictable, requiring constant maintenance whose jurisdiction must be regulated as early as during the planning process itself.

This is no longer solely a matter of hydro-engineers, but requires participation of experts from other fields as well, a number of stakeholders, institutional arrangements, and numerous organizations, i.e. a comprehensive approach to planning.

Successful planning of integral urban projects requires political, economic and civic action. In cases when projects include new concepts, a pending question is how to organize and conduct them. The global practice has indicated that the main challenge in implementing these solutions is the inertia of institutions themselves, which are accustomed to the traditional practice, existing routines and cultural




patterns. (Brown, et al., 2013) Understanding the process of institutional transformation is very beneficial for planners, as institutions pose as the critical aspect of everything that the planners do. (Alexander, 2005) It is necessary to understand the necessity of changing the planning structure, i.e. to understand how institutions adjust in order to be more successfully designed (Beauregard, 2005).

A large number of institutions and organizations represent a heritage of a far simpler past and are often too rigid, hierarchical, and sector-oriented to accept the challenges of complexity, unpredictability and change. (Alexander, 2009) This problem in Serbia is very pronounced.

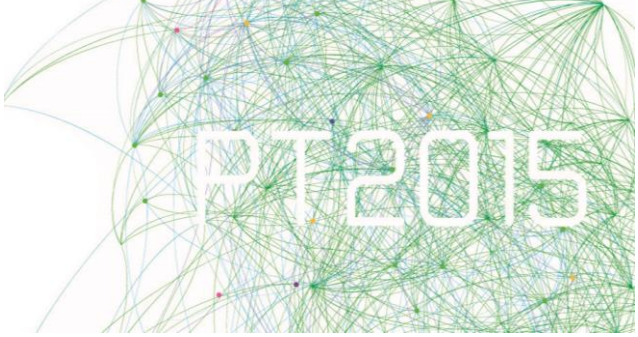
In a situation where Serbian institutions are only beginning the process of decentralization with the existing hierarchical system, it is necessary to plan, implement and execute complex transdisciplinary projects, which pose as a major challenge. Physical and urban planning, within the existing socio-economic and legal framework and in circumstances of the non-functioning market and interest crises for all stakeholders including the government, is trying to accept the challenges brought about by the world practice. (Lazarević Bajec, 2009) This is usually solved by copying the experience of other countries, which proved to be a very unsuccessful practice. Therefore, transformation of the planning process requires a comprehensive reorganization of institutions. (Lazarević Bajec, 2009)

## INSTITUTIONS AND PLANNING

Any changes in the model of planning require the adjustment of institutions as the main infrastructure supporting the planning process (Alexander, 2009; Healey, 2005; Connick and Innes, 2001). Institutionalization and organization pose as common ways of adaptation to unpredictability and innovation, caused by limited knowledge and the constantly increasing and changing complexity (Alexander, 2009).

The term "institution" used to include only formal structures, while today this term expands to various relationships created along the formal structures. According to Patsy Healey, there are two aspects to institutions: The "hard" infrastructure of the social structure, and the "soft" infrastructure of collaboration. "Hard" infrastructure serves the function of preventing and modifying the dominant centers of power, while the role of the "soft" infrastructure is in the building of connections which serve the purpose of mutual learning and strengthening of the political, social and intellectual capital, that promote coordination and flow of knowledge, experience and expertise through various links existing on the local level (Healey, 1997).

Today, the emphasis is increasingly shifting from coordination mechanisms to the social constructions and relationships, as well as to coordination without formal procedures. (Healey, 1997; Connick & Innes, 2001) This changes the rational framework which is now abandoning the concept of command-and-control, and




leads to coordination of the process of turning the knowledge and values into action (Healey, 1999).

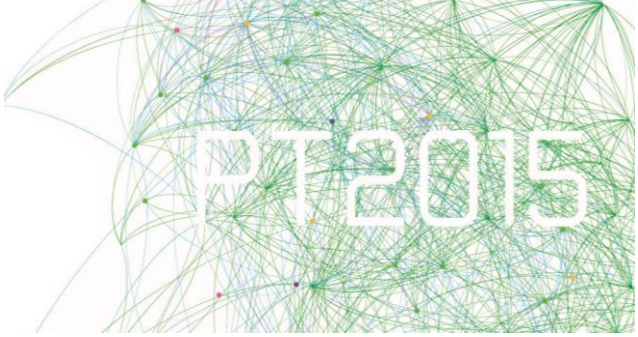
A common global practice nowadays, when it comes to multidisciplinary, complex projects, is for institutional arrangements to be implemented through informal processes and then work them further towards formalization. Formalization is very questionable when it comes to the subject of project innovation, as it is consisted of the regulated planning processes and there is a good chance of destroying any creativity along the way. This is why the process of institutionalization is very important, and how it later becomes a part of formal procedures.

Experts differ in opinions on the process of institutionalization and institution adjustment. While one group of planners and experts such as Stefano Moroni, Willem Salet and partly Patsy Healey believe that institutions should change gradually through the process of maturation of thinking and awareness - as per principles of evolution - and gradual changes that would follow the established fine links and intellectual capital acquired through knowledge and experience, others, such as Ernest Alexander, believe that institutions should be shaped in accordance with project requirements, especially in cases of complex, multidisciplinary projects.

According to Alexander, institutional design must be present at all levels of decision-making and action, including legislation, policy creation, planning, design and implementation. When it comes to multi-organizational projects, this author believes that it is necessary to design institutions of all levels of management, and coordination within the formal and informal processes (Alexander, 2005). Healey views institutional design as the two interactive levels. The first level deals with the construction of the social, intellectual and political capital, occurring during the development stages. The second level is concerned with the shaping of political, administrative and legislative systems, which structure the context of the local community. The second level is the area suitable for institutional design (Healey, 1997).

Before starting on the institutional transformation, it is necessary to understand the dynamics of urban processes and logic of the upcoming practices, as well as the local context in which the complex urban zones and multidisciplinary projects are being planned. This leads to better results in building infrastructure.

The planning system in Serbia is a complex mixture of the conventional hierarchical planning system with a few new concepts and methods. The first one represents a legacy of the Yugoslav-era socialist system, and is reflected in the rigidly defined and institutionalized formal planning. The later one is the “culture” of a non-formal approach to planning with the existing collaborative model of planning (Lazarević Bajec, 2009). Informal system is active and reflected in a series of new strategies, but it cannot be deemed as functional. For now it only




serves the purpose of educating the planners and members of the local administration, but not the purpose of plan implementation. The relationship between the formal and informal systems of planning is still very unclear.

One of the main problems is Serbia's strong hierarchical system of planning. The hierarchical, command-and-control system is difficult to adapt within complex processes (Alexander, 2009), and this is why the integration of multidisciplinary projects poses as a great challenge.

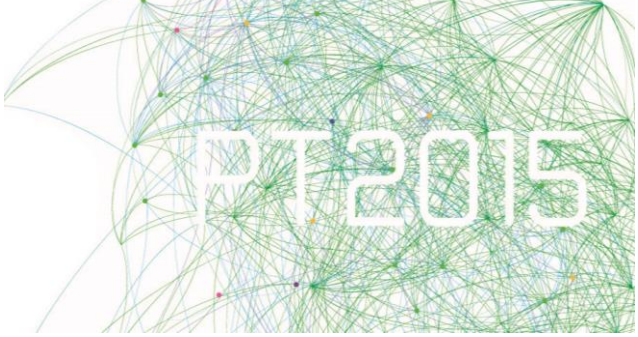
For the purpose of considering and analyzing new opportunities for the integration of multidisciplinary projects into the Serbia's planning system, the next section outlines some examples of regeneration of the devastated water sensitive areas. The example of the Emscher area and regeneration of some city zones in Malmo offer innovative solutions within the framework of institutional arrangement and organization. These projects showcase a number of technical innovation and attempt to rectify the problems of the formal planning systems through informal processes. Special attention will be given to analyzing the path of formalizing these arrangements.

## SELECTED EXAMPLES OF INNOVATIVE INSTITUTIONAL ARRANGEMENTS

### Rehabilitation of the Emscher River valley – main characteristics

The first example is a project of regeneration of the Emscher River valley covering the northern part of the Ruhr region. Up until 1980, this was a densely populated and highly polluted industrial region, with large open spaces. After the termination of coal, iron and steel industries, the remaining heritage waited to be rehabilitated. This was the start of the economic, social, and ecological transformation of this area.

The initiative for the regeneration started in 1980. Implementation had commenced on a regional level under the name of IBA - International Building Exhibition, initiated by the Ministry of Urban Development and Housing, with a planning lasted from 1989 to 1999. Basic comprehensive goals were set on a regional level and included the urban development, social, cultural, and environmental measures as the basis for economic change in the old industrial region. The main development projects were grouped into five thematic units: 1) Rehabilitation of the river and its tributaries (10 projects), 2) Emscher landscape park (300km$^2$ of open space – 19 affiliated projects), 3) Regeneration of the zones used for coil processing (the "Working in Park" project, 21 projects), 4) Regeneration of industrial heritage buildings (6 projects) and 5) New urban development projects: residential areas and associated activities (27 projects) (Shaw, 2002).




**Rehabilitation of the Emscher River valley – institutional organization**

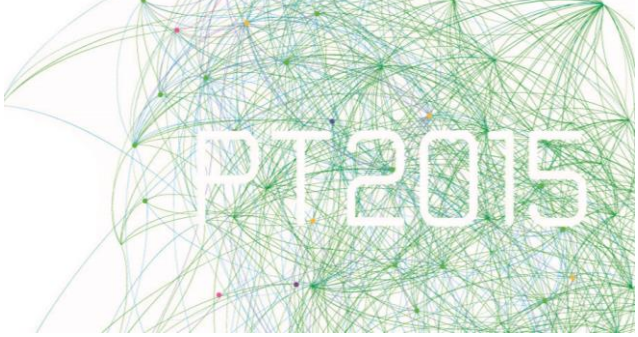
IBA Emscher Park attempted to regenerate the region using various forms of innovative institutional arrangements and policies. The intention was to circumvent and overcome the problems of the formal planning process and the existing institutional structures, which had hindered the development of this region for years (Knapp, et al., 2004). The result was a large number of decentralized projects, created for the purpose of Emscher area regeneration.

In the beginning of the process IBA Company was established, which later became the new regional stakeholder. It is a state-operative, provincial unit of the North Rhine Westphalia government, but it is not included in the decision-making structure, hierarchy, and the budgeting law (Furst & Kilper, 1995). The main idea was to use the IBA, supported by the state but not being the part of the formal system, in order to mobilize regional forces and improve coordination between the institution, local authorities and the existing stakeholders for the purpose of establishing the collaborative structures (Knapp, et al., 2004). The interaction between the participants was not defined by the formal rules and posed as a learning process.

State government is supporting the IBA by granting priority funding for their projects. Hence, two models of organization differentiated within the IBA Company: a) decentralized, mutually-coordinated groups of projects, b) coordination "from above" via budgeting (Furst & Kilper, 1995). Groups of projects are separate entities, not functioning within the formal, hierarchical structures of institutions, but which are, nevertheless, not completely regarded as informal processes. Local government and other agencies are responsible for each project.

The role of the IBA management is to mobilize ideas by organizing international conferences and workshops, to initiate architectural competitions, and set quality standards for the Emscher Park regeneration. The main advantage and quality of IBA is a depoliticized procedure of project selection. This has been achieved through the regulatory system of quality standards, rules of competition, and a domination of experts with many years of experience during the project preparation phase.

A comprehensive regional development programme, combining the reclamation of industrial wastelands, ecology, cultural policy, housing, and urban renewal with the promotion of economic development is shaped on the regional level. The main responsibilities of the decision making body within the IBA Company - Steering Committee include the selection of projects to be implemented in the Emscher area, and decision making in relation to the strategy content and quality standards (Furst & Kilper, 1995).




In order to be elected, each project has to satisfy two conditions: to belong to one of the five above mentioned categories of the project guidelines (thematic units) and to satisfy the set quality standards. The striving of experts for innovative projects has created an environment where the most appreciated and rewarded projects contain innovative solutions. Over the course of 60 simultaneously implemented projects, the public had an opportunity to become acquainted with the process of reconstruction of the region and its progress and rates of success.

**Malmo – characteristics of the project and context of initiation**

Regeneration of Malmo is a success story of modern system of collection, storage and treatment of atmospheric water for the purpose of bringing the devastated urban areas back to life and offering them a completely new and different character.

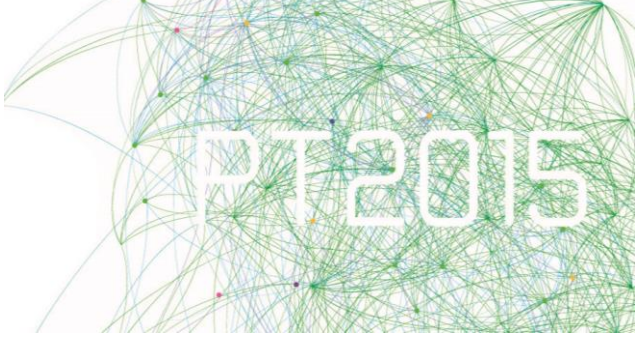
Due to market changes, Malmo had ceased to exist as a solely industrial city and was left with a number of abandoned and non-functional zones. In addition, due to problems with the sewer system and a constant wastewater overflow during the 1980s, some parts of Malmo were left almost completely deserted (Graham, 2009). Facing these challenges, Malmo representatives and experts started creating a new and clearly defined vision of the city, which in ten years' time was supposed to evolve into an eco-town and a center of knowledge, while directing the policies and measures of development in accordance with the principles of sustainable development.

In accordance with the new vision, a set of initiatives, programs and projects came to life. The sewer problem was addressed in a modern, sustainable manner, using new technologies. It soon became clear that the existing planning system and institutional organization were unable to respond to the demands of innovative projects, and that changes were necessary within the process and institutions responsible for tracking the city dynamics and specific characteristics and requirements of innovative solutions.

**Malmo – institutional organization and process of planning**

The process of regeneration of the Malmo zones affected by the sewage started with an initiative and great persistence of a small group of experts, who wished to draw attention to the importance of new approaches to drainage and treatment of atmospheric waters. They managed to implement the first project – Toftanäs Wetland Park, after which the local government representatives, city services employees, and citizens themselves began to recognize the benefits and importance of this approach to the problem-solving.

The entire process was accompanied with promotion of new technologies, so the whole project was conducted under the principle of parallel planning, design, and implementation of a number of smaller projects and so called "interactive



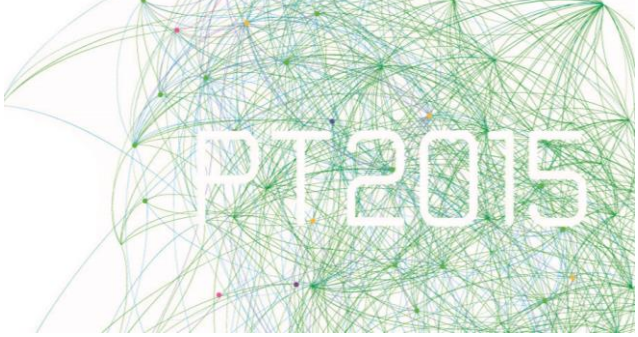

implementations". According to Govert Geldof, the main characteristic of this approach is to determine and define the vision understandable to politicians, investors, and the local community, and then commence simultaneous realization of the planning, design, implementation and maintenance. Experts and other stakeholders work together, learn from each other, and creativity exceeds the limits of design and also depends on stakeholders involved in other phases of the project. Large projects are divided into a number of smaller ones and are implemented during the different time intervals, enabling the possibility to learn from the made mistakes, which could not have been foreseen or anticipated in advance (Geldof, 2005). In this way, the local population is gradually introduced and prepared for the final version of the project, with opportunity to fully understand the advantages of these systems seeing an example of a particular, implemented project. This approach provides great potential for change and improvement of solutions during implementation.

A number of public services were included in the process of regenerating the Malmo devastated areas: Malmo Planning Authority, in charge of planning, Malmo Public Works, in charge of parks and urban greenery, traffic and maintenance, Malmo Real Estate Authority which takes care of the property and the Malmo Environmental Protection Authority – responsible for environmental protection (Stahre, 2008). The project initiator and the main stakeholder was the company Malmö Water, part of the regional organization VASYD formed by the municipal services for water and sanitation of four cities in Sweden. In addition to the public services, a number of stakeholders and citizens took part, who were beforehand informed on the new approaches through pilot projects. Some stakeholders became partners in implementation and maintenance, and the citizens actively took part in the process and offered a range of innovative solutions that were later implemented.

Cooperation of these departments was not a common practice, so the whole project was partly an informal process. Forming of a shared vision was a new step for public services. Likewise, it was necessary to establish a detailed and clearly defined agreement on participation in the financing of the project during the planning, implementation and maintenance phases, as well as the clear division of jurisdictions during the monitoring and maintenance, even before the project development. The objectives were changeable and the process flexible, which enabled alterations and improvement of solutions during the implementation of pilot projects. Cooperation of a large number of stakeholders, multidisciplinary nature of the process, and frequent meetings enabled the establishment of new connections and intellectual and social capital, formed over the period of ten years through informal processes.

## CONCLUSION AND TIPS FOR RESPONSIVE PLANNING

We analysed ways of implementing the innovative concepts in the process of renewal of urban water sensitive places through examples of regeneration of



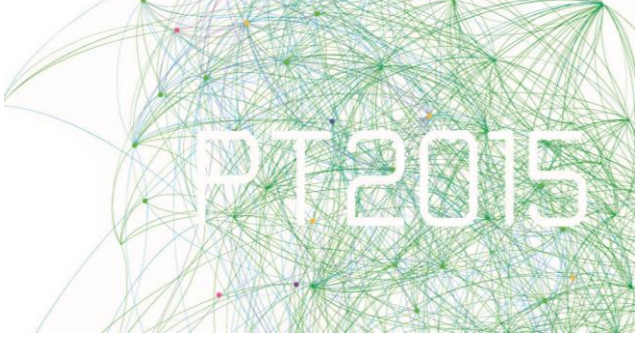

Malmo and the Emscher River valley. Both examples offer new models of planning, i.e. new institutional arrangements created within a specific context.

A common characteristic for both is implementation of projects during the planning phases. In case of the IBA Emscher Park, the entire project consisted of a large number of smaller projects, many of which were simultaneously implemented. Planning methodology varied between them and the planning itself carried very few strategic components. Malmo utilizes common planning methodology, except that the smaller pilot projects are being realized over the course of the entire project, for the purpose of enhancing and improving of the process. Objectives kept changing, making the planning process of Malmo very flexible. Plans are adapted on the grounds of new information.

The planning process in Malmo was implemented as part of the formal planning and management. Unlike the IBA Emscher Park, Malmo does not practice the formation of new institutions, but uses the existing ones. The new cooperation and coordination has been established, with special emphasis on division of budget and jurisdictions. After ten years of informal planning and institutionalization of new methods, this process has commenced. During the year 2000, new policies defining direction of development of this area of water management were established. Later on, due to high demand for these types of projects, city created directives for rainwater management, planning and design. The new directives were officially adopted in 2008 and they outlined jurisdictions of each city service, defined by the clear documentation and responsibilities for each phase of the planning and implementation, in order to avoid confusion and misunderstandings (Stahre & Geldof, 2003). Nowadays, the process of planning the water sensitive places in Malmo is a formal part of the planning process. The only remaining question is whether it retained a high level of flexibility it used to have.

IBA Emscher Park also represents an example of informal planning. However, as in the case of Malmo, there is an indirect control by the means of funding provided by the state. On the other hand, this way of venture financing, which enables access to state funds, provides high degree of autonomy. Autonomy is further increased with the establishment of the special institution - IBA Company and possibility of project control though defined quality standards. Also, the presence of a large number of experts and independence from authority of each city lends IBA the ability to implement a highly depoliticized process (Furst & Kilper, 1995). In addition to funding, everything else is organized within a region, where new venues of communication, cooperation and exchange of ideas are being established.

What makes the IBA particularly successful is the informality, as well as the fact that it was viewed as a temporary thing – a series of workshops, and not as a planning process. However, IBA is actually a mechanism for the institutionalization of the new procedures. The resulting networks transcend hierarchy and formal departments and have a role of removing the institutional




barriers towards social change (Knapp, et al., 2004). IBA managed to institutionalize innovation. What is considered responsible for IBA's success is that it was set as something specific, and not a part of a common practice, which has resulted in a different attitude of stakeholders on regional and local levels. Those are some of the reasons why IBA did not rush to the formalization process, as it would have, in that case, lost some of its most important qualities.

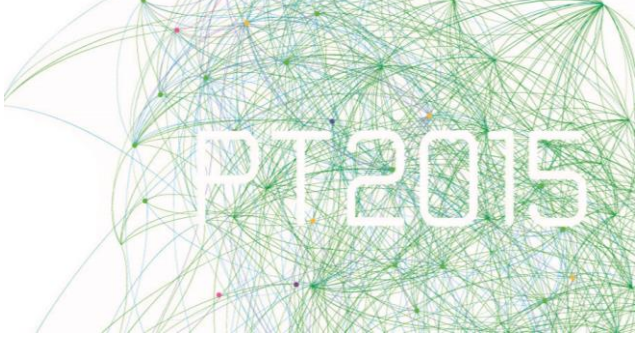
The institutional environment differs in every country and depends on many different factors. It is therefore difficult to speak of experiences that can be fully applied to local practice. These findings and examples may serve only as ideas and incentives for organizing the process of regeneration of water sensitive places in a local setting.

**What are the messages of these examples and can they be considered as the role models of good practice for Serbia?**

Despite great differences in the systems of planning, institutional organization, decision-making processes, and regulations between Serbia, Germany and Sweden, some observations and results may be relevant for Serbian circumstances.

Recent projects initiating urban change in Serbia stem more from the present political moment and opportunism, then a genuine intention to try out the new patterns or introduce innovations into the practice of urban renewal and development. These processes are highly politicized and often lack the protocols of competitions and quality standards, which was the case in the Emscher area. However, informal practices occur hat support local initiatives in smaller towns, mostly in cases of small power plants or initiatives related to energy efficiency. These processes offer quality patterns and institutional arrangements that need to be adopted.

In area of this study's subject there are no such initiatives, and the existing good examples do not provide basis for a transfer into the fields of regeneration of the devastated zones around the small urban watercourses and deteriorated sewer systems. In this sense, examples of good practice from other countries are very valuable. The examples presented here suggest the need for understanding the importance of these projects and setting them up on a priority budgeting list, as well as for creation of new opportunities for "soft" strategies and local initiatives. And as it occurs in other areas, e.g. the role of NGOs in the political arena, openness would enable participation of other stakeholders, whose knowledge and experience would have the capacity of creating good solutions. As stated by Charles Landry – it is necessary to view the urban challenges from different angles and perspectives not necessarily belonging to conventional disciplines dealing with the cities. This would initiate the change of planning procedures and their institutional arrangements, as well we the strengthening of evaluation techniques and relationships between urban planning and other disciplines.




## REFERENCES

Alexander, E. R., 2009. Planning in Complexity—Institutional Design Implications. Journal of Planning Education and Research, 28, pp. 518-524.

Alexander, R. E., 2005. Institutional Transformation and Planning: From Institutionalization Theory to Institutional Design. Planning Theory, 4(3), pp. 209-223.

Beauregard, R. A., 2005. Introduction: Institutional Transformations. Planning Theory, 4(3), pp. 203-207.

Brown, R. R., Farrelly, M. A. & Loorbach, D. A., 2013. Actors working the institutions in sustainability transitions: The case of Melbourne's stormwater management. Global Environmental Change, 23, pp. 703-718.

Connick, S. & Innes, J., 2001. Outcomes of Collaborative Water Policy Making: Applying Complexity Thinking to Evaluation, s.l.: s.n.

Evers, G. J., 2011. *Werk in Uitvoering*. s.l.: Thesis, University of Twente.

Furst, D. & Kilper, H., 1995. The innovative power of regional policy networks: A comparison of two approaches to political. *European Planning Studies*, 3(3).

Geldof, G. D., 2005. *Coping with complexity in integrated water management. On the road to Interactive Implementation.* Deventer: Tauw.

Graham, T., 2009. Malmoe, Sweden: Towards the Sustainable City. in: *Low Carbon Cities*. Porto: ISOCARP, pp. 218-223.

Healey, P., 1997. *Collaborative Planning: Shaping Places in Fragmented Societies*. New York: Palgrave.

Healey, P., 1999. Institutionalist Analysis, Communicative Planning, and Shaping Places. *Journal of Planning Education and Research*, 19, pp. 111-121.

Healey, P., 2005. On the Project of 'Institutional Transformation' in the Planning Field:Commentary on the Contributions. *Planning Theory*, 4(3), pp. 301-310.

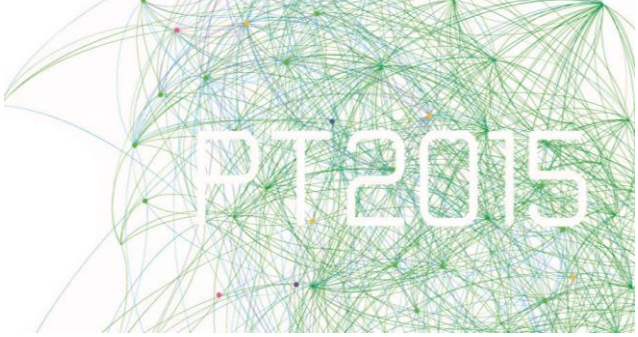
Knapp, W., Kunzmann, K. R. & Schmitt, P., 2004. A Cooperative Spatial Future for RheinRuhr. *European Planning Studies*, 12(3), pp. 323-349.

Lazarević Bajec, N., 2009. Rational or Colaborative Model of Urban Planning in Serbia: Institutional Limitations. *SAJ*, 1, pp. 81-106.

Shaw, R., 2002. The International Building Exibition (IBA) Emscher Park, Germany: A Model for Sustainable Restructuring?. *European Planning Studies*, 10(1), pp. 77-97.

Stahre, P., 2008. *Blue-green fingerprints in the city of Malmoe, Sweden*, Malmoe: VA SYD.

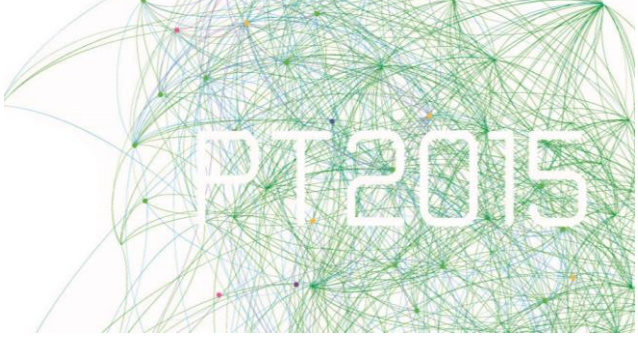
Stahre, P. & Geldof, G., 2003. New Approach to Sustainable Stormwater Planning. Available at: http://greenroofmalmo.files.wordpress.com/2012/02/005-new-approach-to-sustainable-stormwater-planning1.pdf [Last modified 06 2011].




# TOPIC III:

# Lifetime Communities and Participation

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# COHOUSING FOR BUILDING REUSE

**Adolfo Baratta**
Associate Professor, Roma Tre University, Department of Architecture, Via Madonna dei Monti, 40 – 00184 Roma, adolfo.baratta@uniroma3.it

**Fabrizio Finucci**[1]
Assistant Professor, Roma Tre University, Department of Architecture, Via Madonna dei Monti, 40 – 00184 Roma, fabrizio.finucci@uniroma3.it

**Annalisa Metta**
Assistant Professor, Roma Tre University, Department of Architecture, Via Madonna dei Monti, 40 – 00184 Roma, annalisa.metta@uniroma3.it

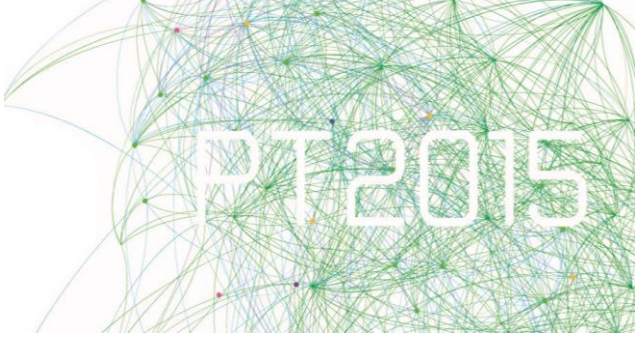
**Luca Montuori**
Associate Professor, Roma Tre University, Department of Architecture, Via Madonna dei Monti, 40 – 00184 Roma, luca.montuori@uniroma3.it

## ABSTRACT

*Many social structures in Western Societies are living a deep changing process because of the adaptation to changes imposed by new economic production conditions, by the new available technologies and by the tendencies of the sustainability paradigm. Complexity of life, alienation, an ageing population, temporary work conditions and migratory flows of vulnerable individuals, are just few example of the new trends. Among the innovative proposed answers, some are coming up from the past in order to join with current tendencies: this is the case of cohousing (born in North Europe during the '70s) associated with the reuse of the existing buildings, both of them are central issues to be considered for the sustainable development. The cohousing, seems to be an effective answer to different complex problems e.g. life organization and cost, alienation, new jobs opportunities; in facts cohousing offers residential functions together with common services, usually managed by the residents. Furthermore, cohousing represents an answer to the housing deprivation, recently worsened by the effects of the economic crisis. For many years in Italy the matter of housing has been faced up with just welfare rather than structural interventions; moreover, the topic of reuse is, at the same time, a problem to be addressed, a strategy to be pursued and an available resource, by virtue of the large entity of the heritage to be reconverted. The paper, based on the results of an ongoing research conducted by the authors with a multidisciplinary approach, proposes a critical thinking over the themes of cohousing and heritage buildings focused on Italian realm, offering at the end a description of a virtuous Italian case study.*

***Keywords**: cohousing, heritage buildings, reuse.*

[1] Corresponding author

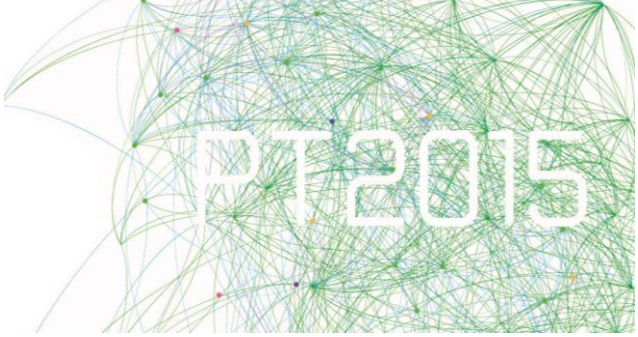



## INTRODUCTION

This conference calls about "public health", the mother of all topics involved in every discourse on urban realm. We explore it from the built environment perspective, keeping together two items, both urgent and central: housing and existing building heritage. The capability of quality housing is the foundation for the quality of life in terms of well-being and social inclusion. Nevertheless, in Italy, the housing issue remains on the margins of political agendas and the urgency to take care of it is now coming strongly to the fore, exacerbated by the economic and financial crisis. When we say that housing is an urgent topic, we do not refer only to the lack of policies for public housing. We refer to a more general lack of attention in dealing with a matter that is continually evolving, just because people, economics, culture are continually changing. Life style is always in progress and thus the idea of quality housing is going hand in hand changing. The actual pressure is of course the house unavailability because of the spreading of poverty of recent years, but also the unsuitableness to demographic and social changes affecting our society, as well the production system, with a heavy impact on social vulnerability. The existing built heritage is another topic deeply connected with public health in urban realm. Italian cities have a huge amount of obsolete and no longer efficient sites, in terms of structure, energy environment, regulation, and use. Several design experiences and recent researches demonstrate the broad spectrum of opportunities connected to reuse of existing places (not just buildings), adapting them to new activities, keeping their original value, when present, or introducing new values, when occurred. In particular, the traditional affection of Italian culture to the conservation and protection is joining the recent attitudes to avant-garde contemporary practices of built habitat transformations. When we speak about existing heritage we refer to public estate, but even more to private properties, that compose diffuse assets. They mainly have residential uses, so guessing to maintain this vocation is often appropriate to keep urban vitality. Thus, we intend to investigate the opportunity to find in cohousing a way for regeneration of housing concern and adaptation of existing buildings as parts of urban structures, working not just on residential units, but also on common areas. We articulate this subject in three parts: the first deals with cohousing as strategy for urban regeneration; the second one is dedicated to feasibility and procedures in Italy; finally, we present a case study in Ascoli.

## COHOUSING AND REUSE OF EXISTING BUILDING HERITAGE

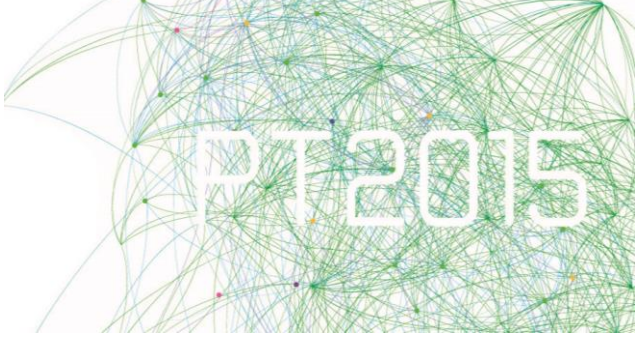
The challenge thrown down by housing problems, intensified by the effects of the serious economic crisis, is one of the most delicate among the many we face, because it involves a growing part of the European population. The deep structural, social and economic changes affecting Italy, such as the aging of the population and immigration of vulnerable people, the new temporary work conditions, the financial crisis and the inaccessibility of the rental market, require to deal with affordable housing solutions, as well as to quality services. Among the different




housing models, cohousing has yet unexpressed potential and offers a test field for innovation. Understood as "a special form of neighbourliness, in which private and shared facilities are combined in order to protect everyone's privacy and at the same time the need for sociality" (Lietaert, 2007), cohousing is a residential solution capable to mitigate some of the problems affecting city dwellers. Shared spaces, services and functions answers to the search for relationships and social networks that cohabitation is able to generate, as well as the well-being improvement perceived by the involved communities. The coexistence of residential and community services is in line with the trend to manage intangible services. In addition, the increased use of the common areas will reduce the size of the private areas with the effect of a reduction in overall costs. Although the benefits of cohousing interventions are already widely explored (Brown, 2004), these advantages can further increase if matched with those generated by the reuse of existing buildings. The new success of dense aggregation models and the opportunity to work on the existing city attest by now shared cultural positions and practices. The development of research plans and projects pursuing urban sustainability through interventions of housing recovery is advancing. In Italy, because of the huge amount of existing sites to renew for new purposes, public and private investors see the recover market as the way out to the decline of construction industry. Since 2006, the building maintenance sector showed an 11% growth, while that of new construction a 15% reduction (CRESME, 2013). Reuse and cohousing can then be virtuous strategies of social, environmental and economic development, with new solutions and forms of partnership. The residents can take advantage of spaces and services that a residential unit usually has not. The same space and services can also be opened to the neighbourhood, maybe in defined time slots and with discounts; public entities can activate urban regeneration policies exploiting disused buildings; private entities can strengthen its role in the community in terms of "social balance" (Sacconi and Degli Antoni, 2011). In Italy, this situation appears in some interventions, such as "Residenza Porta Palazzo" in Turin, which retrieves a building owned by the city; the "Residenza" in Bologna, which recovers a building owned by the Public Company for Human Services for Children; the project "Abitiamo Insieme Ascoli", which offers apartments for rent for young couples. They are all interventions where cohousing is for the city actually the "germ of its own regeneration" (Jacobs, 1961).

## FEASIBILITY AND PROCEDURE MODELS IN ITALY

Since the mid-90s, we live in Italy a phase of continuous weakening of support for residential building. It is difficult to think about public hands interventions for cohousing implementation, because of the recent economic situation and the consequent spending reduction. On the opposite side, the predominantly private nature of some experiences, in which groups of individuals develop their own self-design process, must necessarily be overcome. These experiences tend to transform the groups in gated community (Chiodelli, 2010) and nullify the possible synergistic effects of sharing and openness of cohousing for the nearby territory.

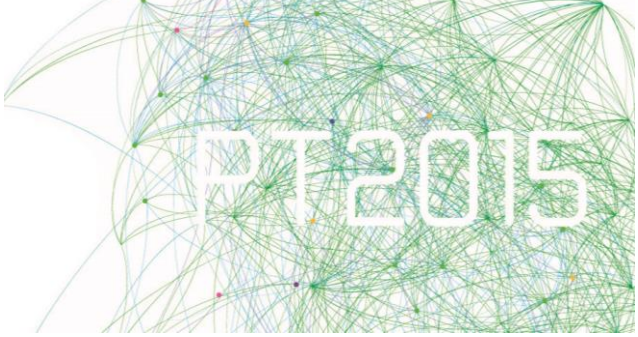



Different types of agreement between cohouser and public decision-makers can offer solution to the problem of closed communities, such as the assignment of property in disuse, in exchange for the construction and management of places and services for the rest of the community (Deriu and Becco, 2011). This would allow the strengthening of local social networks and a consequent increase in the social capital of a territory. Not a few associations promote cohousing through support and facilitation to create cohousers groups. These operations reaffirm the central role of the private initiative of future residents that, at times, take advantages from expert advisors or are entirely self-manage in design and construction stages. In both cases, the uncertainty related to implementation needed time, access to credit and technical difficulties tend to increase the failure risk for the operation. In recent years, the attempts to match different public and private resources increased. In some cases, projects recurred to the Integrated System of Real Estate Funds for Housing (set up by the Prime Ministerial Decrees DM 22.04.2008 and 16.07.2009). These funds (a national one and a network of local funds) are tools to finance real estate projects that try to combine the objectives and aims of social intervention with the guarantee of financial return, hold down within so-called "ethical" limits.

Finally, cohousing can be a privileged field to experiment new forms of partnership as, for example, the corporate grant making foundations, which aim is to combine the financial resources of the enterprises with the social objectives of the no-profit subjects. Many companies require the establishment of enterprise foundations specialized in the financing of high social value projects, promoted and led by non-profit institutions, as a strategy for their corporate social responsibility. For example, a real estate investment economically viable, led by non-profit institutions aimed to the complex set of social benefits generated cohousing, can be associated with grant making foundation of enterprise.

## AN ITALIAN CASE STUDY: ABITIAMO INSIEME ASCOLI

In Italy, several projects related to new forms of cohabitation are spreading up. They recover some models of integration between residential facilities and services; match co-design and social integration paths dedicated to people with special needs or difficulties; improve the evolution of traditional cohousing models. These projects try to intervene with new forms of life sharing and co-design of spaces. The aim is not just to identify new inhabitants' requirement compared to the private sphere of living, but even more to define the places for collective or public use and activities. To expand the idea of cohousing with a strong return of public interventions can satisfy the inhabitants' needs while integrating their community within the places where settled, reducing forms of gentrification through targeted policies. If the cohousing was born and developed in response to specific needs of little communities, it is also true that the strict application of the original model leads today to resemble forms of "private enclave of residential character" or even gated communities. On the contrary, a different development of cohousing models would lead to revitalization policy for entire

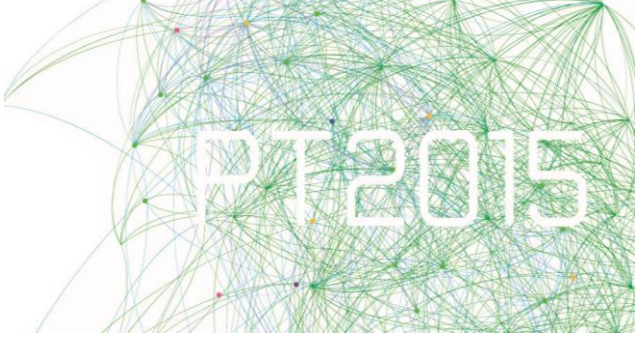



degraded urban areas, through the inclusion of different inhabitants, social mixité, and forms of integration and/or support for disadvantaged groups. In this sense, Ascoli has launched an interesting policy to recover abandoned buildings in the historic core of the city, favouring their transformation into residential settlements with specific qualities in terms of typological innovation. We can mention the transformation of Palazzo Sgariglia, a XVI century building, with important frescos, and the former Convent of the Sisters of the Child Jesus. These case studies allow addressing the issue of recovery of historic buildings in historic settlements, threatened by depopulation.

Sgariglia Palace is a building of considerable size, built along one of the main axes of the historic centre of the city, owned by a noble family in 1908 and then donated to the City of Ascoli. The project, called "Abitare insieme Ascoli", involves the construction of 30 lodgings including 6 for sale and 24 for rent. In total 2,540 sqm are dedicated to residences (for young couples, seniors, students), 275 sqm to integrated services for housing (laundry, meeting spaces and coworking, common and Wi-Fi spaces) and 950 sqm to social and urban services (workshops, exhibition spaces, catering, zero km food). Although the forms of sharing spaces are limited and the proposed model is due to traditional forms of public housing, the particular kinds of common functions and the management model foster integration among different inhabitants within an urban fabric today characterized by a significant residents' aging. In the case study, the stated aim of the promoter is to offer a solution to disadvantaged people and, above all, to "accompany the formation of a network of good neighbourly relations among residents. The goal is to create a community of residents able of enhancing the social environment not only of the building but also for the neighbourhood and the entire city" (AA.VV. 2015). The phase of co-design took place after the housing allocation, to establish the community, promote the participatory planning of common services, support self-management, the drafting of the "Community Rules / Cohabitation Pact" and the constitution of a tenants association. The promoter claimed this stage with the help of facilitators, which led the inhabitants to devise a series of activities in the multipurpose room, in the children playground - open also to the children of other nearby families - and in the garden. "What is required in this community of tenants is to join efforts in the construction of a small network of relations [...] that is also present in good neighbourly relations of everyday life" (ibidem). Thus, this formula does not just imagine a house sharing to develop new forms of horizontal welfare in the selected communities, but proposes a more challenging attempt to engage also the surrounding areas in a process of new cohabitation.

## CONCLUSION

The experiences of Ascoli show that even in Italy is advancing a promising research on new ways of living that eschew purely welfare logic and look at cohousing as a chance to reflect - with active tools - on the many and various ways of contemporary living. They translate in actual places the idea that the economic




dimension is not the only factor that determines situations of homelessness, but there are several new variables, such as the temporary needs, which stimulate new directions of inquiry. Experimental initiatives are addressing the issue of housing in its complexity: consider the needs of a more and more critical access to housing, but also the relational needs, often explained by the participants of the projects, which express the desire to become active in their community and contribute to the whole neighbourhood quality of life.

Beyond the specific case we examined, we find out that if, on the one hand, cohousing research manifested already more than encouraging results from procedural and management as well social improvement points of view, on the other, there is eventually some slowdown in search of architectural results. These new housing models produce new rules and new social pacts. They also produce new kinds of spaces, hybrid situations between home sites and common areas, between public and private. The theme of the threshold, for example, of the passage, appropriately modulated, between different spaces - changing even during the day -, offers enormous opportunities for design. We believe this to be the direction in which promote research, to bring feasibility, social quality and architecture on the same level of advancement.

## REFERENCES

AA.VV. "Il progetto". Abitiamo Insieme Ascoli. Last modified March 23, 2015. Accessed March 31, 2015. http://www.abitiamoinsiemeascoli.it.

Brown, J. 2004. *Comparative Analysis of Energy Consumption Trends in Cohousing and Alternate Housing Arrangements*. Submitted to the Department of Civil and Environmental Engineering at Massachusetts Institute of Technology, June 2004.

Chiodelli, F. 2010. "Enclaves private a carattere residenziale: il caso del co-housing", *Rassegna Italiana di Sociologia*, no. 51 (January): 95-116.

CRESME. 2013. *Il recupero e la riqualificazione energetica del patrimonio edilizio: una stima dell'impatto delle misure di incentivazione*. Roma: Camera dei Deputati, Documentazione e Ricerche.

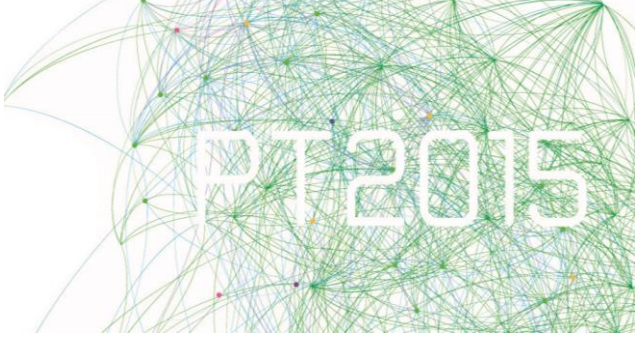
Deriu, F. and Beccu, G. 2011. "Giovani e "secondo welfare". Il social cohousing, una risposta innovativa alle incertezze presenti e future". *Innovare il welfare. Percorsi di trasformazione in Italia e in Europa*. Milano: 29 settembre-01 ottobre 2011.

Jacobs, J. 1961. *The Death and Life of Great American Cities*. New York: Random House.

Lietaert, M. 2007. *Cohousing e condomini solidali*. Firenze: Aam Terra Nuova.

Sacconi, L. and Degli Antoni, G. (eds). 2011. *Social Capital, Corporate Social Responsibility, Economic Behaviour and Performance*. Basingston: Palgrave Macmillan.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# HOW TO DESIGN HEALTHY BUILDING FOR HEALTHY LIVING?

## *COMPLEX NETWORK OF HEALTH*

**Anja Jutraž**
PhD, Assistant, University of Ljubljana, Zoisova 12, 1000 Ljubljana, anja.jutraz@fa.uni-lj.si

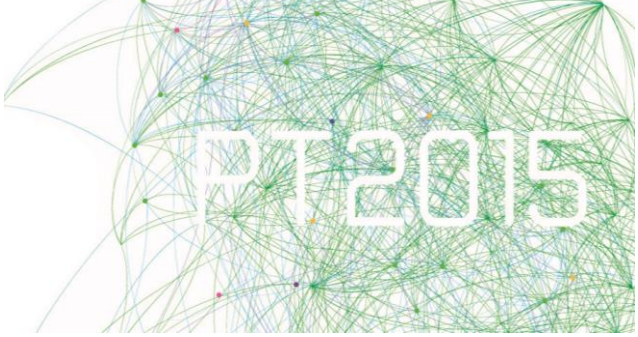
**Sanja Štimac**
Master student, University of Ljubljana, Zoisova 12, 1000 Ljubljana, sanjastimacri@gmail.com

## ABSTRACT

*The purpose of this article is to address the correlation between architecture and our health, more exactly how the design of a building affects our well-being and health. Life cycle of the building could be compared to the circle of life, where building could be seen as a person (mechanical installation system vs. circulatory system). On one side article describes the building, from its position in urban environment (urban planning and urban design, designing smart, social and green city), architecture design (construction of the building, sustainability, resiliency) to the interior design (furnishing, flexibility). On the other site the article explores the person, from its role in the community, and influence of work and living environment on health.*

*More specifically, this chapter will describe the case study Complex Network of Health, which was done as part of the AEC Global Teamwork course at Stanford University in 2014. Team Express has explored under the leadership of prof. Renate Fruchter and many other mentors the principles of designing healthy building (focusing on different scales, from urban design, architecture to interior design). The main idea was to design the engineering building for healthy living, which is part of wider network, where also building could help you to live healthier (the placement of the building in the urban environment, distribution of rooms and program in the building, materials etc.). Moreover the new types of technology for improving healthy living in direct connection to healthy building will be explored, focusing on mobile apps. The main aim of this article is to define guidelines for designing healthy building for healthy living, which will help lay public and professionals by making decisions in the design process. To conclude, the end goal of this article is to show the importance of designing the quality living and working environment for your health.*

***Keywords**: healthy building, healthy living, network, technology, urban space.*




## INTRODUCTION

In past decades when green initiatives took major role in designing public and private spaces, the focus of researches in architecture was on surrounding and how to prolong it and sustain for generations to come. Nowadays the research is mostly focused on living environments, closely connected with the following question: What is happening with the users', their health and prolongation of their life?

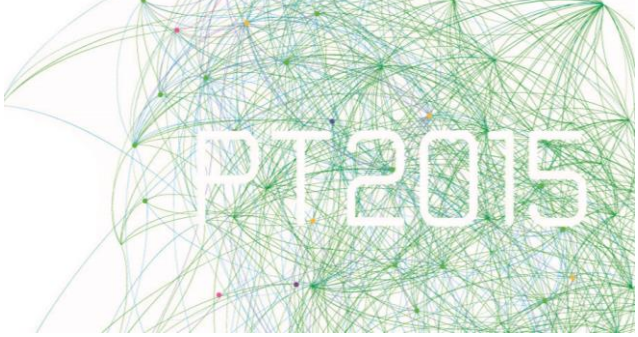
We all get daily information about importance of exercise, eating well, caring about our mental health, but can any of us truly say that we know how to live healthy? The purpose of this article is to address the correlation between architecture and our health, more exactly how to design a building that affects well-being and health. Life cycle of the building could be compared to the circle of life, where building could be seen as a person (mechanical installation system vs. circulatory system). On one side article describes the building, from its position in urban environment (urban planning and urban design, designing smart, social and green city), architecture design (construction of the building, sustainability, resiliency) to the interior design (furnishing). On the other side the article explores the person, from its role in the community, and influence of work and living environment on health.

### Problem definition

The main problem discussed in this article is the lack of connections between human health and his living and working environment (the influence of urban and architecture design on health and life quality). More exactly, we divided the problem into two topics: (1) how to design "healthy building", where the building, from its position in urban environment (urban planning and urban design, designing smart, social and green city), architecture design (construction of the building, sustainability, resiliency) to the interior design (furnishing, flexibility) is defined; (2) how to live healthy in the "healthy building": the person, his role in the community, and influence of work and living environment on health is explored.

To solve a general problem, a specific case study was chosen: design of a new engineering building at the University of Ljubljana, as part of AEC Global Teamwork course at Stanford University, led by prof. dr. Renate Fruchter (Ožbolt, 2008; "PBL lab," 2015). The Swinerton Challenge "Building Healthy" force us to think deeper into the healthy design, from large to small scale, from the construction and architecture on one side, to the psychology and medicine point of view on another side.

The main aim of this article is to show the importance of designing the quality living and working environment for your health. The main research question of this paper is as follows: How to design healthy building for healthy living?

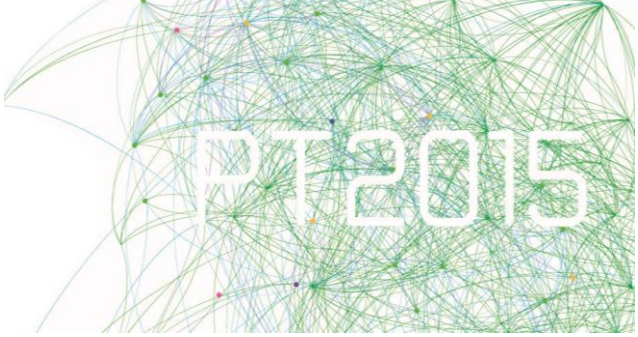



**Methodology**

As a case study the project Complex network of health was chosen. Our research was divided into three stages, which were closely connected to each other: (1) exploring the existing research about healthy building through a literature review; (2) implementation of healthy design principles into development of a new engineering building; (3) defining healthy design principles. In all three stages we used following methods: observation (of the site for new engineering building), literature review, semi-structured interviews (with locals, about their healthy habits).

## PROBLEM BACKGROUND

The city is the ultimate creation of human mind. It is a collection of buildings, people and activities. Development of urbanism and city was so quick in the course of history that sometimes we forgot what kind of influence built environment could have on its users. In past few decades field of architecture and sociology researched many topics on the influence of city environment on people, their behaviour and their habits (Porteous, 1977; Rapoport, 1977). Still most of these researches are focused on how to gain or maintain individuality in today urban spaces (Esser & Greenbie, 1978; Walmsley, 1988), neglecting the fact that people are mostly social persons and that they are dependable on community. Community is base of learning for every human (McMillan & Chavis, 1986). After first waves of trying to understand the city the concerns about speed of development places and its impacts on environment were raised (Betsill & Bulkeley, 2007; Breuste, Feldmann, & Uhlmann, 1997). This question as a product had whole new field of sustainable urbanism and architecture. Initiative focused on environmental protection and use of resources and spaces so that it meet the green initiative; as the least possible impact on surrounding and how to prolong it and sustain for generations to come (Sheppard & Harshaw, 2000; Wu, 2008). New approach brought view on architecture that had not been seen before. The principles of sustainability aim to address the problems of environmental degradation and lack of human equality and quality of life, by supporting development that is sustainable in economic and social terms and is capable of retaining the benefits of a healthy stable environment in the long term. In design process these all was considered, from local environment, construction, use of sustainable and low impact materials, low energy approaches to new technology systems that helped sustain building (Becerik-Gerber & Kensek, 2010; Hinte, Neelen, Vink, & Vollaard, 2003; Karolides, 2002; Krishan, 2001; Sassi, 2006). When solution on how to design and build sustainable cities and architecture, was found, questions about comfort of living was raised. Comfort of living is influencing every aspect of human life as most of our time we spend in schools, offices, and homes. Sometimes they are inadequate equipped and designers are obligated trying to improve the life conditions of their clients and users (Chappells & Shove, 2007; Santamouris, 2013). After improving the conditions of life the one of the last impacts of human life is community. Humans



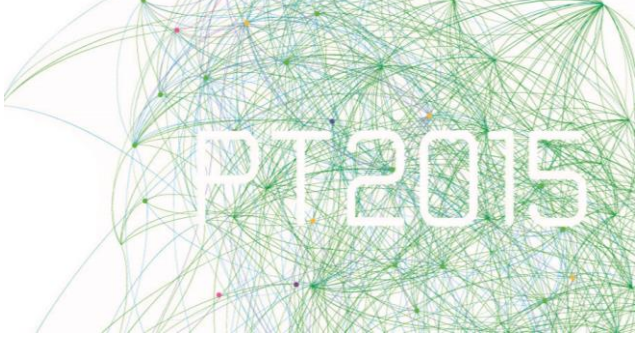

are the vocal points of community, with their essence, and their life. Community is helping them to find the ways to be happy and healthy, and it is the base of learning and development for every human. In the last few years research has been focused on finding the way to build a building that will keep user happy, healthy and be a support in achieving its higher goals (Gregson & Court, 2010; Kultur, 2012; Lyubomirsky, Sheldon, & Schkade, 2005).

Problem background of sustainable design and architecture is that most of researches as we introduced them, for main goal have how to sustain locality, community, building and environment in it, but they are not explaining how to sustain and motivate healthy living in users. Most of researches that are connected to users are about influence that design have on pattern and behaviour of people (Katzschner, 2006; Trigger, 1990). On the other side if we look at researches that are focused on people mostly they contain guidelines for maintaining mental and physical state (Penedo & Dahn, 2005; U.S.Department_of_Health_and_ Human_Services, 1996). However most of information you can get is not connected with how to design city, community or building that will promote and encourage healthy living among the users.

## COMPLEX NETWORK OF HEALTH

Realization on extensive problem background began with a start of AEC Global Teamwork course at Stanford University in 2014. Under the leadership of prof. dr. Renate Fruchter and many other mentors we started the research and design of healthy building. Our team Express was composed of one of the most diverse and unique mix of cultures (Chinese, German, Romanian, Croatian, and Canadian), personalities, and backgrounds (architecture, structural engineering, construction management, mechanical engineering etc.) which gave us opportunity to look at the same problem from different perspectives and with different knowledge backgrounds. The task was to design a new engineering building in Ljubljana, and at the same time solve two challenges: "the DPR Challenge: Total Value for Client and the Swinerton Sustainability Challenge Building Health" ("PBL lab," 2015).

As we were gathering information on how to solve problem that was given to us we were kind of lost. Dividing the project from different views and inputs led us in to realisations that healthy building is much more than just points that were satisfying green initiative goals, especially in the case when user was equal member of equation for the final solution. Healthy building became a connecting grid between different parameters and in time, it developed in a complex network of health that was based in two different philosophies - western idea of physical health and eastern idea of balance inside of body.




**Balance**

One of our first problems that we experienced, as anyone who is involved in architecture does, was defining the site context. Designing for the particular site presents a number of challenges that are closely associated with the location. Through the process we managed to identify five main site challenges, where each challenge represents the existing unbalanced conditions and constraints which the design ultimately reconciled and designed for: balance of the local site conditions, balance of height and depth, balance of stability, balance of connection and balance of social expectations.

If the challenges of the local conditions present an interrelated mix of unbalanced systems, the central theme of our building revolved around the balance of different systems through the fundamental focus on global health system and associated to health networks. Inspired by the ancient Greek idea of Sophrosyne, or in the other words, the philosophy of healthiness from balance (North, 1969), health was also interpreted within the design process as a balance of multiple influences. The concept of health balance also evokes the theme of elemental balance in nature between the five elements. Just as nature exists in the equilibrium of interrelated elements, health can be interpreted as a balance of interdependent factors. In our research it was crucial to connect our building with the rest of the city and to have all the principles that sustainable architecture has to offer to us. Under its influence we defined health design goals that will help us develop and sustain our concept.

**Network of health**

The greater health system can be thought of as scales of interdependent layers. Health layers depict the comparisons between the healthy function of biological systems from the genetic level to protein formations and finally cellular and inter-cellular metabolism. In a similar way, our building was designed to fit into the greater system among layers of network health and urban health, directly linked to the building and its inhabitants. Focusing on each layer with the five aforementioned design goals we set in place, the health concept was approached by looking at the surrounding environment and identifying the networks of health. In the same way that our body health is comprised of systems of healthy networks, the health of our urban system in city of Ljubljana was also a result of the uniquely impactful layers of networks that are at play.

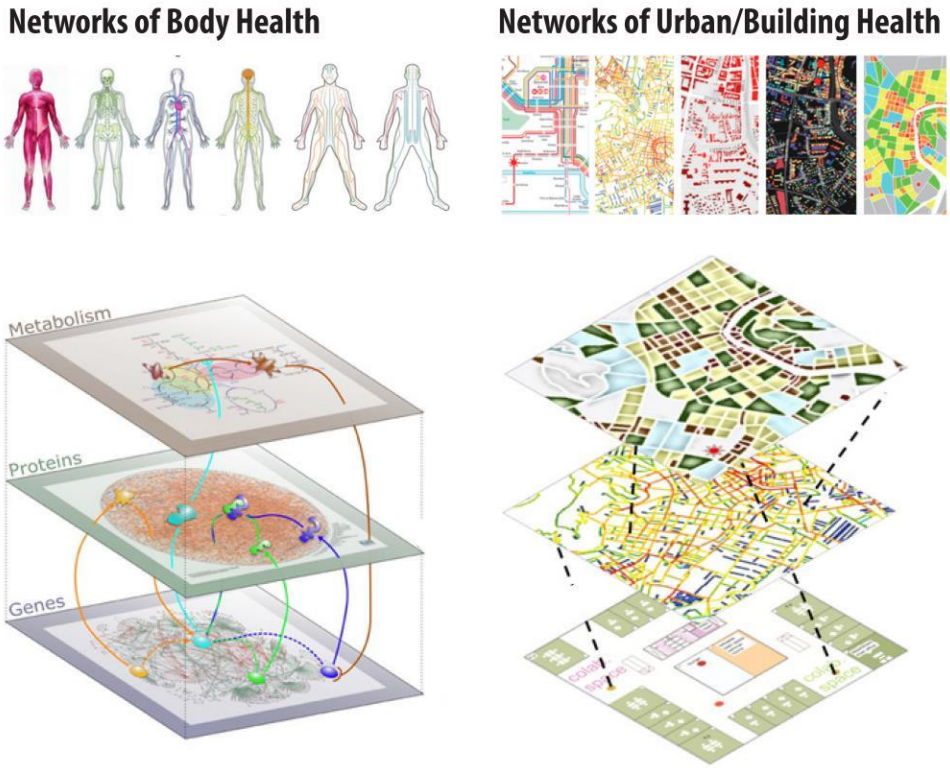
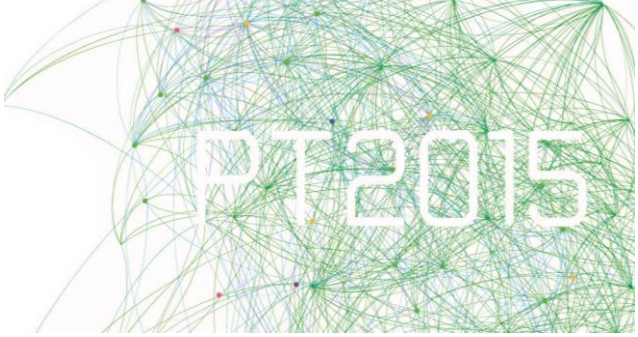



**Figure 1: Networks of body health and networks of urban health ("Express Team," 2015).**

On top of the constructing different layers and connections project was proposing to directly reflect the emotional state of its inhabitants by linking with the masses through the widespread use of smart mobile devices and social networks. Through keyword analyses of the data posted by students and teachers on status updates, the building in effect can compute average levels of emotions and display them for greater awareness of group mentality and emotion. To generate the level of healthy social trust, we believed that the virtual-reality connection is essential for empowering the connection and bond between individuals within the building and throughout the world.

## The healthy design principles

In further research we focused on how our building connects with the city, community, energy, people, urban spaces and our main guideline in our design was still health. The first principle of design was, to use the local environment to align and connect building to the site. In design of the urban space we implemented the privacy stages that shaped our outdoor space. We divided it in three parts - public, semi private and private. The second principle was that this educational building




should not just be a building for educational programs but should also educate its community and incorporate new ways of learning. That was the main reason why we introduced spacious open spaces in order to encourage collaboration and communication, why we used materials that can also educate occasional users on sustainable points of the design and why we tried to introduce furniture and programs that can help brings benefits to our healthy living. The third principle was to have a very clear and easily discernible program distribution throughout the building which allowed us to bring extra value to our investors.

**Total value for the client**

Following the principles that we set to ourselves we managed to design sustainable building that was not only part of community but also a part of the city. The culmination of all the individual parts of the ultimate building and construction concept lead to the definition of "the total value for the client". Coming back to the concept of Sophrosyne, Socrates (North, 1969), a Greek philosopher, once said that "the quest for personal value was more than just the attainment of wealth or material goods" (Gooch, 2008) and that there were other more valuable virtues of one's possessions. Likewise, our concept shows that value is brought to the clients not just in monetary form, but also in other equally powerful and influential forms. We believed that in addition to the monetary value available in profits, our building could provide health reputation with the brand value of the building innovation as well as unquantified free marketing from the number of times social networks are accessed and shared from within the building we had designed. The social health culture generated from the building would in future create innumerable value for all the clients. Finally, the power from health knowledge and the data that can be acquired from the building systems will prove to be invaluable to the owners, allowing free flow of information on the structural health as well as real-time data on health conditions and students in the building. So to top our research on health and designing something that can have long term effect on our users and community.

**Technology: Hygeia APP**

Hygeia APP is an application that gathered knowledge about building and health in one place. Application is envisioned as a network of information, suggestions and data that provide us with general information about the building: levels, sections, spaces, dates, and events that are happening in the building, community and city, and that connects users to high tech part of design. Furthermore the main part of the application is dedicated to health and promots western ways of keeping health: e.g. open urban spaces, encouragement for making breakfast or other healthy meal in "healthy kitchen", it also offers you to check your physical status on different scanners (e.g. blood pressure). The application monitors your state,

balance in your life and suggests how to use building and its features to feel better and healthier.

Moreover, application is also valuable to the owners of the building (investors) and at the same time it promotes user participation. Application gives data on structural performance of building and involves users' feedbacks on BMS system: temperature, ventilation, cold, etc. which at the end helps owners/managers to save money and creates more user-friendly and healthy environment. Outreach part of application allows users to connect with the city, other universities and community. The building becomes a landmark for the city and building/school is going everywhere and also promots healthy living.

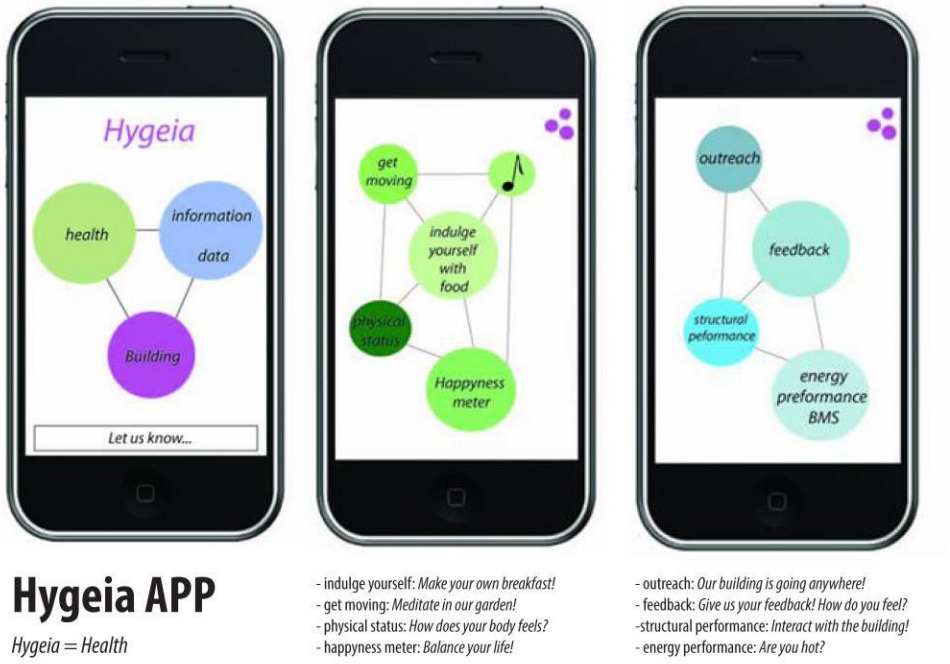
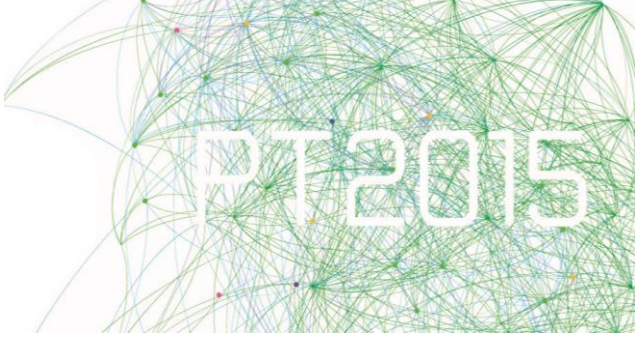



**Figure 2: Mobile application Hygeia, an application that gathered knowledge about building and health in one place ("Express Team," 2015).**

## DESIGNING HEALTHY BUILDING FOR HEALTHY LIVING

Healthy building is directly connected with its users and their way of using the inside and outside space. It is not only about using "healthy" materials, taking into consideration thermal comfort, acoustic comfort, lightening etc.; it is also about educating people how to live healthy. Places where we live and work have a big influence on our way of living, our habits, and consequently also on our health. Even we are not aware of it, many of the health problems have their origin there. Building is teaching us and healthy building should reminds its users on every step how to live healthy.



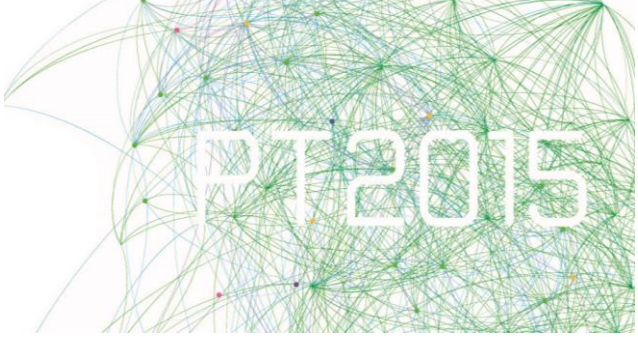

Based on the case study we divided principles of designing healthy building for healthy living into three main groups: (1) building placement on the site, landscape design and connection to the entire city; (2) designing healthy building (from big idea, construction, MEP etc.); (3) interior design and its influence on human health. First, the site location (e.g. whether it is in the green area or near the factory), how it is connected to the city with public transport (also bicycle routes, pedestrian paths), does it have also outside space (garden, etc.) has a huge impact on lifestyle and consequently also on human health. For example, if the place where you live has a good cycling connection with your work, or if there is a recreational area nearby, it promotes more sporty and healthy lifestyle. Second, through the entire construction period of the building health of the final users should be taken into consideration. For example, it is important how much insulation is on the façade, whether there is ventilation or not, what the construction materials are, etc. because these are the things that are installed in the house and cannot be changed. They have a huge impact on thermal comfort, acoustic comfort, and well being of end users. Third, also furnishing and everything else that we placed into the building has the influence on human health (from the plants, decorational elements like courtines etc.). For example, furniture could be composed of different unhealthy materials (e.g. formaldehyde), and also the design of it is dictating our way of living (e.g. the form of the chair etc.). The guidelines will be explored more in detail in our future research project between Faculty of Architecture and Faculty of Medicine, as part of the project "The creative way to practical knowledge", supported by the Slovene human resources development and scholarship fund.

## CONCLUSIONS AND FUTURE WORK

To conclude, not only living or working environment has the impact on our health, but also hereditary diseases, what we eat, what we do etc. have the influence on our health. If we could eliminate at least a few external influences that have bad impact on our health, we are on the right track to healthy living. This case study was only the base for further exploration of healthy building concept. Here we explored the healthy environment in educational building, where students spend in average 6 hours per day, and in the future we will continue with the exploration of working environment (where we spend in average 8 hours per day) and living environment (where we spend in average 16 hours per day).

## ACKNOWLEDGEMENTS

The research was part of AEC Global Teamwork course at Stanford University, PBL Lab, under the leadership of prof. dr. Renate Fruchter, and in collaboration with Swinerton Builders, Adhamina Rodriguez. The presented case study is work of the Team Express (team: Ariel Bai, Mandy Bugzel, Chris Chan, Dorian Curcanu, Yihai Fang, Sanja Štimac, Tianao Zhao; owners/mentors: Ethan Landy,




Anirudh Rao, Anja Jutraž). We would like to thank also to all other mentors and collaborators for their assistance and help.

## REFERENCES

Becerik-Gerber, B., & Kensek, K. 2010. Building Information Modeling in Architecture, Engineering and construction: Emerging Research Directions and Trends. *Journal of Professional Issues in Engineering Education and Practice*, *136*(3), 139–147.

Betsill, M., & Bulkeley, H. 2007. Looking Back and Thinking Ahead: A Decade of Cities and Climate Change Research. *Local Environment*, *12*(5), 447–456.

Breuste, J., Feldmann, H., & Uhlmann, O. 1997. Urban ecology. In *Results of a international conference held in Leipzig,, Germany*. Leipzig, Germany: Springer-Verlag Berlin Heidelbeg.

Chappells, H., & Shove, E. 2007. Debating the future of comfort: environmental sustainability, energy consumption and the indoor environment. *Building Research & Information*, *33*(1), 32–40.

Esser, A. H., & Greenbie, B. B. 1978. *Design for Communality and Privacy*. New York: Springer.

Express Team. 2015. *PBL Lab*.

Gooch, P. W. 2008. The Mission of Socrates and the Mission of Higher Education. In *Socrates or Rousseau: Ancient and Modern Perspectives on Liberal Education - First Annual Ancient and Modern Conference of the Daniel Webster*. Dartmouth College's Rockefeller Center.

Gregson, R., & Court, L. 2010. *Building healthy communities:A community empowerment approach*. London: Community development foundation.

Hinte, E. van, Neelen, M., Vink, J., & Vollaard, P. 2003. *Smart Architecture*. Rotterdam: 010 Publishers.

Karolides, A. 2002. An Introduction to Green Building: Resource Efficiency. *RMI Solutions*.

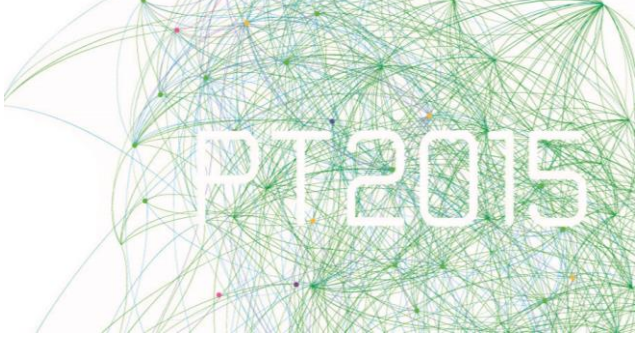
Katzschner, L. 2006. Behaviour of People in Open Spaces in Dependence of Thermal Comfort Conditions. In *PLEA2006 - The 23rd Conference on Passive and Low Energy Architecture*. Geneva, Switzerland.

Krishan, A. 2001. *Climate Responsive Architecture: A Design Handbook for Energy Efficient Buildings* (p. 409). Tata McGraw-Hill Education.

Kultur, S. 2012. Role of Culture in Sustainable Architecture. In *Archi-Cultural Translations through the Silk Road, 2nd International Conference* (pp. 262–268). Nishinomiya, Japan.

Lyubomirsky, S., Sheldon, K. M., & Schkade, D. 2005. Pursuing Happiness: The Architecture of Sustainable Change. *General Psychology*, *9*(2), 111–131.

McMillan, D. W., & Chavis, D. M. 1986. Sense of Community: A Definition and Theory. *Journal of Community Psychology*, *14*(1), 6–23.




North, H. 1969. Sophrosyne: Self-knowledge and Self-restraint in Greek Literature. *The American Journal of Philology*, *90*(3), 360–365.

Ožbolt, M. 2008. *Celostna zasnova objektov kot integrirano projektno delo*. Univerza v Ljubljani.

PBL lab. 2015. Retrieved from http://pbl.stanford.edu/index.html

Penedo, F. J., & Dahn, J. R. 2005. Exercise and well-being: A review of mental and physical health benefits associated with physical activity. *Curr Opin Psychiatry*, *18*(2), 189–193.

Porteous, J. D. 1977. *Environment & behavior: planning and everyday urban life* (p. 460). Addison-Wesley.

Rapoport, A. 1977. *Human Aspects of Urban Form: Towards a Man-Environment Approach to Urban Form and Design* (p. 438). Pergamon.

Santamouris, M. 2013. *Environmental Design of Urban Buildings: An Integrated Approach* (p. 347). London, UK: Earthscan.

Sassi, P. 2006. *Strategies for Sustainable Architecture*. New York: Taylor & Francis.

Sheppard, S. R. J., & Harshaw, H. W. 2000. *Forests and Landscapes: Linking Ecology, Sustainability and Aesthetics* (p. 294). CABI.

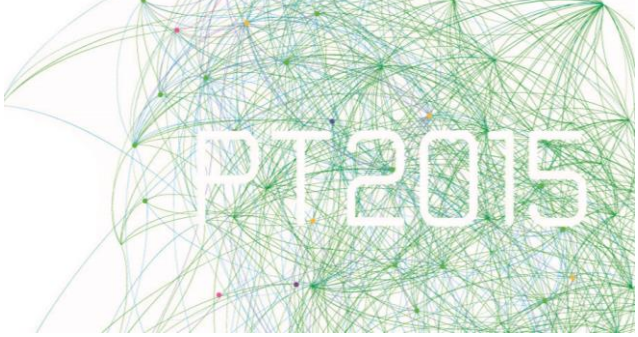
Trigger, B. G. 1990. Monumental architecture: A thermodynamic explanation of symbolic behaviour. *World Arcaelogy*, *22*(2), 119–132.

U.S.Department_of_Health_and_Human_Services. 1996. *Physical Activity and Health: A Report of the Surgeon General*. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion.

Walmsley, D. J. 1988. *Urban living: the individual in the city* (p. 204). Longman House, Burnt Mill, Harlow, Essex, Englenad: Longman Scientific & Technical.

Wu, J. 2008. Making the Case for Landscape Ecology - An Effective Approach to Urban Sustainability. *Landscape Journal*, *27*(1), 41–50.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# PARTICIPATORY URBAN PLANNING AND PUBLIC POLICY

**Višnja Kukoč**
PhD, Senior Lecturer, University of Split, Faculty of Civil Engineering, Architecture & Geodesy, Urban Planning Department, Matice hrvatske 15, 21000 Split, Croatia, visnja.kukoc@gradst.hr

## ABSTRACT

*Public policy comprises the means, methods and ways used by authorities to achieve a desired objective. In this paper we analyse the urban planning as part of public policy and try to establish when public policy is considered the democratic process. In that regard we explore a general theory of urbanisation by highlighting the important stages of its development in a multi-party market economy in the US and a one-party economy in the former Yugoslavia. Later, we analyse the situation of public policy and urban planning in modern Croatia and Split, and compare it with the current situation in Europe. The emphasis is put on the following: democratic process of urban planning, acceptance of urban plans by the wider society, social balance of urban plans and increasing potential of the well-functioning of cities.*

*In the concluding part the development of contemporary services of participatory urban planning and community informatics is considered with an aim of improving the communication between city authorities and inhabitants at lower cost.*

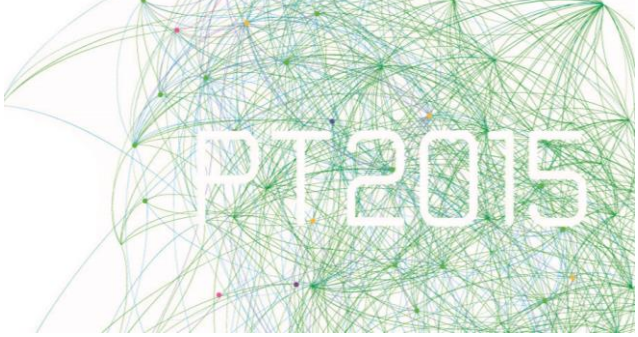
***Keywords**: participatory urban planning, public policy.*

## INTRODUCTION

In this paper we analyse the urban planning as part of public policy in both, multi-party system and one-party system, and try to establish when public policy is considered the democratic process.

## PUBLIC POLICY - DEFINITION

Public policy is an action of government and other public authorities implemented through legislation, programs and activities. "Public policy consists of the means, methods, and principles that the government chooses for the attainment of desired ends. In a democratic form of government public policy develops through an expression of the popular will. To a considerable degree, the popular will, as ascertained by public officials, is determined as a result of pressures. Pressures




come from many conflicting interests and must be weighed in the light of community values with which public policy is concerned. Oftentimes these values are highly subjective. Planning attempts to introduce a degree of objectivity into this realm of subjective judgments, "(Webster, 1958: 5). The part of planning, referring to the physical development of a city is urban planning.

## RESEARCH GOAL AND COVERAGE

We explore whether public policy in developed democracies always includes public opinion and whether the public policy in Yugoslavia, despite the one-party system remains undemocratic. Our case study is Split III, an example of planning and construction of a city region for 50,000 inhabitants that started in 1968 and almost continually going up to the present.

We examine the part of public policy that relates to urban planning and start our research in the second half of the 19th century when Idefonso Cerdà writes his General Theory of Urbanization and coins the word *urbanism* and *urbanization*.

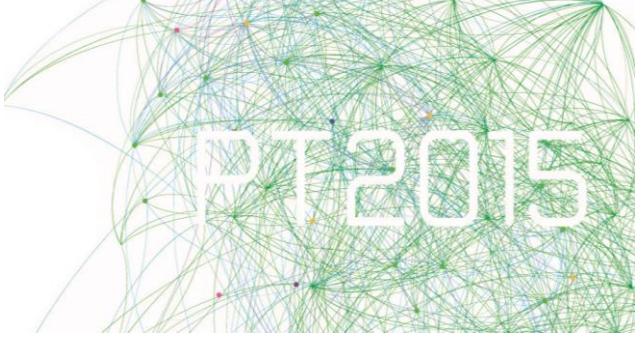
Since public policy develops in parallel with the development of a city we briefly review the development of cities in the US, where the complexity of the phenomenon is greater, and carried out in a shorter time. We single out the essential stages of public policy relating to urban planning, to the time when the former Yugoslavia introduced self-management in the 1950's. At the end of the 1960's, the idea of constructing Split III was created. We conclude our research with analysis of the state of public policy and urban planning in today's Croatia and Split and compare it with the current situation in Europe.

## GOVERNMENTAL FRAMEWORK OF PLANNING IN THE US: 1800 - 1960

In the United States (US), few cities were created prior to the year 1800. Then, only 4% of the population lived in cities, that had more than 8000 inhabitants. During the 19th century a large immigration from Europe took place. In only 10 years some cities increased their population by 80%[1].

By 1890 not a single major city in the US had the appropriate infrastructure nor required services. "The Brooklyn Bridge completed in 1883 by the Roeblings ushered in an era in the building of super-bridges. Before it was completed the New York traffic problem had become worse than it was at the time construction was started, "(Don Martindale in Weber, 1958: 13). The City is in need of everything in unlimited quantities. The US Constitution was adopted in 1787 and the federal government constituted. Values, prevailing in different communities in the US, as

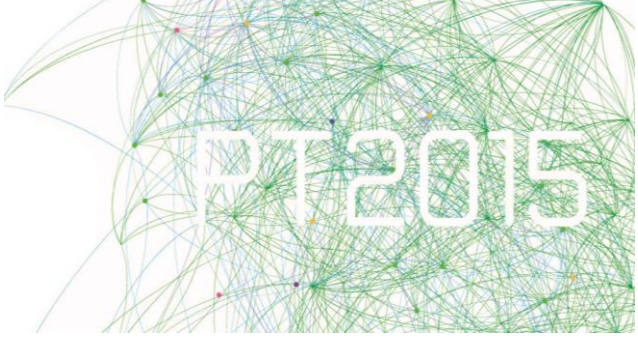
[1] Detroit and Milwaukee, Columbus and Cleveland, twin cities that grow by 80%, (Don Martindale in Weber, 1958:12)




well as government organizations and responsibility, changed in several phases. Public policy became socially sensitive: "Since the turn of the century, the role of the government has very definitely shifted in the direction of providing a positive and creative force in the life and development of the community", (Marshall in Webster, 1958:12). Each state within the US can use federal law-models, in order to develop the organizational structure, procedures, practices and concepts in planning and customizing its own situation, with the study of practices and experiences of others. The organization and content of planning have evolved over time, from civic clubs for progress, civic committees for planning and independent planning commissions, to the official department of planning, as part of the administrative structure of government. At the end of the 1950's state planning agencies implemented the planning programs headed by semi-autonomous commissions, drawn up by citizens. General opinion on citizens' participation in the process of city comprehensive planning is that it is invaluable, but in an advisory, instead of, until then, mandatory role, (according to Webster, 1958, 77-92). "Planning in the democratic process is a citizen responsibility as well as an official one," (Webster, 1958:97). The success of the program requires that more attention be paid to people than to the mechanics of planning, is the opinion expressed in 1952 in the newsletter of the American Society of Planners (in Webster, 1957: 6): "Too often planning has had a bad name because it lost sight of the human beings it was supposed to benefit. The plan for social betterment was conceived by experts, "sold" to reluctant citizens, and carried into action by paid employees. But planning has a different meaning and outcome when people take precedence over blueprint." And Webster says (Webster, 1957:6): "Unless the public has been kept informed during the period when policy is being formulated, it is seldom possible to create a favourable climate of public opinion sufficient to overcome pressures and combat opposition at the time the policy decision is to be made."

"Planning, properly conceived, serves only as an arm to these political representatives to aid them in gathering, evaluating, and interpreting essential data to serve as a basis for making intelligent policy decisions. Under this concept, the planning function is compatible with the policy making responsibilities of either democratic or nondemocratic societies," (Webster, 1957:8).
We conclude that in the US in the 1950's, in the context of urban planning as part of public policy awareness of the need of

- democratic planning process of the city
- acceptance of urban plans by the general public
- the social balance of urban plans
- increasing the potential of a well-functioning city, existed.




## SELF – MANAGED FRAMEWORK OF PLANNING IN SFRY: 1950 - 1990 - CASE STUDY OF SPLIT III

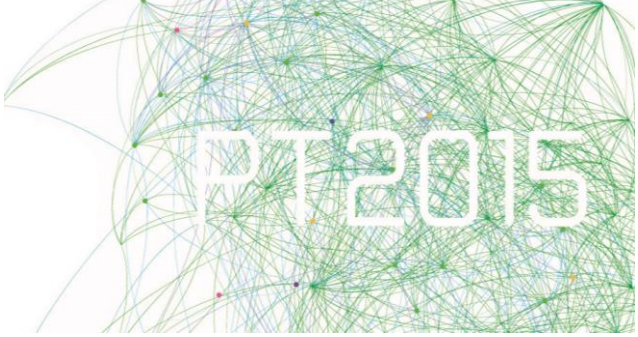
In the Socialistic Federative Republic of Yugoslavia (SFRY), the Constitutional Act of 1953 introduced self-management and social ownership, a special form of collective ownership, and the withering away of the state and state property. The state transferred many powers to the self-governing bodies in the field of education, culture, science, health and social care. The businesses received the right to governance, which resulted in a turnover of goods socially owned and the formation of the market framed with the plan. This period, from 1950 to 1965, represents the period of the greatest economic ascent, and also the growth of cities.

We conclude that the public policy of SFRY in the 1950's through withering away of the state, self-management and the right to governance introduced elements of democracy in the one-party system.

Urban planning, according to Mušič (1976 in 1980: 288) at the time did not lag behind the US, " Those years, sometime after 1958, meant new, richer, development period for our urbanism. This is not a specific period only for us, because everywhere in the world during those years, or slightly before this period, urbanism began to be regarded as a true social discipline, that among other things combined aesthetic-shaping undertakings with scientific research, namely in its large range of architecture (urban design) up to the planned regulation of the region (the wider scope area of the city). Mušič (1972 in 1980: 207) on the planning and related public policy also says: "That moment, when we would start, for example, to describe the decision-making power enjoyed by sectors as carriers of investment decisions or municipalities as carriers of political decision-making in the region, we would probably learn that many of our problems are actually problems of spatial planners of the world as well. I also know that myths of spatial planners of the world are our myths."

In such a system the Split III programming for the urban design state competition brought a new approach. At the time a wider society – with its specific organizations like city councils of culture and education and social and health affairs, Split organization of architects, a city chamber of economy, political organizations, Split construction enterprise and the like – participated with data and proposals. Particular surveys, on subjects like the number of apartments, their contents and equipment for the single investor, or who wanted to buy a parking space in public garages and on which location on the site, are carried out and their results implemented in the programming, based on which the state competition is announced.

Authors of the winning design were Mušič, Bežan and Starc, from Ljubljana, Slovenia. Their proposal was the base for drawing up of the urban development program and plan as well. This process was carried out on the basis of self-




management - discussions and coordination. The same procedure took place at a later stage of construction. All companies and organizations in Split were invited to submit information and give expert opinions, which were then placed in the Split III urban development program, especially for small healthcare clinics, schools, kindergartens and playgrounds (*** 1970: 2). The city planners gave the final form of the program that was then voted for by the Split Municipality Assembly.

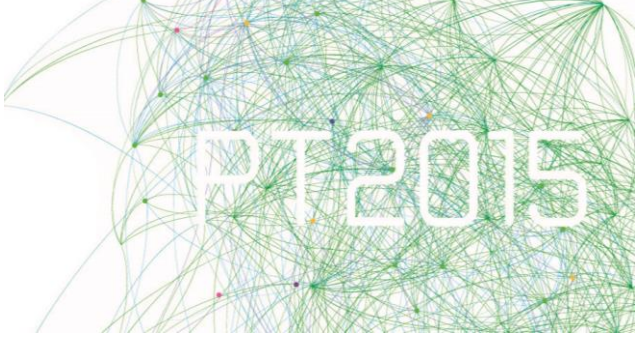
Public policy, especially urban planning, in the frame of which Split III occurred lead to the conclusion that the project was organized through:
- a democratic process of city planning,
- acceptance of urban plans by the narrow public,
- socially balanced urban development plan,
- increasing the potential of a well-functioning city.

## GOVERNMENTAL FRAMEWORK OF PLANNING IN RC: 1990-2015

The Republic of Croatia (RC) Constitution and two key laws define the framework for the development of public policy and urban planning since 1990. The Croatian Constitution enacted in December of 1990 abandoned the systems of public ownership and nationalized social assets. The Law on Amendments to the Law on Construction Land (NN 53/90) abolished social ownership over construction land. The Law on compensation for the property confiscated during the Yugoslav communist rule (NN 92/96), unused construction land returned to the original owners at their request. Other laws did not introduce instruments that would allow planning and delivery of facilities for public and social purposes.

At the end of 2005 the General Urban Plan (GUP) of the city of Split was adopted. In the introductory text authors state “The basic problem is the inability to derive plans that create spaces for public and social purposes. The reasons are twofold regime to dispose of the land, and the differences between needs and resources which cities have available for the provision of land and regulation of public spaces, social facilities and infrastructure systems."

In the context of the current legislation in Croatia, citizens have the right to express their comments and suggestions to the plan posterior to the authors of urban plan explanations, solutions, guidelines and measures that are an integral part of an urban plan. The possible results are minor changes and additions to the urban plan that do not undermine the basic concept. From this we can conclude that the aforementioned public policy and urban planning, which relate to the procedure described:
- does not democratize the process of urban planning,
- does not increase the acceptance of urban plans,
- does not encourage the social balance of urban plans,
- does not increase the potential of a well-functioning city.




## FRAMEWORK OF PLANNING IN EUROPE IN THE 21ST CENTURY

Communication between city authorities and the population in the 21st century is of major importance. If good, it provides for greater efficiency and transparency. Transparency is achieved by the availability of relevant documents and information that can be reached by Internet development. " An effective and sustainable urban planning is only possible with the participation of as many persons concerned as possible." (Benner, Eichorn, at all, 2009: 431) For this purpose, it is necessary to design data models and formats that will suit their exchange and the urban planning, but must also offer the ability to access data via the Internet, like the model tested in Hamburg in 2008. With this kind of technology, an important step in the democratization process of adopting plans and pro-active citizen participation and cooperation at an early stage of the design concept can be provided and:

- democratic process of city planning,
- acceptance of urban plans to a greater extent,
- increasing the social balance of urban plans,
- increasing the potential of a well-functioning city, can be achieved.

## CONCLUSION

Cities need to be managed by the adoption of modern and democratic forms of cooperation between residents and authorities. Urban planning can achieve its full potential through public policy that would in the most logical way solve many functional imbalances of life in the city. "The way we design our streets, open spaces, public buildings and neighbourhoods will give shape to urban society for a long time to come", (Gehl in Rogers and Power 2000: 230).

## REFERENCES

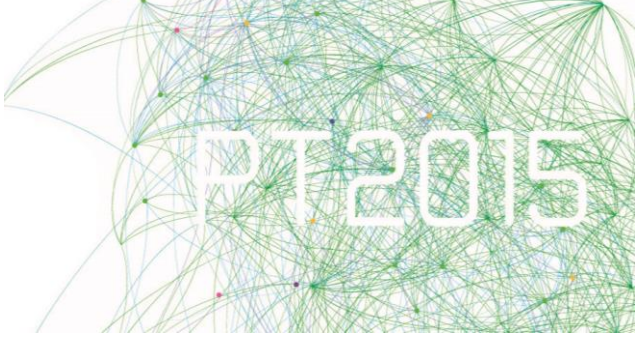
Benner, J.,Eichorn. T.,Geiger, A., Häfele. K-H., Krause, K-U. 2009. “Public Participation and Urban Planning supported by OGC Web Service”. Proceedings of the 14th International Conference on Urban Planning and Regional Development in the Information Society. Sitegs. Spain (pp. 431-38)

Mušič, V. 1980. Urbanizem -bajke in resničnost. Ljubljana: Cankarjeva založba.

Rogers, R. and Power, A. Cities for a Small Country. London: Faber &Faber.

Weber, M. 1958 (first print 1921). The City. New York: Coolier Books.

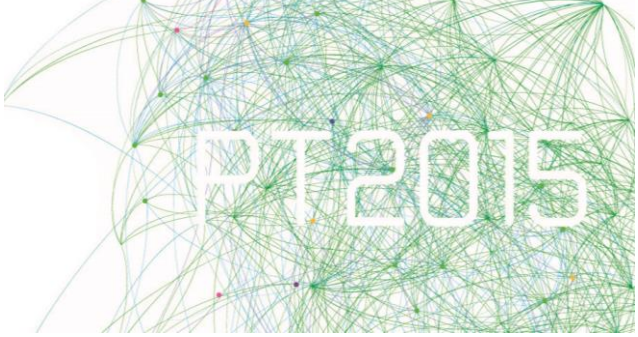
Webster, H. D. 1958. Urban Planning and Municipal Public Policy. New York: Harper&Brothers.




# TOPIC IV:

# Cultural Patterns and Sensitivity

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# SENSE OF PLACE IN ARCHITECTURAL DESIGN: TOWARDS HEALTHY PLACES P&T 2015

**Eglė Navickienė**
PhD, Associate Professor, Vilnius Gediminas Technical University, Faculty of Architecture, Pylimo g. 26/1, 03227 Vilnius, Lithuania, egle.navickiene@vgtu.lt

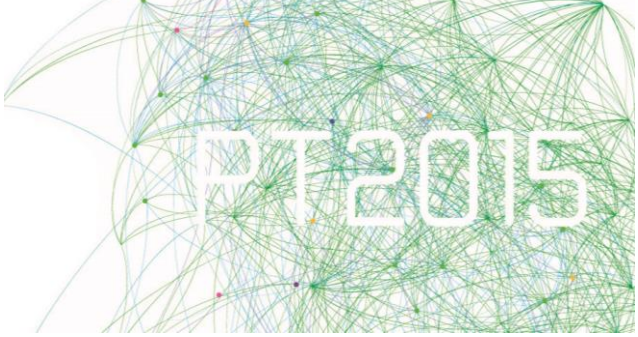
## ABSTRACT

*The paper deals with the link between the qualities of place and people's relation to it, and their mental health, or well-being. The aim of the paper is to identify the structure of sense of place, which may be applied as a guideline for architectural design heading towards creation of healthy places, based on place-bound architectural results that positively affect mental health. Composition of sense of place is laid out by benefiting from interdisciplinary conceptions of place and sense of place; three major components: physical setting, human activities and meanings, are identified. Analysis of Lithuanian place-sensitive buildings of high architectural quality, explores the link of architectural objects to people's well-being using the criteria set according the identified structure of sense of place.*

***Keywords****: place, sense of place, healthy places, mental health, Lithuanian architecture.*

## INTRODUCTION

The connection between human health and built environment is recently been acknowledged and studied. There is an undeniable link between the qualities of place and people's relation to it, and their mental health, or well-being in general, although it gets less attention in environmental health literature, compared to environment's impact on physical health and social capital. The paper deals with the human interaction with place, like the factor affecting people's mental health and one of determinants of general well-being. The author believes that people's interaction with place that impacts their well-being, from architectural standpoint may be revealed using the notion of sense of place as an investigation tool; composition of sense of place may be laid out comprehensively, outreaching architectural knowledge, by benefiting from interdisciplinary conceptions of place and sense of place. The aim of the paper is to identify the multiple structure of sense of place, which may be applied as a guideline and tool for architectural design heading towards creation of healthy places, based on sensitive and place-bound architectural results that positively affect individual and collective mental health. Analysis of place-sensitive buildings of high architectural quality, selected from recent Lithuanian practice, explores the link of architectural objects and human




interaction with these objects to people's well-being using the criteria set according the identified multiple structure of sense of place.

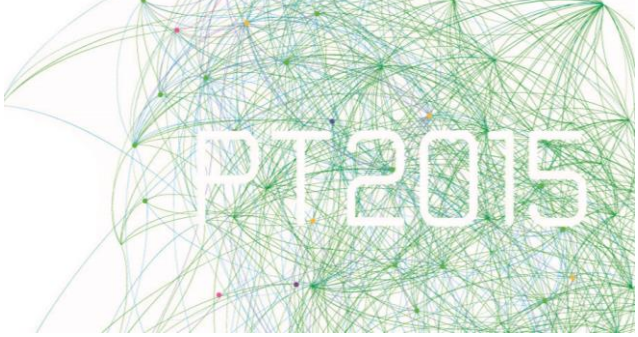
## PLACE AND MENTAL HEALTH

The awareness of the connections between health and place, that 'place matters', is rising during the last decades. The qualities of place represent more than its physical features. The objective (location, physical elements) and subjective (sense of place, place attachment, etc.) aspects of place are intertwined in a dialectical relationship, and both must be taken into account when seeking to understand affect on health in specific localities (Poland *et al*, 2005). Physical activity, accessibility, transport alternatives, social capital, participation and empowerment, safety and privacy are the aspects of built environment that physical health and social interaction benefit from. Other factors of relationship between health and place, like impact of built environment on our cognitive, emotional, and spiritual well-being, rootedness, the sense of history and tradition, are important for mental health (Butterworth, 2000).

Places affect people's mental health (cognitive or emotional wellbeing) in many ways. People gain spatial orientation from place cues. Places affect people's performance and can provoke certain actions. Some places help to connect with other people; some places help to relax. The qualities of place are more important factors than jobs in creating emotional bonds between people and places they are attached to. Places with unique ecological, architectural, historic, or geographic features contribute to emotional health, satisfaction, and well-being of local community through a deep-rooted sense of place, sense of history and tradition, feeling of self-control and personalization of the environment. Buildings and spaces are imbued with meaning and spiritual resonance, which people 'read' as they pass through them; they symbolize personal histories, interpersonal relationships, and shared events, as repositories of 'collective memory'. Built forms evoke sentiments, emotions and passions. Loss, destruction, or change in a location has the potential to affect an individual's psychological well-being, people feel a sense of loss and grief; new arrivals frequently experience mental health issues arising from grief associated with removal. Forced removal from place and land has been catastrophic for many indigenous peoples (Butterworth, 2000, Frumkin, 2003).

## PLACE AND A SENSE OF PLACE: INTERDISCIPLINARY CONTRIBUTION

Architectural design focuses on physical characteristics of setting, aesthetic and functional aspects of architectural object much more than cognitive and emotional aspects of interaction between people and built environment – aspects described by notion of sense of place. Comprehension of sense of place in architecture might be extended by interdisciplinary knowledge about place and sense of place; often



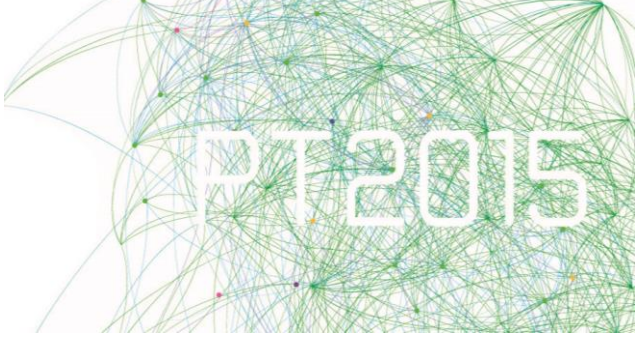

the notions of place and sense of place overlap and converge. The considerations in cognate disciplines are confined to the aspects that contribute to creation of healthy places by architectural means.

In disciplinary point of view of geography, places are perceived holistically through the senses, memory, intellect and imagination: places are based on meanings and symbols, experienced subjectively. There are three interwoven elements of place: physical setting, human activities, and meanings that arise from the experiences (Relph, 1997). Places embody feelings, images and thoughts of those who live, work or otherwise deal with that space (Tuan, 1977). A phenomenological approach explores the meanings and experiences of place: a place as a result of space in addition to character and place identity; the latter denote a general comprehensive atmosphere (Norberg-Schulz, 1976). Anthropological place is distinctive and easily 'read', meaningful to its occupants and visitors, with a clear sense of history, also relational, contingent and in process; it is concerned with identities, relationships and stories (Auge, 1995). Environmental psychologists treat a place not as an object, but as a part of a larger whole felt through the actual experience of meaningful events; the place experience is a total sensual experience (Najafi, Shariff, 2011). Place-sensitive sociology defines place by geographic location, material form (physical compilation of things and objects through which happen social processes), and investment with meaning and value (Gieryn, 2000). In cultural heritage conservation, heritage places are stratified in interacting tangible and intangible values and people's experience: natural and man-made environment, social or spiritual practices, customs, traditional knowledge, use, associations and meanings (Navickienė, 2012). Heritage places are formed by: form, function, and meaning, through which people experience their culture (Kamel-Ahmed, 2015).

For geographers sense of place is individual's feeling, perception, and reaction to places; it can be widely shared throughout a community (Relph, 2007). For phenomenologists sense of place is an emotional connection with place via understanding its symbols and meanings. Environmental psychologists disclose sense of place as an interacting combination of location, landscape, and personal involvement (Najafi, Shariff, 2011). In the concept of sense of place psychologists distinguish sense of belonging to places (a bond between people and places) and place meaning (symbolic meanings ascribed to places) (Kudryavtsev *et al*, 2012). In sociological point of view sense of place embraces individuals' and groups' identification of place by mental mapping, attribution of meaning embedded in cultural understanding of the terrain, ascribed qualities to the material and social stuff (Gieryn, 2000).

## MULTIPLE COMPOSITION OF SENSE OF PLACE

Place and sense of place are complex systems incorporating material, social and interpretive domains acting autonomously and in a mutually dependent way. The




review of literature gives an overlapping picture how sense of place (place) is structured. The generalised composition triangulates three major elements of sense of place: physical setting, human activities and attributed meanings, reconsidered through architectural comprehension.

Physical setting and its material form covers: natural environment defined by terrain and vegetation influenced by geo-climatic conditions; and anthropogenic environment – tangible man-made elements like cultural landscape, infrastructure, buildings and other objects. The physical domain in the field of architectural design is considered most, actualized by its primary tasks based on aesthetic, artistic, tectonic, contextual, structural, and environmental values.

Domain of human activities covers multiform social processes occurring in the place. The connection with past cultural experience is established in a dual way, through historic legacy of bygone epochs and through continuous local tradition. Cultural heritage links people to their history and offers them supporting memories. Memories, both individual and collective, are place-oriented; they are embodied through images and narratives (Kamel-Ahmed, 2015). Traditional knowledge and customs by their nature are determined by their place, and are therefore rooted, static, and "immobile" (Norberg-Schulz, 2000). Social dimension of places is important as they saturate social life; all kinds of uses, activities and practices are located there. Social, cultural and traditional values are regaining their importance in architectural design as an identity-making tool, sustaining dynamic process of social and cultural continuity.

Symbolic meanings attributed to a place require personal involvement and bonding between individual/community and locality. Meanings relate to the perceptual and the psychological aspects of environmental experience. Interaction between human and place is perceived via senses (seeing, listening, scenting, touching), interpreted via cognitive thought and felt emotionally. The values people give to the place and the qualities people invest to it contribute to richness and heterogeneity of meanings. Symbolic meanings ascribed provide community with a source of pride and belonging (place attachment) (Kamel-Ahmed, 2015, Najafi, Shariff, 2011, Kudryavtsev *et al*, 2012). Communicative interpretation and reflective interaction in architectural design depends on in-depth usage of local semantic codes, symbols, associations, inspirations, and it contributes to reflection and enhancement the inherent qualities and achieving the holistic place-bound integration.

## PLACE-SENSITIVE ARCHITECTURE: CASE STUDIES

The identified multiple composition of sense of place (place) is transformed into a set of criteria appointed to determine the level of place-sensitivity of an architectural object and its communicative interaction with people. The set of criteria includes 1) physical context: natural and anthropogenic environment; 2) social–cultural experience: historical experience (cultural heritage, memories,

narratives, images); social activities, uses, and practices; traditional knowledge and customs; 3) meanings: cognitive interpretation, values, and associations; emotional bond; perception via senses. The scheme may be applied in architectural design striving for the objects that are contextual to their setting and interact with people in a holistic way, thus positively affecting individual and collective mental health. The cases for analysis are selected according 1) sensitivity to the place pointed out in the professional reviews, and 2) architectural quality that was assured by major national prizes. Case studies are: the villa "Sea. Sand. Wind" in Juodkrantė (architects G. Prikockis, A. Prikockienė, I. Tikuišytė, and A. Velutis together with the artist M. Jonutis, 2008); the holiday house by the Kalvių lake (architects V. Adomavičius, V. Vyšniauskienė, 2001); and the block of apartment houses in Krivių Street, Vilnius (architects T. Balčiūnas, A. Skiezgelas, V. Biekša, M. Kanevičius, 2008).

## Physical context

The harmonious relationship with physical context depends on the level (quality and amplitude of features regarded) of integration into natural setting and urban environment. The block of apartment houses in Krivių Street, Vilnius is located in sensitive urban and natural environment – Vilnius Historical Centre (UNESCO World Heritage site), part of Užupis historic suburb, featuring conventional gable houses and free-standing wooden villas; it borders with Kalnai Park. Successful integration into natural and historic urban contexts was achieved by irregular scattering of houses that leaves shifting visual openings into greenery behind, and reflects disperse character of local urban morphology. Traditional architectural shapes are rehashed by gable roofs, proportions, materials and colours, "polished" up to minimalism, laconic volumes and silhouettes purified up to archetypal image. The architecture of holiday house by the Kalvių Lake holds highly contextual relation to nature (treated as a characteristic feature of Lithuanian identity in architecture), when architectural object dissolves in natural

**Figure 1: The block of apartment houses in Krivių Street, Vilnius (architects T. Balčiūnas, A. Skiezgelas, V. Biekša, M. Kanevičius, 2008). (Source: author's photo).**

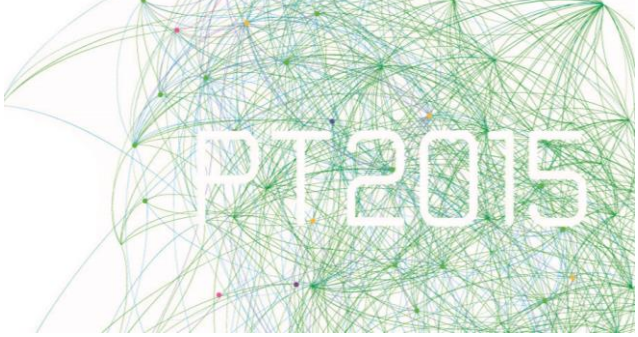
**Figure 2: The holiday house by the Kalvių Lake at Kaišiadorių district (architects V. Adomavičius, V. Vyšniauskienė, 2001). (Source: www.abvp.lt).**

landscape becoming a part of it. It is achieved by passive relationship to the natural setting: prolonged volume is sensitively laid down along the slope; scale, materials, textures and colours are in keeping with surrounding trees and meadows; the landscape scenery of the plot is maintained as found; the expression of building exterior is inconspicuous. Modest respect and contextual approach to environment, visual openness, and easy readable images of both buildings create cosy, coherent, welcome atmosphere, positively affecting people.

**Social–cultural experience**

The aspect of social–cultural experience covers historical, traditional and social dimensions. Continuity of local historical experience was a main inspiration for the architecture of the villa "Sea. Sand. Wind" in Juodkrantė. Luxurious romanticism villas from the end of 19th and the beginning of 20th century featuring timber frame structure and craftsmanship of carpenters, surrounding the site, guided the architects. Shape, tectonic system, elaborated expression and crafted façade decorations of villa creatively interpret the pattern of neighbourhood elements, survived or memorised in images; therefore villa's architecture lends the charming character and identity exceptional to place. The subtle narrative of history and tradition is readable and comprehensible. The villa "Sea. Sand. Wind" in Juodkrantė extends historically settled social activities and uses of the coastal resort – it functions as a holiday home. Modern variation of function of neighbouring historical villas bridges historical and contemporary villas into continuity in spite of half of a century long brake during the Soviet period. Moderately innovative adaptation of local building tradition, rooted in traditional knowledge of vernacular architecture, is implicated in the holiday house by the Kalvių Lake. The traditional timbered building structure secures the representation of national identity through ethnographic tradition as timbered building type is the conventional one in rural areas of Lithuania. It is a modern interpretation of the structure of round logs locked extending past the corner exposed in both exterior and interior.


**Figure 3, 4: The villa "Sea. Sand. Wind" in Juodkrantė (architects G. Prikockis, A. Prikockienė, I. Tikuišytė, and A. Velutis, artist M. Jonutis, 2008). (Source: www.archmap.lt).**

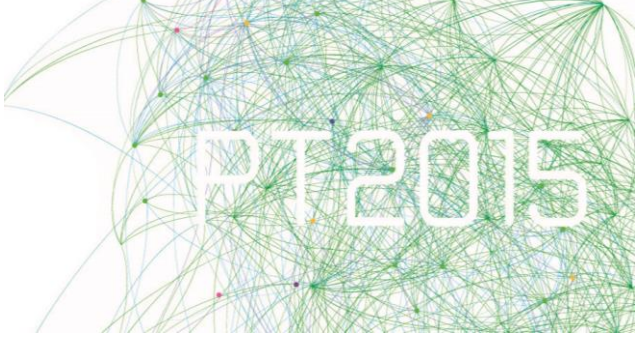



### Meanings

Meanings attributed to places reflect cognitive, emotional, and perceptual personal involvement and bonds to a place. Beside direct attributes, the villa "Sea. Sand. Wind" in Juodkrantė communicates regional identity codes by symbolic meanings. It weaves the stories about lasting grandeur of coastal resort, luxury and uniqueness of holiday home, masterly craftsmanship. The picturesque artist's carvings celebrate natural forces: sea, sand and wind, that shape the ecosystem of Curonian spit, and narrates motives of fairy-tales. The deeper look to the style of handcraft ornamentation evokes the associations with weathercocks – the unique feature of this region used to mark a particular village's ownership of sail-ship. The meanings, narratives and associations anchor the architecture of the villa to the local resort culture. The traditional outlook in the holiday house by the Kalvių Lake highlights the emotional bond with place referred to a larger ethnographic region. As Lithuanian identity is deeply connected with its rural culture, the traditional structure of the house recalls one's personal experiences and memories. One can imagine the rough texture and smell of timber surfaces, soft muffled sound. The senses evoke impressions of cosy atmosphere, quietness, safety, and harmony; interrelate with permanent values and nostalgia.

## CONCLUSIONS

Relationship between place and mental health, from architectural standpoint, covers impact of built environment on people's cognitive and emotional well-being, rootedness, the sense of history and tradition. Interdisciplinary knowledge about place and sense of place, reconsidered through architectural comprehension, highlights its three major components: 1) physical context: natural and anthropogenic environment; 2) social–cultural experience: historical experience, social activities, and traditional knowledge; 3) meanings: cognitive interpretation, emotional bond, and sensory perception. The impact of places on human mental health may be elaborated and enhanced by architectural means. Focus on the sense of place, as a tool for architectural design, gives priority to more communicative method in design, for interpretation and interaction with a place guided by cognitive thought and feeling. It aims to sensitive and place-bound architectural result that positively affects people's cognitive and emotional well-being. Architectural design grounded by sense of place takes advantages of three synergetic components of sense of place. Creative architectural interpretation of intrinsic characteristics of physical context enables harmonious relationship to the setting and place-bound integration. Respectful connection with inherited historic legacy, sustaining continuity of traditional knowledge, communicative transmission of social experience, collective memories and narratives enables rootedness to culturally shared origins and social experience. In-depth interpretation of symbolic meanings, semantic codes, associations, and also perceptual enhancement and emotional bonds stratify communicative links and reflective interaction between people and places. Multifaceted and integrated




architectural approach based on three components of sense of place leads to holistic, rooted and fulfilling link between people and places, contributing to creation of healthy places by architectural means.

## REFERENCES

Auge, Marc. 1995. *Non-Places. Introduction to an Anthropology of Supermodernity*. London: Verso.

Butterworth, Iain. 2000. *The Relationship between the Built Environment and Wellbeing: a Literature Review*. Melbourne: Victorian Health Promotion Foundation.

Frumkin, Howard. 2003. "Healthy Places: Exploring the Evidence". *American Journal of Public Health* 93, no. 9 (September): 1451–1456.

Gieryn, Thomas F. 2000. "A Space for Place in Sociology". *Annual Review of Sociology* 26: 463-496.

Kamel-Ahmed, Ehab. 2015. "What to Conserve? Heritage, Memory, and Management of Meanings". *International Journal of Architectural Research* 9, no. 1 (March): 67–76.

Kudryavtsev Alex, Richard C. Stedman and Marianne E. Krasny. "Sense of Place in Environmental Education". *Environmental Education Research* 18, no. 2 (April): 229–250.

Navickienė, Eglė. 2012. "Infill architecture: chasing changes of attitudes in conservation of urban heritage". In *HERITAGE 2012 - proceedings of the 3rd international conference on Heritage and Sustainable Development* 2: 1325-1334, Barcelos: Green Lines Institute.

Norberg-Schulz, Christian. 1976. "The Phenomenon of Place". In *The Urban Design Reader*, edited by M. Larice & E. Macdonald, 125-137. London: Routledge.

Norberg-Schulz, Christian. 2000. *Architecture: Presence, Language, Place*. Milano: Skira.

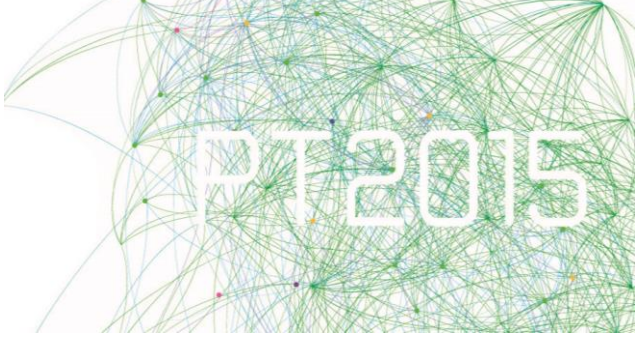
Poland, B., Lehoux P., Holmes D., Andrews G. "How place matters: unpacking technology and power in health and social care". *Health and Social Care in the Community* 13, no. 2: 170–180.

Relph, Edward. 2007. "Spirit of Place and Sense of Place in Virtual Realities". *Techné: Research in Philosophy and Technology* 10, no. 3 (Spring): 17-25.

Najafi, Mina, Shariff, Mustafa Kamal Bin Mohd. 2011. "The Concept of Place and Sense of Place in Architectural Studies". *World Academy of Science, Engineering & Technology* 5, no. 56 (August): 871–877.

Tuan, Yi-Fu. 1977. *Space and Place: The Perspective of Experience*. Minneapolis, MN: University of Minnesota Press.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA



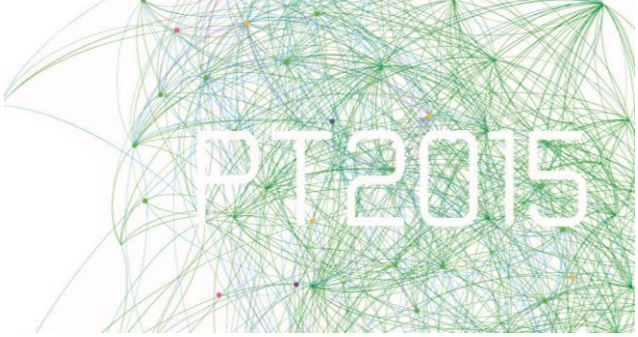

# HOLIDAY HOMES IN THE VICINITY OF SPLIT, CROATIA, DESIGNED BY FRANO GOTOVAC – CONTINUITY OF ARCHITECTURAL HERITAGE

**Vesna Perković Jović**
PhD, Assistant Professor, University of Split, Faculty of Civil Engineering, Architecture and Geodesy, Croatia, Split, Matice hrvatske 15, vesna.perkovic@gradst.hr

## ABSTRACT

*Frano Gotovac, a Split architect, is known as a designer of residential areas and dwelling houses in Split and Omiš. In the course of his entire career Frano Gotovac also designed holiday homes for his friends, including some fifteen houses in the area of Split, characterised by the quality of architectural expression, specific spatial organisation, and well-thought-out plot utilisation. Gotovac drew inspiration from the rural settlements in Dalmatia. He modified some traditional architectural forms, such as the slanting roof and arched windows, adapting them to suit the modern architectural expression. He rarely used some traditional building materials – half-round tile and stone – only exceptionally heeding recommendations of urban plans concerning their use with a view to achieving a "satisfactory" look of a typical coastal house. The houses are rather small, like the historical ones, built with inexpensive building materials, in accordance with the modest finances of the investors. Following the historical examples of country-style residential architecture, Gotovac always strives to establish a contact between the houses' interior and exterior, avoiding direct views of the neighbouring houses. It was not always easy with regard to weekend-cottages densely constructed on small plots and close to one another, unlike traditional summer residences owned by few wealthy individuals. The houses represent the author's contribution to the humanisation of space in weekend cottage settlements frequently built without any urban plans, signifying the architect's concept and his specific approach to the modern country-style architecture in the circumstances of socialist economy. Many areas in Dalmatia, bearing marks of year-long uncontrolled illegal construction, have been deprived of their identity. The question of how to re-establish the natural connection with the tradition and historical and cultural patterns, how to build in future without jeopardising the inherited values – these questions are still extremely relevant and pressing. Gotovac's well-tried designing method, his concepts and aims, as well as the author's valuable realisations, can all help in searching for answers and dealing with contemporary designing tasks in the areas rich in architectural tradition.*

***Keywords**: Dalmatia, modern architecture, Frano Gotovac, holiday homes.*



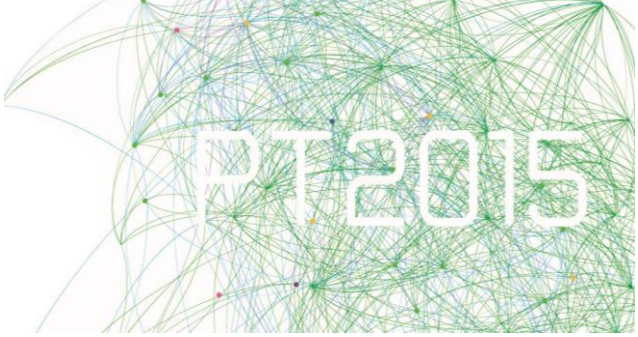

## INTRODUCTION

Architecture and urban development in Dalmatia viewed over a longer period, from the mid-1960s to the present day, has shown an increasing departure from tradition, frequently resulting in violating natural environment and architectural heritage. Although the reasons are diverse and numerous, they can be reduced to several major ones. Construction with no urban plan or even legal permission has left indelible traces in the area. With globalisation processes, though bringing a number of advantages, particularly in economy, the local architectural tradition has been gradually disappearing, and architecture is, more than ever, influenced by general world trends in art. Nevertheless, the greatest damage to the landscape has been caused by the construction from the mid-1990s to the present day. The houses seem to be increasing in dimensions, and are not adjusted to either the size of the plot or the immediate surroundings, all with a view to gaining as much profit as possible.

## GENESIS OF GOTOVAC'S HOLIDAY HOMES

Gotovac's holiday homes are modernist in architectural expression in keeping with the time of construction. They are designed by means of traditional elements of rural architecture and historical summer residence architecture typical of Dalmatia. His houses are a result of a close collaboration between the architect and the investor, on the basis of the author's year-long analyses and theoretical reflection. Gotovac established the basic difference between the former summer houses commissioned by wealthy owners and constructed on spacious plots and weekend-cottages, although both have been built with a purpose of recreation and entertainment out of the city. The latter are built on small plots. By rows of houses arranged into amorphous ambiences weekend settlements are created, lacking the essential characteristics of organised settlements which have for centuries been present in this area.[1] "Gotovac is convinced that a holiday home should be a wall – in summer one sits on the shady side, and in winter on the side exposed to the sun."[2] As a rule, the houses are small in size, inspired by rural architecture, corresponding to small plots and financial means of their owners. In Gotovac's opinion, it is extremely important that the small rooms should be "forcing" the owners to use the outdoor spaces, thereby making the touch with nature unavoidable. The house is just a necessary shelter, conceived as an "accompanying content" to the overall composition of the plot. Traditional Dalmatian houses were designed both as homes and husbandry facilities and they have never been used for recreation or entertainment.[3] It is for this reason that Gotovac models the outdoor spaces after the famous historical complexes of Dalmatian summer residences.[4] By connecting the indoor and outdoor spaces, terraces and gardens, as well as utilising

[1] Gotovac, 1980.
[2] According to Miljenko Boban, author's friend and owner of a house at Okrug Gornji on island of Čiovo. (Okrug Gornji, October 2007).
[3] Freundenraich, 1962: 165-190.
[4] Fisković, 1966.




spatial elements typical of Dalmatia, such as the inner courtyard, porch, summer kitchen, and open terraces, Gotovac creates very pleasant spaces to be used during summer months. He always tried to avoid direct view of the neighbouring houses by using a number of designer's tricks. He frequently criticised urban plans in their attempt at regulating the construction along the coast by issuing "recommendations" on the houses' appearance: stone-lining, double-slanting roof covered with half-round tile, wooden window shutters, etc.[5] Gotovac believed that what mattered was not the material, but the volumes and proportions of the houses.[6] The selected examples of holiday homes show how referential realisations are outlined, illustrating the author's specific approach to the construction along the Adriatic coast, at the same time indicating his departure from mass construction typical of the time. In some of the houses a sculptural treatment of the entire volume can be traced, while in some other cases the emphasis is laid on large wall surfaces of the façade, fragmenting of the house's volume or the entire volume composed as several overlapping prisms.

## THE BANOVIĆ HOUSE

In 1968 a single-storey house was built in Zaostrog[7] according to Gotovac's design dating from 1962. It is situated close to the sea, along a promenade connecting several neighbouring settlements of the Biokovo seaside. The plot, fenced by high walls, offers a beautiful view of the sea. The wide vistas are valued by the author and, following the tradition of historical summer residences, brought into the house's interior in order to become a part of the atmosphere. It is with this consideration in mind that Gotovac designed the floor level 50-70 cm higher than the surrounding terrain, while the wall facing the sea and the promenade is articulated with a low wall and a metal fence to provide an unobstructed view. The garden around the house is grown with Mediterranean vegetation. The house features two entrances: the "winter" one from the east, and the "summer" one from the west across an open terrace. The living-room and the kitchen, taking up the central part of the ground-plan, are accessed from the entrance. The living-room features a fireplace, approximately occupying the geometrical centre of the house. The author here relies on centuries-long experience of traditional architecture, as well as the fact that the hearth represented the centre of the house because it was where people lived.[8] The discreetly separated north part of the ground-plan represents the night tract, containing two bedrooms and a bathroom. In the modernist manner the author thus achieves two uninterrupted lines extending in opposite directions, connecting the interior to faraway views. One line connects the openings of the living-room and the kitchen extending in the east-west direction, while the other one connects the bedroom window and the terrace door in the north-

[5] Smoje, 1965.
[6] Gotovac, 1979.a; Gotovac, 1979.b.
[7] Anagraphic mark: Croatia, Zaostrog, Kapeć 9.
[8] Freundenraich, 1962: 107.

south direction. Gotovac pays particular attention to the open terrace as the most important part of a summer residence. Well protected from the wind and view, the terrace is inserted between the house's walls in the south part of the ground-plan. The unavoidable view of the sea is ensured through a large arched opening in the wall. A pleasant atmosphere is enhanced by a flower-bed on the south fringe of the terrace, also protecting the house from the neighbours' view. The external appearance of the house is characterised by modernist simplicity: external openings are wedged into smooth wall surfaces. The west façade, lined by roughly cut stone, is given more prominence by the author: with the afore-mentioned arched opening it remotely resembles historical summer residences.

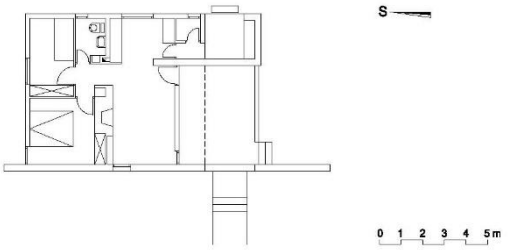



**Figure 1: Banović House, ground-plan.**

**Figure 2: View from the west.**

## THE BUĆAN HOUSE

The house was built in 1972 according to Gotovac's design dating from 1970 on a sloping terrain of the north side of the island of Čiovo.[9] The dense pinewood, converted to a garden grown with various Mediterranean vegetation, extends towards the sea at the bottom of the plot. This small house has come closest to the model of historical summer residences set in landscape, occupying a smaller south part of a relatively large plot[10], thereby achieving a sense of intimacy. The house organically grows, developing longitudinally across the terrain, and is conceived as a mostly unique volume articulated with overlapping parts. Gotovac shapes the volume by means of the inventory of Dalmatian architectural heritage: slanting roof, half-round tile, and arches on the façade. The fragmenting of the volume, modelled after the rural architecture of Dalmatian settlements, is not mechanically accepted – it is rather in harmony with the ground-plan organisation. The chimneys, one within the living-room and the other between the covered porch and the outside terrace, are dominant elements of the architectural composition. The living-room exudes a very intimate atmosphere due to a central position of the fireplace. The house is harmoniously, slightly romantically composed.

[9] Anagraphic mark: Croatia, Slatina (island of Čiovo), Pod Roka 4.
[10] Effective area of the house is 28 $m^2$, the plot area is approximately 800 $m^2$.

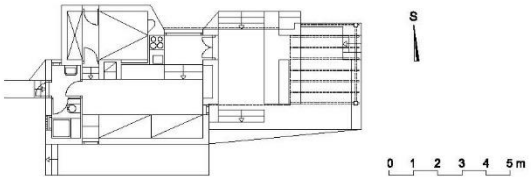



**Figure 3: Bućan House, ground-plan.**

**Figure 4: View from the north.**

## THE MÜLLER HOUSE

At Splitska, on the north side of the island of Brač, a two-storey house was built in 1981, according to Gotovac's design dating from 1980. The plot is situated on the former agricultural terrain, witnessed by a stone-hut found on the south part of the plot and incorporated into the garden surrounding the house. The house consists of two volumes: the south one is higher, with a lower north volume attached to it, differently shaped. While the south volume is a regular prism covered by level roof sun-terrace, the north volume, oriented towards the sea, is articulated by means of elements "typical" of Mediterranean architecture – slanting roof and stone-lined façade. The chimney towers above the basic volumes and is a dominant element of composition. On the east side Gotovac designs an open concrete winding staircase, giving access to the roof terrace and connecting the two volumes into a unique composition. The north part of the ground-floor is occupied by a spacious living-room with a kitchen, while the south part features a summer kitchen, common in Gotovac's summer homes, and utility rooms. A single staircase in the central part of the ground-plan gives access to the bedroom and the bathroom on the first floor. The ground-floor and the first floor are visually connected by a large opening in the wall dividing the two volumes. The house was subject to major changes – the summer kitchen was replaced by a bedroom and the façades were subsequently lined in stone.

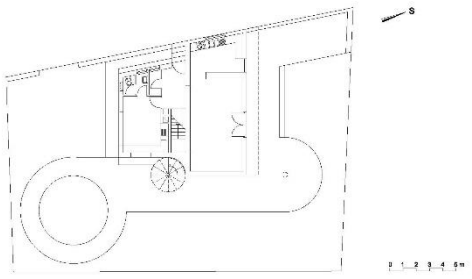



**Figure 5: Müller House, ground-plan.**

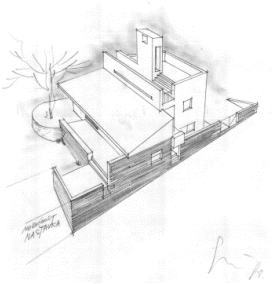
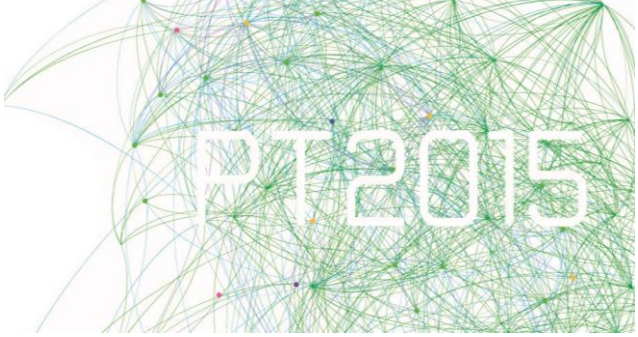


**Figure 6: Perspective.**




## CONCLUSION

Holiday homes designed by the architect Frano Gotovac are modernist in their visual expression. Gotovac drew inspiration from the traditional rural architecture and famous examples of period country-house architecture in Dalmatia. By their size and contents, the houses correspond to the needs and financial means of the owners in the latter half of the 20th century. Constructed within amorphous weekend settlements and lacking any urban characteristics (a church, a square, streets), Gotovac's houses morphologically stand out from the majority of neighbouring buildings designed by means of "typically" Dalmatian architectural elements. They represent his attempt at imbuing the space with traditional Dalmatian spirit, although sometimes, unfortunately, without much success, even in the immediate surroundings. The settlements along the Adriatic coast have been built for years by cramming the houses with no plan or sense of proportion, devastating both nature and the architectural heritage. Since urban sanation is very difficult to implement due to the dense construction of the settlements, registering and protecting the houses of high artistic value, like the ones analysed here, could contribute at least towards establishing of the cultural identity of the place in question. The author's well-tried designing method should serve as an incentive and guideline to today's architects in their pondering of space in the areas rich in cultural tradition.

## REFERENCES

Fisković, C. 1966. Kultura dubrovačkog ladanja: Sorkočevićev ljetnikovac na Lapadu. (Culture of Dubrovnik country-houses: Sorkočević's summer residence on island of Lapad.) Dubrovnik: Historijski institut Jugoslavenske akademije znanosti i umjetnosti.

Freudenreich, A. 1962. Narod gradi na ogoljenom krasu. (People building on bare Karst.) Zagreb-Beograd: Savezni institut za zaštitu spomenika kulture.

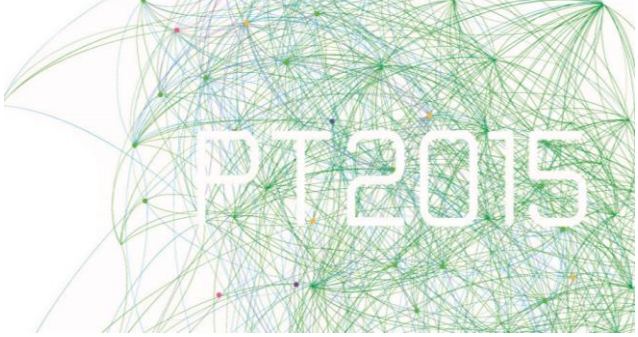
Gotovac, F. 1979.a ''Je li 'divlja' gradnja baš tako divlja?.'' (''Is 'wild' construction really as wild as it seems?.'') Split: Nedjeljna Dalmacija, no. 416: (April), 4.

Gotovac, F. 1979.b ''Rat lukova i krovića.'' (''War between arches and roofs.'') Split: Nedjeljna Dalmacija, no. 451 (December): 22-23.

Gotovac, F. 1980. ''Fenomen zvan džumbus.'' (''Phenomenon called chaos.'') Split: Nedjeljna Dalmacija, no. 477 (June): 7.

Smoje, M. 1965. ''Weekend kućice prijete Jadranu.'' (''Weekend-cottages threaten Adriatic.'') Split: Hortikultura 32(11), no. 4: 46-49.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# ARCHITECTURE AND ITS AFTERLIFE; GREEN URBANITY

**Gabriella Medvegy** [1]
PhD, Associate Professor and Vice Dean, Faculty of Engineering & IT, Architectural Institute, University of Pécs, Hungary, 7624 Pécs, Boszorkány utca 2., Hungary, medvegygabriella@pmmik.pte.hu

**Gábor Veres**
PhD, Associate Professor, Faculty of Engineering & IT, Architectural Institute, University of Pécs, Hungary, 7624 Pécs, Boszorkány utca 2., Hungary

## ABSTRACT

*It seems that designers have to adopt a kind of polyhistor role in our depressed economic atmosphere. This is linked to the fact that architects are becoming increasingly sensitive to society's problems, and there are more and more architectural projects that react to social problems. Economic and ecological aspects are also given priority. Architects find it more and more important to consider the return of the invested capital or try to find answers to ecological questions. Is it just a passing fad? I'd rather call it a tendency.*

*Cities clearly have a fundamental wish for more greenery and it cannot be solved purely by applying structures with vegetation such as a green roof or a green wall. It is more inspiring and interesting when the architect integrates greenery into the design process, and it is harmonised with the newly built space in the process of creation. Obviously, the right Ecological Design Method works in a more complicated way, but it's worth thinking about the impact of a built element on its natural environment and vice-versa*

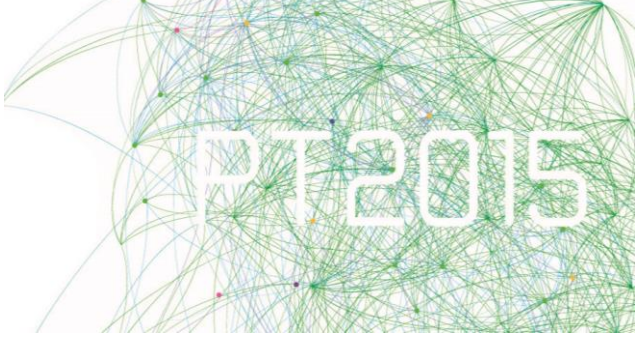
*Main statement: The definition of "green urbanism" has to be introduced into the glossary of architecture. It's not the same to speak about a semi-natural building or a building in nature, and it is important to define the role of vegetation in the process of creating built environment.*

***Keywords****: greenery, urbanity, architecture*.

## NEW WISH OF THE CITY - AFTER URBANISM!

As a contemporary vision, the picture of placing greenery in the built environment is becoming clear in the minds of today's architects. THIS IS A NEW DESIGN

[1] Corresponding author




METHOD. The above claims are confirmed; 'Living Environment' is an inspiring effect not just in the projects of practicing young architects, but in the minds of students at design schools too. The symbiosis of the 'building' and the 'greenery' is made certain; the designed building is formed by nature, just like a surreal vision with easy indications for its urban origin.

Regarding to the above mentioned visions, the designed building is formed together with its surroundings. The greenery is becoming 'substantial' (so to say a construction material) around the building. The elements of 'living nature', the 'weather', the 'soil', the 'mud', the 'fog' (etc.) become 'building materials' and important parts of the concept.

The phenomenon characteristic of the design process is nothing more than the result of the changed thinking about living in a city; when the needs of the 'neo-urbanised' humans are built into the conception by the designer during the design process, and the designers are inspired by the new manifesto **'back to the nature'**. The 'neo-urbanised' types of humans are highly skilled, escaping from the city despite of using every corner of it. Nevertheless, these new citizens cannot change their environmental footprint any more – even with the help of the above mentioned urban and ecological aspects –, and the designed project at the end cannot be as **'natural'** as it was understood in the old times. Instead of the idiom 'natural', it is better to use 'craft-designed', 'ecological', 'sustainable', 'agri-tectural' (after DC+Renfro), or the expressions of 'urban-design', or 'landscape-urbanism' have to be used – in fact, today's 'renaissance man' is being reborn now. The architectural project almost becomes a sociological case study whether the designer wants it or not – we can even call it a 'pathography'. I guess a new type of design method is emerging.

## CASE STUDY 1 – LOW LINE

I wish to confirm the above mentioned statements with two really fresh examples. The first is about the reconstruction of the historic trolley terminal, the Williamsburg Bridge Trolley Terminal on 'Low Line' – Lower East Side of New York City between Brooklyn's Williamsburg Trolley neighbourhood and Manhattan's Lower East Side– in the city of 'The High Line'. The Public Transport Terminal was opened in 1903, and has been closed since 1948 when trolley service was decided to discontinue. Despite of the out-of-function period, the site is still impressive and its opportunities to make it public somehow are recognised – located in the middle of (under) the green areas of New York, and is easily accessible by citizens.

The reconstruction – redefinition - of the Terminal is designed by James Ramsey of Raad Studio, this is the 'Delancey Underground'. The idea is based on a special solar technology; the natural light is collected by parabolic solar items, comes in through tubes – containing lenses and mirrors –, and is forwarded to hexagonal

reflectors, with the help of fibre-optic cables quite a sci-fi atmosphere is generated according to the designer's plan. The technology is able to transmit enough 'natural' light to support photosynthesis and transfer the energy to grow plants and trees, that way create an 'underground park' after the reconstruction – by 2018. The technology is currently modelled.

**Figure 1: The trolley terminal today – photo: Courtesy of Danny Fuchs.**

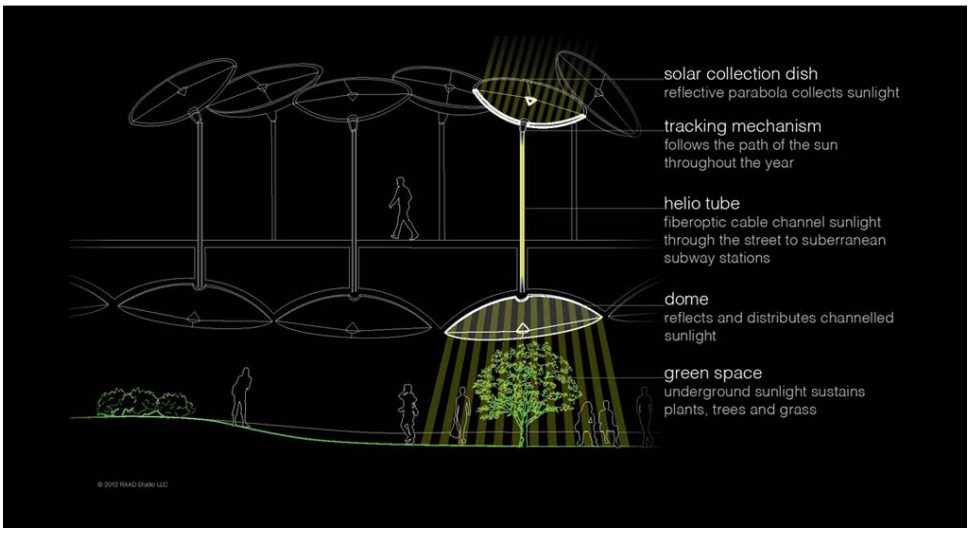



**Figure 2: Illustration of the operation of 'fibre-optic' technology.**

The concept meets high-tech engineering and technology, ecological aspects, the need for redefining out-of-function industrial infrastructures, and last but not least – the need for green spaces for the urbanised citizens of New York. This is a new type of public place – an answer for the 'wish' of people of the 21st century.

The designers were inspired by the new phenomenon in architectural conceptual thinking; the next level of publicity and the connection with nature in the design of common places. People need ecological decisions in publicity (so to say urbanity), and wish to redefine their connection with living greenery and replace themselves in society. Designers have to follow the changed comfort aspects in urban spaces.

**Figure 3: A rendering of Delancey Underground with sunlight streaming through Ramsey's "remote skylights".**

## CASE STUDY 2

The same effects can be prognosticating in the projects of university students. Well-educated students are especially sensitive for their economic, social and natural environment; they already feel the changes in design. As the second example for the meaning of 'green-urbanity' in today's design concepts, let me briefly introduce the Final Project of Ms Petra Sebestyén, a master's degree graduate of the Architecture Program of the Faculty of Engineering at the University of Pécs, Hungary, supervised by Gabriella Medvegy Dr.

There are the possible contents of 'water', 'greenery', 'dynamism', and 'publicity' in architecture in her focus. The project is located in Zirc, Hungary, between an old

arboretum and the living area. The primary function in the project is a bottling industrial building for mineral water, but the question is more complicated; how is the 'Bottling Plant' located lying between the greenery and the human environment?

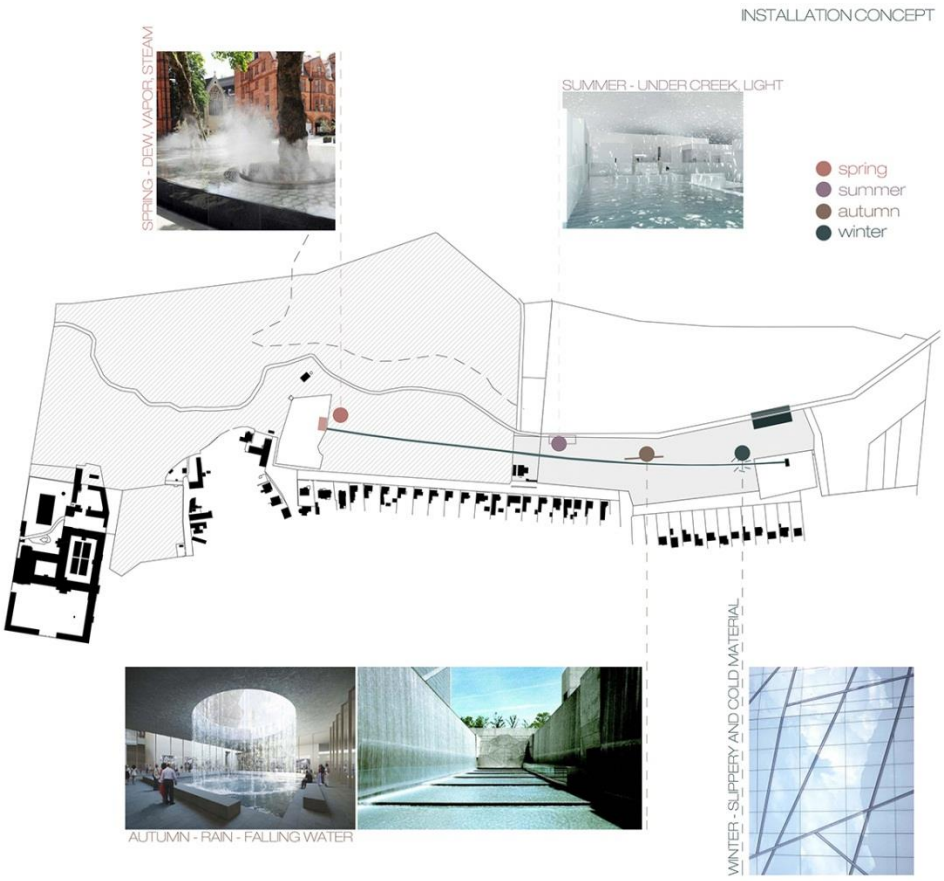



**Figure 4: Petra's first impressions with inspiration examples for the organization of the project. Characteristic natural elements.**

The building becomes a natural element based on the design concept, stringed to the pathway and the soil between the arboretum and the town. We can't speak about a building anymore; just about parts of dynamic effects and contents with wide and functional spaces in the end – with the main function of bottling. There aren't any walls, roofs, details anymore; just primer elements of architecture including monolithic borderlines, horizontal and vertical transparent facades (can be water or glass or empty space). Architecture becomes a puffer-part of greenery or nature with public or urban contents in places. The project entered into the international workshop '4 Author 4 Tutor' in Beijing, China as a nice example of changing design aspects in Europe, and is being processed. It had major success during the first open presentation of the workshop; to articulate the meaning of 'water' or

'nature' in architecture presents a serious challenge not just for the Designers of Nowadays in Europe, but in the Far East as well (with some other contents).

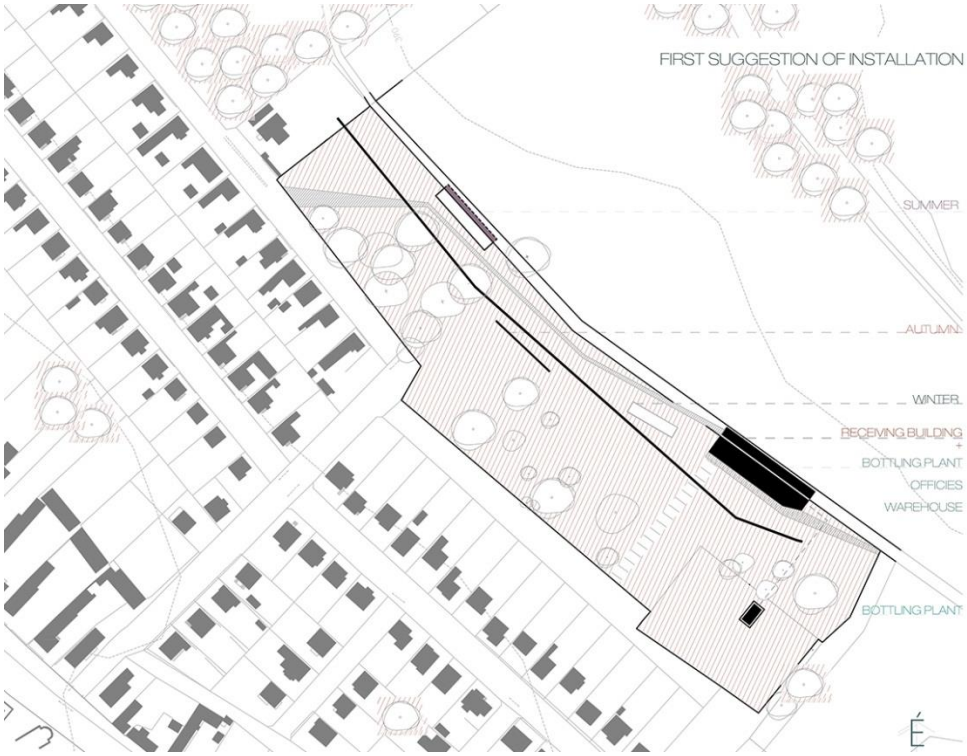



**Figure 5: The plot of the building and its close environment in Petra's project.**

## CONCLUSION

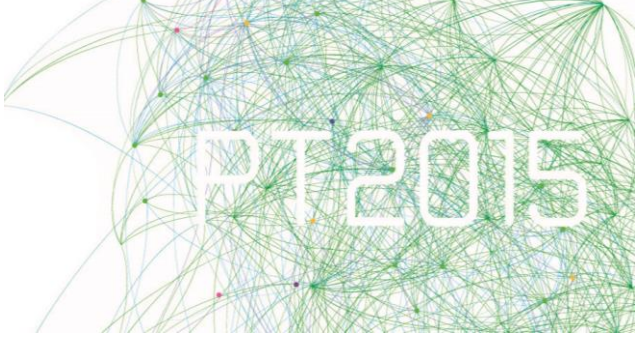
Based on changing human's aspects, designers are inspired by the new meaning of 'greenery' or 'ecology' in design processes. The role of 'nature' has changed and become a design element – a construction material. Semi-natural buildings are not the same as building nature any more. It is a nice challenge for Designers!

## REFERENCES

Davidson, J. 2011. "The Low Line – a plan for a new park banks on subterranean photosynthesis". *New York Magazine* (Published Sep 16, 2011) Journal article.

Greenemeier, L. 2012. "Tunnel Vision: Subterranean Park to Stay Sunny with Fiber-Optic Skylights". *Scientific American* (Published Sep 14, 2012) Journal article.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# INVESTIGATION OF RELATIONSHIP BETWEEN CULTURE OF THE INHABITANTS AND QUALITY OF HOUSING

**Ana Špirić**[1]
PhD candidate, Institute for Intellectual Property of Bosnia and Herzegovina, Akademika Jovana Surutke 13, Banja Luka, a.spiric@yahoo.com

**Sanja Trivić**
PhD student, Projekt plus DOO, Brace Potkonjaka 8, Banja Luka, sanja_trivic@yahoo.com

## ABSTRACT

*The primary concern of this paper is to determine the extent to which planning practice through the creation of various qualities of housing affects the personal identity of the inhabitants. The personal identity has been explored through the culture of the inhabitants. Anthropological approach, the most adequate for the research topic, defines culture as a set of learned patterns of human behaviour and thinking. According to Edward Sapir's view, personality is taken as totality of all those aspects of behaviour which give the meaning to an individual in society and differentiate it from other members in the community and is explored through attitude towards oneself, the others and the world. Individuality is analysed as the indicator of quality of housing and is observed through the relation private-public, that is, individual-collective and imply introvert attitude towards urban surrounding. In order to determine the culture of the inhabitant dependence on the quality of housing, the research assumes that the higher the level of individuality of housing is the higher level of culture of the inhabitants of that space is. Considering the research tasks the survey has been selected as the most appropriate instrument of research. The survey was conducted in Banjaluka, on the sample of 300 respondents.*

***Keywords**: culture of the inhabitant, personal identity, quality of housing, individuality, Banja luka.*

## INTRODUCTION

The development of personal identity in terms of raising mutual understanding and respect between individuals is one of the general objectives of the current cultural policies. As the cultural policies are often the subject of criticism and dissatisfaction of citizens and professionals who participate in its planning and

[1] Corresponding author

implementation, paper has attempted to ascertain the extent to which planners work affects the development of personal identity. The urban planners work is examined through creating the various spatial qualities of housing function, being the most common and most complex function in the cities. The goal of the research is to determine the existence of positive correlation between improvement of the quality of housing, being the urbanism practice topic, and the process of personal identity development, being the basic of collective consciousness. In case of this positive correlation existence, housing may be used as a strategy to positively affect identity and relationships between people in everyday situations.

As cultural aspect of housing implies emphasizing user identity, seen through relationships with other individuals (Erik Erikson cited in Golubović, 2006), in this work the personal identity of the individual is viewed through a culture of space user. Anthropological approach, the most adequate for the research topic, defines culture as a set of learned patterns of human behaviour and thinking. By defining personality as the totality of all those aspects of behavior which give the meaning to an individual in society and differentiate it from other members in the community, Edward Sapir emphasizes the attitude towards oneself, the others and the world (Sapir, 1974). Similar opinion is given by Ivan Cifric and Krunoslav Nikodem. According to them, the relations, foundations of individual's identity shaping, are represented in attitude towards oneself, the others, nature and god (Cifric and Nikodem, 2006). Results of numerous studies dealing with the relationship between housing and personal identity of inhabitants indicate that housing quality influences personal and social identity through physical solutions that facilitate behaviour and social interaction. The origins of this thinking arise from the field of environmental psychology. On the other hand, studies show that the provided level of individuality is the most important factor that affects quality of housing. Accordingly, in this paper individuality is analysed as the spatial indicator of quality of housing.

In order to determine the personal identity of the inhabitant dependence on the quality of housing, the research assumes that the higher the level of individuality of housing is the higher level of culture of the inhabitant of that space is. Research tasks are related to examining the attitude of an individual towards self, the others and the world. Considering the research tasks the survey has been selected as the most appropriate instrument of research. The survey was conducted in the beginning of 2008 in the central zone of Banjaluka, on the sample of 300 respondents. The boundaries of research area are: in the north west- Omladinska street and Krajiskih brigada street, in the north east- Milana Radmana street and Sveti Sava street, in the south east- Mladen Stojanovic street, Gunduliceva street and river Vrbas and in the south west- Solunska ulica (figure 1). The research area refers to space as defined by Ruzica Bogdanovic, who beliefs that the urban quality is always related to the state in city center (Bogdanovic, 2000). The same polygon is analyzed with the aim of defining housing typology according to various urban parameters that affect quality of housing, respectively the level of individuality.

The purpose of creating typology is recognizing deferent levels of individuality which could affect people's behaviour and social interaction in deferent ways. The analysis shows that each type of housing has a certain level of individuality. The determined level of individuality of different housing types is compared with the results of the survey in order to identify those urban parameters which positively influence the development of personal identity. For the analyses of data in this research, the method of conclusion statistics is applied. Within this method, the statistical analysis of cross-tables (chi-square test) is applied.

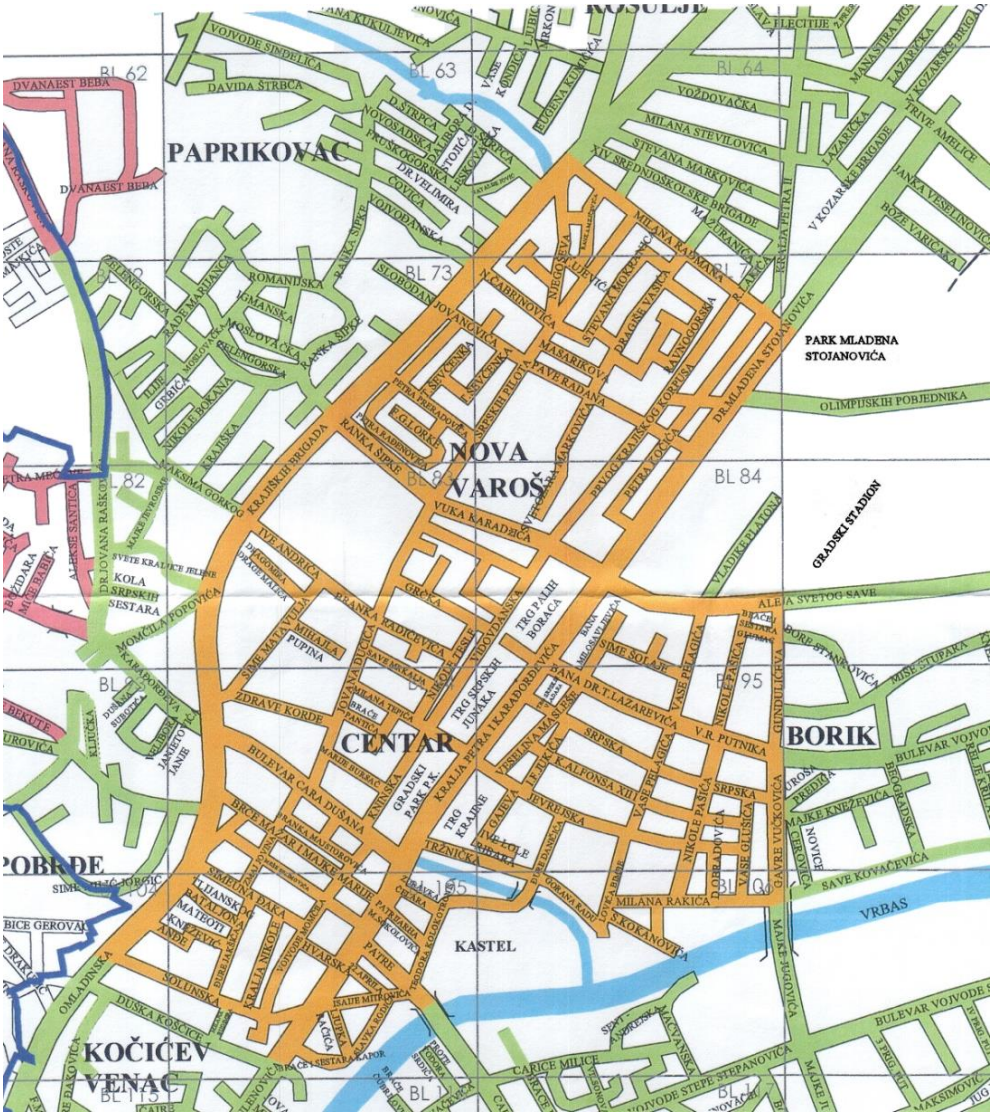
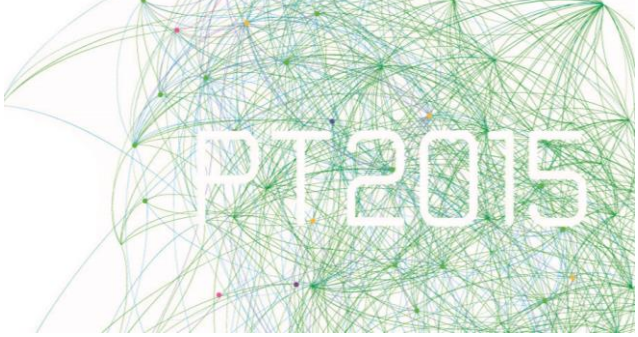



**Figure 1: The first city zone – according to administrative division of the City of Banja Luka.**




## INDIVIDUALITY AND HOUSING TYPOLOGY

Individuality, expressed through everyday life of an individual, for the purposes of the case study is taken as the spatial indicator of quality of housing. The relation between the level of individual and collective in housing effects the organization and quality of the house. In case the housing has many qualities of individual, its quality is improved, but at the same time its urbanity is reduced (Stoiljkovic, 2009). Individuality and privacy are being observed through the relation private-public, that is, individual-collective and imply introvert attitude towards urban surrounding (Kalcic, 2001). Individuality implies autonomy, independence and a certain level of being singled out from the closest surrounding (Alexander, 2005).

The given spatial criteria of individuality, in accordance with which the most important urban parameters are determined (building stories, site use, density of housing units per story, the position of the building on the belonging lot, access for vehicles and pedestrians, parking, level of noise, existence of open spaces, sunlight and ventilation), conditioned the following typology of housing in the central Banjaluka zone.

Type 1 provides a very high level of individuality. It implies single-family housing within detached houses and houses on the edge of the lot, with stories mostly up to G+1+L (ground floor + story + loft). These buildings are accessed from the lower level roads (residential street). The parking is provided within belonging lots. Described urban parameters provide a low level of noise, good sunlight and ventilation. One housing unit per story, existence of intimate gardens and front gardens are additionally some of the factors providing a very high level of individuality.

Type 2 provides high level of individuality. It implies single-family housing with business in the ground floor, houses on the edge of the lot, with stories up to G+2+L (ground floor + two stories + loft). These buildings are accessed from the lower level roads (residential-business street). Parking is provided within belonging lots, but only for the residential part of the building. Described urban parameters provide medium level of noise, good sunlight and medium level of ventilation. One housing unit per story and the possibility for development of intimate gardens into depth of the lot, physically separated from the business next to the road, are an opportunity to gain privacy.

Type 3 provides the highest level of individuality. It implies single-family housing within detached houses with stories up to G+1+L (ground floor + story + loft). Although the lots of these buildings are between the roads of different levels, the access to the buildings is provided from the lower level roads (residential street). Parking is provided within belonging lots. Described urban parameters provide a low level of noise, good sunlight and ventilation. The spacious comfort of the lot,

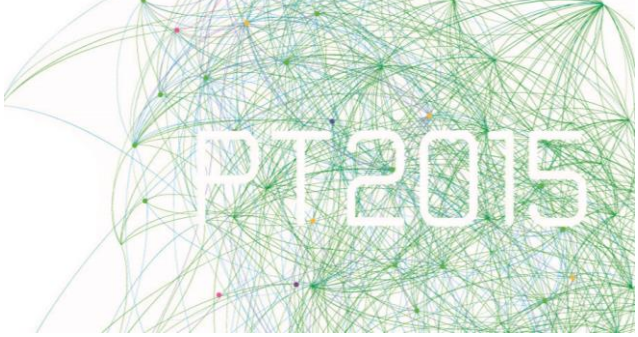
one housing unit per story, existence of intimate gardens and front gardens are additionally some of the factors providing the highest level of individuality.

Type 4 provides a medium level of individuality. It implies multi-family housing within detached houses and houses on the edge of the lot, with stories up to G+4+L (ground floor + four stories + loft). These buildings are accessed from the lower level roads (residential-business street). Parking is provided within belonging lots. Described urban parameters provide medium level of noise, good sunlight and medium level of ventilation. Up to four housing units per story, existence of common gardens which are not arranged in the shape of front gardens are additionally some of the factors providing medium level of individuality.

Type 5 provides a very low level of individuality. It implies multi-family housing with business in the ground floor, within houses on the edge of the lot, with stories up to G+6+L (ground floor + 6 stories + loft). These buildings are accessed from collector roads (residential-business street). Parking is provided within belonging lots for the residential part. Described urban parameters provide very high level of noise, medium level of sunlight and medium level of ventilation. Up to four housing units per story and no gardens are additionally some of the factors implying very low level of individuality.

Type 6 provides a low level of individuality. It implies multi-family housing, rarely with business in the ground floor, detached houses, with stories from G+5 (ground floor + 5 stories) up to G+14 (ground floor + 14 stories). These buildings are accessed from the lower level roads (residential-business street). Parking for several buildings is provided within common lot. Described urban parameters provide medium level of noise, good sunlight and good ventilation. Up to eight housing units per story, existence of half-public open spaces are additionally some of the factors implying low level of individuality.


**Figure 2: Line of determined level of individuality in accordance with types of housing.**

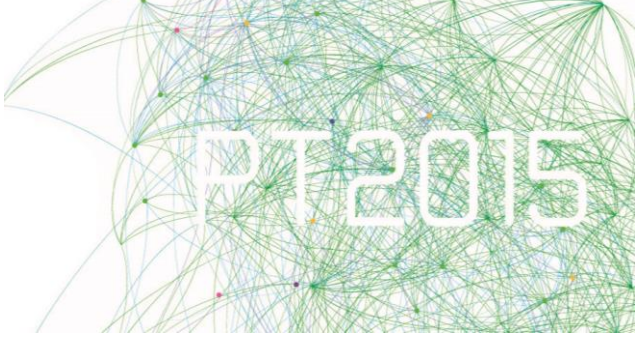



The analyses of the above housing types show that the highest level of individuality is found in detached family house, as well as that it gets lower going towards types of multi-family housing (figure 2). The conditions provided by single-family housing in the center of the city, regardless whether it is housing with or without business, are more human, provide larger comfort, that is, the level of offered quality of housing is higher.

## CASE STUDY RESULTS

The goal was to determine personal identity dependence on individuality. From defined concepts of culture and identity, three tasks of the research emerged. They are related to examining the attitude of an individual towards self, the others and the world. The aim is to point the importance of the way an individual summarizes its own perception about itself, that is, the way it relates to others and the world in general. In accordance with established tasks of the research, the following indicators are defined: 1) attitude towards the world- interest in events in the world, ability for objective evaluations and absence of prejudice, 2) attitude towards oneself- realistic evaluation of self and acceptance of self as is, thus 3) attitude towards the others- respect of someone else's personality, sensitivity to the needs of others and conduct in accordance with such norms and moral principles that can be taken as general. In accordance with goal of the research the following hypothesis emerged. The higher the level of individuality is, being the spatial indicator of quality of housing, the higher level of culture of the inhabitant of that space is. With the goal of getting reliable research results, the main hypothesis was decomposed in several sub-hypothesis. They represent the relation between a particular parameter of the above determined typology of housing and tasks set. Based on the number of urban parameters and tasks set, it is possible to set a large number of sub-hypothesis, but considering the importance of particular sub-hypothesis for the goal defined in this paper, the following ones are set: 1) The more stories a building has, the attitude of individuals towards the others is worse; 2) Inhabitants of single-family houses have better attitude towards the world; 3) Inhabitants of residential buildings with business in the ground floor have worse attitude towards the world; 4) The more housing units per story there is, the attitude of an individual towards the others is worse; 5) The better the living space is arranged, the better the attitude of inhabitants towards the world is; 6) The more intimate space around the building is, the better the attitude of an individual towards the others is; 7) The more intimate the space around the building is, the better the attitude of the inhabitants towards the world is. Data analyses gave the following results.

Considering the determined level of individuality, the expected result is supposed to indicate the best attitude of individual towards oneself regarding type 3, and the worst regarding type 5. However, the analysis shows that examinees of type 3 and type 5 have the same attitude toward themselves, while examinees of type 1 have the worst. The expected result is supposed to indicate the best attitude of individual



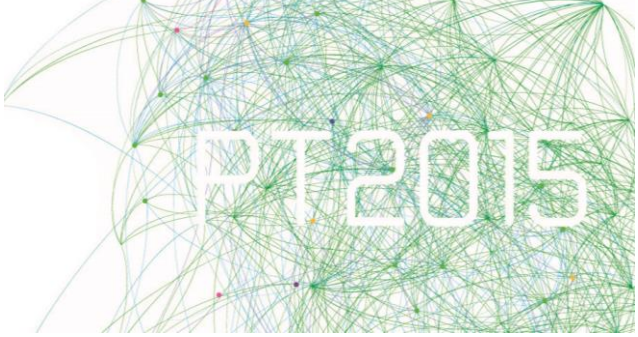

towards the world regarding type 3, and the worst regarding type 5. The analysis shows that the assumed relation regarding type 3 is confirmed, while instead of examinees of type 5, examinees of type 1 have the worst attitude towards the world. The examinees of type 4 and 5 have the same attitude towards the world. Finally, considering the determined level of individuality, the expected result is supposed to indicate the best attitude of individual towards the others regarding type 3, and the worst regarding type 5. The analysis shows that the assumed relation regarding type 3 is confirmed, while instead of examinees of type 5, examinees of type 6 have the worst attitude towards the others.

### Research conclusion

The conclusions of the research are made based on comparison of the found quality of housing and evaluated level of culture of its inhabitants. Based on this relation, previously defined hypothesis and sub-hypothesis are confirmed or denied. Considering the fact that sub-hypothesis 1, 2 and 3 are denied research conclusions that confirm the rest of sub-hypothesis are presented for the purposes of this paper. Investigation of the relation of number of housing units per story and attitude of an individual towards the others shows (with the exception of type 6) that with the growing number of housing units per story the attitude of the inhabitants towards each other is worse. Thus, sub-hypothesis 4 is confirmed. Investigation of the relation of living space arrangement and attitude of inhabitants towards the world shows that with the growing level of living space arrangement for a particular housing type also grows the level of the attitude of an individual towards the world. This implies that sub-hypothesis 5 is confirmed. Investigation of the relation of level of intimacy of the yard and attitude of the inhabitants towards each other shows that (with the exception of type 1) the higher the level of intimacy of the yard is, the better the attitude of the inhabitants towards each other is. This implies that sub-hypothesis 6 is confirmed. Similarly to the previous statement, investigation shows that (with the exception of type 1) the higher level of intimacy of the yard conditions the better attitude of an individual towards the world. Thus, sub-hypothesis 7 is confirmed.

## CONCLUSION

An example of questioning the responsibility of urban planners for development of personal identity, through creating the various levels of individuality and housing qualities, is shown through a case study performed in Banjaluka. Taking into account obtained results, it can be concluded that the number of housing units per story, level of arrangement of open spaces and intimacy around the building are urbanistic parameters important in achieving individuality. In other words, the fulfilment of these parameters would provide increasing the level of culture of the space users. This confirms the relative responsibility of urban planners for personal




identity development, implying the existence of positive correlation between urbanism practice, and the process of personal identity development.

## REFERENCES

Alexander, C. 2005. *A Vision of a Living World: An Essay on the Art of Building and the Nature of the Universe*. Berkeley California: Center for Environmental Structure.

Bogdanović, R. 2000. "Stanovanje u centralnoj zoni grada." in *Principi i praksa održivosti u razvoju naselja u Srbiji 1*, edited by Ružica Bogdanović i Borislav Stojkov, 141-173. Beograd: Udruženje urbanista Srbije.

Cifrić, I & Nikodem, K. 2006. "Relacijski identiteti. Socijalni identitet i relacijske dimenzije." *Društvena istraživanja*, br. 3 (89): 331-358.

Radenović, S. 2006. "Nacionalni identitet, etnicitet, (kritička) kultura sjećanja." *Filozofija i društvo,* br. 3: 221-237.

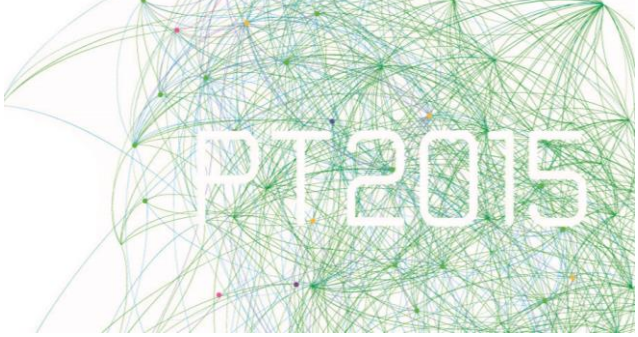
Kalčič, I. 2001. "Today's Dwelling Culture as Result of Inherited Principles, Customs and Needs." Accessed November 10, 2009. http://www.theslovenian.com/articles/kalcic.htm.

Sapir, E. 1974. *Ogledi iz kulturne antropologije.* Beograd: XX vijek.

Stojković, B. 2007. *Evropski kulturni identitet*. Beograd: Službei glasnik.

Stoiljković, B. 2009. "O fenomenu individualnog i kolektivnog u arhitekturi stanovanja." *Nauka + Praksa*, br. 2: 29-32.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# UTOPIAN PROJECTS DRAWINGS AS INDICATORS OF MODERN SOCIETY NEEDS

**Vladimir Kovač**
University of Belgrade, Faculty of Architecture, Bulevar kralja Aleksandra 73/II,
kovachshach@yahoo.com

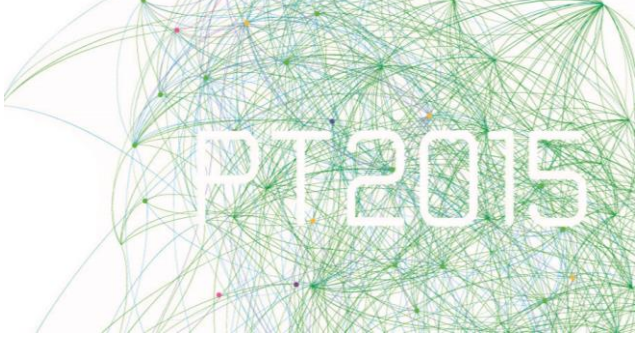
## ABSTRACT

*The paper explores architectural drawing as a medium of representation of utopian visions, which aim to indicate needs and problems of modern society. Architectural drawing has always been a powerful tool for reviewing and representing the space, both material and mental – social space. Thus, drawings of utopian projects from the sixties and seventies of the last century had followed and generated significant social changes. Starting from that period until today, architectural drawing remained the model of detection and conceptualization of the problems each community faces and fights.*

*Unfortunately, modern cities are not the places that will provide a sustainable and humanized tomorrow for us. In such environment, drawings of futuristic projects and utopian visions are opening new topics and suggesting possible solutions. Also, in this process, architectural drawing is recognized as a model of creating a deflection from the recent social practices and anachronistic principles of urban development and, therefore, it is opening the possibilities of new concepts and alternatives. Hence, the aim of the paper relates to exploring and defining the parameters of the social context that caused the production of utopian projects, and thus established drawing as a medium of their presentation.*

*The study begins with an analysis of social conditions in the period of decades after the Second World War, which brought specific and avant-garde utopian projects. In those years, architectural drawing was recognized as a means of struggle against the repressive principles of post-war modernism. Finally, the study focuses on drawings of modern utopias and cities of tomorrow, and reviewing the characteristics of the social context in which these utopias were created.*

***Keywords***: *architectural drawin, utopia, distopia, representation (of space), city of tomorrow, society.*

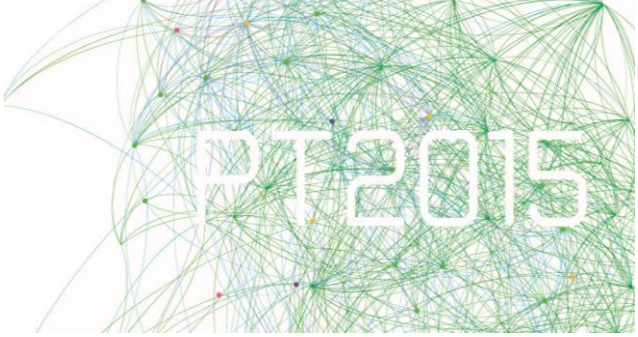



## INTRODUCTION - DEFINITION OF THE TERM *UTOPIA*

When we talk about utopias, there are always more questions and unknowns than answers. However, no society can survive, nor be called a community, without its construct of a utopian world, because, as Oscar Wilde states "a map of the world that does not include Utopia is not worth even glancing at" (Wilde 2009). For understanding the phenomenon of utopia, it is necessary to present a brief historical discourse of the development of this determinant. The creator of the very concept of *utopia* is the English Renaissance writer and philosopher Thomas More, who published a book of the same title[1] in 1516. This novel, which describes fictional ideal island state *Utopia*, was created with the purpose of criticizing social and political organization of former England. Describing the ideal country, More used literary form of the novel and the language of sarcasm, and even in the very root of the word there was a double meaning, since the term utopia could mean the Greek *eutopia* (εὖ + τόπος), which means a good place, and *autopia* (οὐ + τόπος) which means non-existent place. Relying on More, Lewis Mumford explains that "the word *utopia* usually indicates the end point of human folly or human hope - futile dream of perfection in the *Land of Never End* or rational attempts at reorganization of the human environment and its institutions, as well as improving its imperfect nature in order to expand the possibilities of everyday life" (Mamford 2009:6). Later, during the historical period, the word *utopia* was rooted as a term that generally describes the concept of state or arrangement that is not feasible or is unrealistic and impossible. Only in the 20th century new types of utopias appeared, *anti-utopias* or *dystopias*, which also represent a fictional society, but they are the antithesis of utopias. Such concepts were created in the atmosphere of large social tragedies and suffering, like many civil wars or world wars were. Although anti-utopia is often identified with the dystopia, the difference is that dystopia does not pretend to be a system of well-being, while anti-utopia is planned or presented as utopia, but for some reason utopian concept collapsed (Rüsen et al. 2005:230). Due to its unambiguous negative connotations, dystopia is often used to actualize problematic issues related to politics, religion, technology and the environment, that is, the society as a whole. Therefore, dystopia is related to social constructs such as poverty, pauperism, political oppression or totalitarianism.

Based on the aforementioned, if the term utopia is brought in correlation with architectural drawing, it is clear that the drawing itself, because of its imaginative nature, becomes fertile ground for design and conception of utopian visions and projects. Therefore, in the remainder of this paper the relation between architectural drawing and utopias is going to be analysed, with the purpose to indicate problems and needs of the society and the social order.

[1] Full title of the first publication of *Utopia* from 1516, which was printed in Latin, was: *De Optimo Reipublicae Statu deque Nova Insula Utopia (Of a republic's best state and of the new island Utopia)*




## RELATION BETWEEN UTOPIA AND ARCHITECTURAL DRAWING

It was stated earlier that the concept of utopia refers to anything that is not feasible. However, as the Hungarian sociologist and philosopher Karl Mannheim states, this view does not completely exclude the possibility of utopia to be realized (Manhajm 1978:191). However, the realization of utopian concept is not reflected in immediate feasibility of what is presented by it, but in the destruction of the system which utopia opposes. This is a crucial determinant in the consideration of the definition of utopia and its setting in relation to the influence of the architectural drawings. Accordingly, architectural drawing can be perceived as a direct medium of utopian principles of interpretation and thus becomes an indicator of social needs. To consider a drawing a gesture of utopia, it is necessary to define the discursive elements that describe architectural drawing as a very product of utopian awareness. Speaking of utopian awareness, Mannheim states the following:

> *Utopian is the awareness that is not congruent with 'being' which surrounds this consciousness. This incongruity is always visible in fact that this kind of consciousness in experience, thinking and actions is oriented towards the factors that that 'being' does not incorporate as realized. But we will not consider utopian each orientation that transcends the given 'being' and that is in this respect 'someone else's' reality'. For utopian orientation, we will consider only those which 'transcendent reality' and, advances into action and in the same time partially or completely decomposes present existential order.* (Manhajm, 1978:191)

If we analyse the utopian nature of settings of architectural drawing, according to Mannheim's standpoints, we come to the conclusion that it is necessary that visual display defined by drawing transcends reality. Also, it is necessary that the concept of overcoming or transcending reality by drawing takes place simultaneously with the process of destabilization and destruction of certain social (or political) system. Comprehended in this way, from the point of view of utopia, drawing becomes a means of direct representation of social relations and ideological construct, because its purpose is to change certain order. Mannheim further defines this incidence noting that "the desirable images become utopia when they get a revolutionary function" (Manhajm 1978:191).

In fact, it is these kinds of connotations, in the context of architectural drawing that we recognize in the period after the Second World War, which coincides with the optimal environment for utopian and dystopian production. Especially the sixties and seventies of the twentieth century, brought us drawings of architectural designs that were not created with the idea to be realized, but their influence is determined through the media of visual presentation. These utopian visions were a new discourse in the presentation of architectural space, which was reflected on the field of social practices as well. During this period, drawings of projects of movable and variable futuristic structures of the London group *Archigram*, the Italian *Archizoom* and *Superstudio*, *Situationists*, and the French group *Utopia*, *Buckminster Fuller*, as well as drawings of modular structures of Japanese *Metabolists* led by Kenzō

Tange, were created. All these projects were created as utopian, anti-utopian or dystopian visual provocations, and were a response to the repressive architecture and principles of post-war modernism. In this period, architectural profession was faced with a number of conceptual problems, which were reflected in the improvisation of original modernist postulates in terms of rapid economic and technological prosperity. It is important to note that CIAM itself *(Congrès Internationaux d'Architecture Moderne)* "reinterpreted its goals, striving to work on forming a physical environment that will meet the emotional and material needs of people" (Blagojevic, 2007:175). The modernist establishment, led by Le Corbusier and Frank Lloyd Wright, in defiance of the needs of the new era and society, planned repressive and inert architecture (Genevra 1999:7). This practice was met with criticism of experts, and a large number of architects, theorists of architecture, planners, and sociologists have argued for a new position which was based on the hypothesis that the space of the city is not only a direct result of architects or urban planners, but the product of complex social relations and practices (Lefebvre 1991).

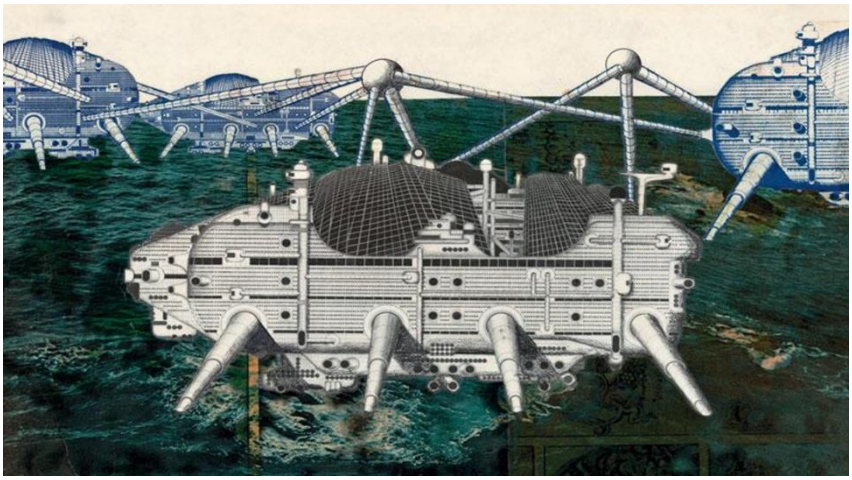


**Figure 1:** ***Walking City on the Ocean*****, Archigram / Ron Herron (1966).**

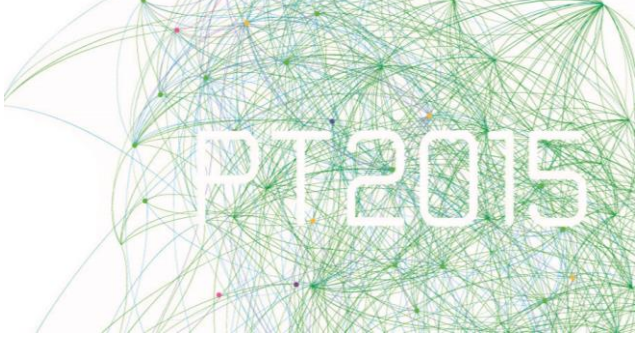
Creating in avant-garde ambience of neo-avant-garde, which criticized the modernist practice, many architects produced drawings of utopian and futuristic projects that were, by their conception, far beyond needs of contemporary society and its technological development, even from the present day perspective [Figure 1]. However, as *dystopias*, these drawings were closely related with the ideology of critique and concept of production of social space. When it comes to this topic, there is a statement in Lefebvre's work that "space has no social existence independently of an intense, aggressive and repressive visualization" (Lefebvre 1991:286), which in fact defines the significance of representation of architectural drawing as a utopia, or a dystopia.

## ARCHITECTURAL DRAWING AND CONCEPT OF MODERN UTOPIA

After a period of the last neo-avant-garde of late modernism, as some theorists of architecture call the period of the sixties and seventies of the last century (Lachmayer 2012:417), the production of utopian projects in their original form began, with no tendency to make them dystopias or to transform them into anti-utopias. However, architectural drawing still remains a means of detection of actual social needs and the way of representation of concepts of habitats of the future. In ambience in which there are less and less social utopias, human need to return to nature and its resources, and to develop the concept of sustainable habitat, takes precedence. "The ecological crisis, in addition to the realistic views of nature protection and sustainable development, induced so-called deep environmentalism, which is essentially a type of utopia of re-harmony between man and nature" (Kalanj et al. 2004:23). This concept of symbiosis of man and the environment is defined with the term *ecotopia* (Feireiss 2011:111).

The concept of ecotopia was elaborated and is still being elaborated upon by many architects, and one of them is Djordje Petrovic, who, back in the eighties of the last century, explored and visually conceived projects of many futuristic ecotopias in the form of paintings and drawings. It is interesting to note that some of Petrovic's drawings and projects are gaining analogues interpretations in today's time, which speaks about contemporary actuality of the questions and problems which the society faced 30 years ago [Figure 2]. These Petrovic's visions indicate the intention of the author to define essential problems of modern man in the form of drawings or paintings, which could ultimately be associated with "the fundamental questions of our existence and continuance" (Petrović, 2004:52).

**Figure 2:** ***Sub Marinopolis (left)*****, Djordje Petrovic (1986);**
***Ocean City (right)*****, Arup / Alexander Hespe and Alanna Howe (2010).**




## CONCLUSIONS

> *"We do not have any more time for mirrors of life facing the past, only for the other world, which is not similar to our own anymore, a new polis printed on an endless journeys of unpredictable secrets."* Petrovic (2004:52)

With these words, Djordje Petrovic, the visionary architect, indicated the necessity of searching for utopias, as personifications of ideal habitat. We have already concluded that it is difficult to imagine a society that, in its structural-design, excludes the concept of utopia. Referring to the French philosopher Paul Ricoeur (Ricoeur 1986:360), a contemporary sociologist, Rade Kalanj points out that "a society without utopia is unthinkable, because it would be a society without any aspirations. Utopia is a constant 'conversation' with the history which 'swallows' it, inverts it and puts it in its service, but it could not put an end to it, because it would be the end of itself" (Kalanj et al., 2004:23). In such environment, architectural drawing imposes itself as an inexhaustible source of utopianism that serves for the constant review of needs, and the boundaries of the society. Drawings of utopian visions have multi-layered and multiple-significance role, which is reflected in the indication of key social discourses. Because, regardless of whether it is about utopias, dystopias or anti-utopias, "the attitudes and beliefs that people have about the future is what in fact eventually causes any future" (Mamford 2009:119).

## REFERENCES

Благојевић, Љ. 2007. *Ниви Београд: оспорени модернизам*. Београд: Завод за уџбенике, Архитектонски факултет универзитета у Београду, Завод за заштиту споменика културе Београда.

Feireiss, L. 2011. *Utopia Forever: Visions of Architecture and Urbanism*. Berlin: Die Gestalten Verlag.

Genevro, R. 1999. ”Introduction”, In: Dessauce, Marc (ed.). 1999. The inflatable moment: pneumatics and protest in '68. New York: Princeton Architectural Press.

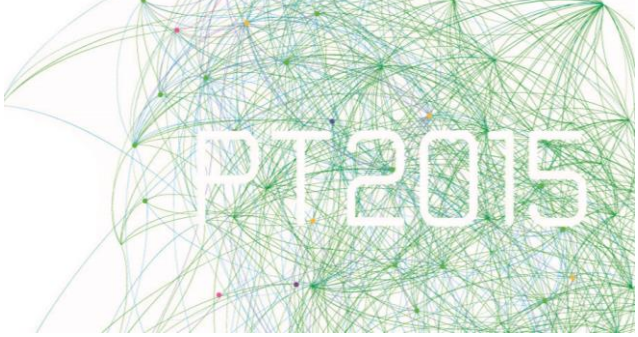
Kalanj, R; Rothstein, E.; Muschamp, H.; Marty, E. M. 2004. *Utopijske vizije*. Zagreb: Jesenski i Turk.

Lachmayer, H. 2012. ”Archigram: The Final Anant-Garde of an Ageing Modernism?.” In Crompton, Dennis (ed.). 2012 (1994). *A Guide to Archigram 1961-74*. New York: Princeton Architectural Press.

Lefebrve, H. 1991 (1974). *The Production of Space*, Oxford: Blackwall Publishing.

Mamford, L. 2009 (1922). *Priča o utopijama*, prev. A. Golijanin, Čačak: Gradac.

Manhajm, K. 1978 (1965). *Ideologija i utopija*. Beograd: Nolit.




Mor, T. 2012 (1516). *Utopija*, Beograd: Plato.

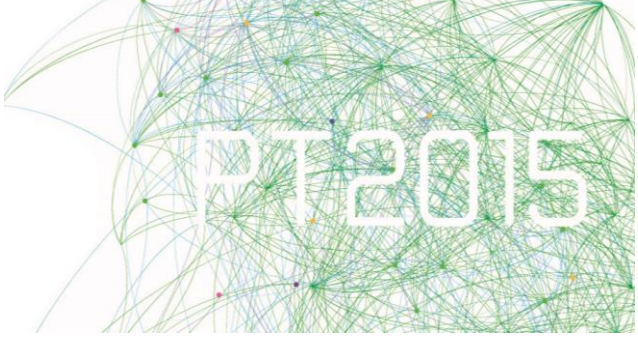
Petrović, Đ. 2004. *Kosmička umetnost: Svemirska vertikala*. (typescripts) Archive of the office for visual communication 341 / UB-Faculty of Architecture

Ricoeur, P. 1986. *Lectures on Ideology and Utopia*. NY: Columbia University Press.

Rüsen, J.; Fehr, M.; Rieger, T. 2005. *Thinking Utopia: Steps Into Other Worlds*. Oxford / NY: Berghahn Books.

Vajld, O. 2009 (1891). *Duša čovekova u socijalizmu*, Beograd: Karpos.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# YOUTH AND THE FEELING OF SAFETY IN PUBLIC SPACES

**Svetlana Stanarević**
PhD, Assistant Professor, University of Belgrade, Faculty of Security Studies, 50 Gospodara Vučića St. Belgrade, svetlana.stanarevic@yahoo.com, stanarevic@fb.bg.ac.rs

**Stevan Tatalović**[1]
Master student, Teaching Assistant, University of Belgrade, Faculty of Security Studies, 50 Gospodara Vučića St., Belgrade, tatalovic.stevan@gmail.com

## ABSTRACT

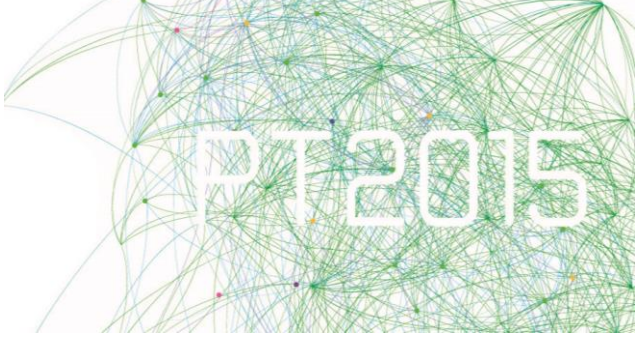
*Current re-examinations and fresh perceptions of the notion defined as public space call for new approaches to the organization and design of public spaces and embracing the differentiated perspectives on the important role they play for certain social groups, each with their different needs for using and moving within those spaces. This text raises several issues, one being how to make a public space closer to young people, many of whom see it as the only place where they feel fully independent, where they can be integrated and reintegrated, and where fear and insecurity are mitigated by preserving differences, with freedom of movement in city streets, squares, parks, city transport and similar places. Another issue concerns attempts to reconcile the need for spontaneity, adventure, risk-taking, a chance to experience a sense of surprise in urban environments, which appeal to young people for these very reasons, with efforts to ensure greater safety and remove insecurity from city streets. The famous sociologist Zygmunt Bauman himself asked the following question: Is it possible to overcome fear at the same time avoiding boredom? (Bauman, 2009). Finally, is public surveillance, as a form of monitoring public spaces, sufficiently acceptable and understandable to young people, to what extent does it invade their privacy, to what extent does it create for them a feeling of safety, and to what extent does it really contribute to ensuring their safety and security in a public space?*

***Keywords**: youth, safety, public spaces, public surveillance, risk.*

## INTRODUCTION

The values of public space are often promoted in literature on urban planning studies, as well as on human geography, urban geography, development geography, sociology of cities, social ecology, criminology, political science and many other related disciplines. There are many ways, both in literature and

[1] Corresponding author

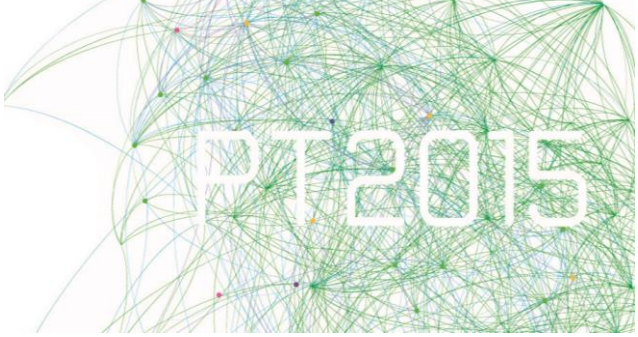



practical life, in which public space can be debated, researched and correlated with other similar or kindred terms.

Public space is most commonly defined as a forum that encourages encounters and intermingling between people of different classes, races, ages, religions, ideologies and cultures (Berman,1986, Harvey,1992) and as such serves as fertile ground for mutual respect, political solidarity, tolerance and civil/civic discourse (Walzer,1986). If viewed as a place open to all, it also promotes tolerance that allows room for "great differences between neighbors" (Jacobs, 1961). In other words, public space is a meeting point, a part of a city or another area within the public domain that helps promote social interaction and a sense of togetherness. Examples of such spaces include city squares, parks, market places, shopping malls, public green spaces, sidewalks, wharfs, special areas within convention centers, premises in public buildings and public spaces in private buildings.

Public space, occasionally referred to as community space (Crane, 1999), is not just the gaps between buildings and is not just physical space – it is considerably more than that. It is a "community resource" and "reflective of broader cultural facets and mechanisms of our urban life" (Butcher, Thomas, 2003). All this suggests that, when talking about public space, we should identify geographic, demographic, social and other characteristics, spatial and temporal alike. As many authors state, public space cannot be measured only by its physical traits but must also serve people as a vital resource for the community in which function (or purpose) always trumps form. If a space, its creation and maintenance, cannot be accessed and enjoyed by people of all ages, capabilities and socioeconomic statuses (who play a key role in its identity), it is necessary to take action and make changes. For example, initiatives advocating positive intergenerational interaction and multiculturalism contribute greatly to relieving tensions that disrupt social life and can be a source of insecurity. It also contributes to a better understanding between all the people who use this space and to the promotion of greater closeness and better dialog between citizens and authorities. Because according to Jane Jacobs, *"Cities have the capability of providing something for everybody, only because, and only when, they are created by everybody"* (Jane Jacobs, 1961).

Public space as a completely open social phenomenon with almost oversaturated meanings left behind by different actors requires a review of existing approaches to its arrangement, designing and control, and the provision of new ones, in order to satisfy the needs and requirements of all its users. Young people are only one of the categories of users of that space with their distinctive features, above all as a separate social group, with their specific use of public space and their specific movement and behavior and, of course, with their specific needs which they satisfy within that space. In the following section we will attempt to explain how these features and specific needs are manifested and how the young view the issue of security in that space.




## THE YOUTH AND PUBLIC SPACE

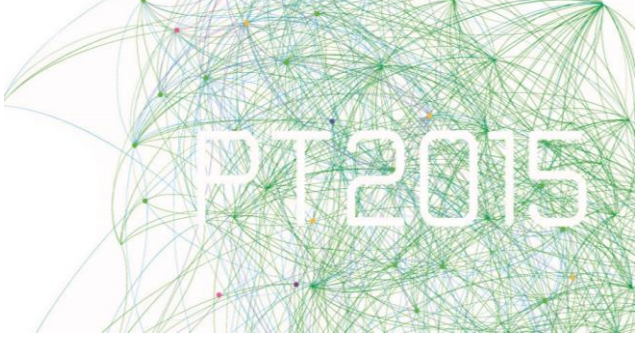
As we know, young people are a great potential, but many of them encounter difficult challenges, risks and threats on the road to their development. Croatian sociologists V. Ilišin and M. Radin have two approaches to young people: they see them as a resource, i.e. as representatives of future social forces, and as a problem, given their tendency to various forms of deviant behavior (Ilišin & Radin, 2007).

Different social processes and relationships lead to uneven exposure to risks, while the means and possibilities available to individuals, communities or entire populations collectively determine their social vulnerability. Due to numerous specificities, the young stand out as a separate socially vulnerable group, which is why it is important to examine, from various aspects, what makes them vulnerable. The youth are exposed on a daily basis to numerous security risks and threats many of which are present and manifested precisely in public space, specifically in places most commonly used for movement and carrying out all manner of activities. Economic conditions and different social problems are generally regarded as the main causes, but the physical environment also affects security. Furthermore, the way cities and their parts are planned, designed and built determines which people identify themselves with the environment they live in and how the appearance of urban space is managed. The layout and organization of urban space also affect the level of security in public space making it either safer or more dangerous.

Public spaces represent a condensation and essence of the main characteristics of urban life, and these places, besides being vulnerable and exposed to various forms of danger and attack, are also places of discovery, learning, of developing and affirming individual identities and communities, which do not respect the established hierarchical order (*O´Neill, 2002*). This makes public spaces appealing to young people as they are the only place where the youth can feel fully independent, where they can be integrated and reintegrated, with the possibility of moving freely in city streets, squares and parks, using public transport and accessing freely and safely many other spaces that involve large numbers of young people in one place.

In that regard, public space is space that belongs to everyone and many laws relative to public spaces are adopted to ensure people's safety. However, is this really the case? As far as safety in public spaces is concerned, the young have a unique position, being at the same time sources of danger and victims of insecurity and unsafety. With their behavior, forms of communication and ways of manifesting their personal, social and creative needs, young people often provoke fear in others, but at the same they experience fear of different sources of unsafety as well as risks and threats to which they are exposed in public space.

In the lives of young people public space has perhaps a greater and different kind of significance than for other users. They use it as a place for meeting friends, an



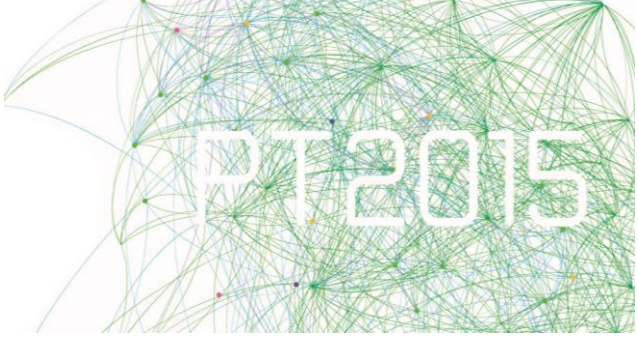

alternative venue of an event, a place for socialization, but also a place to escape to (from family, school, problems). The young rely on public space being financially less capable and more dependent than adults; their age often restricts their movement and not all of them can get a driver's license, so most are obliged to use public transport. In any case, there are fewer restrictions regarding entering public space, which makes the young feel that they can enjoy using that space.

It is precisely the way in which the young use public space that constitutes the problem which needs to be addressed, seeing as different users have different expectations from a publicly used space. Culture, age and gender are only some of the factors that influence an individual's expectations of how he or she should behave in public space. In addition, those in charge of managing a space also have their own expectations of which type of behavior is acceptable, and which is not.

Urban development processes have a great deal of influence on public spaces, especially the ever-growing privatization and space management by hiring private security and creating locations with semi-public privately-owned facilities and the ever-increasing number of campaigns to clean public spaces. This approach, which involves risk management, has two goals: to control movement and segregation of certain groups. Despite the atmosphere of seemingly diminished risk, results show that investigation into the causes of tension over public spaces disregarded the attitudes of marginalized people, particularly the young ones (Wilson, Rose, Colvin, 2010). One of the challenging issues is, for example, the attitude of young people toward risk managers or physical and technical security personnel. Namely, interaction between the youth and physical and technical security personnel is often negative, saddled with stereotype and prejudice, and affects their use of public space, which potentially restricts their right to use public space.

When it comes to the control of access to public space as a hard measure of control, video surveillance is regarded as another significant measure in addition to physical and technical security. Different studies on video surveillance show that the young, especially those deemed problematic, are monitored and treated differently by surveillance operators (Norris & Armstrong, 1999; Smith 2004). This overlaps with broader public space policies in which young people are perceived as "flawed consumers" (Bauman, 1998) and are often part of a process of exclusion which reduces their legitimate right to occupy a city's public space and socialize and participate in it. It is precisely for this reason that it is necessary to look into how young people perceive surveillance in public space, how they react to it and how they articulate their right to privacy and information concerning surveillance systems.

Reducing fear of crime in certain spaces can increase the number of people who use those spaces, but it also raises people's awareness of security. There is a plethora of studies on the perceptions of CCTV managers and the public regarding the role of this system in crime prevention. These perceptions are usually positive,



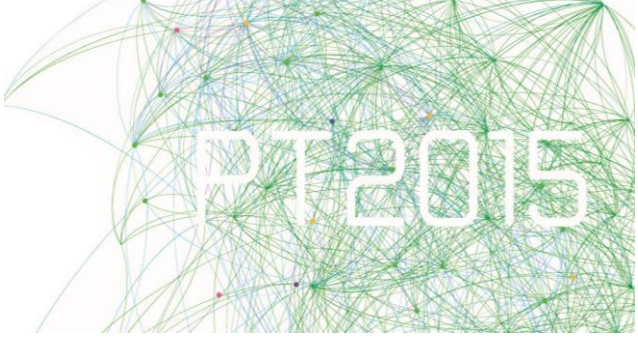

but it is hard to produce evidence of actual crime reduction. Is CCTV the best option? According to a research asking the public to rank desired crime prevention strategies, CCTV came in third, after police patrols and better street lighting (Bennett, T. and Gelsthorpe, 1996). In many cases CCTV did not reduce crime, in some it did; at any rate, it is the context in which this issue is addressed, investigated and analyzed that matters.

As in each of the aforementioned instances of overlapping terms, the focus is on the ethical framework as the basis for analysis of the protection of young people and public spaces using existing mechanisms, which brings us to the issue of privacy. In short, privacy can be defined as "a state of being free from outside intrusion in one's personal life" and security as "a real or perceived safety from physical and psychological harm". Privacy is essential for self-development and individual expression, while security allows each individual the basic ability to achieve his or her major life goals. Some surveillance measures involve loss of privacy and the restrictions should be set in such a way as to ensure that adequate security is provided while maintaining the right to privacy. What remains questionable is the extent to which the young differ from other groups when it comes to giving up the right to privacy.

## CONCLUSION

For a number a of years now there has been a global trend of "discovering" and reaffirming public spaces, from reshaping, redesigning, and introducing new contents to the increasingly important role of public space as a public stage, indicator and modifier of social circumstances (Stanarević, Đukić, 2014). Accordingly, strategic, planning and design initiatives related to public spaces are being launched with the participation of political and public sector representatives, different users, owners and entrepreneurs, who are often brought together by common goals and interests.

Among the variety of motives that bring together these numerous actors with many common interests in public space, citizen security and safety, as extremely important reasons for general public participation, are becoming more and more prominent. There is an increasing responsibility of everyone involved to develop policies and strategies which will not further marginalize the young, who are already vulnerable enough and exposed to different negative influences in public space. That is why it is important to raise the issue of accessibility and adequate appearance/design of such space that would consider young people's needs and experiences with regard to the distribution of public information that could be the best recommendations with explicit provisions concerning the rights of marginalized young people. Moreover, it is necessary to establish practices which would prevent exacerbation of the already vulnerable position of young people and criminalization of their use of public space while at the same time including and




consulting them in different studies and in making decisions about issues arising in public space.

## REFERENCES

Bauman, Z. 2009. *Fluidni život.* Novi Sad: Mediteran Publishing.

Bauman, Z. 1998. *Work, consumerism and the new poor.* Buckingham: Open University Press.

Berman, M. 1986. "Take it to the streets: conflict and community in public spaces". *Dissent*, 33 (4): 470-94.

Bennett, T. and Gelsthorpe L. 1996. "Public Attitudes Towards CCTV in Public Places", in *Studios on Crime and Crime Prevention* 5(1):72-90.

Butcher, M., Thomas, M. 2003. *Ingenious, emerging youth cultures in urban Australia*. Melbourne: Pluto Press Australia.

Crane, P. 1999. "Young people and public space: developing inclusive policy and practice". *Queensland University of Technology.*

Fyfe, N. and Bannister J. 1998. "The Eyes Upon the Street: Closed Circuit Television Surveillance and the City". in N. R. Fyfe, ed. *Images of the Street: planning, identity and control in public space*. London: Routledge.

Harvey, D. 1992. "Social postmodernism and the city" in *International Journal of Urban and Regional Research*, 16 (4): 588-601.

Ilišin, V. and Radin, M. 2007. *Mladi: Problem ili resurs*. Zagreb: Institut za društvena istraživanja.

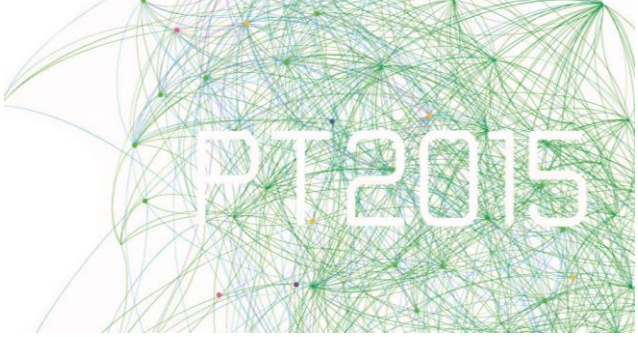
Jacobs, J. 1961. *The Death and Life of Great American Cities*. New York: Vintage Books.

Norris, C. and Armstrong, G. 1999. *The Maximum Surveillance Society: The Rise of CCTV*, Oxford: Berg.

O' Neill, M. 2002. "Youth curfews in the United States: the creation of public spheres for some young people" in *Journal of Youth Studies* 5, 49-67.

Smith, G. 2004 "Behind the Screens: Examining Constructions of Deviance and Informal Practices among CCTV Control Room Operators in the UK", in *Surveillance and Society* 2(2/3): 376-95.

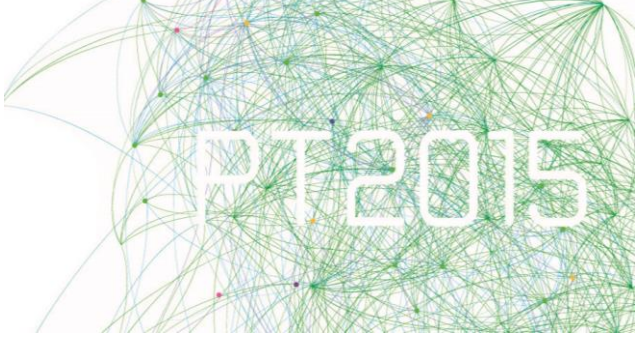
Stanarevič, S. and Đukić, A. 2014. "Planning and Designing Safe and Secure Open Public Spaces in Serbia" in *Proceedings of First International Academic Conference on Places and Technologies 2014*, University of Belgrade.




Faculty of Architecture, Professional association Urban Laboratory and University of Belgrade – Faculty of Philosophy.

Walzer, M. 1986. “Pleasures and Costs of Urbanity”, in P. Kasinitz, ed., Metropolis: Center and Symbol of our Times. New York: New York University Press.

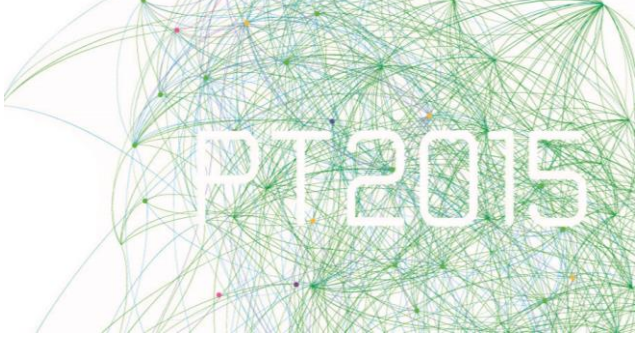
Wilson, D., Rose, J., Colvin, E. 2010. Marginalised Young People, Surveillance and Public Space, A Joint Project of the Dchool of Political and Social Inquiry, Monash University and Yuoth Affairs Council of Victoria.




# TOPIC V:

# Health Intensive Care

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# OPTICAL COHERENCE TOMOGRAPHY - GUIDED PRIMARY PERCUTANEOUS CORONARY INTERVENTION IN ACUTE MYOCARDIAL INFARCTION

**Igor Kranjec**
MD, PhD, FESC, Associate Professor Medicine/Cardiology (retired), Dept Cardiology, University Medical Center Ljubljana, Zaloška 7, 1000 Ljubljana,
igor.kranjec@gmail.com

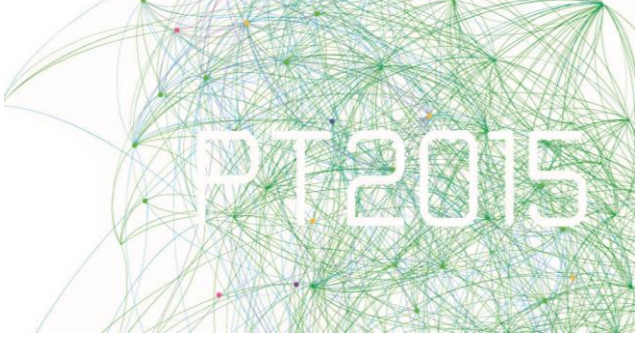
## ABSTRACT

*Primary percutaneous coronary intervention (PCI) is associated with a certain risk of post-procedural ischemic complications. Therefore, stent implantation technique in the acute myocardial infarction settings should be optimal to improve short- and long-term clinical outcomes. Optical coherence tomography (OCT) is a light-based imaging modality with an excellent resolution that enables in vivo visualization of the coronary artery structures reported only by the patho-histological studies. Consequently, OCT should help the operator in decision-making throughout the whole primary PCI procedure. OCT seems particularly useful in evaluating culprit lesions, assessing thrombus burden, selecting a proper stent type and size, optimizing the post-implantation result and detecting stent-related vascular injuries. OCT is widely used in everyday clinical practice but has not been adequately tested in properly designed large clinical trials. However, its ease of use and safety is likely to promise its routine use during the primary PCI in the near future.*

***Keywords**: acute myocardial infarction, primary percutaneous coronary intervention (PCI), optical coherence tomography (OCT), OCT-guided primary PCI.*

## INTRODUCTION

The primary aim of percutaneous coronary intervention [PCI] is to obtain excellent results in all attempted lesions without the threat of any procedure-related complications. However, it is equally important to guarantee that the benefits of revascularization remain durable. Post-procedural ischemic complications represent a risk continuum largely determined by the initial clinical setting, ranging from low risk in patients with stable coronary artery disease [CAD], to intermediate risk in patients with acute coronary syndrome [ACS], and extending to high risk in patients with ST-segment elevation myocardial infarction [STEMI] (Cook, Windecker, 2009). In our all-comers population including 8,237 patients, for




example, primary PCI performed for STEMI was associated with considerably increased risk of stent thrombosis [ST](HR 2.95, 95% CI 1.80 to 3.72, p<0.0001), any myocardial infarction [MI](HR 2.61, 95% CI 1.61 to 2.91, p<0.0001), and recurrent STEMI (HR 3.85, 95% CI 2.59 to 5.72, p<0.0001).

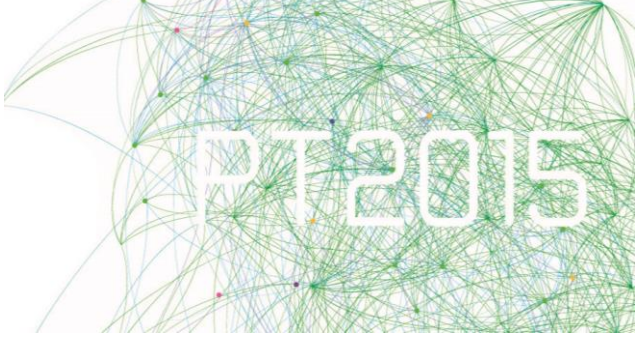
Stent implantation in the STEMI setting may allow various pathogenetic mechanisms run aggressively and, thus, lead to more ischemic events. Large necrotic cores of disrupted vulnerable plaques and higher platelet reactivity can create a potent pro-thrombotic environment (Ahn, Lee, Yoon et al. 2012; Cutlip, Abbott, 2013. Massive thrombotic remains despite vigorous thrombo-aspiration as well as the epicardial vasoconstriction, which is only partly responsive to nitrates, may lead to a substantial underestimation of the vessel size and, consequently, to the implantation of the undersized stents.4 Adjunctive endovascular imaging would certainly appear very helpful in discovering many of the aforementioned unfavorable features and appropriately guiding PCI procedures. Intravascular ultrasound studies (IVUS) have so far clearly demonstrated that stent underexpansion, alone or in combination with other PCI-related abnormal lesion morphologies (e.g. tissue prolapse, thrombus, dissection), contributed to the occurrence of ST or restenosis (Cheneau, Leborgne, Mintz et al. 2003; Sonoda, Morino, Ako et al., for the SIRIUS Investigators. 2004).

Optimal coherence tomography [OCT] is a promising, light-based imaging modality using near-infrared wavelengths (range ~1.3 μm). The imaging shows superior spatial resolution (~15 μm) compared to other endovascular systems currently used in vivo, such as IVUS (~150 μm) and angioscopy (~150 μm). The high resolution of OCT enables visualization of vulnerable plaque characteristics only reported by pathohistological studies. It is not surprising that, in STEMI patients, the fibrous cap disruption (73% vs. 40% vs. 47%), erosion (23% vs. 0% vs. 3%), and thrombus (100% vs. 33% vs. 100%) have been identified more frequently by OCT in comparison with IVUS or angioscopy (Kubo, Imanishi, Takarada et al. 2007).

This review, therefore, describes the current status of OCT to guide decision-making during primary PCI. Furthermore, the data from literature will be compared with our initial experiences.

## DECISION-MAKING DURING PCI

The potential for clinical applications of OCT during PCI seems to be in various fields, such as pre-interventional evaluation of target coronary arteries, procedural guidance of PCI, and follow-up assessment of vascular healing. New exciting challenges, such as providing luminal measurements for selection of appropriate stent dimensions, evaluation of the optimal landing zones for stent deployment, and three-dimensional vessel reconstruction, will keep us focused in the near future (Karanasos, Ligthart, Witberg et al. 2012). In the course of the primary PCI,




however, the most important imaging endeavors should be aimed at the following targets:

*Evaluation of culprit lesion characteristics, particularly in patients with diagnostic uncertainties on coronary angiograms;*
*Assessment of residual thrombus burden after thrombectomy or selective administration of GP 2b/3a antagonists;*
*Assessment of inappropriate stent deployment (e.g. underexpansion, incomplete stent apposition, residual stenosis):*
*Assessment of stent-related vascular injury (e.g. tissue prolapse, intra-stent dissection, edge dissection, intra-stent thrombus).*

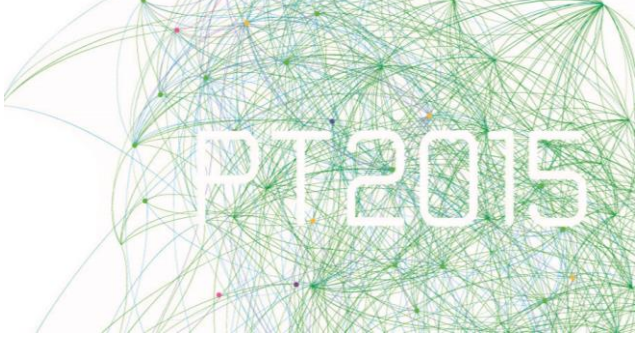
## CULPRIT LESION

Acute MI is usually provoked by sudden disruption of the vulnerable plaque followed by obstructive thrombosis. Pathological characteristics of the vulnerable plaque include a thin fibrous cap with macrophage infiltration and a large lipid pool. In OCT images, necrotic lipid pools appear as diffusely bordered, signal-pool regions with overlying signal-rich bands corresponding to fibrous caps (Prati, Regar, Mintz et al., 2010). Thin-cap fibroatheromas are characterized by a large necrotic core with a thin fibrous cap (<65 μm). Fibrous cap disruption is identified by a presence of fibrous cap discontinuity and a cavity formation of the plaque, while fibrous cap erosion is characterized by loss of the endothelial lining with lacerations of the superficial intimal layers. Intracoronary thrombus recognized by the globular mass protruding into the vessel lumen from the surface of the vessel wall; red thrombus appears as high-backscattering structure with dorsal, signal-free shadowing, whereas white thrombus looks as a signal-rich, low-backscattering structure.

Kubo et al. (2007) investigated using OCT 30 patients with acute MI. They found lipid-rich plaque in 93% of all culprit lesions, fibrous cap disruption in 73%, erosion in 23%, and thrombus in all lesions. In our series of 23 consecutive patients with acute MI, we were able, combining plaque disruption with adjacent thrombus, to confirm the culprit lesion in each patient (Table 1).

**Table 1: OCT findings in 23 consecutive patients with acute myocardial infarction.**

| Characteristics | N (%) |
|---|---|
| **Plaque disruption** | 22 (91.7%) |
| **Intravascular thrombus** | 21 (87.5%) |
| **Tissue prolapse** | 22 (91.7%) |
| **Intra-stent dissection** | 16 (66.7%) |
| **Edge dissection** | 13 (54.2%) |
| **Incomplete stent apposition** | 12 (50.0%) |
| **Intra-stent thrombus** | 13 (54.2%) |
| **Further interventions after OCT** | 8 (34%) |




| | |
|---|---|
| **Balloon dilatation** | 8 (34%) |
| **Stenting** | 6 (26%) |

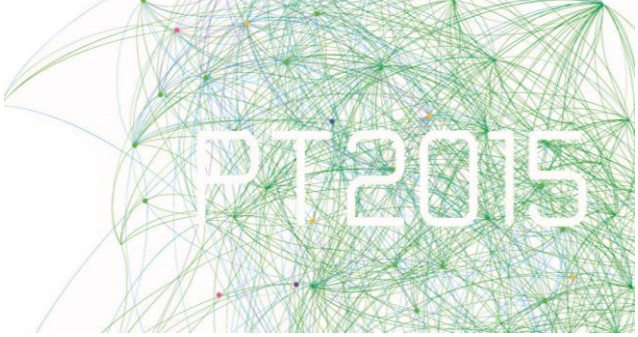
## THROMBUS REMOVAL

Despite patent infarct-related artery, up to 30% of patients do not achieve adequate myocardial perfusion after the primary PCI (Onuma, Thuesen, van Geuns et al., 2013). No-reflow phenomenon has been ascribed to distal embolization of thrombus or plaque fragments, vasoconstriction, and reperfusion injury. The use of thrombectomy devices, particularly manual aspiration, has been shown to improve epicardial blood flow, blush score, myocardial tissue perfusion, and, in TAPAS trial, to significantly decrease cardiac death and repeat MI (Svilaas, Vlaar, van der Horst et al.., 2008). However, some recent OCT studies have cast some doubt about the efficacy of thrombectomy. Onuma et al. (2013) investigated 141 STEMI patients: PCI with manual thrombus aspiration failed to increase coronary flow area as well as stent area compared with PCI alone. Moreover, OCT guidance for thrombus removal has been lately tested in two studies including 100 ACS patients. Imola et al. (2011) concluded that manual thrombectomy appeared to be a useful tool for improving myocardial perfusion. Yet the thrombectomy managed to remove only ~50% of intravascular thrombus formation regardless of the initial amount, with similar values for STEMI and non-STEMI. Moreover, after stent deployment, OCT always revealed thrombotic masses despite optimal angiographic result. In another study (Di Giorgio, Capodanno, Ramazzotti et al., 2013), additional high-pressure dilatations led to a significant increase in stented area and lumen area; they also decreased in-stent thrombus area. Fortunately, values of epicardial and tissue myocardial perfusion as well as clinical outcomes were not detrimentally affected by such additional dilatations.

In our acute MI patients, manual thrombus aspiration was performed in 54.2% of patients. Despite the attempted thrombus removal, we were able to demonstrate by means of OCT significant amounts of thrombotic masses in most (87.5%) patients which persisted in 54.2% even after stenting (Table 1). Our results, therefore, confirm the established opinion in literature that the efficacy of manual thrombus aspiration is not optimal.

## STENT DEPLOYMENT

**Stent underexpansion** is defined based on established IVUS criteria of optima stent expansion: a) in-stent minimal lumen area ≥90% of the average reference lumen area, b) ≥100% of lumen area of the reference segment with the lowest lumen area (Prati, Di Vito, Biondi-Zoccai et al., 2012). Incomplete stent apposition occurs if there is a visible separation of a stent strut from the vessel wall (sum of strut thickness + abluminal polymer thickness) (Prati, Di Vito, Biondi-Zoccai et al.




2012; Prati, Guagliumi, Mintz et al., 2012). Finally, reference luminal narrowing is defined as a lumen area <4.0 $mm^2$.

In a mixed population containing 40.9% patients with stable CAD and 59.1% with ACS, Prati et al. (2012) recognized incomplete stent apposition in 29.7% compared with 50.0% of our MI patients. Whereas stent deployment pressures were nearly identical in both groups (16.7±2.8 Atm vs. 16.9±2.1 Atm in our group), post-dilatation was performed only in 54.2% in our patients. Prati et al. (2012) reported, somewhat surprisingly, significant reference lumen narrowing only in 2.8%.

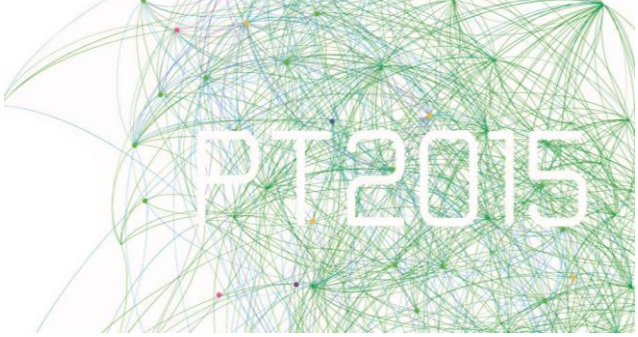
## STENT-RELATED INJURY

Tissue prolapse is a convex-shaped protrusion of tissue between adjacent stent struts toward the lumen, without disruption of the continuity of the luminal vessel surface (Gonzalo, Serruys, Okamura et al., 2009). The distance from the arc connecting adjacent stent struts to the greatest extent protrusion should be >50 μm. Intra-stent dissection is a disruption of the luminal surface in the stent segment (Prati, Guagliumi, Mintz et al., 2012; Gonzalo, Serruys, Okamura et al., 2009). It can appear in two forms, as a linear rim of tissue with a clear separation from the vessel wall, plaque, or stent struts, or as an empty cavity behind the struts. Edge dissection is defined as the presence of a linear rim of tissue with a width of ≥200 μm and a clear separation from the vessel wall of plaque that is adjacent (<5 mm) to a stent edge (Prati, Di Vito, Biondi-Zoccai et al., 2012; Gonzalo, Serruys, Okamura et al., 2009).

Gonzalo et al. (2009) investigated 73 consecutive patients, 41 with stable CAD and 32 with ACS. They reported tissue prolapse in 97.5%, intra-stent dissection in 91.1%, and edge dissection in 21.4%. The rate of different features of the vascular damage did not differ between different clinical presentations though the surface of tissue prolapse was found more extensive in unstable patients. Interestingly, we found in our MI patients less intra-stent dissections (66.7%) and more edge-dissections (54.2%), equally distributed between proximal and distal stent edges.

## VASCULAR HEALING

Lots of post-PCI findings may appear concerning at first sight, even if angiographically invisible. They may trigger additional or even unnecessary interventions to alleviate potential adverse outcomes. For further refinement of PCI, it is fundamental to understand the natural history and clinical impact of various OCT-defined abnormalities. In general, acute findings after stenting such as edge dissections, tissue protrusion, and incomplete stent apposition, detectable only on OCT, tended to be smaller than those seen on both OCT and IVUS. Most of them will resolve completely at follow-up (Kume, Okura, Miyamoto et al., 2012). Serial OCT data strongly suggest that the frequency of incomplete stent



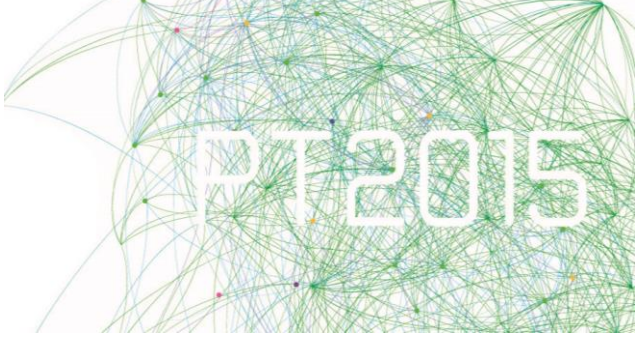

apposition spontaneously decreases through the filling of the stent-lumen gap with neointima, without any clinical events at mid-term follow-up (Kubo, Imanishi, Kitabata et al., 2008). Gutierrez-Chico et al. (2012) investigated in more detail the relationship between various limits for incomplete stent apposition and whether or not it persisted through up to 13 months follow-up. They realized that strut-lumen distances <270 μm resolved in all cases and those <400 μm in 93% of cases, without any occurrence of ST.

Previous reports have suggested an association between angiographic as well as IVUS-detected edge dissections and early ST (Radu, Raber, Heo et al., 2013). These and other studies consistently showed that, in addition to edge dissections, other abnormal findings were concurrently present, most consistently a low minimal lumen diameter/area and poor stent expansion, but also a reduced final epicardial flow (TIMI <3). Although there is not yet sufficient data to indicate which angiographically silent edge dissections will lead to adverse events, and thus require additional intervention, it is thought-provoking that longitudinal extensions up to 8 mm in previous IVUS studies and circumferential extensions up to 3 mm by OCT have been associated with an uneventful long-term clinical course (Nishida, Colombo, Briguori et al., 2002; Raeber, Radu, 2012).

## CLINICAL CONSEQUENCES OF OCT FINDINGS

Despite the widespread use of OCT, prospective randomized clinical trials testing the ability of OCT to guide PCI and to assess its impact on cardiovascular outcomes have not been performed so far. It is against this background that Prati et al. (2012) took the initiative and propose a pragmatic scheme to guide PCI with the use of OCT. Their study included a total of 670 patients, 264 patients with stable CAD, 197 patients with non-STEMI, and 209 patients with STEMI. 335 patients underwent OCT-guided PCI and 335 control patients were treated with angiographic guidance alone. The following actions were recommended when OCT disclosed such procedural issues not immediately recognized by angiography: 1) edge dissection and reference lumen narrowing required the implantation of an additional stent at the edge of the previously implanted stent; 2) stent underexpansion required further dilation of the previously implanted stent with a non-compliant balloon of the same diameter at ≥18 atm or with a semi-compliant balloon having a diameter ≥0.25 mm larger than the previously used balloon at ≥14 atm; 3) incomplete stent apposition required further dilation of the previously implanted stent with a non-compliant or semi-compliant balloon having a diameter ≥0.25 mm larger than the previously used balloon at ≥14 atm; 4) thrombus required further dilation of the previously implanted stent with a non-compliant or semi-compliant balloon of the same diameter at 8-14 atm for 60 seconds.

Findings resulting from OCT led to additional interventions in as many as 34.7% of the subjects. Specifically, further stenting was performed in 12.6% of cases.




Additional balloon dilatation was needed in 22.1% of cases: in 14.0% to fix stent underexpansion and in 8.1% to reduce intra-stent thrombus.

Short-term outcomes were similar in the OCT and control group. On the other hand, unadjusted analyses at mid-term follow-up showed that the OCT group had a significantly lower 12-month risk of cardiac death (1.2% vs. 4.5%, p = 0.010), cardiac death or MI (6.6% vs. 13.0%, p = 0.006), and a composite of cardiac death, MI, or repeat revascularization (9.6% vs. 14.8%, p = 0.044). OCT guidance was associated with a significantly lower risk of cardiac death or MI even at extensive multivariable analysis adjusting for baseline and procedural differences between the groups and at propensity-score adjusted analyses. Unfortunately, potential differences in clinical outcomes between stable and ACS patients were not reported.

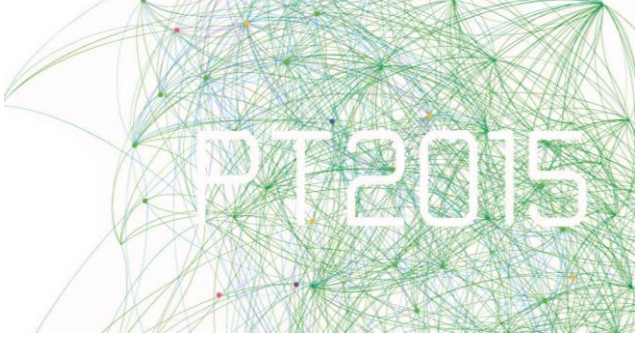
In our group of acute MI patients, OCT findings resulted in 8 (34%) additional interventions: balloon dilatation was performed in 8 (34%) and stenting in 6 (26%) patients. No additional thrombus extraction was carried out in this series of patients. Early hospital rehabilitation was accomplished without any delay. The long-term results are still expected.

## FEASIBILITY, SAFETY, EFFICACY

Our cases were performed using FD OCT Ilumien system (LightLab, St Jude Medical, Westford, MA, USA) and Dragonfly probes. We were able to negotiate all culprit lesions even after stents had been implanted. New probes are miniaturized and very fast, with a 50 mm pullback obtained in only a few seconds. New probes are miniaturized and very fast, with a 50 mm pullback obtained in only a few seconds. The pullbacks were performed during the continuous injection of contrast medium through the guiding catheter using an injection pump (flow rate 3-4 ml/s) or manually. The images were electronically exported for off-line review; the rate of 1 frame/mm was selected for analysis. Out of 4,940 collected frames, inappropriate visualization due to insufficient contrast clearing precluded analysis of 398 (8.0%) frames. Significant out-of-screen loss of image was found in 21 (0.4%) frames.

The safety of FD OCT imaging depends mainly on the mechanical characteristics of the probe and the amount of contrast injected. In our study, data acquisition was not directly associated with any major complications (e.g. spasm, dissection, life-threatening arrhythmia, severe ischemia) and no significant differences in post-procedural renal function were found. In one case, however, the operator was, based on OCT measurements, excessively aggressive with balloon sizing and provoked a vessel rupture which was immediately covered with additional stent.

Cost-effectiveness studies for the OCT-guided primary PCI in acute MI have not been performed yet. However, some deductions can be made from similar IVUS




studies. Mueller et al. (2003) found that in-hospital costs for procedural personnel, capital equipment, and disposable devices were evidently higher in the IVUS group compared with angiographically-guided controls. On the other hand, 2-year major adverse event-free survival was significantly higher in the IVUS-guided group (80% vs. 69%, $p<0.040$). They concluded that, when used in a provisional stenting strategy, routine IVUS imaging is cost-saving half the time. It should be mentioned that, at the time of our study, the prices for the IVUS and OCT probes were basically the same (IVUS 1.193 Eu vs. OCT 1.048 Eu). Considering the unrivalled high resolution of OCT combined with its ease of use, the prospect of OCT becoming an indispensable imaging tool is challenging (Nakazawa, Finn, Joner et al., 2008).

## CONCLUSIONS

Primary PCI for acute MI is associated with frequent post-procedural events. Novel OCT guidance can recognize many pathogenetic mechanisms involved in adverse clinical outcomes. It can reliably discover culprit lesion, assess residual thrombus burden, examine appropriate stent implantation, and help to repair stent-related vascular damage. This approach is feasible, safe, and probably cost-effective. Certainly we need more scientific data to help us defining relevant cut-off values for OCT-detected angiographically silent adverse features justifying additional intervention. We believe that new approaches, such as luminal measurements, selection of the most appropriate landing zones, and three-dimensional vessel reconstruction, will make the primary PCI even more attractive.

## REFERENCES

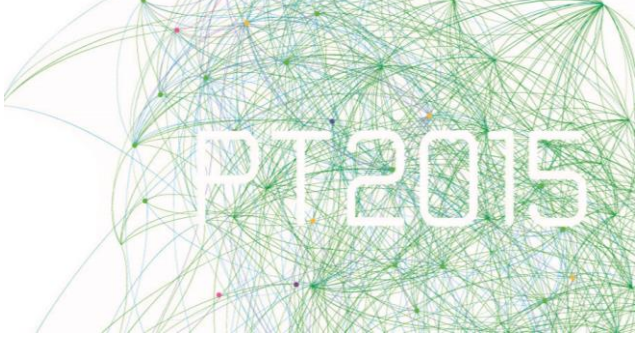
Ahn, S.G., Lee, S.H., Yoon, J.H. et al. 2012. Different prognostic significance of high on-treatment platelet reactivity as assessed by the VerifyNow P2Y12 assay after coronary stenting in patients with and without acute myocardial infarction. *JACC Cardiovasc Interv* 5:259-67.

Cheneau, E., Leborgne, L., Mintz, G.S. et al. 2003. Predictors of Subacute Stent Thrombosis Results of a Systematic Intravascular Ultrasound Study. *Circulation* 108:43-7.

Cook, S., Windecker, S. 2009. Early Stent Thrombosis: Past, Present, and Future. *Circulation* 119:657-9.

Cutlip, D., Abbott, J.D. 2013. Coronary artery stent thrombosis: incidence and risk factors. http://www.uptodate.com. 2013.

Di Giorgio, A., Capodanno, D., Ramazzotti, V. et al. 2013. Optical coherence tomography guided in-stent thrombus removal in patients with acute coronary syndromes. *Int J Cardiovasc Imaging* Feb 15. [Epub ahead of print]




Gonzalo, N., Serruys, P.W., Okamura, Z. et al. 2009. Optical coherence tomography assessment of the acute effects of stent implantation on the vessel wall: a systematic quantitative approach. *Heart* 95: 1913-9.

Gutierrez-Chico, J.L., Wykrzykowska, J., Nuesch, E. 2012. Vascular tissue teaction to acute malapposition in human coronary arteries. Sequential assessment with optical coherence tomography. *Circ Cardiovasc Interv* 5: 20-9.

Imola, F., Mallus, M.T., Ramazzotti, V. et al. 2011. Manual thrombus aspiration in acute coronary syndrome: frequency-domain optical coherence tomography efficacy evaluation. *Europ Heart J 32* (Abstract Suppl): 401.

Karanasos, A., Ligthart, J., Witberg, K. et al. 2012. Optical Coherence Tomography: Potential Clinical Applications. *Curr Cardiovasc Imaging Rep* 5:206–20.

Kubo, T., Imanishi, T., Kitabata, H. et al. 2008. Comparison of vascular response after sirolimus-eluting stent implantation between patients with unstable and stable angina pectoris: a serial optical coherence tomography study. *JACC Cardiovasc Imaging* 1:475-84.

Kubo, T., Imanishi, T., Takarada, S. et al. 2007. Assessment of culprit lesion morphology in acute myocardial infarction. *J Am Coll Cardiol* 50:933-9.

Kume, T., Okura, H., Miyamoto, Y. et al. 2012. Natural history of stent edge dissection, tissue protrusion and incomplete stent apposition detectable only on optical coherence tomography after stent implantation. Circ J 76:698-703.

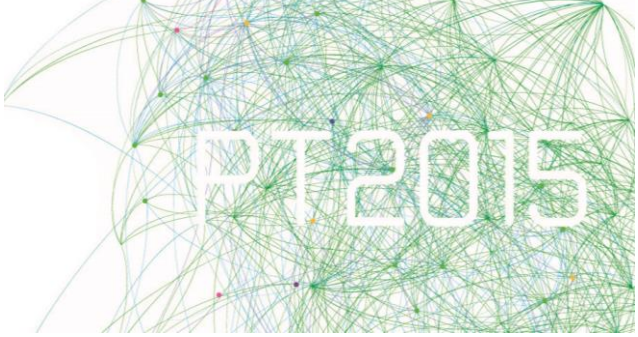
Mueller, C., Hodgson, J.B., Schindler, C. 2003. Cost-effectiveness of intracoronary ultrasound for percutaneous coronary interventions. *Am J Cardiol* 91:143-7.

Nakazawa, G., Finn, A.V., Joner, M. et al. 2008. Delayed arterial healing and increased late stent thrombosis at culprit sites after drug-eluting stent placement for acute myocardial infarction patients. *An Autopsy study. Circulation* 118:1138-45.

Nishida, T., Colombo, A., Briguori, C. et al. 2002. Outcome of nonobstructive residual dissections detected by intravascular ultrasound following percutaneous coronary interventions. *Am J Cardiol* 89:1257-62.

Onuma, Y., Thuesen, L., van Geuns, R.J. et al. 2013. Randomized study to assess the effect of thrombus aspiration on flow area in patients with ST-elevation myocardial infarction: an optical frequency domain imaging study – TROFI trial. *Europ Heart J* doi:10.1093/eurheartj/ehs456.

Prati, F., Di Vito, L., Biondi-Zoccai, G. et al. 2012. Angiography alone versus angiography plus optical coherence tomography to guide decision-making during percutaneous coronary intervention: the Centro per la Lotta contro l'Infarto-Optimisation of Percutaneous Coronary Intervention (CLI-OPCI) study. *EuroIntervention* 8:823-9.




Prati, F., Guagliumi, G., Mintz, G.S. et al. 2012. Expert review document part 2: methodology, terminology and clinical applications of optical coherence tomography for the assessment of interventional procedures. *Europ Heart* J 33:2513-22.

Prati, F., Regar, E., Mintz, G.S. et al. 2010. Expert review document on methodology, terminology, and clinical applications of optical coherence tomography: physical principles, methodology of image acquisition, and clinical application for assessment of coronary arteries and atherosclerosis. *Europ Heart* J 31: 401-5.

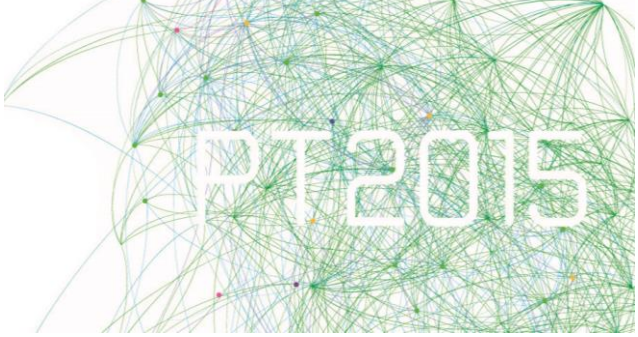
Radu, M.D., Raber, L., Heo, J. et al. 2013. Natural history of optical coherence tomography-detected non-flow-limiting edge dissections following drug-eluting stent implantation. *EuroIntervention* 9:1085-94.

Raeber, L., Radu, M.D. 2012. Optimising cardiovascular outcomes using optical coherence tomography-guided percutaneous coronary interventions. *Eurointervention* 8:765-71.

Sonoda, S., Morino, Y., Ako et al., for the SIRIUS Investigators. 2004. Impact of Final Stent Dimensions on Long-Term Results Following Sirolimus-Eluting Stent Implantation Serial Intravascular Ultrasound Analysis From the SIRIUS Trial. *J Am Coll Cardiol* 43:1959–63.

Svilaas, T., Vlaar, P.J., van der Horst, I.C. et al. 2008. Thrombus aspiration during primary percutaneous coronary intervention. *N Engl J Med* 358:557-67.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# FRACTAL ARCHITECTURE OF THE CORONARY ARTERY TREE

**Matjaž Klemenc**
MD, PhD, Associate Professor of Internal Medicine, General hospital of Nova Gorica', Intensive care unit, Padlih borcev 13, 5290 Šempeter pri Gorici, Slovenia, klemenc.matjaz@gmail.com

## ABSTRACT

*The coronary artery tree is developed according to the hypothesis of minimum energy cost - the energy required to circulate blood is minimized. Coronary artery branching has fractal nature and act in accordance with most important properties of fractals: self-similarity and non-integer dimension. Murray was the first to describe mother/daughter vessel relations in vascular bifurcations according to the cost function: the cube of the radius of the mother vessel equals the sum of the cubes of the radii of the daughter vessels. Bifurcations of coronary arteries are anatomical - functional transitions within the coronary artery tree which implement a distributive function. Coronary bifurcations are by nature prone to development of atherosclerosis. Intracoronary flow exerts friction on the vessel wall, named shear stress. A low shear stress, which is recognized as atherogenous factor occurs along the internal edge of a curve or behind obstacle and on the side opposite the carina in bifurcations. Pathological examinations and intravascular imaging techniques prove that atheroma is often present in bifurcations and develops in areas with low shear stress. Percutaneous coronary interventions (PCI) on bifurcations are technically demanding for operator and they are associated with higher rate of in-stent restenosis and thrombosis. The aim of PCI is to restore normal flow in each axis of bifurcation. Understanding haemodynamics based on fractal nature of bifurcations makes possible to calculate the diameter of diseased branch by measuring diameters of two angiographycally normal or near-normal branches.*

***Keywords**: fractals, coronary artery bifurcations, percutaneous coronary interventions.*

## INTRODUCTION

Coronary arteries have two important functions: distributive and hemodynamic. Distributive function of the coronary tree is responsible for conduction of a stream of blood to reach every myocardial cell. Nature has resolved this task by branching. Branching pattern is simple and is based on successive dichotomous division. A parent vessel segment divides into two branches. Later, each of these two branches divides again, and so on (Fig. 1). At the each step we can see the same dichotomous branching process. As the numbers of branches at each junction is the same, the system has fractal character.

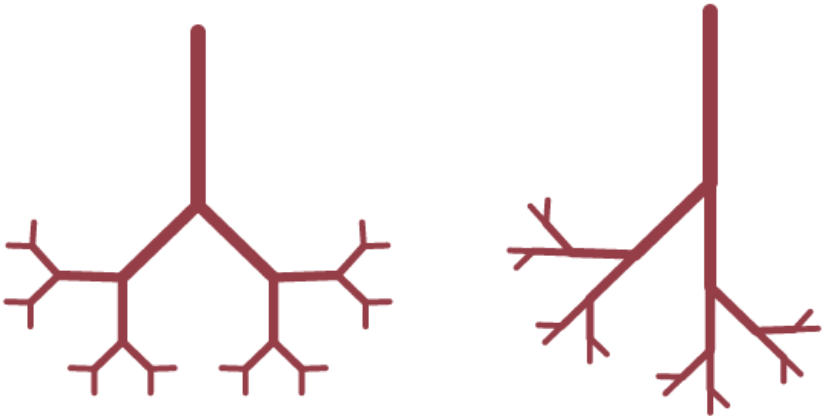
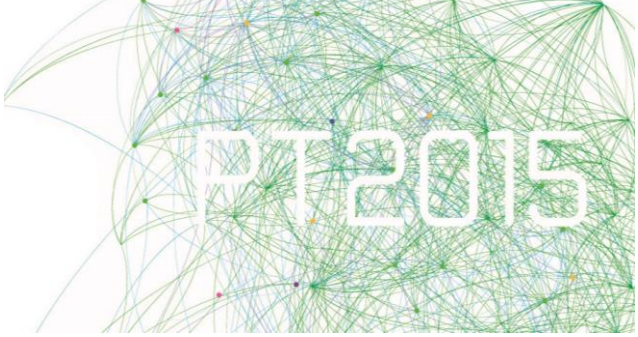


**Figure 1: Fractal geometry of vascular tree: symmetrical (left) and non-symmetrical bifurcations (right).**

Hemodynamic function of the coronary arteries is related to the dynamics of the flowing blood. In order to bring the velocity of blood stream to a level, which is low enough to permit the exchange of metabolic products across the capillary wall an increase of cross sectional area is required. It has been calculated that the increase in cross sectional area from aorta to that in the capillary bed is between 500 and 1000 fold (Milnor 1989). According to the law of conservation of mass the average flow velocity in the capillaries must be lower than that in the aorta by the same factor.

## MURRAY'S LAW

Cecil Murray was the first to describe mother/daughter vessel relations in vascular bifurcation. In his seminal paper from 1926 he presented two antagonistic features of vascular tree. Namely, if the vessels are too small, the energy required to drive the blood through them is too high. On the other hand, if the volume of the vessels is too large, the volume of blood becomes a burden to the whole body. Murray proposed a quantitative relation between the flow rate and diameter of the vessel




based on minimal sum of the energy required to drive flow through the vessel and the energy expenditure required to maintain the volume of blood filling the vessel (Murray 1926). The final solution of the minimalization of the energy consumption was the "cube law": the cube of the radius of the mother vessel equals the sum of the cubes of the radii of the daughter vessels (Equation 1):

$$d_0^3 = d_1^3 + d_2^3 \qquad (1)$$

This relation has been tested several times (Zamir and Brown 1983, Mayrovitz and Roy 1983). As the tests show considerable scatter some investigators proposed an extended form of Murray's law (Equation 2):

$$d_0^x = d_1^x + d_2^x \qquad (2)$$

with the value of the exponent x ranging from 1 to 4 (Sherman 1981, Roy and Woldenberg 1982).

## GENERALIZATION OF MURRAY'S LAW

Murray's law can explain the nature of bifurcation quite well, but can not predict the total length or volume of distal tree from the diameter of a mother vessel. Zhou et al found that the diameter of a stem and the volume of a crown are related to the crown length through power law relationship (Equation 3):

$$d_N = l_N^{[(4-3\varepsilon)/4(3-\varepsilon)]} \qquad (3)$$

where $d_N$ is stem's normalized diameter, $l_N$ is crown's normalized total arterial length and $\varepsilon$ is crown's equivalent resistance parameter (Zhou 1999).

Ten years later Huo and Kassab proposed four structure-function scaling relations including diameter-length, volume-length, flow-diameter and volume-diameter relations, based on the minimum energy hypothesis and volume scaling relation (Huo and Kassab 2009) (Equation 4):

$$V_c = K_v D_s^{2/3} L_c \qquad (4)$$

where $V_c$ and $L_c$ are cumulative vessel volume and length, respectively, and $D_s$ is the diameter of the vessel segment. The scaling volume relation was validated by comparing morphometric data of several organs and species.

## CORONARY BIFURCATIONS - FINET'S LAW

Gerard Finet et al examined 59 subjects with strictly normal coronary arteries. Normal coronary angiography was defined by a rigorously parallel lumen edge without demonstrable presence of atherosclerosis. A quantitative coronary angiography for automatic detection and quantification of coronary bifurcations was used to measure reference diameters of the mother vessel and two daughter vessels (Finet et al 2007). The ratio (R) of mother-vessel diameter to the sum of the two daughter-vessel diameters was 0.678 (Equation 5):

$$R = D_m/(D_{d1} + D_{d2}) = 0.678 \quad (5)$$

where $D_m$ is the diameter of the mother vessel, and $D_{d1}$ and $D_{d2}$ are the respective diameters of the two daughter vessels. This ratio held at all levels of bifurcation: i.e., whatever diameter the mother vessel. Also, the relative reduction between the mother- an major daughter-vessel diameters was also constant at all scales of observation. The study established the fractal nature of the geometry of the epicardial coronary artery tree, and gave a uncomplicated and precise fractal ratio (i.e. 0.678) between the diameters of the mother and two daughter vessels.

## FROM FRACTALS TO PERCUTANEOUS CORONARY INTERVENTIONS

Bifurcations of coronary arteries are anatomical - functional transitions within the coronary artery tree which implement a distributive function. Coronary bifurcations are by nature prone to development of atherosclerosis. Intracoronary flow exerts friction on the vessel wall, named shear stress (Figure 2a). A low shear stress, which is recognized as atherogenous factor occurs along the internal edge of a curve or behind obstacle and on the side opposite the carina in bifurcations (Figure 2b). Pathological examinations and intravascular imaging techniques prove that atheroma is often present in bifurcations and develops in areas with low shear stress.

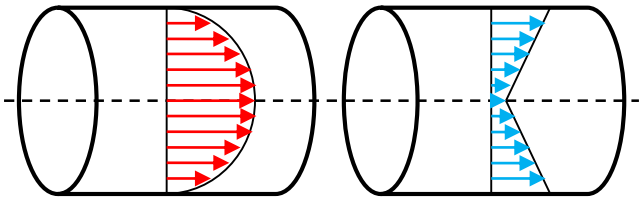


**Figure 2a: Velocity (red arrows) and shear stress (blue arrows).**

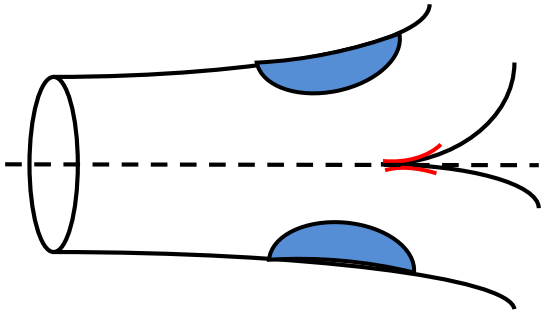


**Figure 2b: Red area - high wall shear stress, blue area - low wall shear stress.**

Percutaneous coronary interventions (PCI) on bifurcations are technically demanding for operator and they are associated with higher rate of in-stent restenosis (i.e. neointimal proliferation) and thrombosis. The aim of PCI is to restore normal flow in each axis of bifurcation. By applying geometrical rule (for example Finet's law), interventional cardiologists can determine the correct diameter of atherosclerotic vessel by measuring of angiographycally normal or near-normal branches (Fig. 3).

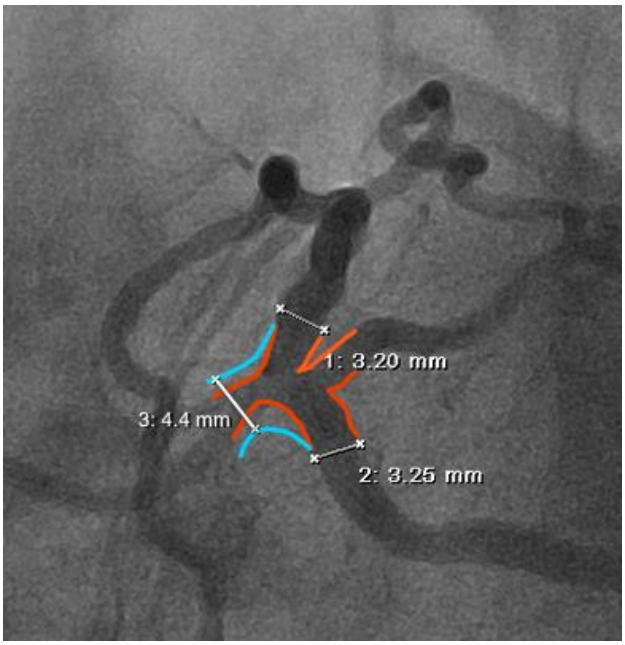
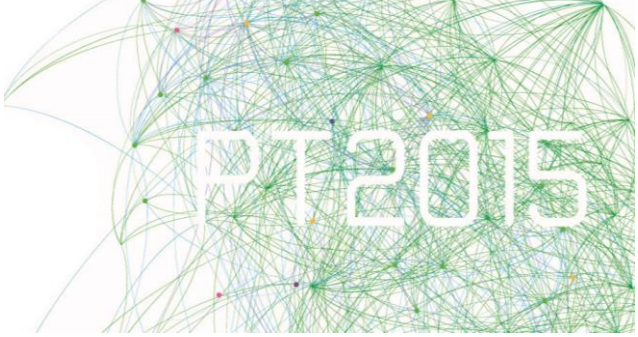



**Figure 3: Left main coronary artery (LMCA), left anterior descending (LAD, 3.20mm), intermediate artery (IM) and left circumflex artery (LCX, 3.25mm). Calculated diameter of "normal" LMCA = (3.20mm + 3.25mm) x 0.678 = 4.4 mm.**




## CONCLUSION

Understanding haemodynamics based on fractal nature of bifurcations makes possible to calculate the diameter of diseased branch by measuring diameters of two angiographycally normal or near-normal branches. The goal of percutaneous coronary interventions on bifurcations is to restore best possible blood flow and minimize additional haemodynamic disturbances.

## REFERENCES

Finet, G., Gilard, M., Perrenot, B. et al 2007. Fractal geometry of arterial coronary bifurcations: a quantitative coronary angiography and IVUS analysis. Eurointerv 3: 490-498.

Huo, Y. and Kassab, G.S. 2009. A scaling law of vascular volume. Biophysical Journal 96:347-353.

Milnor, W.R. 1989. Hemodynamics. Baltimore: Williams and Wilkins.

Murray, C.D. 1926. The physiological principle of minimum work. I. The vascular system and the cost of blood volume. Proc. Natl Acad. Sci. U.S.A. 12, 207-214.

Zamir, M. and Brown, N. 1982. Arterial branching in various parts of the cardiovascular system. Am. J. Anat. 163, 295-307.

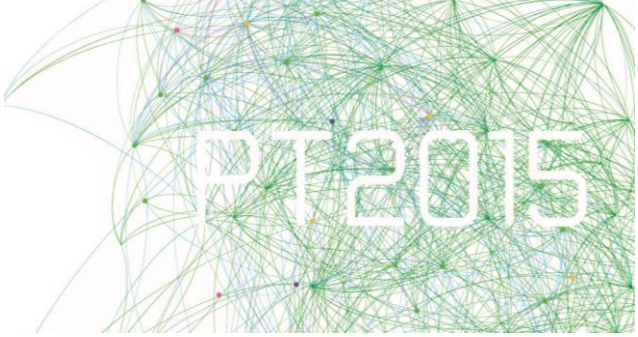
Mayrovitz, H.N. and Roy, J. 1983. Microvascular blood flow: evidence indicating a cubic dependence on arteriolar diameter. Am. J. Physiol. 245, H1031-H1038.

Sherman, T. F. 1981. On connecting large vessels to small.The meaning of Murray' s Law. J. Gen. Physiol. 78,431-453.

Roy, A.G. and Woldenberg, M.J. 1982. A generalization of the optimal models of arterial branching. Bull. Math.Biol. 44, 349-360.

Zhou, Y., Kassab, G.S., Molloi, S. (1999). On the design of the coronary arterial tree: a generalization of Murray's law. Phys Med Biol 44: 2929-2945.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# HUMANIZATION OF DIALYSIS: GREEN AND COZY

**Jadranka Buturović-Ponikvar**
PhD, Professor, Deprtment of Nephrology, University Medical Center Ljubljana, Zaloska 7, 1000 Ljubljana, Slovenia; Jadranka.buturovic@kclj

## ABSTRACT

*Dialysis was among the most important achievements of medicine of 20th century. It enabled millions of patients to survive acute or end-stage kidney failure. Today we are witnesses of increasing number of patients living with dialysis for more than 40 years. The longest dialysis survival in Slovenia is 42 years and 4 months (on June 1, 2015), the highest hemodialysis survival reported from Japan is 44 years and 9 months.*

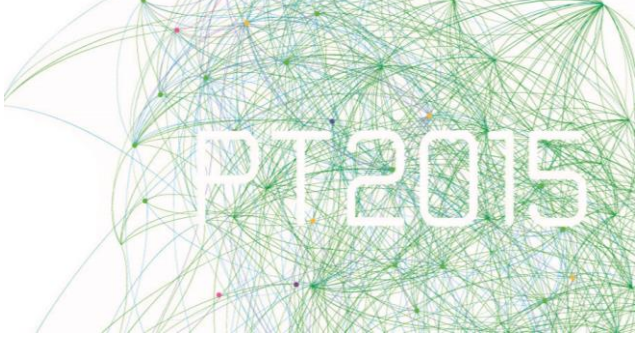
*It is estimated that at the end of 2013 more than 2.5 million of patients were alive worldwide treated by maintenance dialysis, with annual growth estimated 6-7%. Treatment was delivered through 35.000 dialysis centers with an average number of 64 patients per center (estimated data are provided by Fresenius Medical Care).*

*In Slovenia there are 23 dialysis centers, 16 public (in-hospital) and 7 private, (either incorporated in small buildings providing also other services or as free-standing dialysis centers).*

*In the future we have to face several challenges in providing dialysis treatment: ecological and quality of life related.*

*Eco-practices within dialysis are already explored in some countries (Great Britain, Australia) and should be focus of further dialysis development: minimizing water usage and wastage, decreasing power consumption, optimal waste management and developing recycling programs for potentially reusable materials, designing smart buildings.*

*Quality of life in increasingly important focus of dialysis treatment. Survival is not enough. Coming 3 times a week in dialysis center for a session usually lasting 4-5 hours, the patients live a significant part of their life there, with a lot of social interactions. Our focus should be not only providing medical part of the treatment but also cozy and friendly athmosphere during the day or night. Such atmosphere may be provided with the help of dedicated architects and designers at acceptable cost. It may be especially important for in-hospital dialysis centers, to make often "threatening" hospital environment more pleasant, that may be of special importance for chronic hemodialysis patients.*




*Nocturnal dialysis represents a specific challenge. This is prolonged hemodialysis during the night (7-8 hours), with the patient sleeping during the treatment. It provides the best survival and may provide the best quality of life for the selected group of patients.*

*In conclusion, dialysis in future should focus not only on medical treatment quality but in parallel with that on eco-practices and atmosphere during treatment. It seems there is a lot of room for improvement at acceptable cost. Close collaboration of health care workers, patients and experts from non-medical fields would be necessary to achieve these goals.*

***Keywords**: dialysis; hemodialysis; quality of life; health-related quality of life; green dialysis;*

## INTRODUCTION

Dialysis was among the most important achievements of medicine of 20$^{th}$ century. It enabled millions of patients to survive acute or end-stage kidney failure. Today we are witnesses of increasing number of patients living with dialysis for more than 40 years. The longest dialysis survival in Slovenia is 42 years and 4 months (on June 1, 2015), the longest hemodialysis survival reported from Japan is 44 years and 9 months.

It is estimated that at the end of 2013 more than 2.5 million of patients were alive worldwide treated by maintenance dialysis, with annual growth estimated 6-7%. Treatment was delivered through 35.000 dialysis centers with an average number of 64 patients per center (estimated data are provided by Fresenius Medical Care).

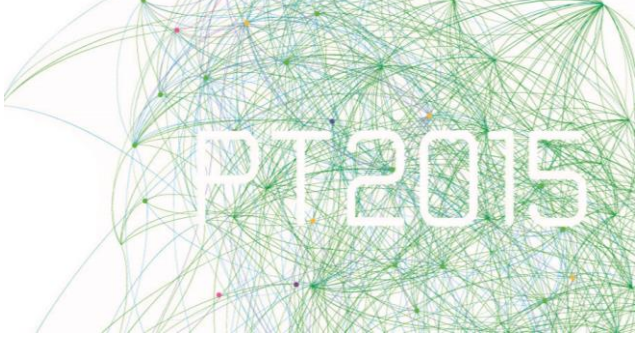
In Slovenia there are 23 dialysis centers, 16 public (in-hospital) and 7 private, (either incorporated in small buildings providing also other services or as free-standing dialysis centers), taking care of 1401 dialysis patients at the end of 2013.

Both new and all dialysis patients increase in age and comorbidity. That has to be taken into account when planning new dialysis facilities or adapt existing ones.

The main challenges we have to face in the future of dialysis treatment are expected to be ecological and quality of life related.

## GREEN DIALYSIS

Eco-practices within dialysis are already explored in some countries (Great Britain, Australia) and should be focus of further dialysis development: minimizing water usage and wastage, decreasing power consumption, optimal waste management and developing recycling programs for potentially reusable materials, designing smart buildings.




Enormous quantities of waste products are produced by hospitals and pose an ecological challenge. Dialysis, both hemodialysis as well as peritoneal dialysis, generate a lot of waste products, with a high proportion of hazardous waste (potentially contaminated by human pathogens). Non-hazardous materials have potential for recycling, however use of different types of plastic, glues, inks and labels prevents some of the remaining material to be recycled. If awareness of industry on disposal issue after dialysis would be increased, solutions to use recyclable materials in dialysis may be explored. We should also focus on increasing the awareness of the personnel to differentiate between "careful" and "careless" dialysis disposal. Acknowledging the problem of waste disposal may potentially result in important savings while preserving the quality of care.

## HOW TO IMPROVE PATIENTS' WELLBEING IN DIALYSIS CENTER

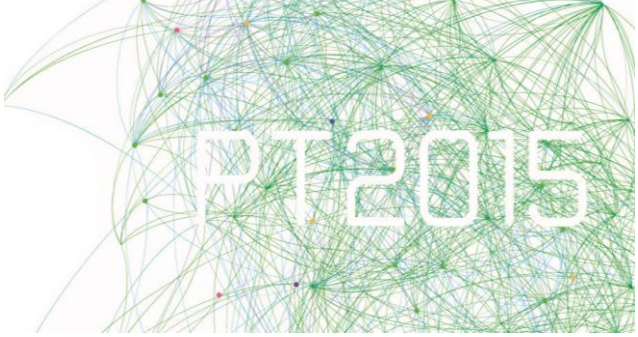
Quality of life in increasingly important focus of dialysis treatment. Survival is not enough. Coming 3 times a week in dialysis center for a session usually lasting 4-5 hours, the patients live a significant part of their life there, with a lot of social interactions (fellow patients, nurses, physicians, administrative and supportive staff). Our focus should be not only providing medical part of the treatment but also cozy and friendly athmosphere during the day or night. Such atmosphere may be improved with the help of dedicated architects and designers at acceptable cost. It may be especially important for in-hospital dialysis centers, to make often "threatening" hospital environment more pleasant, that is of special importance for chronic patients that spend such a long time in hospital. As the proportion of old and very old patients is increasing, special consideration should be dedicated to the elderly.

### The time during hemodialysis

The duration of standard dialysis procedure is 4-5 hours and it is important to enable patients to spend such a time as useful and pleasant as possible. During this time the patient can be offered various activities such as watching television, using internet through laptop, tablet or smart phone, reading, sleeping, exercising in dialysis bed or chair. Even in busy in-hospital dialysis center there is a room for improvement of the general atmosphere in the center and potential to increase privacy of dialysis patients. In a satellite dialysis center at Stare Pravde in Ljubljana dialysis in a single rooms offer the possibility that dialysis patients may spend some of dialysis time with relatives, friends or even business partners.

### Meals during or after dialysis

In many European centers, including all Slovenian dialysis centers, the food and beverages are served during hemodialysis session. In addition to that, in some centers meal is served after hemodialysis. The special issue of a meal during hemodialysis session is that the patient can be offered food and beverages that is




otherwise restricted because of diet (as dialysis procedure can correct all potential imbalances). Improvement in this area could add to the quality of well being during dialysis, improve patients' satisfaction and even adherence to dialysis therapy. For some patients meal during dialysis in important part of general food intake. Inspiration for serving a meal or beverages can be taken from food and beverage service during transatlantic flights and modify that well functioning practice to comply medical requirements.

### Nocturnal hemodialysis

Nocturnal dialysis represents a specific challenge. This is prolonged hemodialysis during the night (7-8 hours), with the patient sleeping during the treatment. It provides the best survival and may provide the best quality of life for the selected group of patients. It is usually performed in dark dialysis room, with only dialysis monitors providing some light. Monitoring of patients during nocturnal dialysis is a special challenge. Compromises are required between patients' wishes not to be disturbed during sleep and necessity to provide safety of the procedure, that includes patients' monitoring.

### Dialysis staff

Dialysis staff at University Medical Center Ljubljana are hard working health professionals, providing 24/7 hemodialysis service to both chronic as well as acute patients needing hemodialysis. The design of dialysis rooms and places for nurses recreation should take into account the necessity for staff relaxation.

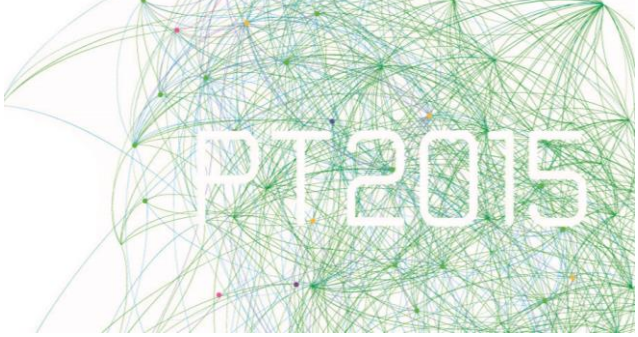
## CONCLUSIONS

In conclusion, dialysis in future should focus not only on medical treatment quality but in parallel with that on eco-practices and pleasant as possible atmosphere during treatment both for the patients as well as dialysis staff. It seems there is a lot of room for improvement at acceptable cost. Close collaboration of health care workers, patients and experts from non-medical fields would be necessary to achieve these goals.

## REFERENCES

Agar, J.W.M. 2015. Green dialysis: The environmental challenges ahead. *Seminars in Dialysis* 28, no2 (March-April): 186-192.

Beben, T., Rifkin, D. E. 2014. The elderly are different: initiating dialysis in frail geriatric patients. *Seminars in Dialysis* 28, no3 (May-June): 221-223.

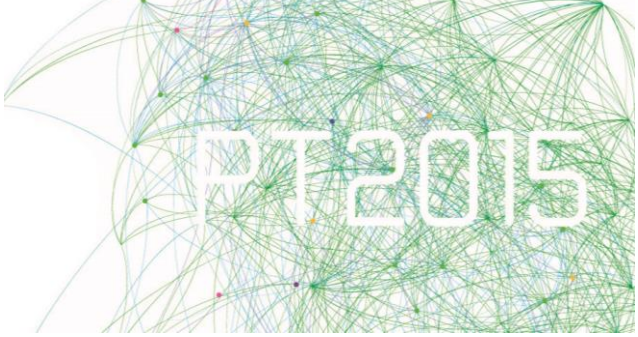



Jacubovic, B., Yan, A., Wald R. 2014. In-center nocturnal hemodialysis. *Seminars in Dialysis* 27, no. 2 (March-April), 179-87.

Piccoli, G. B., Nazha, M., Ferraresi, M., Vigotti, F. N., Pereno, A., Barbero, S. 2015. Eco-dialysis: the financial and ecological cost of dialysis waste products: is a "cradle-to-cradle" model feasible for planet-friendly haemodialysis waste management? *Nephrology, Dialysis and Transplantation* 0: 1-10. Doi: 10.1093/NDT/gfv031. NDT Advance Access published March 24, 2015

Slovenian Renal replacement Therapy Registry: 2009, 2010, 2011 and 2012 Annual reports. ISSN 1855-4784. Department of Nephrology, University Medical Center Ljubljana, Ljubljana, Slovenia, 2014

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA



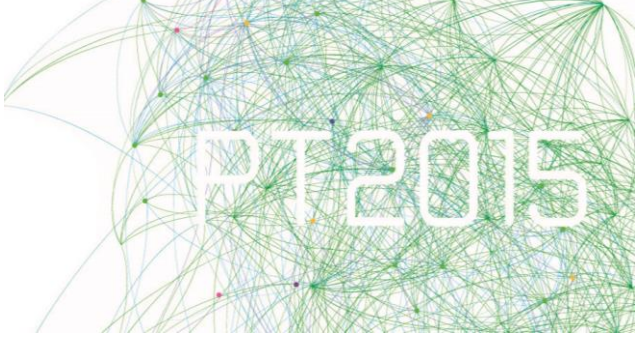

# CONTEMPORARY CHALLENGES OF PUBLIC HEALTH AND AN ACTIVE APPROACH TO OVERCOME THEM

**Marko Vudrag**
MD, PhD, Assistant Professor, National Institute of Public Health, Department of Nova Gorica, marko.vudrag@nijz.si

## ABSTRACT

*Socio-economic and life conditions as well as other circumstances (family, work, cultural and environmental) including social inclusion and life style are health determinants that have a powerful influence on one's health status. Considerable socio-economic, political and demogaphic changes generate public health problems. The current health status of the developed world is as follows: the population is growing old, cardio-vascular diseases, cancer, diabetes, obesity and mental disorders are on the rise. Only a »health to all policies« strategy will be able to solve these issues, as public health (PH) has to be a »mutual pursuit of permanent health improvement of the whole population«. Upgrade of the Health System – a Step Further is a document issued by the Ministry of Health of the Republic of Slovenia a few years ago. It tackles the establishing of such a system, since it includes solidarity, assessibility, quality and efficacy and pinpoints the key functions of PH, which are: a) health monitoring and evaluation, b) acknowledgement of health problems / challenges and risk assessment, c) threats management and d) chronic disease prevention and health promotion. In this paper, the third function of PH as stated in the Upgrade is emphasised, since globalization sometimes erases boundaries set between the developed and underdeveloped world and at least two determinants typical of underdeveloped world overlap: high poverty rate and communicable diseases. The latter demand careful consideration and planning, particularly when it comes to threats management. The current communicable disease management programmes are in some segments insufficient and the credibility of the national immunization programme is being questioned in terms of its obligatory vs voluntary status. At least three communicables diseases and the related immunization programmes need a thorough re-consideration: measels, influenza and pneumoccocal infections. Proven programmes will need to be critically considered and amended accordingly. The first and the third function of PH overlap and the population's health needs are being studied, also with a help of health economics.*

***Keywords**: public health, health determinants, upgrade of health system, public health functions, immunization programme.*




## INTRODUCTION

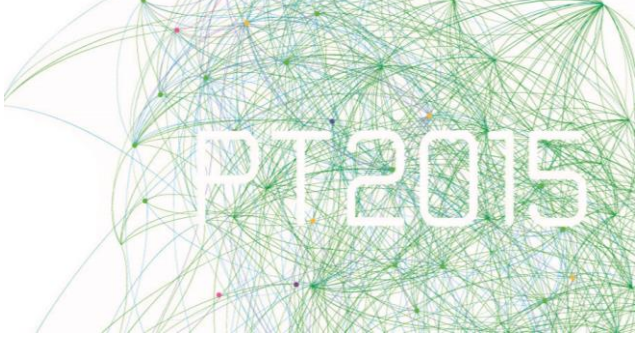
Through development and urbanization, mankind has won the right to determine what is best for it and its environment. Such anthropocentric way of thinking – or better still a trend, generates huge problems, as it is drifting away from the basic task of civilization, which is to provide sustainability. All of this consequently results in negative influences on all aspects of life, including health. Due to selfish interests, we have been changing the world very fast in an uncontrolled experiment without having the slightest idea about its outcome. Therefore the global crisis that this society is facing needs to be looked upon as a conflict of interests rooting out of environmental ethics in which the naturity and necessity of all single components of the environment must be perceived as its inherent value (Olen, 1992). In the natural and social environment only man has their »interest«. And it is one's interest that generates value. That is why people have cinically invented the idea that nature has no value (Bedau, 1991; Leopold, 1992), since it has no interest.

All socio-political and economic programmes (and objectives) have a tendency of progress and development overtaking the trend of »growth for itself«, which resembles the behaviour of a tumor cell.

Here we come upon the crucial question: »Is development always progress?« Nowadays, development - that is not necessarily progress - improves the quality of our lives, but at the same time brings along numerous healths related downsides, such as:

- Reduction of physical activity (overpopulation, lack of public sport grounds);
- Increased intake of junk food (too much sugar and additives);
- Easy access to tobacco, alcohol and illegal drugs;
- Increased traffic with air and sound pollution;
- Increase of marginal groups, violence, poverty, economic and social inequality;
- Notable increase of chronic non-communicable diseases referred to and perceived as huge public health problems.

Economic growth, urbanization, better health system and other improvements have brought us the »western population health pattern«, which means the increase of cardio-vascular diseases, cancer, obesity, mental disorders and diabetes.




Developing countries have a health pattern of their own: high poverty rate, high neonatal death rate, short life span and communicable diseases.

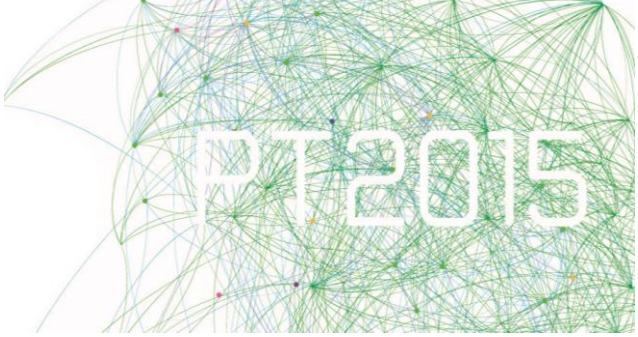
Globalization 399 has an 399 important influence on these patterns. In just a few decades, it has fueled up and globally allocated socio-economic and demographic health problems.

Poverty, malnutrition, no food production, orphans, lack of drinking water, diarrhoea and several communicable diseases are not a »privilege« of underdeveloped world alone. They can be present anywhere. According to some estimations, in just 20 years' time two billion people will live in the suburbs of big cities (Davis, 2006). It is a paradox of its own that this fastest growing category of people does not enjoy any privileges of this development and urbanization, since urbanization is happening without industrialization. Employment does not exist; people are socially and demographically discriminated and excluded from economic streams, which leaves them little or no access to education or health services. Structural changes dictated by financial power centres are a key factor in creating this situation, as they reduce the possibility of formal employment. No local food production, low income and no social programmes lead to rapid marginalization, poverty, prostitution, slavery and other negative health indicators.

What about Slovenia? Where is it in this map; is it safe and outside this frame?

Regardless of this question, the need of a change is obvious, and presently we are faced with the need to reconsider and reorganize the current health system. The latter should be efficient and should consider solidarity, accessibility, quality and efficiency. With this, public health (PH) should play the key role with its »health in all policies« philosophy and strategy. With this in mind, Government and Health Ministry of Slovenia have recently published *Upgrade of Health System – a Step Further*. It is meant to be a new CONCEPT of PH () Republika Slovenija Ministrstvo za zdravje RS, 2011). *Upgrade* is meant to create four basic PH functions, all of which are promising, but this article is going to focus on the third one: *threats: recognition and their management*. Environmental risks, chemization and threats of communicable diseases are constant challenges, partially due to globalization which contributes to overlapping of health patterns of developed and underdeveloped countries in at least two determinants: poverty and communicable diseases.

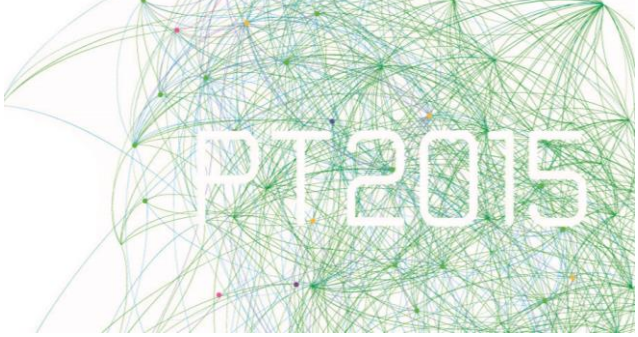
While health protection from environmental risks and chemization demand monitoring based and data interpretation risk assessment, communicable disease management demand the redefinition of national *Immunization programme*. That means that it needs to be upgraded as far as some communicable diseases are concerned, such as measles, B hepatitis, and influenza or pneumococcal infections, whereas some protocols and algorithms need to be updated.




Health-economic analyses have predicted favourable results in case of new pneumococcal infections immunization programme launch, since the scale of health problems and the burden of pneumococcal infections in the whole population are very high (IVZ, 2011). This is what happened, as since 2015 there has been routine vaccination with conjugate vaccine against pneumococcal infections for children under one year old. This vaccination is non-obligatory and covered by the insurance. Vaccination is otherwise a very good way of erasing unequality of health services and creating better health and relieving the pressure on the budget.

## DISCUSSION

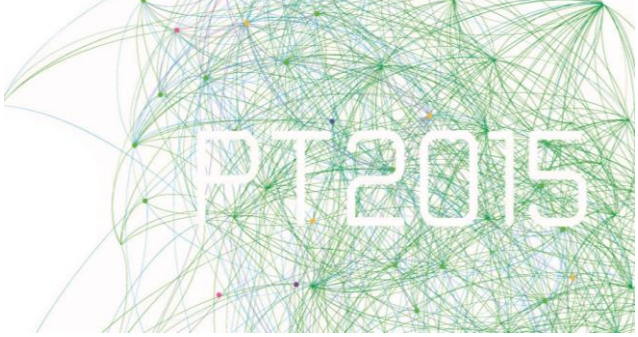
In recent time, health professionals have highlighted the problems of PH, mostly through campaigns »Health in all policies« and »Health in urban areas« both run by WHO (WHO, 1978; WHO 2010). They make one think that problems of PH are a result of a complex co-dependency of multiple factors, circumstances and conditions that generate measurable health inequalities. A good example of co-dependeny among socio-economic factors (poverty, living conditions, education etc.) and health is very clear (Belović et al., 2005). Since health and socio-economic inequalities (collateral damage of globalization) are in the centre of attention, they have also become the biggest challenge of all health policies all over the world. This is also where the ideas of how to overcome contemporary PH problems and stop unwanted consequences come from. An active approach referred to as a »new CONCEPT« and based on national needs and global facts is the only possible alternative for handling and overcoming PH problems. *Upgrade* defines this active approach within four key functions, and it is political will and social consensus that will decide whether or not to concentrate it on huge socio-economic, demographic and environmental changes. Implementing *Upgrade* in real life through integrated policies, strategies, insurance and other sectors' programmes could be synergic and would most certainly be successful at lowering health inequalities and budget pressure. Implementation of the third key function guidelines of Upgrade (threats management) and what it would mean in the real life together with the first function (health economics in health needs planning) will be described and shown as a case study – pneumococcal infection. Until now, pneumococcus vaccination was either payable or covered by health insurance (when there was a medical indication). Now, children under the age of one can be vaccinated by the current immunization programme if their parents opt for it. That is something, but not enough from the public health aspect. That is why *Immunization programme* needs to be redefined with much more emphasis on pneumococcal infections including the launch and implementation of a new and financially covered vaccination programme against these infections since they cause serious health problems. This precaution will minimize pneumococcal infection threats which will have a positive effect on the health system from the economic aspect as well.




Pneumococcal infections are an important cause of morbidity and mortality all over the world, including Slovenia. They are the leading cause of death in children under the age of five that can be prevented by vaccination (WHO , 2009; Centers for Disease Control and Prevention, 2006). WHO estimates that more than a million children die of pneumoccocal infections every year around the world, particularly of invasive pneumococcal disease (IPD) that accounts for up to 15 million cases (O'Brien et al., 2009). It is bacteria that cause serious diseases like otitis, pneumonia, IPD or meningitis. These diseases can often be fatal or result in serious damage which calls upon the need for vaccinating children since week six of their life onwards. Children in their early childhood (until the age of five) and the elderly people (age 65 and more) are most susceptible to pneumococcal disease. Particularly the elderly are in danger of developing pneumonia that can be fatal. By immunizing these two groups (< 5 and > 65 years of age) the incidence of pneumococcal disease (otitis, pneumonia, bacteriemia, meningitis) would most certainly drop. Most European countries already have national immunization programmes that include pneumococcal infections and provide conjugate vaccines (EUVAC.NET). In Slovenia, children could be vaccinated at the age of six weeks onwards with two doses in a two-month interval followed by another boost dose in the second year of their life. Pediatritians at the primary level could vaccinate their little patients at their regular check-ups. The elderly should also be vaccinated following different schemes depending on the type of vaccine. Such a measure would most certainly lower the number of cases of respiratory infects, the use of antibiotics and the incidence of resistant pneumococcus strains.

There is still no knowledge of the pneumococcus strains that are currently active in Slovenia (such a study would be much appreciated), whereas in Europe there are over 90 identified strains. Some of them are highly pathogenic and cause the worst cases of IPD, which is very important from the immunological point of view. As far as Slovenia is concerned, the laboratorial tracking of IPD has been going on since 1993 (Paragi et al., 2003). It seems that the incidence of invasive infections reaches its peak in children of one year of age and pneumococcus has been identified as the major cause (ZNB-UPB1/Ur.l. RS, št. 33/2006, IVZ). According to the latest Slovene data on IPD for the period between 2004 and 2010 introduced in December 2010 at the Section of Preventive Medicine meeting in Portorož, this theory has a solid ground (Paragi et al., 2010). The major isolated pneumococcus strains that caused IPD were 1, 6A, 6B, 14, 18C, 19F and 23F.

In Slovenia, the vaccines available now can cover all the major pathogenic and most agressive and frequent types being active in Europe. These vaccines are: 23 valent polysaccharide vaccine for adults and children above two years of age used against the most frequent pneumococcus strains and 10 (PhiD-CV) and 13 (PCV-13) valent conjugate vaccine for children under the age of two (Inštitut za varovanje zdravja RS). Until 2010, a 7 (PCV-7) valent conjugate vaccine was available, too.



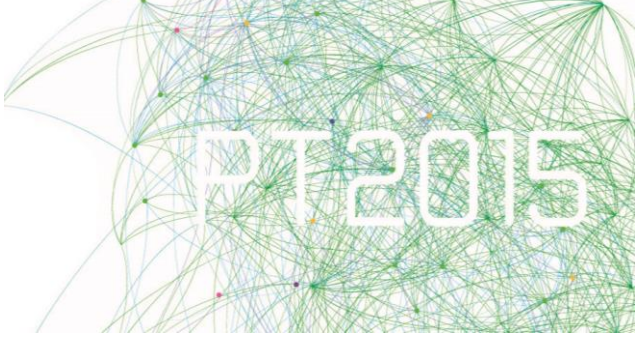

Looking at the »Slovene« pneumococcus strains causing IPD and the types that are in the vaccines, it is clear that the 7 valent vaccine does not cover IPD for types 1 and 6A, whereas the 10 valent vaccine does not cover the 6A strain. The 13 valent vaccine covers all pneumococcus strains. Numerous sources report cross protection; for instance the PCV-7 the 6B type should cross cover 6A, while 19F does not cover 19A, whereas PHiD-CV supposedly has a cross protection between 19F and 19A (Park et al., 2008; Eskola et al., 2001). Additional studies will be necessary to prove that theory, particularly to get to know all the active types better.

Why is it that polysaccharide vaccine is suitable for adults and children aged two and more only, whereas conjugate vaccines can be used for infants as well? It is an antigen that influences the complicated way of immune response. It is important to know that pneumococcus has a polysaccharide capsule that protects it from antibiotics as well (it contributes to the resistance to ordinary antibiotics), but at the same time it is the polysaccharide from the capsule that is crucial for the development of immune response in the host (Brueggemann et al., 2003; Magee et al., 2001). In vaccination, a polysaccharide antigen causes B cell activation that produce low affinity antigens in marginal zones of follicles and the spleen (Kraigher et al., 2011). After a few months, this antigen response weakens, since it does not have the same course of action as memory T cell response in germinal follicle centres.

Small children, particularly those under the age of two, have underdeveloped marginal spleen zone and germinal follicular centres. That is why their response to polysaccharide vaccines is weak and so is extrafollicular activation, since there is no T cell activation. At the same time, protein (peptide) antigens activate long lasting memory T and B cells from germinal lymph node centres (follicular maturing) (Kraigher et al., 2011). Lack of memory T cells will recognize any additional polysaccharide vaccination as the first one. This could be overcome by biding a peptid to a polysaccharide antigen through a complicated technology. Conjugate vaccines that activate also T cells and memory – secondary immune response have been produced. This way in 13 valent vaccine, there is a conjugated nontoxic diphterial reactive carrying protein (CRM197) on polysaccharides that creates in receivers active immunization against IPD, pneumonia and otitis. Children aged 6 weeks to 5 years old can be vaccinated with it (Prevenar 13, 2009).

In the 10 valent vaccine, eight strains were conjugated (as an antigen) on polysaccharide D protein (from Haemophilus influenzae), in type 18C tetanus toxoid and in type 19F diphtheria toxoid.

It is suitable for children between six weeks of age and two years old and in them it creates active immunization against IPD (sepsis, meningitis, bacterial pneumonia and bacteriemia) and acute otitis (Synflorix, 2009). Even though conjugates differ in their immune response, it is not for this article to provide the answer to the question as to why they conjugate different peptides, as more clinical studies as




well as more precise knowledge of active pneumococcus strains in the Slovene territory would be needed.

## CONCLUSIONS

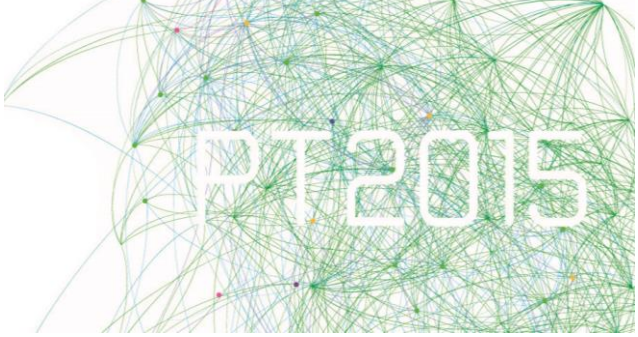
PH has a key role in *Upgrade of the Health System* as it promotes the best upgrade model – multisector ACTIVE APPROACH where all the activities will tend to promote health care and early disease detection. Such an approach takes a carefully planned primary care network, accessible to all people in their living and working environment. *Upgrade* could and should generate positive changes in public service within PH in the direction of obtaining synergies among health system providers. In order to achieve that, a flexible network of health services and providers is necessary taking into consideration demographic, epidemiological, logistic and infrastructural changes. That also means that horizontal and vertical networking of regional primary and secundary care institutions within the existing health care system is absolutely necessary (Republika Slovenija Ministrstvo za zdravje RS, 2011). At this new (local) level, most health care needs could be met, since a suitable economic and geographical allocation of human and material resources will be the necessary guarantee of nondiscriminatory accessibility.

PH can be defined as an act of prevention and health promotion that are a part of health care system and as such also crucial for health maintaining. *Upgrade* is in its core PH with a clear emphasis on monitoring and studying the health situation and addressing the health needs of the population, also with the help of health economics.

Redefinition of national immunization programme with the launch of pneumoccocal infections vaccination not just for children under the age of one as a voluntary vaccination could be a case study of putting *Upgrade* into practice. In other words, one's decisions about their health matter, whereas governmental and municipal and insurance policy responsibility is to protect and improve the health of the whole population. It is multisector ACTIVE APPROACH of PH that sends a clear message to the Government that the necessary way of upgrading the health care system is »bottom up« - the inductive method, instead of »vice versa« - the deductive method. Making experiments with public health is not tolerable – health care system is and must always be a non – political territory and cannot tolerate political competition for the votes of the people.

## REFERENCES

Bedau, H.A., Ethical Aspects of Environmental Decision Making, v Environmental Decision Making: A Multidisciplinary Perspective, ed. Chechile R.A. et al., Van Nostrand Reinhold, New York, 1991.




Belović, B., Buzeti, T., et al. Strategija za krepitev zdravja in akcijski načrt za zmanjševanje neenakosti v zdravju v pomurski regiji. Murska Sobota: Zavod za zdravstveno varstvo Murska Sobota, 2005.

Brueggemann, A.B., Griffiths, D.T., Meats, E., Peto, T.E., Crook, D,W., Spratt, B.G., Clonal relationships between invasive and carriage Streptococcus pneumoniae and serotype- and clonespecific differences in invasive disease potential. J Infect Dis. 2003;187:1424–1432.

Centers for Disease Control and Prevention. Vaccine preventable deaths and the global immunization vision and strategy, 2006–2015.MMWRMorb Mortal Wkly Rep 2006;55:511–5.

Davis, M., Planet of Slums: Urban Involution and the Informal Working Class (2006).

Eskola, J., Kilpi, T., Palmu, A., et al: Efficacy of a pneumococcal conjugate vaccine against acute otitis media; N Engl J Med 2001, 344(6): 403-409.

EUVAC.NET. National Childhood Vaccination Schedules.

Inštitut za varovanje zdravja RS. Center za nalezljive bolezni in okoljska tveganja. Oddelek za program cepljenja. Priporočila za cepljenje otrok s konjugiranimi pnevmokoknimi cepivi. Dostopno na: http://www.ivz.si/Mp.aspx?ni=92&pi=5&_5_id=671&_5_PageIndex=0&_5_groupId=206&_5_newsCategory=&_5_action=ShowNewsFull&pl=92-5.0.

IVZ. Cepljenje otrok proti pnevmokoknim okužbam. Predlog vključitve cepljenja v letni Program cepljenja in zaščite z zdravili. Ljubljana, februar 2011.

Kraigher, A., Ihan, A., Avčin, T., Cepljenje in cepiva – dobre prakse varnega cepljenja. Ihan, A.,: Dodatek Cepiva in imunost. 2. Likarjev simpozij – Cepiva in cepljenje, 22. junija 2011.

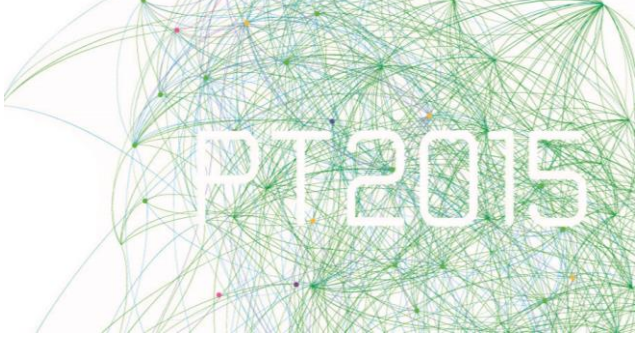
Leopold, A., The Land Ethic, v Olen, J., Barry, V., Applying Ethics, Wadshworth, Belmont, 1992.

Magee, A.D., Yother, J., Requirement for capsule in colonization by Streptococcus pneumoniae. Infect Immun. 2001;69:3755–3761.

O'Brien, K.L., Wolfson, L.J., Watt, J.P., et al; Hib and Pneumococcal Global Burden of Disease Study Team. Burden of disease caused by Streptococcus pneumoniae in children younger than 5 years: global estimates. Lancet. 2009;374(9693):893–902.

Olen, J., et al, Applying Ethics, Wadshworth, Belmont, 1992.

Paragi, M., Kastrin, T., Mioč, V., Čižman, M., Epidemiološke značilnosti povzročitelja pnevmokoknih okužb. Redno letno srečanje Slovenskega zdravniškega društva, Sekcija za preventivno medicino, 4.12.2010, Portorož.




Paragi, M., Kolman, J., Kraigher, A., Cizman, M., Gubina, M., Ribic, H., Slovenian Meningitis Study Group. Possibility of application of new pneumococcal conjugate vaccines in children in Slovenia.Vaccine. 2003 Dec 1;21(32):4708-14.

Park, S.Y., Moore, M.R., Bruden, D.L., et al: Impact of conjugate vaccine on transmission of antimicrobial-resistant Streptococcis pneumonia among Alaskan children. Pediatr Infect Dis J 2008, 27(4); 335-340.

Prevenar 13, Povzetek glavnih značilnosti zdravila, 9.12.2009.

Republika Slovenija Ministrstvo za zdravje RS, Nadgradnja zdravstvenega sistema do leta 2020 – Korak naprej, Februar 2011.

Synflorix, Povzetek glavnih značilnosti zdravila, 2009.

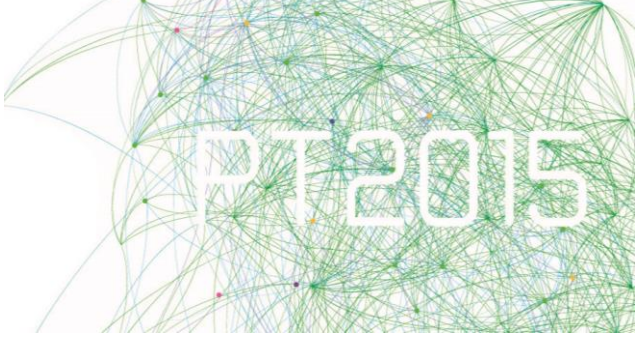
*WHO. 2010 World Health Day: "Urbanization and Health".*

WHO. Declaration of Alma-Ata. International Conference on Primary Health Care, Alma-Ata, USSR, 6-12 September. 1978.

WHO. Global immunization data, oktober 2009, http://www.who.int/immunization/newsroom/GID_english.pdf.

ZNB-UPB1/Ur.l. RS, št. 33/2006, IVZ: Prijavljeni primeri - podatki epidemiološkega spremljanja nalezljivih bolezni v Sloveniji.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# ANALYSIS AND CONTEMPORARY APPROACH OF SPACE DESIGN OF INTESIVE PSYCHIATRIC CARE UNIT

**Nevena Dutina**
MSc, Union Nikola Tesla University, Cara Dusana 62, Belgrade, nevena_d@live.com

**Aleksandra Dutina**
Doctor of Medicine, Clinic for Psychiatric Disorders 'Dr Laza Lazarevic', Visegradska 26, Belgrade, dutinaa@gmail.com

## ABSTRACT

*This paper presents a modern approach of designing the Intensive psychiatric care unit, where the space and current conditions at Intensive psychiatric care of Clinic for Psychiatric Disorders "Dr Laza Lazarevic" in Belgrade were analyzed. Emphasis is placed on the modern concept of designing space in terms of functionality and efficiency in order to fulfil adequately a set of activities in health care. Studying this case through comparative analyze, an optimal architectural solution was made for the specific conditions of psychiatric patients' care, in order to create human and functional space in the clinics of this type.*

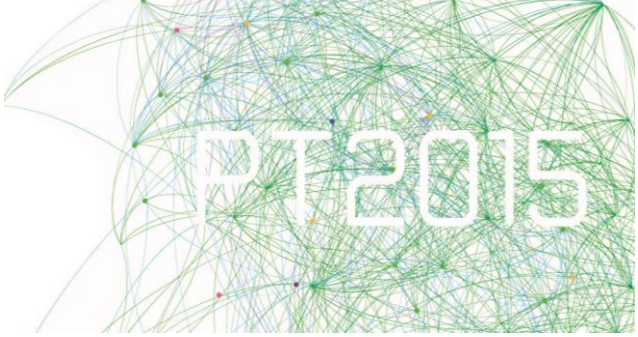
***Keywords**: design, intensive care, psychiatry, functional space.*

## INTRODUCTION

Clinic for psychiatric disorders „Dr Laza Lazarević"is the oldest psychiatric hospital in the southeast part of Europe, which was founded in 1981. (Munjiza 2011). In within of Emergency psychiatric service of Clinic, there is a unit of Intensive psychiatric care where an average of 90% of 3500 patients, who are hospitalized annually because of psychomotor agitation and loss of capacity for self-control, spend time (Nenadovic et al. 2012).

Intensive psychiatric care is a type of psychiatric treatment of patients, conducted in a closed specialized psychiatric ward, and includes observation, diagnosis and treatment of psychiatric emergency cases (Bowers et al. 2008).

Intensive psychiatric care unit appears as a separate psychiatric unit since the 1970s in the UK and the 1980s in the United States, Australia and Canada (Bowers et al.). In Clinic for psychiatric disorders „Dr Laza Lazarević" such units exist since 2011., while in other psychiatric clinics and hospitals in Serbia, intensive care units are still only present only as separate rooms on the clinical psychiatric wards.




## INTENSIVE PSYCHIATRIC CARE UNIT

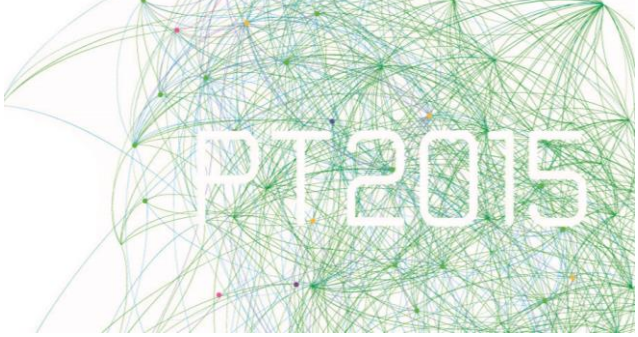
The most common emergencies that require intensive psychiatric care are suicide, auto and hetero aggressiveness and all states of agitation with distinct psychopathological disorders. According to the literature (Bowers et al. 2008, Nenadovic et al. 2012), typical patients in these wards are younger men , single, unemployed , people with schizophrenia or mania, people who tend to abuse alcohol, psychoactive substances and have a personality disorder, and the most common reason for hospitalization is aggressiveness. Intensive psychiatric care units are designed to create a secure and controlled environment for calming psychomotor extremely excited psychiatric patients in the short term, with high educated staff and a limited number of beds. Guidelines suggested that number of employees is the same as the number of beds for patients or in a ratio of 1: 1. The principal members of the medical team are psychiatrists, psychiatric residents, nurses and technicians who are highly qualified and trained in clinical psychiatry emergency (Dolan and Lawson 2001, Chang, Gitlin, Patel 2011).

First choice in the treatment of patients in Intensive psychiatric care units is parenteral dosage forms of drugs due to poor compliance and rapid action of the drug. Also, patients who are in severe psychomotor agitation, as a specific measure applied under controlled conditions in these departments, are subjected to mechanical fixation for the purpose of physical restraint because of a possible danger to the patient and / or the environment. Patients who require this type of comprehensive level of care and treatment are hospitalized over Emergency psychiatric service, Centre for Emergency Medicine or by transferring them from other clinics. Patients themselves can seek treatment or to be brought by family members, emergency medical assistance and / or police employees. Treatment could be voluntary if the patient is willing and capable for giving consent or approval, or, if he/she is not able or unwilling to consent to treatment, then he/she is forced.

Time spent in Intensive psychiatric care unit varies, but it usually last 2 to 6 days. Calming the acute clinical picture which is the reason for admission to such department, the patient is transferred to other psychiatric wards in accordance with its general mental and physical condition and psychiatric diagnosis (Bowers et al. 2008).

## REVIEW OF THE PREVIOUS RESEARCHES

Location of PICU has often been the topic of debate among experts. According to Dix and Page (2008), one possible benefit of locating the PICU on the first floor may be a patient's discouragement to escape through the windows. Despite that, disadvantage of locating PICU on the ground floor is easily avoided by window specification and limited opening. This location would provide access to an enclosed secure garden which is recommended by research of Department of




Health (2002), Dix and Page (2008) and the NHS Estates Department design guidance (1996).

If PICU is a part of the hospital, an entrance to the ward should be positioned near to the main entrance in order to avoid traffic through the rest of the hospital (Department of Health 2002).

Connection between aggressive behaviour and the number of patients in the rooms is closely related (Richter and Whittington 2006). Thompson et al. (2012), Lawson and Phiri (2000) and Schweitzer, Gilpin, And Frampton (2004) concluded that single rooms are superior to multi-bed rooms in terms of patient safety and privacy. Furthermore, one of the benefits of a private bedroom existence is that a person who is suicidal or becoming very disturbed may be able to be safely maintained in their own room without the need to escalate them into separate intensive care facilities or other more restrictive care (Ministry of Health 2002). An area of 10 $m^2$ is recommended and it should be designed and furnished as bed-sitting rooms to enable different activities in privacy (NHS Estates 1993). Several authors highlighted the needs of glass doors for patients' room, allowing the nursing staff to observe each critical patient closely.

However, numerous studies indicate that PICU should accommodate with at least 6 beds (Dix and Page 2008, Bartolini et al. 2003, Jacobs and Dawson 2003), with 8–12 beds are considered as the optimum (Valentin and Ferninande 2011, Department of Health 2002) in order to provide better observation.

Separate male and female restrooms should be provided, separately for staff and patients, and should be equipped with the necessary equipment (Thompson et al. 2012).

One of the most consistent recommendations in researched literature is the importance of reducing the institutional-looking environment of the facility. Insufficient space for the movement of patients could make tensions which lead to aggressive behavior. A number of smaller rooms (TV room, dining room, sitting room), furnished in a homely style and for different uses, would provide a more therapeutic environment than it would be achieved with a single large space (NHS Estates 1993). Patients should be allowed to choose between different possible activates, such as socializing, watching TV, playing games. Also, it should be defended a special room for visits.
Unobtrusive observation for staff should be provided by avoiding numerous corridors and corners. Direct or indirect (by video monitor) visualization of patients should be provided for nurses. The Society of critical care medicine design guidance for ICU (1995) suggested the design which allows a direct line of vision between the patient and the central nursing station.

## ANALYSIS OF THE CURRENT CONDITION OF INTENSIVE CARE UNIT IN THE CLINIC FOR PSYCHIATRIC DISORDERS "DR LAZA LAZAREVIC"

The ICU of Clinic for Psychiatric Disorders "Dr Laza Lazarevic" is placed on the ground floor which contributes to rapid admission of acutely disturbed patients. It consists of two units totalling 24 beds. Patients, who exhibit highly agitated behaviour, are accommodated in The Psychiatric Intensive Care Unit 2 with 12 beds while the remaining 12 beds are located in The Psychiatric Intensive Care Unit 1, which is analysed further in this paper.

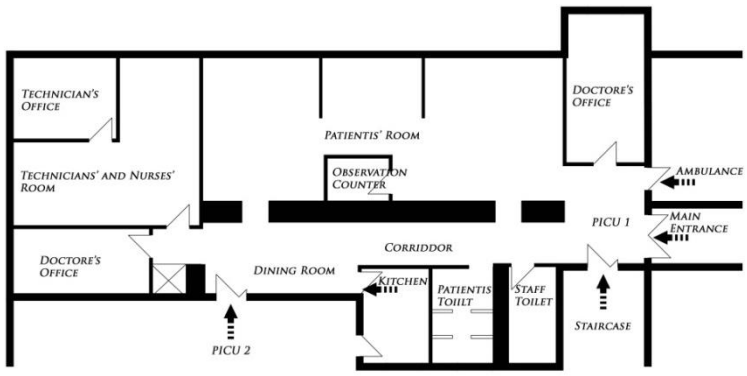
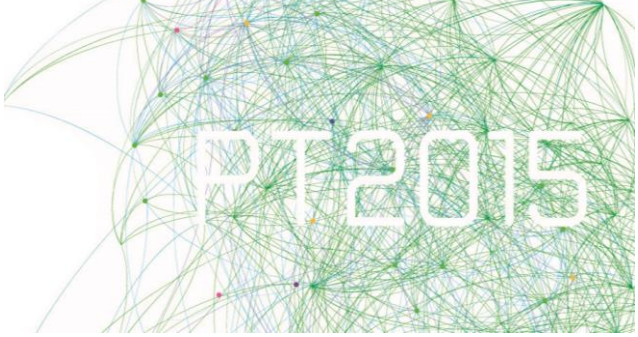



**Figure 1: Current Design of Psychiatric Intensive Care Unit 1 .**

Clinic is accessed via two entrances: one leads, via corridor, through the admission ward and ambulance to the PICU 1 and further to the main stairs, while the other entrance, across the main vertical communication, connects all the independent wards. Five internal doors directly lead to PICU 1: one door provides connection between PICU 1 and ambulance, two doors between PICU 1 and PICU 2 (one directly and one through the kitchen) and the remaining two doors provides connection between PICU 1 and the main corridors. All five doors are locked manually all the time.

Two doctors' rooms are positioned at the beginning and the end of corridor, while between them is patients' room. The main purpose of these rooms is to enable individual and private meeting between staff members and patients. Also, it is provided pleasing the daily living needs for each patient, such as having a toilet and shower facility. In the unisex bathroom, the existence of intimacy is not clearly defined. Separate toilet facilities are provided for staff, but it is unisex toilet with one squat toilet and one shower.

Besides bathroom, males and females share bedroom. Furthermore, the absence of these room doors contributes to the lack of patients' privacy, but better observations of patients. Room for technicians and nurses does not have direct




visual contact with patients. However, two steps elevated counter has a purpose of monitoring within patients' room. Evenly placed windows and height of the patient's room contribute to the presence of natural light during most of the day and the circulation of fresh air.

The main food preparation is performed in another Clinic, located 25 km away. Every day, prepared meals are delivered to the small kitchen on the ground floor that has no direct connection with the main entrance. Further, it is served in both wards, PICU 1 and PICU 2, in separate improvised dining room, which is practically part of the main corridor. Also, dining room serves as a space for permitted visits from patients' relatives.

## RECOMMENDATION

Several recommendations, based on identified problems, were made. The necessary once included:

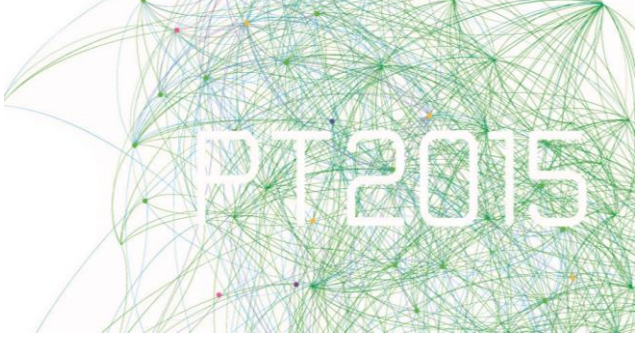
- single room for more disturbed patients,
- room for visits,
- it should be provided more privacy inside of bathrooms, such as putting shower curtain with the track recessed into the ceiling,
- formation of nurses' directly visual contact with patients from their room which suggested by nurses who are working in this hospital,
- expand nurse's observation station.

The desirable changes included:

- physical separation of male and female bedrooms and bathrooms in order to provide privacy and safety,
- proper dining room,
- room for different social activities for patients,
- in this project has not been analyzed the possible existence of the exterior environment, but it is suggested the access to an enclosed garden area.

## CONCLUSION

Facility design may act as a tool for faster recovery of patients.
It is essential to modify the PICU 1 to be flexible enough to change their use and functionality over time. Most problems could be overcome by improving the design of PICU 1. However, due to obvious lack of space to implement all it is necessary to improve the functioning of PICU 1, a possibility of merging PICU 1




and PICU 2 had been necessary considered and within one ward two seclusion rooms should be established.

## REFERENCES

Bertolini G., Rossi C., Brazzi L., Radrizzani D., Rossi G., Arrighi E., Simini B. (2003). The relationship between labour cost per patient and the size of intensive care units: a multicentre prospective study. Intensive Care Medicine, 29, 2307–2311.

Chang, Gitlin, Patel. 2011. The depressed patient and suicidal patient in the emergency department: evidence-based management and treatment strategies. Emerg Med Pract no. 13, 1–23.

Department of Helath (2002). Periera, S., & Clinton, C. (Eds.), Mental Health Policy Implementation Guide. 58-58. Retrieved 2015, from www.doh.gov.uk/mentalhealth.

Dix, R., & Page, M. (2008). Physical enivironment. Psychiatric Intensive Care (2nd ed., pp. 294-305). New York, N.Y: Cambridge University Press.

Dolan, Lawson. 2001. Characteristics and outcomes of patients admitted to a psychiatric intensive care unit in a medium secure unit. The Psyhiatrist no. 25, 296–9.

Jacobs R., Dawson D. (2003). Hospital efficiency targets. Health Econ, 12, 669–684.

Lawson, R. and Phiri, M. (2000). Room for improvement. Health Service Journal, 110, 24–27.

Ministry of Health, 2002. Criteria for the Design and Refurbishment of Psychiatric Acute and Intensive Care Facilities., Ministry of Health, New Zealand.

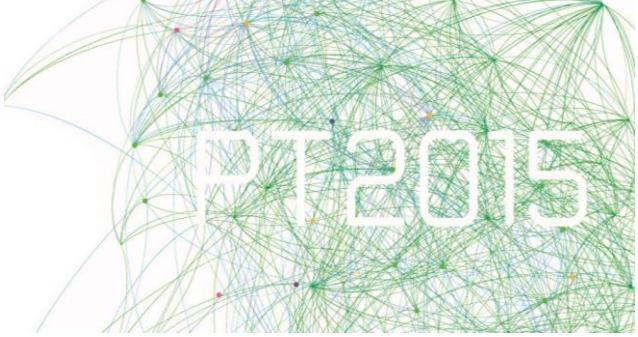
Nenadovic, Jovicic et al. 2012. "Epidemiološka studija pacijenata pregledanih u Urgentnoj psihijatrijskoj službi Klinike za psihijatrijske bolesti "Dr Laza Lazarević" u period jul 2011.g.-jun 2012.g.". Prvi Kongres Udruženja psihijatara Crne Gore.

NHS Estates. 1996. Accommodation for people with mental illness. Health Building Note 35: Part 1 – the acute unit. Leeds: Executive Agency of the Department of Health.

NHS Estates. 1996. Accommodation for people with mental illness. Health Building Note 35: Part 1 – the acute unit. Leeds: Executive Agency of the Department of Health.

Richter, D., & Whittington, R. (Eds.). (2006). Violence in Mental Health Settings: Causes, Consequences, Management (p. 347). New York, N.Y.

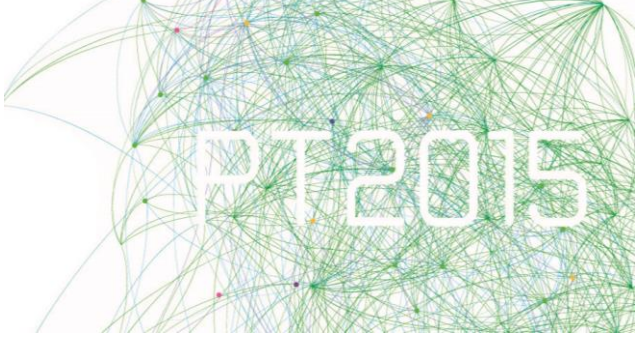
Schweitzer, M., Gilpin, L., & Frampton, S. (2004). Healing Spaces: Elements of Environmental Design That Make and Impact on Health. Alternative and Complementary Medicine, 10, 71-83.




Taj, R., & Sheehan, J. (1994). Architectural design and acute psychiatric care. Psychiatric Bulletin, 18, 279-281.

Thompson, D., Kamilton, K., Cadenhead, C., Swoboda, S., Schwindel, S., Anderson, D., … Petersen, C. (2012). Guidelines for intensive care unit design. Critical Care Medicine, 40(5), 1586-1600.

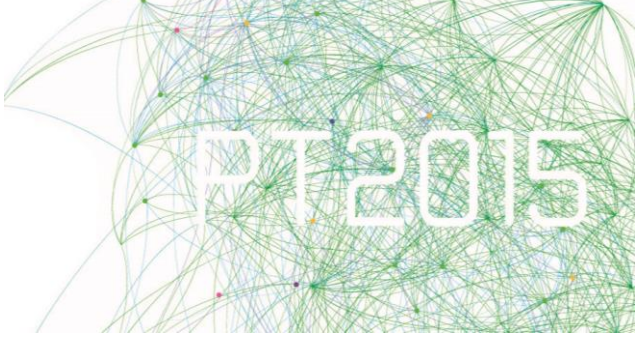
Valentin, A., & Ferdinande, P. (2011). Recommendations on basic requirements for intensive care units: Structural and organizational aspects. Intensive Care Medicine, 37, 1575-1587.




# TOPIC VI:

# Inclusive and Accessible Environment

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# TOWARDS INCLUSIVE FIRE SAFETY DESIGN

**Valeria Tatano**[1]
Full professor, Università Iuav di Venezia, Department of Architecture and Arts, Dorsoduro 2196, 30123 Venezia, Italy, valeria.tatano@iuav.it

**Elisabetta Carattin**
PhD, Università Iuav di Venezia, Department of Architecture and Arts, Dorsoduro 2196, 30123 Venice, Italy, carattin@iuav.it

## ABSTRACT

*Fire safety's main goal is to guarantee fire prevention and safety of all occupants in a building in the event of an emergency.*

*The application of inclusive design to fire safety does not impact the approach to fire prevention and protection of buildings as regards plant and construction related aspects (e.g., structural fire resistance, compartimentation etc) yet it changes the approach to the design of egress systems.*

*Just to give an example, it is not always possible to hypothesize immediate egress of persons with disabilities, in conformity with current procedures.*

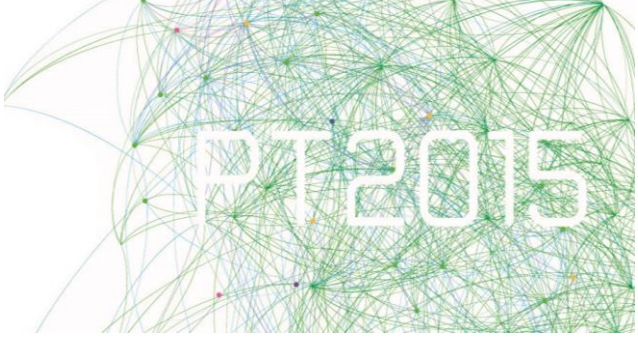
*Italian building regulations, in accordance with the European ones, provide for the adoption of various solutions, like progressive horizontal evacuation, which consists of moving occupants from an area of the building that has become dangerous to a safe place, while waiting to be rescued: such places commonly include Areas of Refuge and emergency elevator systems, which operate like mechanical tools capable of functioning even during an emergency in order to let people egress safely from the building.*

*Such devices and approaches, although present for years by now in the building codes, are in fact still not particularly used and, especially, almost unknown by the end users, as demonstrated by recent research conducted in Italy and abroad.*

*Scientific literature actually focuses on the importance of letting everyone know what to do in case of fire and on being informed on the principles of the building's emergency and evacuation plans that should be designed for all buildings of medium and high complexity.*

*The purpose of this paper is to discuss the tools currently available to ensure inclusive fire safety, through the analysis of the latest international experiences on*

[1] Corresponding author




*this issue, in order to contribute to a deeper understanding on the part of designers and the scientific community.*

***Keywords**: fire safety, inclusive design, evacuation strategy for disables people, area of refuge.*

## INTRODUCTION

Fire safety for people with disabilities aims to protect occupants in the event of a fire, in addition to allowing safe accessibility to public and private buildings for anyone.

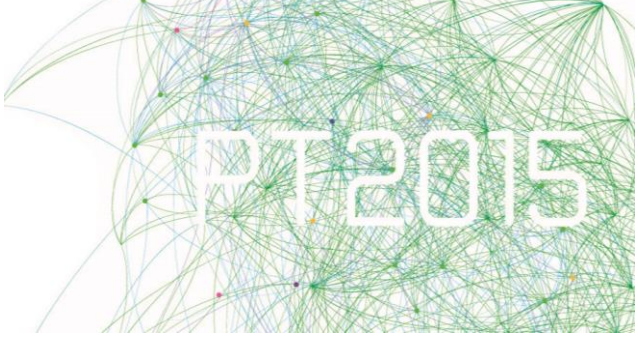
The general principles on which fire protection measures are structured, in order to cope with an evacuation, rely on a procedure that is thought to allow people to get out of the building and, simultaneously, let rescuers get in "in order to let occupants, who may be everywhere in the building, reach a place of safety and allow rescue squads to get inside of the building, to explore it and get out of it" (Council Directive 89/106/EEC, 1994).

From a fire safety point of view the presence of people with disabilities in buildings, whatever their occupancy type, forces us to take into consideration that not all the solutions adopted to allow evacuation can be actually valid for 'all' and that they rather may prove to be little or not suitable for 'few'.

In particular, all the measures concerning to the task "reach a place of safety" in the past have been oriented towards the realization of the complete evacuation of buildings, mainly through horizontal and vertical exit paths and stairs that lead occupants actually outside of the building. Such an assumption may not always be effective in case of people with permanent, and even temporary, motor impairments. Instead, it could even prove not to be functional for people with other kind of disabilities (e.g. visual and auditory) in the event alarm and signage systems, and a specific emergency plan, are not properly designed.

The evolution of the concept of "inclusive design" earlier (J. Clarkson, R. Coleman, 2013) and of today's "inclusive fire safety design" (a new definition that is proposed here to identify the subject matter) has led to the development of better solutions to ensure the possibility of autonomous or assisted evacuation, temporally articulated, through devices and strategies that can make buildings safer for everyone. Provided that the occupants are aware of the existence of these devices and know how to use them.

Ensuring Inclusive Fire Safety is here considered a paramount factor since it may have significant repercussions on the quality of people's lives, both in terms of personal autonomy and opportunities for socialization, contributing to a real culture of inclusion where *all* people can take their part and act as citizens to all effects.




However, a building's compliance with a code may not be the only issue when it comes to reaching such a goal. We also need to make sure that occupants and rescuers know how to behave, and use fire safety devices, in the event of an evacuation.

## INCLUSIVE EGRESS STRATEGIES

In Italy the first operational indication to ensure a safe evacuation from multi-storey buildings for persons with disabilities dates back to 1994 and is located in a technical regulation for the design of tourist and hotel accommodation. In such buildings the realisation of an "area of refuge", defined as a "safe static place contiguous and communicating with a vertical escape route or inserted therein", was requested by the regulations.

This space should not hamper the usability of escape routes and be such as to ensure the permanence of people with reduced or impaired motor skills while waiting to be rescued". (D.M. 9.4.1994, Approvazione della regola tecnica di prevenzione incendi per la costruzione e l'esercizio delle attività ricettive turistico - alberghiere).

This device, according with what is requested from other European regulations (eg BS 5588-8: 1999, ISO / TC 59 / SC), consists of a space where those who cannot leave the building immediately can stay and wait for help. The Area of Refuge should be located on each floor, so as to be independently accessible and be preferably clearly identificable and marked on the emergency stair landings, rather than in specific and confined areas, although 'contiguous and communicating' with an emergency exit path.

Indeed, closed and confined rooms, even if marked with specific signage systems, may be difficultly identifiable by the occupants. Research on wayfinding in complex environments, for example, has demonstrated that code complying emergency exit signs cannot always be enough to direct people to a safe place (Carattin, 2011). In addition, as regards areas of refuge, it could result very uncomfortable for the people to stay there even if accompanied by another person.

From a fire safety management perspective, on the other hand, when dealing with buildings in which autonomous egress is almost impossible, such as hospitals and kindergartens, progressive horizontal evacuation is expected to adopt. With such a method people can move (or be moved) in an adjacent compartment, able to contain them and protect them until the fire has been extinguished, or until it becomes necessary to proceed to a subsequent evacuation to a safe place (D.M. 18.9.2002, Approvazione della regola tecnica di prevenzione incendi per la progettazione, costruzione ed esercizio delle strutture sanitarie pubbliche e private).

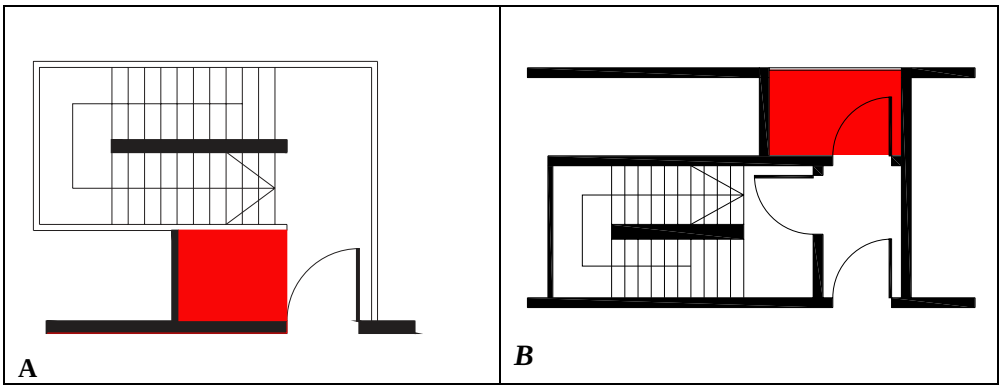



**Figure 1: Schematic representation of possible locations of the Area of Refuge.**

***Variant A:***
Area of Refuge inserted inside of an emergency exit stair's compartment.
This AR is usually designed by dimensioning the landing connecting the building and the vertical escape route, using as a safety element the characteristics of the compartment required by the regulations.
Advantages: the person who stays in this AR is directly in contact with other occupants and assists at the evacuation, understanding the times and the operational modalities.

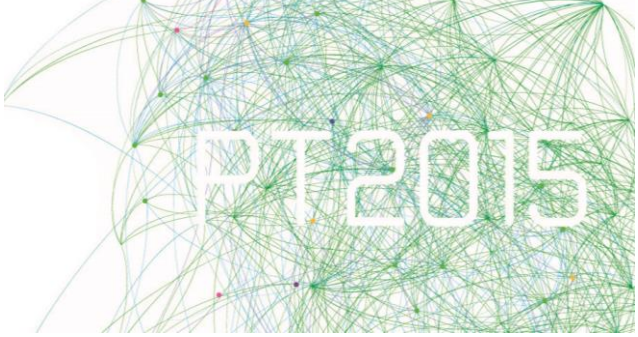
***Variant B:***
AR adjacent to an emergency exit stair's smoke compartment.
This AR is designed as a special compartment, compartmentalized and separated from the rest of the building and from the vertical exit pathway through a smoke compartment.

In multi-storey buildings an alternative to the use of emergency stairs, which can be difficult or impossible to use either alone or with the help of trained staff, is represented by appropriately designed elevators, such as egress elevators and firefighter elevators (Kuligowski, E., 2003).

As regards egress elevators, thanks to their plant engineering and structural characteristics, they can be used in case of fire for assisting the evacuation of people with reduced or impaired motor skills. The latter, instead, are for use by rescue teams and, possibly, for the emergency evacuation of the occupants.

These, as a whole, are the prevailing strategies to ensure the evacuation in case of danger for all. Anyway, it is paramount that all considerations to ensure accessibility, such as obstacles-free and appropriately indicated paths (e.g. steps and gradients), must be taken into account.

The process of evacuation of people with disabilities is specifically related to the users' different physical and sensory characteristics. Generally speaking, there are many similarities with the evacuation models adopted for high-rise buildings. When performing these models, in fact, it is currently difficult to figure out a




complete and immediate evacuation of all occupants through the only use of exit stairs.

The main egress strategies can be summarised into four main approaches, namely: total evacuation, phased evacuation, defend-in-place and delayed evacuation (Ronchi, E. & Nilsson, D., 2013). All of these require the use of many egress components, such as stairs and evacuation elevators.

The delayed evacuation approach is intended for people with disabilities and in such a case, in addition to areas of refuge, refuge floors (that are already mandatory in buildings with more than 25 floors in some regulations) are also used (Hong Kong Building Department, 1986; Williamson, BJ & Demirbilek, N., 2010). Anyway, in general, the evacuation approach to be used depends on the severity and specificity of the event, not on the type of people present in the building. Refuge floors, for example, are safe places that may be used by everyone while waiting for their turn to use the elevators or stairs, not only by people with disabilities. This is actually what the authors mean with "inclusive approach".

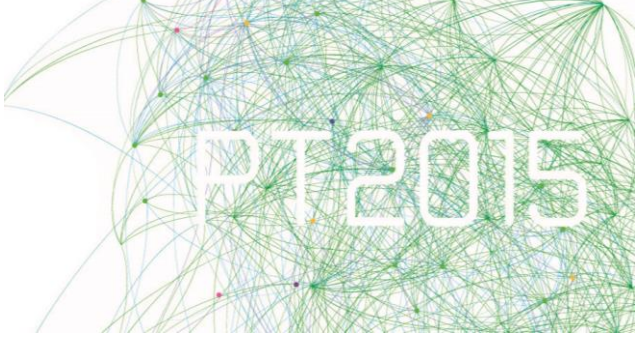
## THE END USERS' KNOWLEDGE ABOUT THE DEVICES FOR INCLUSIVE EVACUATION

The tools and management approaches adopted in Italy for the evacuation of people with disabilities are similar to the ones present in other countries, especially in England and the United States which were the first coutries in the world that introduced the concept of Area of Refuge as a means to let people egress through distinct evacuation phases, in addition to other specific solutions for people with disabilities and for other occupants who may be interested in such solutions.

Anyway, are the end users aware of the presence of such devices and of the related egress procedures? Scientific literature on this topic is still scarse, with only few case studies (one of them is about to be concluded by the authors in Italy).

In the UK in 2008, the Department for Communities and Local Government has undertaken a survey (D.C.L.G. 2008) with the aim of figuring out how to improve evacuation procedures for people with disabilities and to check the effectiveness and weaknesses of the current guidelines on emergency egress. The research was carried out in order to find out the end users' perspecitve of both the workers and people with disabilites. As regards the workers, 35 professionals involved in emergency procedures have been tested. The researchers themselves admitted this sample is enough to provide a range of opinions, yet not statistically significant.

The most interesting considerations emerged from the question "How does a disabled person get from a fire refuge to a place of safety?" The answers referred to many possibilities, e.g. Assistance & Evacuation Chair: 25%; Assistance (Trained): 24%; with Personal Emergency Evacuation Plan: 13%; Lift /




Firefighting lift: 6%. This various range of responses demonstrates that even specialists may not clary be aware of the procedures.

It was also asked to indicate the main problems of an evacuation system based on fire refuges and, in this case, the participants highlighted that the main factor of success of the evacuation depends on human factors, such as: the possibility that the people in charge of assisting the disabled persons are out of the office or have hurted themselves, malfunction of the management system or lack of proper training.

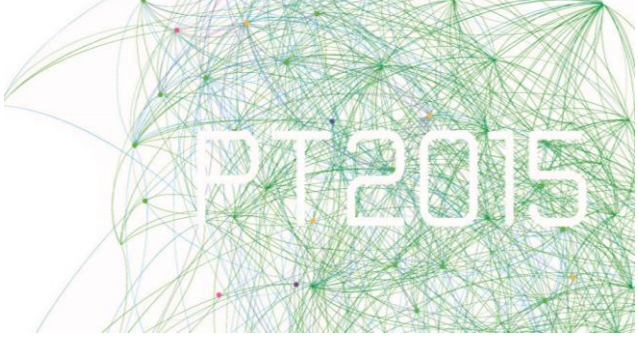
The University of Ulster in Belfast (UK) has conducted a research by sending questionnaires by mail to 300 people with multiple sclerosis and subsequently focusing on a focus group of 12 people chosen among all responders (McConnell, N. Boyce, K. 2012).

In particular, the results relating to the level of knowledge and understanding of the use of Refuge Areas are very intersting: half of the respondents said they had never heard of Refuge Areas and 60.4% of respondents felt that they would not be comfortable remaining in a refuge area for more than 10 minutes without further assistance. In addition, respondents declaired very little knowlede also about other systems that may be of help in an egress, such as evacuation lifts or evacuation chairs. For example, 80.7% had little or no awareness of an evacuation lift and many said they would be afraid to use it since they are concerned that it might stop at a floor invaded by smoke or fear of being trapped inside. In particular, this last sentence demonstrates that users do not know all the characteristics of an evacuation lift and highligthts the importance of focusing on proper communication and training in order to let people effectively use it.

People with disabilities have been claiming for decades the right to live and move autonomously in buildings and cities, and this goal has been largely achieved. Today a person with disabilities can move on the streets and have access to public and private buildings. On the other hand, this higher level of accessibility may paradoxically become a new element of concern, if these people are not prepared to deal with emergency situations, using the egress systems and devices that are designed for them.

## CONCLUSIONS

- There is still a gap between the aim of the standards, research and reality. Specific surveys show that the end users do not know about the devices and methods of evacuation that regard them directly. This is a serious problem because in case of real danger these devices, like refuges, could prove completely useless.




- Everyone should have the same right to evacuate safely from a building.

- There is currently the need to improve the prepairedness of professional and end users through the use of an approach based on better communication (Carattin, E.; Labate, E.; Meneghetti, C.; Pazzaglia, F.; Tatano, V., 2012).

- Inclusion should be taken into account from the decision-making process first. In this regard, it could be useful to think about setting a participatory process to revise objectives and functions of the devices prescribed by the regulations as relates to evacuation.

## REFERENCES

British Standards Institution. 1999. BS 5588-8: 1999. Fire precautions in the design, construction and use of buildings. Part 8: Code of practice for means of escape for disabled people.

Carattin, E.; Labate, E.; Meneghetti, C.; Pazzaglia, F.; Tatano, V. 2012. "Human Wayfinding Abilities to Reach an Area of Refuge in a Virtual Environment". Proceedings of the 5th International Symposium on Human Behavior in Fire 2012, Interscience Comms, London, 2012, pp. 557-563.

Carattin, E. 2011. "Wayfinding architectural criteria for the design of complex environments in emergency scenarios". In: Evacuation and human behavior in emergency situations. Advanced research workshop proceedings (ed. Jorge A. Capote, Daniel Alvear), Santander oct. 21st 2011, Universitad de Cantabria, pp. 209-222.

Clarkson, J.; Coleman, R. 2013. "History of Inclusive Design in the UK". In Applied Ergonomics XXX, 1-13.

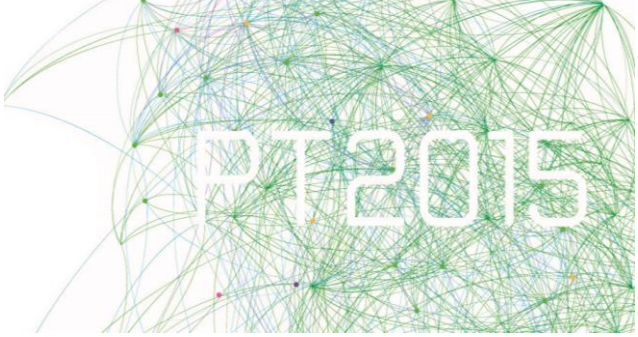
Communication of the Commission with regard to the interpretative documents of Council Directive 89/106/EEC. 1994. Interpretative Document Essential Requirement No 2 Safety in case of fire, Point 4.2.5, Evacuation of occupants. Official Journal C 62 Volume 37 of the European Communities 28 February 1994.

Department for Communities and Local Government. 2008. *The adequacy of refuges, escape stairs and management procedures*, BD 2441, London, March 2008.

Hong Kong Building Department. 1986. Code of Practice for the Provision of Means of Escape in Case of Fire and allied requirements.

ISO/TC 59/SC, 16 N N 63. 206. Building Construction – Accessibility and Usability of the Built Environment, 2008.

Kuligowski, E. 2003. Elevators for Occupant Evacuation and Fire Department Access. *Proceedings of the CIB- CTBUH International Conference on Tall Buildings*, 20-23 Oct.,



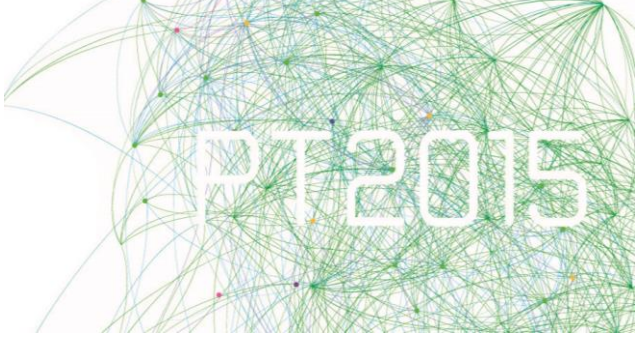

CIB Publication No: 290.

McConnell, N.; Boyce, K. 2012. "Knowledge Of Refuge Areas In The Evacuation Of Multi-Storey Buildings: The End Users' Perspectives." In Fifth International Symposium on Human Behaviour in Fire.

Ronchi, E.; Nilsson, D. 2013. "Fire evacuation in high-rise buildings: a review of human behaviour and modelling research". In Fire Science Reviews 2:7.

Williamson, B. J.; Demirbilek, N. 2010. "Use of lifts and refuge floors for fire evacuation in high rise apartment buildings". Proceedings of the 44th Annual Conference of the Architectural Science Association, ANZAScA 2010, Unitec Institute of Technology.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# INCLUSIVE AND THERAPEUTIC URBAN ENVIRONMENT: INVOLVING USERS IN THE DESIGN PROCESS

**Ilaria Garofolo**[1]
Full professor, University of Trieste, Department of Engineering and Architecture, Piazzale Europa 1, Trieste, garofolo@units.it

**Barbara Chiarelli**
Research architect, University of Trieste, Department of Engineering and Architecture, Piazzale Europa 1, Trieste, barbarachiarelli@hotmail.it

## ABSTRACT

*Public open space can play a therapeutic role by ensuring its full accessibility and usability: that concerns the possibility of moving independently, safely and easily in a reliable and familiar environment that allow relationships and easy access to goods and services.*

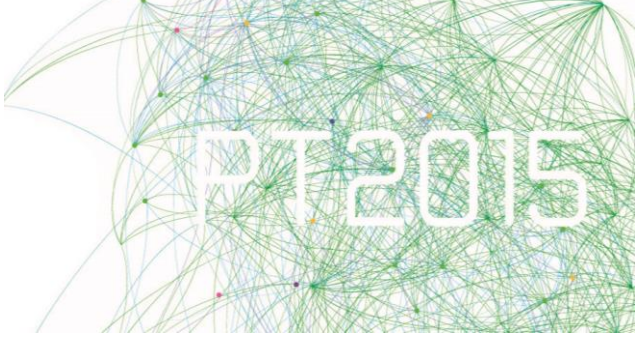
*ICF, International Classification of Functioning, Disability and Health, officially entrust the environment the power to enable or disable people to develop their life, according to their temporary or permanent conditions.*

*All those involved into interventions on the built environment have a great responsibility: the concept of designing for "standard man" should be overcome and different requirements from a broader segment of population need to be considered, guaranteeing the possibility for all to take part actively to daily life, fostering social inclusion by means of the highest level of accessibility.*

*To adopt a methodological approach for a rethinking of the organization and functionality of open spaces and pathways and to establish a shared process to get effective and affordable solution in the frame of a wider plan for accessibility is the goal of the LabAc project, developed in Friuli Venezia Giulia Region - Italy and supported by the local community and Administrations. The paper will present the results of experiences developed within LabAc project in the case study of Trieste Municipality.*

***Keywords**: inclusive design, key actions, urban spaces, participation, accessibility.*

[1] Corresponding author




## INTRODUCTION

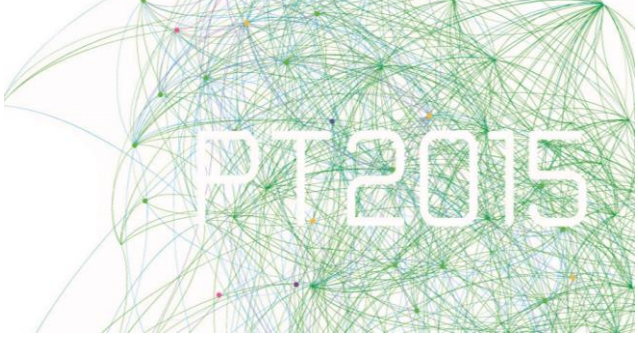
Urban spaces for all is recognized as one of the essential conditions for achieving integration, equality and quality of life for citizens and more generally for people living in a city, in particularly for vulnerable people (people with disabilities, people with reduced mobility, elderly and children).

We can refer to some pilot experiences developed by several Italian municipalities in the last years, which fostered to frame the tasks of urban and spatial planning, of building, of social housing, of service providers in a strategic and common vision linked to wider policies of social inclusion. Policies, which in the view of mainstream, are profitable from the economic point of view and at the same time a key element for the actual achievement of sustainability: environmental accessibility being the key to pursue goals.

## ACCESSIBILITY AS A KEY TO DEVELOP INCLUSION THROUGH THE DESIGN PROCESS

Accessibility is a relative and dynamic concept and we must consider it not as a product but as an ongoing process that starts from an initial conflict between opposing needs and which tends to a mutual adaptation of values and behaviors in the shared environment. We cannot defined it in an absolute sense, but in relation to the "synthesis of the levels of satisfaction" referred to different user profiles (Laurìa, 1993). Considering the functional profiles of persons allows the setting of a rational and methodologically correct assessment of accessibility of the living spaces, because it refers to the person and to his needs, and it is not expression, in abstract terms, of the built environment's features.

ICF (International Classification of Functioning, Disability and Health) represented the cultural leap to a new awareness of the role that the environment plays into enabling or disabling people, in relation to the action they perform in it (Schneidert, 2003). Assuming disability not as individual condition that concerns a minority of people, but as a fact that affects everyone and that everyone can experience in their lifetime, ICF has shifted the focus from disability to the overall functioning of a person in relation to his/her temporarily or permanently state, and to and the interaction with a set of conditions. This interaction creates situations of potential "vulnerability" or "risk" - the different types of barriers – and it may induce discrimination. The design process has the task to point out "facilitator" elements of the built environment. In this sense, Universal Design is the process that sets the quality of relationships between people and the living context, basing on the inclusive concept of "user" and on the study of the potentialities held by the context to enable people to use and to enjoy it. The UN Convention on the Rights of Persons with Disabilities, moreover, remarks this key role when suggesting (Art.2) Universal Design as path to find out solutions to shape a "therapeutic"



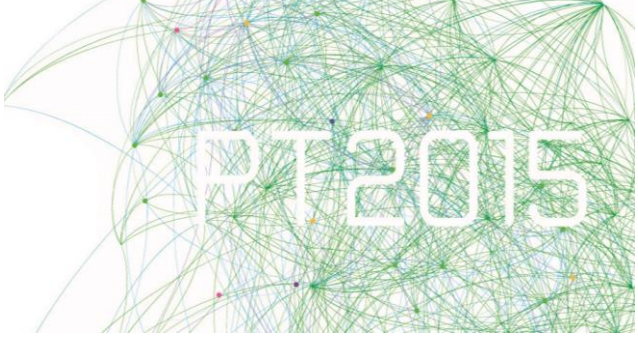

environment, as the one that structurally encloses the possibility of access and the appropriate use of all personal capabilities, in a barrier free interaction with it.

Universal design is inclusive when ascribes to the community the task of bridging the gap between the capabilities provided by the people and the skills required from the living context. The knowledge of the provided capabilities is critical to a effective project: for this reason, we cannot deny the value of the contribution that the users can give to the final result, as real "experts" of their abilities who day by day directly experience the consequences of a disabling environment. These experts should be involved since the beginning of the process, and contribute to it from concept to design validation, in a perspective of full and real participation. Talking about universal and inclusive design imply, therefore, to consider *limits* - which we need to know and on which action can be taken -, to list some *priorities* - that we cannot ignore or evade – and to set a *combination of solutions* able to allow the mutual adaptation between man and environment, to eliminate or reduce the potential discrimination and to promote inclusion.

## THE LABAC EXPERIENCE

To redevelop public space in terms of accessibility requires a plurality of coherent actions and a series of scheduled interventions according to a plan, which is at the same time a strategic tool and opportunity to develop socialisation experiences and community empowerment.

LabAc is a project coordinated by the Province of Trieste under the Law 41/1996 aimed to develop innovative models the to manage actions and services addressed to people with disabilities. LabAc is integrated into the " Zone Plans on Disability Area", applied to the whole Province territory that is 6 Municipalities. It started in 2011 and it has been developed into two phases, called LabAc 1 and LabAc2. The first phases (2011-2013) aimed at the encoding of the participatory process. Besides the operating rules for the process governance, the work focused on the *identification of the actors* (that all interfere in the management of space), on the *development of operational tools* (useful to the survey, to return and to use the collected data), on the *setting of guidelines* (to help designers and decision makers to develop solutions). The second phase (2014-2015) aims at the implementation of the operational tools tested in the first phase and shifts the focus from planning activities to intervention strategies (implementing at the same time the design guidelines). Going beyond what established by the existing standards (which require the drawing up of plans for eliminating the architectural barriers). LabAc is first an experimental process for innovative governance policies, to allow transition from the culture of "shooting down" the architectural barriers to the culture of planning spaces and services accessible to all, by increasing their level of accessibility. Willing to raise the public awareness on the issues of autonomy, the aim is to shift accessibility issues from being "heritage" of technical culture to




become common cultural heritage, thus promoting the understanding and acceptance of diversity, regardless of the causes that generate it.

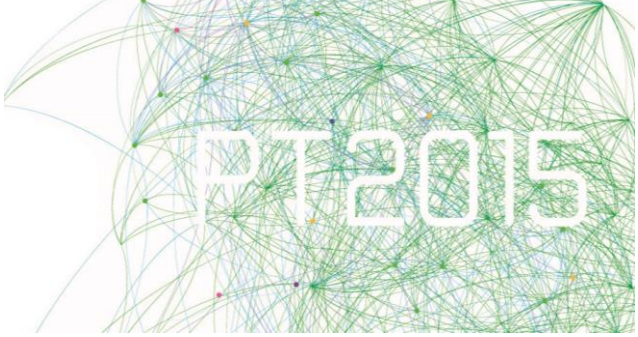
As responsible of management of public spaces and guarantor of freedom in safe movement on city routes, the Municipality plays a crucial role to achieve social inclusion by promoting participation to decision making among several stakeholders (final users including the vulnerable groups, those who perform public services, organizations, institutions, committees.). The individual opinions of such a complex group objectively contribute to reach shared and effective solutions; providing methodological elements can help local councils to consider needs and requirements in the different project they develop, to ensure accessible and safe places for all. Methodology developed in LabAc project is based on steps and different tools, which apply all the stakeholder and foster different goals. To plan resources and to schedule interventions, municipality starts the process mapping the accessibility level of targeted areas in terms of actual usability; this step is developed by means of participated surveys where involved stakeholders have the opportunity to express their qualitative judgment about critical issues. Operative tools, which support this step, are questionnaires and technical record form.

***The operative tools: opportunities and criticism***

Participative surveys represent the occasion for identifying problems, observe the surroundings from different standpoint, but also develop concepts decisions to act and plans for what to do, taking the advantage from the other's difference to order what to do in a new way. For professionals stakeholders, the participated process represent the occasion to extend their skills to do new things and replace old ways with new options; thus improving the ability to contribute to effective solution by using each the other (Zeisel, 2006).

Questionnaires provide useful qualitative data when focusing well-defined problems, recognizing what dimensions and concepts they want to deal with and how to manage the achieved data once developed the survey. Therefore, a big effort has been done to develop the questionnaire and the record forms to deliver to participants when they were involved into the diagnostic of targeted areas. The work focused on how to organize the questionnaire (pointing out identification of relevant elements, coding ID, number of given questions, etc.); on ways to code categories of required information to achieve to make them effective for further steps (that is the drawing up of map of accessibility level for urban pathways); and how to formulate questions to let all participant to be able answering (that is a question of precision to let responders to understand questions, simplicity, avoiding complicated words with multiple meanings, and neutrality, to prevent implicit influencing the direction of respondent's answers) (Zeisel, 2006).

Following some sample surveys, reflections were made about some criticisms related to the complexity of the surveys (to manage in terms of time duration and



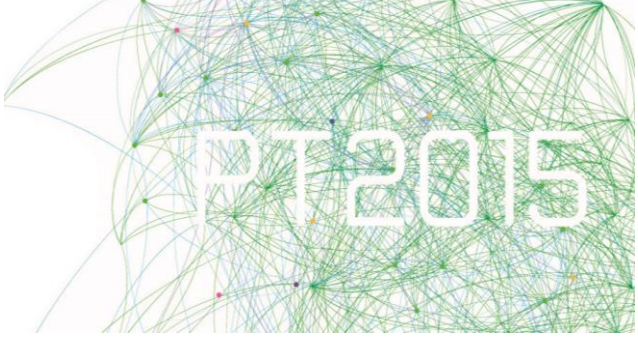

representativeness of the pilot group) and the need to collect technical data beside opinions of participants. The developed experiences in Phase 1 also showed the lack of appropriate experience of technicians in the field of participative process and expertise in Universal Design. This affects very much the approach to a new way of thinking (and managing the design or design assessment process) for the redevelopment and revitalization of public spaces, in terms of therapeutic and inclusive environment. At the end of Phase 1, beside the achieved results and products, suggestions came for improvement of the operative tools.

## FROM THEORY TO PRACTICE: GUIDING THE RECOVERY OR TARGET PUBLIC SPACES

In Phase 2 the project involved all the partner Municipalities into the development of some pilot actions where to test the results of Phase 1. According to the plans for intervention of each Municipality, the LabAc methodology was tested to support the design of shared solutions to improve and enhance new-targeted public areas. The common features of the projects were: the limited dimension in terms of involved area and low available budget to develop the intervention, the need to meet requirements of groups of users with special needs, the need to develop "pilot solution" as best practices which could be repeated in other similar contexts.

### *Trieste target project: the recovery of a public space facing a new social housing complex*

The project developed in Trieste allowed satisfying the needs of two actors: ATER the Local Agency for Social Housing, as owner and manager of a dwelling block in the city center; and the Municipality of Trieste, as owner and manager of the public square facing the block and of the surrounding pathways. The occasion was the close delivery of flats, the most of which for weak users (people with severe disabilities). The complex, built on an area of 2200 sq.m. had a cost of 7 million Euros, and consists of 37 apartments between 38 and 70 sq.m. with 140 parking spaces, a nursery school, a gym and three commercial spaces. The need to allow future inhabitants, as well as the other citizens, to access the building and the small square that represents one of the few "social" space in the area, called for a deep investigation of the actual state of the urban accessibility of the neighboring streets. At the same time, the City Council expressed the need to address the analysis process around that area, which falls in the second batch of the so-called "plan for pavements" started by the administration. This plan, which includes a census of all urban existing criticism in order to implement a redevelopment operation over 3-4 years, should interest about 200 town streets, with a total investment of 6 million Euros. Following the LabAc methodology, two surveys were carried out to test the accessibility level of the area and participants were selected according to the representativeness of the stakeholders: technicians and professionals from the



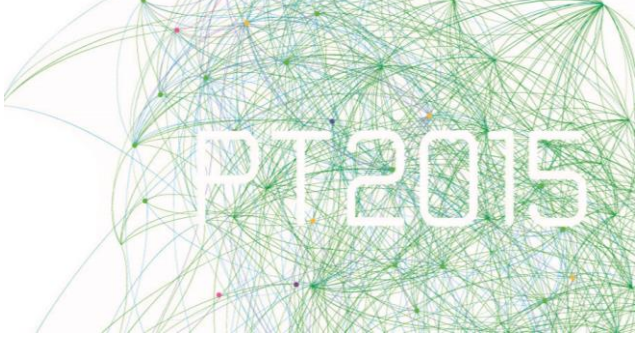

Technical Offices of the Municipality, from ATER, from the social and health local Departments, and from the association of persons with disabilities. Moreover, the survey was open to a representative group of students from the University of Trieste, courses of Inclusive&Universal Design (to help raising awareness among the future designers). During this experiences a new recording tool was tested (a special spreadsheet to be filled by technicians and which automatically elaborates the information); the aim was to "measure" the level off accessibility. The result of processing data from the new form, mostly dealing with the actual compliance of requirements to the ongoing regulations, were matched with the data related to the past interventions in the area, owned by the Municipality's offices.

Combining the results of the qualitative and quantitative questionnaires and forms, the main result of the action was the draft of a map that represents a snapshot of the state of accessibility of the area. This map aims to be the operative tool to support the technical offices in the decisional steps. It helps to set priorities for the maintenance interventions, to allocate the available resources first in those spots where accessibility is altogether lacking, to stich up urban paths connecting strategic places (healthy services, bus stops, daycare centers, etc.); to intervene with tailored solutions to achieve a satisfactory usability of public spaces, following the suggestions given in the guidelines for design.

## CONCLUSIONS

By steering the analysis of a case study, concerned by multiple actors, it is possible to trigger a concerted work, getting an enrichment in terms of the contributions of the various actors, who are able to express proposals, needs, and viewpoints. Experience has shown the importance of an exchange and comparison between different technical areas. Experience also showed how it is necessary to point out a protocol that regulates the carrying out of the process, which also calls for a strong figure of coordination and liaison among stakeholders. Moreover, the experiences highlighted the importance of supporting the different phases of the process with ICT, to develop inspections streamlined in terms of time consuming, reliability of responses, to help the data management and updating once developed interventions. Last but not least, the lack of communication among different stakeholder and the missing knowledge of special needs of the final users call for implementing actions with education and information process, even in the view of long life learning, to raise the awareness of personal responsibility to help the making of more inclusive common living environments.

All these suggested actions will be the core of the LabAc 3 phase, which proposal is under implementation with the sign of a new protocol of understatement among actors.



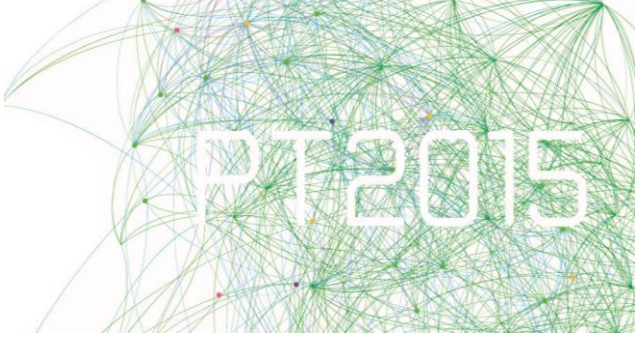

## REFERENCES

Laurìa, A. (ed). 1993. *Persone "reali" e progettazione dell'ambiente costruito*. Rimini: Maggioli Editore, Collana Edilizia & Urbanistica.

Schneidert, M., Hurst, R., Miller, J., Ustün, B. 2003. "The role of environment in the International Classification of Functioning, Disability and Health (ICF)." Disabil Rehabil. Jun 3-17;25(11-12):588-95.

Zeisel, J. 2006. "Side effects of cooperantin" In *Inquiry by design. Environment/Behaviour/Neuroscience in Architecture, Interiors, Landscape and Planning*, edited by John Zeisel 75-90. Ney York-London: W.W.Norton & Company.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# DEVELOPING INNOVATIVE SOCIAL HOUSING TO FOSTER INCLUSIVE COMMUNITIES

**Silvia Grion**[1]
Research architect, University of Trieste, Department of Engineering and Architecture, Piazzale Europa, 1 - 34127 Trieste, grion.sil@gmail.com

**Paola Coloni**
Coordinator of "Trasporto Facile", Local Committee of People with Disabilities, via Cordaroli, 26 - 34135 Trieste, pcoloni@alice.it

## ABSTRACT

*Inclusive communities should enable people to carry out daily life at the best condition, regardless of their abilities, increasing the quality of housing conditions and creating the necessary means for an independent living.*

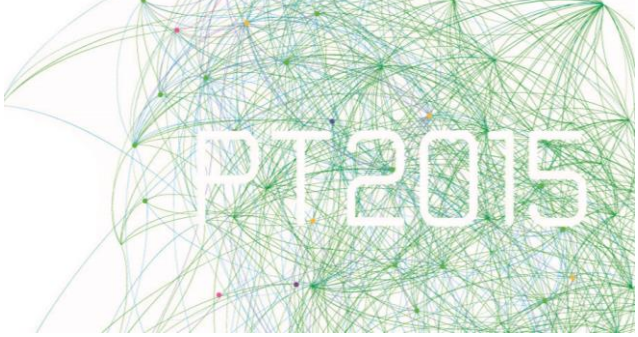
*Dealing with social housing, it should be a task to guarantee opportunities for the weaker categories of users (elderly, people with disabilities) to live in affordable and accessible houses, designed according to the principle of Universal Design: that is to ensure accessibility for all, and to enable people to live in their own homes even if limited in their functionality. Designing universally does not mean making special adjustments, but to ensure inclusion and good usability for all.*

*According to the ongoing regulations, social housing should meet the need of persons with disabilities, and guarantee at least a certain amount of estate to be "accessible" to allow an independent living. However, there is a gap between what should be and what it is in reality: several experiences show that the "accessibility" according to the law is far from the real requirements and very often what is considered an accessible flat is actually uncomfortable and unfits the final users' needs, while creating discriminatory conditions.*

*What is the responsibility for that? What's the role of public Agencies to promote the culture of accessible and inclusive living, even through promoting innovative accommodation typologies and the use of technological equipment to help special users? Is it important to involve the users in the developing process to perform a multi-functional design to provide different options, offering opportunities for all and enhancing autonomy?*

*The paper will explore these issues, presenting the case study of the local Agency for Social Housing in Trieste (Italy), which experienced the question of allowing*

[1] Corresponding author




*accessible new flats and developed some pilot projects in the field of therapeutic living environment.*

***Keywords**: accessibility, social housing, user involvement, multi-functional design, inclusive communities.*

## INTRODUCTION

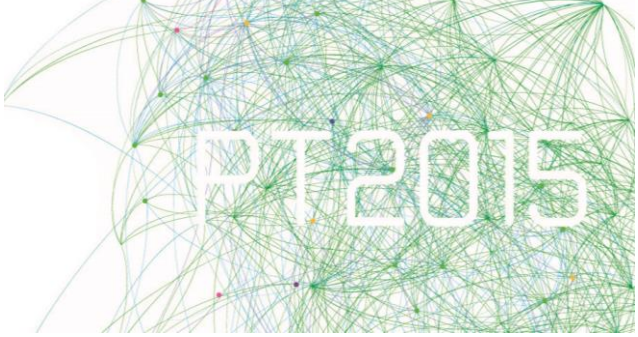
In the society of the twenty-first century, the concept of *smart city* is now established, and refers to an urban environment which can actively improve the comfort and quality of life of all its citizens, managing to meet their needs, regardless of their condition. So in each community it should be a right granted to all to have living spaces designed according to criteria of accessibility, safety and well-being, especially if we talk about housing. The house has always a very special significance, especially if we consider the most vulnerable or people with special needs, such as children, the elderly and people with disabilities.

Home is a safe and welcoming place, where to find rest, shelter, but it is also relational space, where to meet and cultivate social relationships and friendships. Hence the need for a space to relate without difficulty and allow self-determination according to personal needs, habits, wishes and desires. Indeed, it is the quality of an environment that determines the degree of disability when a person enters into relationship with it.

As claimed by the ICF, International Classification of Functioning, Disability and Health, there is a close link between health and environment, so that disability can not be considered a characteristic of the person, but rather a health condition in a hostile environment. In this view, it's clear the importance of making homes accessible and really usable to limit exclusion, overcoming the logic of institutionalization and the false need for "special" buildings, to strengthen the process towards inclusion and finally to achieve better designs for all, offering more options and occasion to enrich the spatial experience (Monzeglio, 2006).

## SOCIAL HOUSING AND UNIVERSAL DESIGN

Dealing with residential buildings, in Italy the path toward a design that meets the needs of vulnerable categories of users started in the late '80s, when designers were called to consider accessibility as a requirement for housing, both private and public. A national law defines three qualitative levels of usability for persons with reduced or limited sensory capacity or mobility: **accessibility** (the possibility to reach a building, to comfortably access it and to make use of space and equipment in conditions of adequate safety and autonomy); **visitability** (the possibility to access communal living spaces and at least a toilet in each unit); **adaptation** (the




possibility to adapt building spaces at affordable costs and to equip them fully and comfortably).

The legal requirements for public housing also state that access must be guaranteed for outdoor spaces and common areas. Furthermore, at least 5% of housing provided in new constructions must be accessible, with a minimum of one unit per building. At last, each housing unit must be visited or adaptable in all parts and for which accessibility and/or visitability is not required yet.

However, this is an approach that leads to the creation of environments and solutions for special needs. Therefore it is necessary to take a different point of view that considers accessible design not as a special design, addressed to a certain category of users, but as a means that, respecting and considering human differences as a resource, is able to shape environments characterized by a higher quality and livability. Hence, adopting the principles of Universal Design it would overcome this limit, thus planning for person of any age, size and ability, ensuring all necessary means for an independent living.

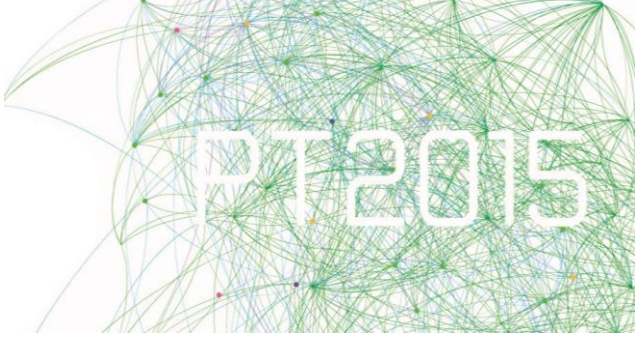
Universal Design is a revolutionary but practical leap forward in the evolution of building and design procedures and it succeeds because it goes beyond specialization, promoting the design for products and building so that everyone can use them to the greatest extent possible.

Taking into account the human being in all phases of his life, limitations can affect not only motor deficit but also visual, auditory, sensory and cognitive, more relevant in old age. Therefore, it becomes crucial, while designing, to assess not only the possibility of movement, but also of spatial understanding, of vision in relation to different sensory and cognitive limitations, using a multi-sensory design that considers parameters in reference to wayfinding, gestural, visual and auditory reachability. It is not enough that a flat is available, but it must be also usable. In fact, the concept of usability includes the ability to "use", broadly speaking, each room, furnishing, installation. This concept goes far beyond the mere absence of architectural barriers, but calls for the ability to act, to do, to loaf at home in an easy, safe, independent and enjoyable way, by any person with equal dignity and opportunity (Monzeglio, 2006).

## TRIESTE CASE STUDY

### Local context

The Province of Trieste is the smallest among Italian provinces, but it is the fourth largest considering population density. It also holds the highest aging index with 28.2% of the total population over 65 years old. This causes a high proportion of




women among inhabitants, typical of elderly populations, and a smaller average size of family units, often consisting of a single elderly component.

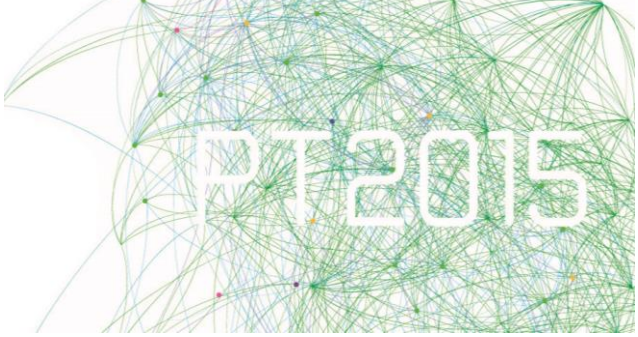
Considering the housing issue, the origin of Social Housing in Trieste date back to the mid-nineteenth century. Since its establishment, in alternate phases depending on the complex economic and political events which affected Trieste during the twentieth century, the local Agency for Social Housing (ATER) produced much of the blocks in the city, turning its commitment not only to healthy and cheap housing, but also to the provision of collective spaces and equipment that would improve living conditions and strength social relations among inhabitants. ATER currently administers about 13.000 accommodations. Analyzing tenants, they represent more than 40% of the population of rents in the whole province; they represent a sample of the main features of the province itself and considering all occupants – both renters and owners – the most of them are 65 years old, that is about 34% of the total (Davi, 2014).

These facts should therefore make us reflecting on the actual needs of the real user, considered as a human being who, during the various stages of its existence, comes to different physical conditions and different degrees of skills.

**ATER's construction activity**

In the last three years ATER's construction activity was particularly dynamic, planning to create about 250 new residential apartments. As for the process, ATER deals with the overall management of the process of the intervention, from the stage of pointing out the building areas, to the design – from the preliminary project to the final design, resorting to internal professionals and/or with external commitment – and the following contract to other companies and planning supervision (Davi, 2014).

Although in accordance with the current law about accessibility, many experiences show that the only compliance with the law often leads to a dichotomy between legal usability and real usability. Meeting legal requirements is therefore necessary but not sufficient to create spaces that can be really enjoyed by everyone. The aim should be, in fact, not to guarantee the minimum required by the laws, but to think about how all types of users may interact, showing a real interest in the different conditions in which each individual can experiment in their lifetime. The role of the designer is so crucial because it affects the real possibility of enjoyment by everyone. The direct experience of people with physical disabilities who visited apartments dedicated to them showed how the lack of attention and of sensitivity during designing create unlivable environments. In fact if we don't consider the operating space required for a person in a wheelchair, it makes impossible to use independently the spaces, as much as to do the most ordinary activities, like taking the clothes from the wardrobe or open a window. Sometimes however the shape of environments produces condition of discrimination for the future tenant, such as




having to choose between being able to use the toilet or install the washing machine, or not being able to get out on the balcony.

**Innovative projects**

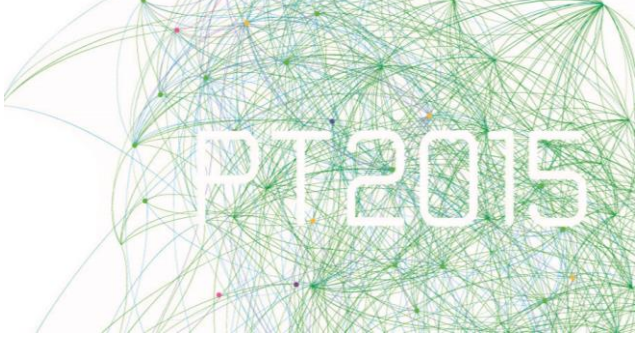
Beside ordinary design activity, the local Agency for Social Housing in Trieste recently promoted some innovative projects aimed at increasing protection and social integration in public housing and preventing the lack of self-sufficiency, with particular attention to people with special needs. Among these experiences two meaningful projects can be remarked: "Presto a casa" ("Back home soon"), in the field of therapeutic living environment, and "S.HO.W - Social Housing Watch", which focused on outdoor spaces of a social housing suburb.

The main goal of "Presto a casa" is to allow people who due to traumatic events or aggravate degenerative diseases are suddenly in a situation of reduced mobility, to recover autonomy thanks to temporary use of an expressly equipped living space. Indeed, after the period of rehabilitation in health care centers, to return home can be problematic because of changing needs and the presence of barriers to free movement. Thanks to this innovative project the person can experience, jointly with the family, all the solutions implemented in a training-apartment and he can consciously decide which of these will be suitable in his home.

The project is the result of an interdisciplinary process during which the working group, characterized by different competences – architects, engineers, plant engineers, doctors, physiotherapists and social workers – conceived guidelines for building design, plant design and furnishings.

The pilot project produced two flats, equipped with home automation technologies, proper design and construction of spaces and furnishings, as well as with a selection of aids that can be used to perform usual daily activities, like cutting bread, taking off own clothes, opening of the window shutters. Thanks to the experience recently gained with specific projects in the field of home automation and ergonomics, it was possible to use the most accessible solutions to the general public available on the market, replicable in ordinary homes, without the need of deep changes for spaces and structure.

These two training-flats were addressed to people who will experience tools, devices and structures to help them to manage and control their activities, domestic capabilities and interactions with the outside world, in full respect of the security both of person and environment and of living comfort. It represents a necessary test to allow concerned person to decide what is actually useful in his specific case and then make aware choices of adaptations of his house, selecting the cheapest and most technically feasible solution in order to improve the quality of life once back home (Cechet, 2011).




The second project, "SHOW - Social Housing Watch", has been developed within the Italy-Slovenia Cross-Border Cooperative 2007-2013 program. It is an experimental community watch of Social Housing policies aimed to realize similar experiences in the field of redevelopment of two target areas: Borgo Zindis in Italy, and Koper in Slovenia.

Borgo Zindis is a suburb of Muggia (Trieste Province) that in the past was a fishing village. Overlooking the bay, the village is far from the city core and it spreads out over the hillside. While feeling a sense of community and belonging, the village also takes the risk of isolation. Today the suburb is suffering from economic isolation as there are currently no available commercial activities or services, an elderly population and a decreased workforce due to the lack of professional opportunities.

The goal of the project SHOW is the redevelopment of Borgo Zindis' outdoor residential areas according to the plan developed within a participate process. Thanks to elimination of architectural barriers and enhancement of public outdoor spaces it will allow for more and better usability of the area and improving the overall livability of the suburb.

One of the strength point of this project is the involvement in designing process of local inhabitants, that daily use that spaces and understand difficulties so much as good features.

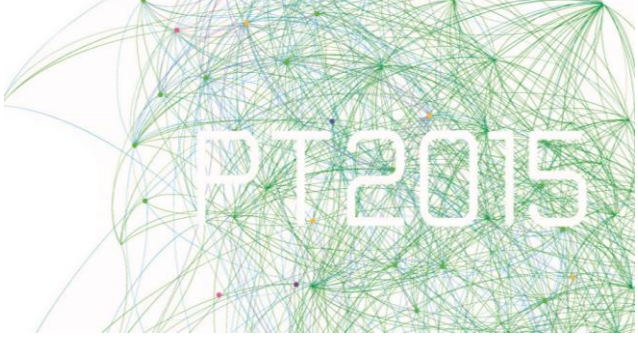
## CONCLUSIONS

The described experiences suggest some observation on the need to improve management both of the design process and the allocation of public housing.

*Interpretation of the law*: the mere knowledge and application of the legislation is not enough to create housing opportunities that follow the principles of accessibility, reachability of places and equipment, safe use, environmental and psychological comfort, aesthetics. It must therefore be necessary to interpret the legal requirements in a reflective and critical way, to allow the rise of adopting accessible to everybody solutions from a natural, subjective determination, and not from what the law requires.

*Flexibility and customization of space*: it would be desirable to consider during the life of vulnerable people the occurrence of "temporary" or "permanent" changes, caused by physical and mental deterioration, which determine the urgency of modifying environments, adapting to the new different needs.

*Involvement of end users*: to initiate participatory processes that involve the end users could foster a more aware design and responsive to the real needs.




*Mapping and special list*: to draw up a list dedicated to impaired people (currently there is only one list) and to map the characteristics of accessible housing and their location, would facilitate the matching user-housing, simplifying procedures for the allocation of apartments and allowing to better meet the needs and requirements of the person.

*Consider the needs-based*: allocation of housing to vulnerable people should consider also some factors relating to distance accommodation/job, the availability of close essential services and the presence of a good infrastructural network to ensure greater autonomy and independent living.

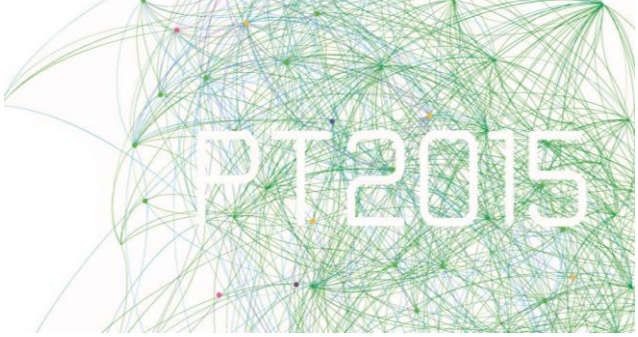
## REFERENCES

Davi, C., and Gortani, O., Zorzenon, L. 2014. *ATER Trieste bilancio sociale 2013*. Trieste: ATER Trieste.

Cechet, A. 2011. "Due appartamenti 'palestra' in via Capitolina." *ATER Informacasa*, Anno X, n. 51 (Giugno): 17–20.

Monzeglio, E. 2006. "Criteri e schemi tipologici per una residenza fruibile" *Progettare per tutti*, October 2006. Accessed April 13, 2015. http://www.progettarepertutti.org/formazione/residenze_moneglio_06.pdf
www.show.ater.trieste.it. Accessed April 13, 2015

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# URBAN PUBLIC SPACES ACCESSIBLE FOR ALL: A CASE STUDY IN A HISTORICAL DISTRICT OF ROME

**Lucia Martincigh**[1]
Professor, Architect, Department of Architecture, Roma Tre University, via Madonna dei Monti 40, Rome, Italy, lucia.martincigh@uniroma3.it

**Cecilia De Marinis**
PhD, Research Assistant, Architect, Department of Architecture, Roma Tre University, via Madonna dei Monti 40, Rome, Italy, arch.ceciliademarinis@gmail.com

## ABSTRACT

*The liveability of a city like Rome is endangered by vehicular traffic and, as consequence, urban spaces are generally not accessible to all users; this is a problem that is particularly felt in residential districts.*

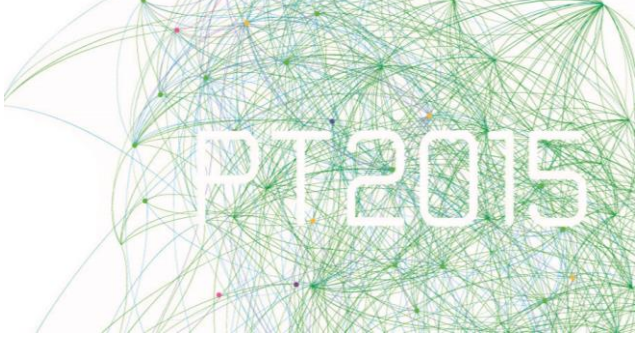
*The Department of Architecture of Roma Tre University has recently moved to Testaccio, a historical, famous, working class district of the city, where Piattaforma Testaccio, an association of dwellers, is very active.*

*A collaboration started between this association and University, with the aim to improve the urban environment where dwellers, teachers and students spend their everyday life. A study, involving academic staff and students of the course "City and Environment" together with some members of the association, was run with the aim of solving one of the most important problems highlighted by the association: the accessibility of public spaces. To this aim, it was used a prescriptive tool: "the Environmental Island" that can be applied in areas that are mainly residential.*

*Special methodologies, already tested in some European funded research, were applied to assess the level of accessibility of pavements, crossings and bus stops, the quantity of public space available to pedestrian and its fruition, the density and the continuity of the pedestrian network. Such assessment considers the exigencies of different categories of PRM (people with reduced mobility) as defined by the European Parliament, considering not only mobility or sight impaired people but also people affected by temporary problems. Solutions were proposed to create inclusive and accessible urban environments, considering also facilities to make easier and more comfortable walking and moving around, to facilitate orientation and the use of public services and without overlooking safety.*

*The next step of the process concerns a meeting with the Association members for the presentation of the identified solutions and for their evaluation by the dwellers.*

[1] Corresponding author




***Keywords**: inclusive design, accessible environment, assessment methodologies, urban design, environmental island.*

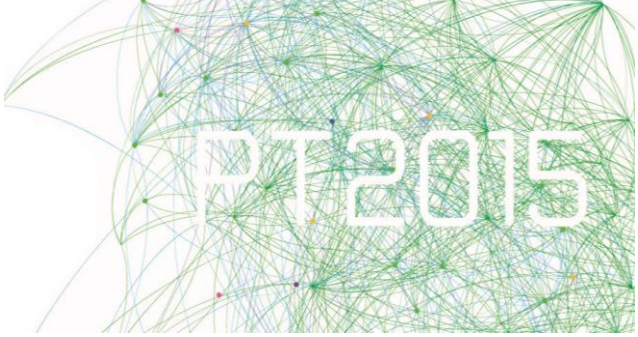
## INTRODUCTION

The Department of Architecture of Roma Tre University aims at developing innovation through research and education in architecture. An important aspect concerns the involvement of students, teachers and researchers in applied research and pilot projects. The Department has recently moved to Testaccio, a historical, famous, working class district of the city, where Piattaforma Testaccio, a local association of dwellers, is very active. It aims at fostering a debate among dwellers, associations and institutions on prior issues for improving the quality of life in the district. The main purpose of the association is to make Testaccio become a reference for the whole city of Rome: a pleasant environment with accessible paths, free of vehicular traffic and with a good public transport supply.

A collaboration started between Piattaforma Testaccio and University, with the aim to improve the urban environment where dwellers and university people spend their everyday life. A study, involving academic staff and students of the course "City and Environment" together with some members of the association, was run with the aim of solving one of the most important problems highlighted by the association: the accessibility of public spaces and of historical sites. To this aim, it was used a prescriptive tool: "the Environmental Island" that can be applied in areas that are mainly residential. The liveability of a city like Rome is indeed endangered by vehicular traffic. In Rome circulate 668,4 cars and 148,2 motorcycle per thousand inhabitants (ISTAT, 2014). The high number of vehicles produces several negative effects on the liveability of the urban environment: first of all, high levels of air and noise pollution, but also an increase of the risk of accidents because of the great amount of vehicles and of their high speed. This situation, summed to the presence of many architectural barriers, makes urban spaces generally not accessible to all users (Ministero Lavori Pubblici, 1989; DPR n. 503/1996).

## THE DISTRICT OF TESTACCIO

The district is located in the centre of the city: its boundaries are the Tiber river, Via Marmorata, a urban high speed road and the Aurelian roman walls. A regular grid, following two main directions, structures the urban fabric, a typical eighteenth-century housing development. In 1883, a slaughterhouse and working class housing facilities were built, at the beginning by private companies, then, in different phases, by public institutions. Today Testaccio is attractive at urban scale for its leisure activities: eating places and wine cellars, cultural facilities such as the museum "Macro", University, archaeological and historical sites and a colourful market. The neighbourhood is characterized by a distinct sense of community, as shown by the presence of the association "Piattaforma Testaccio", and by a strong sense of identity and belonging.




## THE COURSE OF "CITY AND ENVIRONMENT"

The course of "City & Environment" is taught during the 2nd year of the Urban Design MSc[2], at the Department of Architecture of Roma Tre University. It deals with the analysis, structuring and design of the urban environment, considering its interaction with built surroundings and local environmental factors; it detects compatibilities and incompatibilities, at various scales, with the aim to define appropriate actions for a sustainable upgrading, in relation to performances such as accessibility, safety, comfort and attractiveness (Christophersen, 2002).

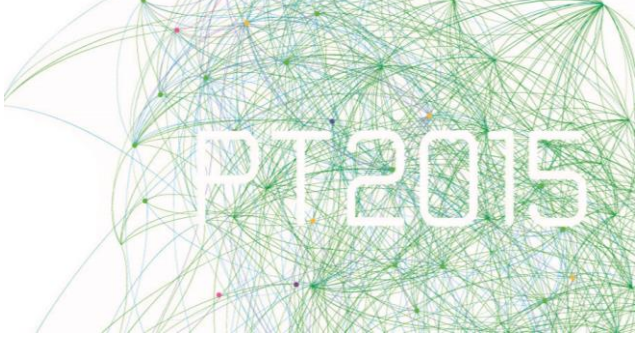
During the course, students are invited to study a district, to spot the main problems of the urban environment and to propose innovative solutions. The analysis is based on methodologies developed, applied and tested in previous European and national research experiences, which provide indications both on the assessment of the situation and the definition of intervention strategies, up to the proposal of design solutions.

For the project of the district, a specific prescriptive tool, the "Environmental Island", considered in the Italian legislation on Urban Traffic Plans, is applied (Ministero dei Lavori Pubblici, 1995). The "Environmental Island" is described as an urban zone, located in mainly residential areas, characterized by local streets, surrounded by main roads. The main aim of this tool is to improve liveability of urban spaces by "environmental" features; mentioning the "pedestrian network continuity", it allows to consider pedestrians as the core of the mobility planning and to give them priority, to reduce private vehicles circulation, to control car speed levels by different devices, for increasing safety and accessibility for the most vulnerable users.

## METHODOLOGIES TO ASSESS THE LEVEL OF ACCESSIBILITY

For the issue of accessibility, it was important the European project "TTAT - Training Tools for Accessible Towns", in which the Department of Architecture was involved. The focus was on the concept of multifaceted users that refers not only to people with specific permanent inabilities, as wheelchair users or blind people, but rather turns to the greatest possible number of users, considering their transitory conditions, related to contingencies and changes in age (Last, 2005). The collection of best practices, reported in France, UK, Italy, Romania and Greece, dealt with several situations and aspects characterizing an ideal itinerary: along the pavement, crossing the street, transport interchange point, urban furniture, way-finding[3]. The focus was on accessibility but the interface with other performances

[2] University of Roma Tre, Department of Architecture has a BSc+MSc programme, constituted by a single 3 year BSc and by three different 2 years MSc, for a 5 years programme in total.
[3] "TTAT - Training Tools for Accessible Towns". 2010-2012. Coordinator: Luc Givry. www.town-for-all.org




(safety, comfort and legibility of the street environment) was also considered. The comparison of various laws and technical norms, the analysis of technical solutions and case studies made the researchers acquire an extensive know-how that was used afterwards in the analysis of districts such as for example Testaccio. For the methodologies to identify problems and solutions, to assess the level of priority and their appropriateness, reference was made to research works previous carried out, such as PROMPT - New means to PROmote pedestrian Traffic in cities[4], SIZE – Life quality of senior citizens in relation to mobility conditions[5], ASI – Assess implementations in the frame of the Cities of Tomorrow[6] (Steg, 2003), carried out by the author in the Department. For the use of some indicators, reference was made to a national research PRIN (Projects of Research of National Interest): The mobility factor in the upgrading of brownfields (Amirante, 2008).

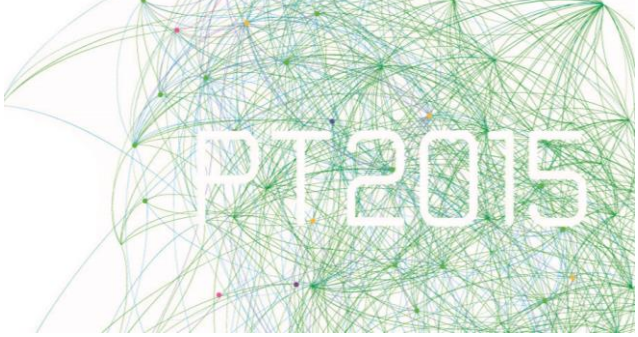
In the research PROMPT, one work package was dedicated to the study of accessibility in urban spaces. Methods for defining: the most used path, in order to understand where it was more important to act; the distance/travel time ratio, in order to find out possible "time" barriers that cumulate to "architectural" barriers; the detour ratio, in order to understand the use effort were studied[7]. In the research SIZE, methods for identifying and classifying problems pointed out the lack of accessibility of pavements, because invaded by various vehicles or in bad conditions (holes, cracks, tree roots, slippery materials etc.) and the impossibility of accessing facilities, such as bus stops and restrooms, in urban areas (Martincigh, 2011). In the research ASI, various methods for assessing the level of accessibility were proposed for the access to public transport, sidewalks and crossings, providing parameters and minimum conditions (thresholds) (Martincigh, 2009). In the PRIN research, indicators of state and of transformation were defined and proposed for application; many had to do with accessibility, both directly (percentage of accessible crossings and pavements, density of the pedestrian networks, accessibility of the public transport network) and indirectly (pavement/carriageway ratio, multifunctional pavements) (Martincigh, 2012). The various methods used in PROMPT (Rauhala et al, 2003), the methods used in SIZE

[4] Martincigh, L., *WP7: Solutions Report.* "PROMPT – New Means to PROMote Pedestrian Traffic in cities". Coordinator: Kari Rauhala. VTT Building and Transport, Helsinki (2000-2004). http://prompt.vtt.fi

[5] Kaiser H.J., Kraus B., "*Results of quantitative studies with senior citizens*", Deliverable D12, Report from WP8, Institute of Psychogerontology, University of Erlangen, Nuremberg. SIZE – Life quality of senior citizens in relation to mobility condition. Coordinator: Ralf Risser - FACTUM, Research Institute in Mobility and Traffic, Wien (2001-2006).
www.size-project.at

[6] Martincigh, L., Urbani, L., Department of Design and Architectural Studies, University of Roma Tre, Rome (I). *WP6 "Design and concepts for toolbox, databank and model application, to be used as a basis for pilot study*" and WP7 "*Results and Assessment of the pilot study*" Deliverable D11 ASI – Asses Implementations in the frame of the Cities of Tomorrow. Coordinator: Ralf Risser - FACTUM, Research Institute in Mobility and Traffic, Wien (2002-2005). www.factum.at/asi.

[7] Rasanen. J., *WP2: Accessibility – Synthesis Report.* "PROMPT – New Means to PROMote Pedestrian Traffic in cities". Coordinator: Kari Rauhala. VTT Building and Transport, Helsinki (2000-2004). http://prompt.vtt.fi




for identifying problems and solutions and some of the proposed appropriate solutions, the methods for assessing accessibility used in ASI and some of the indicators defined in the PRIN research were used for the analysis and proposal for Testaccio district.

## THE APPLICATION TO THE CASE STUDY: EVALUATION OF THE PROBLEMS

Specifically, in the study of Testaccio, in relation to the topic of accessibility, students have analysed the requirements of all the users (Gunnarsson, 1995), in particular of PMR (Argentin, 2000), and tried to solve the problems that urban spaces cause to these users, making paths, sojourn spaces and facilities more accessible, usable and comfortable. The issue of accessibility appears relevant in the district and, by an analysis applying the methods described before that use specific criteria and parameters, it is possible to say that there are some recurrent problems: the lack of accessibility of pavements and bus stops, in particular there is no combination of ramps and steps to meet the needs of different users, negotiating the change in level between pavement and carriageway; the lack of continuity of the pedestrian network, due to many interruptions such as driveways for example, together with the high vehicular speed, that makes crossings dangerous, contribute to make the urban space not accessible. Using a systematic approach, previously tested in another case study area, paths and crossings, with homogeneous characteristics and the same level of accessibility, were classified, considering also theoretical pedestrian flows, in order to define the priority of action and its range (Martincigh, 2012).

## SOLUTIONS FOR AN INCLUSIVE AND ACCESSIBLE URBAN ENVIRONMENT

In relation to accessibility, some strategies and technical solutions were identified by the students, together with the academic staff, of the course "City & Environment" in order to improve the urban spaces of Testaccio district. Design solutions, at low cost but at high social impact as well as at higher added value, were proposed in order to create inclusive and accessible urban environments; also facilities to make easier and more comfortable walking and moving around, to facilitate orientation and the use of public services, without overlooking safety, were considered. Indeed, this holistic approach, meeting various requirement classes, gives an added value to the urban environment, concerning accessibility of the destination (distance and travel time) and accessibility of the path (qualitative and quantitative characteristics).

The most interesting solutions are:

To widen the walkways in order to provide the minimum space required for wheelchair passage and change of direction (90 cm) and for use of the white cane (120 cm), according to Italian legislation (Ministero Lavori Pubblici, 1989; DPR n. 503/1996).

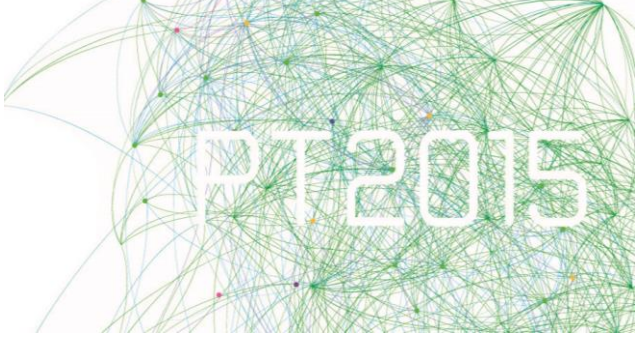
To organize multifunctional walkways, i.e. pavements divided in functional zones in order to provide the space required for different uses, where pedestrian flow is considerable. Every zone responds to a different speed of walking and has congruent width, in relation to flow and activities (Vanderslice, 1998). Referring to the indications of the European research PROMPT and to informal experiments, it can be said that walkways, which host buildings entrances, shop windows and entrances, seats and other equipment for performing various activities for rest and refreshment, need to be at least 5,00 – 6,5 m wide.


**Figure 1: The possible functional zones of a multifunctional pavement and an application in Vancouver (CAN).**

To guarantee a guidance system for visually impaired people, that helps them for their orientation in the space when the pedestrian path is connected with the carriageway or is interrupted by driveways, at bus stops and other public services (Lauria, 1994). To this aim, in Italy, it is widely used the LOGES system (Path for Orientation, Guidance and Safety).

To provide the continuity of the pedestrian network, negotiating or eliminating the discontinuities such as driveways and the various approaches to the nodes i.e. crossings (Mc Millen, 2001). An interesting solution is to design raised crossings that, forcing to reduce the vehicular speeds, make the crossings safer for pedestrians; also in this case adequate signage for visually impaired people was provided (Sanz Alduan, 1999).

Another solution is to provide accessible ramps, with an adequate slope, in order to allow a safe passage for wheelchair users. A good practice to meet the needs of different users is to combine the short ramp, for people with reduced mobility, with




the step, easily perceptible by blinds, when the pavement has to connect with the street level or is interrupted by driveways (Di Sivo et al. 2008).

To design accessible and also comfortable bus stops, providing several elements: lighting that provides safety at night; shelter or well-oriented trees, for shading during the warmest hours of the day, in summer; sign information; ischiatic seating for older people; LOGES system (Argentin, 2000; UTP, 2008).

To design parking spaces along the pavement for wheelchair users. It is considered accessible if it is flush with the pedestrian areas, or connected to them by ramps and it must be properly marked and located next to pedestrian paths and close to buildings or facilities (Argentin, 2000).

To design appropriate and specific furniture for PMR, such as benches with backrest and armrest, with correct height and incline; planters for garden therapy, having appropriate height to be used by wheelchair users (Argentin, 2000; Saba, 1999; Vescovo, 1997).

## CONCLUSION

As already mentioned, a meeting with the Association members, for the presentation and evaluation by the dwellers of the identified solutions, should be soon organized in order to have clear which are the best choices to make. Then, a systematic accessibility plan will be drawn up for the whole district, following the example of the accessibility plans already made by many European cities.

## REFERENCES

Amirante, M. I. 2008. *Effetto città stare vs transitare La riqualificazione dell'area dismessa di Napoli Est*. Firenze: Alinea.

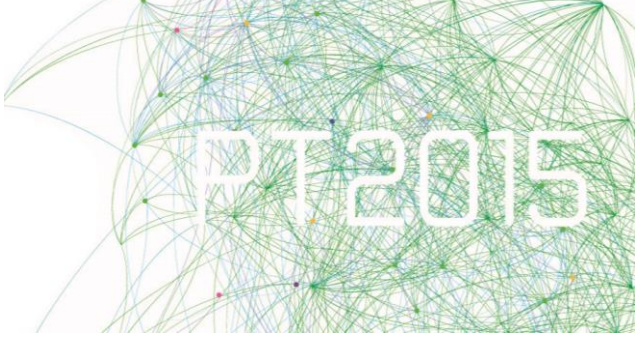
Argentin, I., Clemente, M., Empler, T. (2000). *Costruire le pari opportunità, Quaderno tecnico per progettare e realizzare l'accessibilità*. Comune di Roma, Ufficio Consigliere Delegato per i problemi dell'Handicap: Roma.

Christophersen, J. 2002. *Universal design. 17 ways of thinking and teaching*. Norway: Husbanken.

Di Sivo, M., Schiavone, E., Tambasco, M., 2005. *Barriere architettoniche. Guida al progetto di accessibilità e sicurezza dell'ambiente costruito*. Firenze: Alinea.

Gunnarsson, O. 1995. *Problems and needs of pedestrians*. Goteborg: Chalmers University of Technology.

Istat. 2014. *Italia in cifre*. Roma: Istat.




Last, E. 2005. *Disability and Liveable Environments: disabled users in sub-national governance*. London: ESRC/ODPM.

Lauria, A. 1994. *Pedonalità urbana. Percezione extra visiva, orientamento, mobilità*. Rimini: Maggioli Editore.

Martincigh, L. 2012. *Strumenti di intervento per la riqualificazione urbana*. Roma: Gangemi Editore Spa.

Martincigh, L. 2011. *Mobilità e qualità della vita nella terza età. Indicazioni di intervento per agevolare la fruizione dell'ambiente urbano*. Roma: DEI.

Martincigh, L. 2009. *La mobilità sostenibile: un toolbox per la valutazione dei progetti/Sustainable mobility: a toolbox for design assessment*. Roma: DEI.

McMillen, B. et al. 2001. *Designing Sidewalks and Trails for Access, Part II, Best Practices Design Guide*. USA: Federal Highway Administration, US Department of Transportation.

Ministero LLPP. *Direttive per la redazione, adozione ed attuazione dei piani urbani per il traffico*. Gazzetta Ufficiale n. 146, 24 giugno 1995. Roma: Ministero di Grazia e Giustizia.

Ministero LLPP. *Prescrizioni tecniche necessarie a garantire l'accessibilità, l'adattabilità e la visitabilità degli edifici privati e di edilizia residenziale pubblica sovvenzionata e agevolata, ai fini del superamento e dell'eliminazione delle barriere architettoniche*. Gazzetta Ufficiale n. 145, 23 giugno 1989. Roma: Ministero di Grazia e Giustizia.

Rauhala, K. et al. 2003. *New means to PROMote Pedestrian Traffic in cities – Summary of the PROMPT projects and results*. Rome: Di Virgilio.

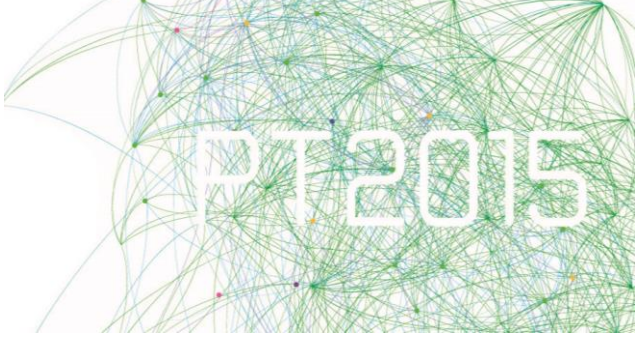
Saba, M. A. 1999. "Proposta per un percorso che renda accessibili i giardini circostanti il Casale di Giovio , Roma" in: *Paesaggio Urbano* 1/1999. Rimini: Maggioli Editore.

Sanz Alduan, A. 1996. *Calmar el trafico*. Madrid: Centro de Publicaciones Secretaria General Tecnica Ministero de Obras Publicas, Transportes y Medio Ambiente.

Steg, L. et al. 2007 "Assessing life Quality in Transport Planning and Urban Design" in: Marshall, S., Banister, D., (ed). *Land Use and Transport. European Research Towards Integrated Policies*. Oxford: Elsevier.

UTP (Union des Transports Publics et Territories). 2008. *Les bus et leurs points d'arret accessible à tous. Guide Methodologique.* Lyon: CERTU.

Vanderslice, E. (ed.). 1998. *Portland Pedestrian Design Guide*. Portland: City of Portland Office of Transportation, Engineering and Development Pedestrian Transportation Program.

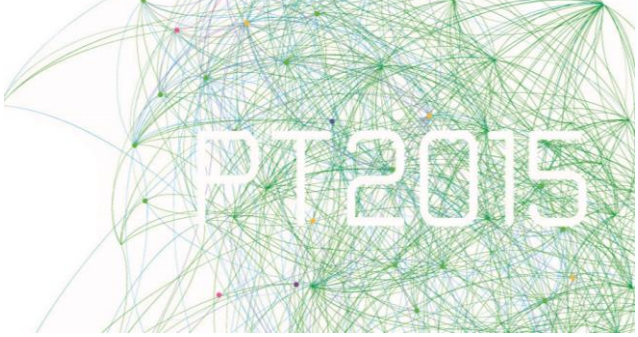



Vescovo, F. (ed.). 1997. *Progettare per tutti senza barriere architettoniche.* Rimini: Maggioli Editore.

www.town-for-all.org (T.T.A.T. Training Tools for Accessible Towns)

DPR n. 503. 24 luglio 1996, "Regolamento recante norme per l'eliminazione delle barriere architettoniche negli edifici, spazi e servizi pubblici." Gazzetta Ufficiale n. 227, 27 settembre 1996. Roma: Ministero di Grazia e Giustizia.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# ECOLOGICAL LANDSCAPE, PHYTODEPURATION AND MANMADE WETLANDS IN MAGOK LAKE PARK, SEOUL

**Cristian Suau**
PhD, Senior Lecturer in Architecture & GPO Co-ordinator , University of Strathclyde, 75 Montrose street, G11XJ, Glasgow, UK, cristian.suau@strath.ac.uk

**Carmelo Zappulla**
PhD, Lecturer, IAAC (Institute for Advanced Architecture of Catalonia), 102 Pujades street, 08005, Barcelona, Spain
GIRAS-TEC, Research group Member, UPC (Barcelona School of Architecture), Av. Diagonal, 649-651, 08028 Barcelona, Spain
carmelo@externalreference.com

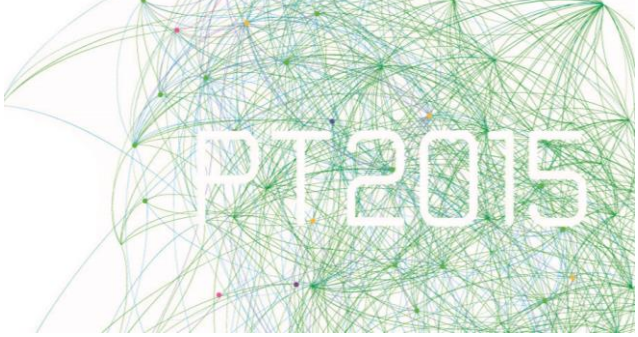
## ABSTRACT

*The right to clean water is a vital resource in consolidated emerging urban economies. Alternative fresh water resources and public wastewater management represent one of the most valuable services. However fresh water requires an adequate and advanced depuration technique: the Integrated System of Phytodepuration (ISP).*

*The expansion of mega-cities worldwide has generated many derelict voids. The proliferation of highly polluted brownfields is a constant characteristic, which is likely to continue and increase in future. If left to fall into neglectfulness and urban inertia, these spaces will have a detrimental effect on local neighborhoods in terms of social health, wellbeing, local economies and environmental qualities.*

*The development of urban parks in urban voids has been generically implemented without environmental and ecological recovery strategies. Waterscape is not just an aesthetic feature but also a decisive element in the production of the space. The construction of manmade wetlands (bio-remediators) offers landscape, ecological and environmental qualities that heals polluted environments.*

*This study explores innovative waterscape systems in the brownfield of Magok basin, Seoul: http://issuu.com/cristiansuau/docs/urban_park_seoul*
*The landscape design scheme reproduces natural self-depurative processes in a controllable environment by taking into account both the strategic location and necessity for ecological remediation. An innovative water-terracing systems (eco-formations) are proposed as water phytodepuration treatment. It consists of offsetting contaminants on wastewater surface, through the establishing of native plants and aeration. These terraces are dwelled by aquatic plants (macrophytes), which reproduce the natural purification processes frequently in humid climates.*




*The development of this "artificial wetland scheme" is based on octagonal eco-formations. They aim to create a social catalyst as well as a healthy environment, providing recreation and amenities combined with the gray water biological and distillation treatments.*

***Keywords**: ecological landscape, eco-urban park, waste water treatment, integrated system phytodepuration, Magok Lake Park (Seoul).*

## INTRODUCTION ON MAGOK LAKE PARK

Transformation is an act or process of changing places. Formal or informal urbanisations are the direct output. This phenomenon of massive 'metapolisation' is physically transforming both urban and rural landscapes by creating diffuse and in-transit habitats. The beginning of the 21st century is defined by the radical urban transformations in Asian mega-cities and specially South Korea. How do the incessant urban dynamics affect the infrastructural quality of cities mainly regarding the right to public spaces and clean water? How do urban parks can transform brownfields into vivid ecological wetlands? This study explores the urban co-existence between restored nature and eco-artificiality of a grand basin along the Han River of Seoul, which analyses the spatial and environmental capacities of the Magok area as an ecological aquatic park through a series of waterscapes, transport structures and building types.

By underlying eco-formations the design scheme offers a distinctive landscape recovery strategy on site. These landforms accommodate an archipelago of ecologies supported by leisure and recreational amenities through water terracing networks. With a complex system of land-transport infrastructure currently being implemented at Magok, the scheme takes a pragmatic bio-remediation approach by utilising the surface water networks, grey water treatment plants and existing slope.

## MAGOK WATERSCAPE FEATURES

The waterscape features are characterised by the following distinctive elements:

A. Water-Transport Connectors

Between the Magok site and the Han River sits the Olympic Expressway, which is the main transport spine that connect the shores of the river. The study alters the expressway water barrier (embankment) by placing a buffer frontage with a system of barrage, sluice gates and fish pass to Han River. The significance of this barrage allows that waterfronts and jetties form a regulated inner navigation plan defined by a central waterway route. The tangible significance of having physical access to the river water is essential from a biological and functional viewpoint. Apart from the Han River gateway, there is another waterway connection between the north and

south basins. From the Yangcheon-gil road, a floodgate, sluice and fish pass is also proposed to bridge the difference of water levels and to stimulate biological migration through the water-transport route.

B. Wetland Buffers

Along the shoreline of the proposed aquatic park, the scheme establishes a transitional zone that deals with rainfall water and surface drainage to purify the wetland habitat close to the urban edge.

C. Water Terracing

The inner waterfront forms a series of variable 'waterscapes' within the site. These distinctive elements, acting as the surface water treatment system, give visual and dynamic attributes to the Magok recovery plan.

The popularity of this segment of tourism, as a branch of the economy has considerably grown in the last decade. Basic causes and motives are noted in the growth of interest in culture; increase of cultural capital; growth of the aged population in developed countries...

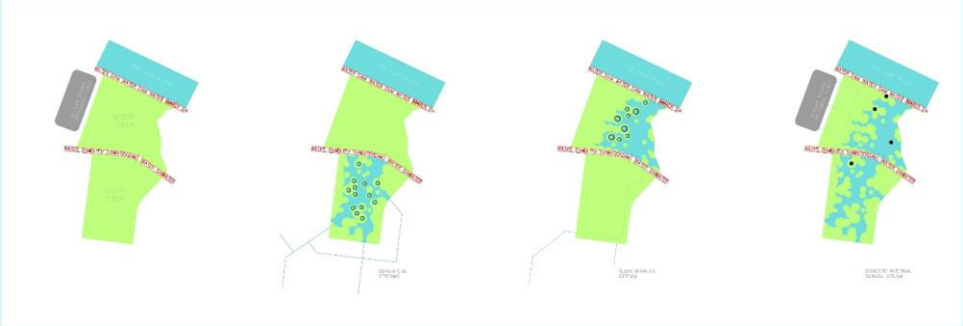
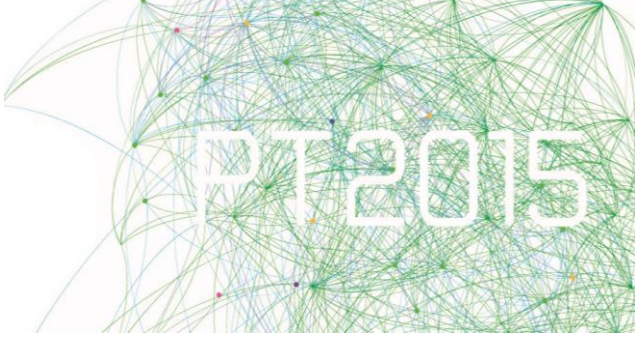


**Figure 1: Waterscape scheme in magOk park. (Source: P. Henshaw, K. Hong, E. Rovira, C. suau, M. Tepedino, N. Toribio, C. Zappulla, 2008).**

## WATER TREATMENT MANAGEMENT IN MAGOK LAKE PARK

The Han River barrage is a key project in the regeneration of Magok Waterfront. It secures freshwater for the whole basin. The barrage is a 24/7 service operated by Magok harbour authority. The change from greywater into freshwater creates a unique public space throughout:




A. The river barrage:

It consists of three sluice gates, two locks which allows drain down of impoundment and migratory fish to pass. It also acts as flood defence.

B. Environmental management of dissolved oxygen:

Water basin requires dissolved oxygen level within the impoundment to be maintained at or above 5mg/l constantly by using water mixing system (pipes, compressor stations, diffuser heads and oxygenation barge).

C. Water quality monitoring:

It consists of digitalised data collection of dissolved oxygen, pH, temperature, conductivity and turbidity from several monitoring stations.

D. Debris/litter management:

Debris deposited in the area is collected and disposed of on a daily basis. Waste is removed from water by using floating bulldozers or water-witches (one tonne scoop lifting capacity). Then collected debris is separated wherever possible for recycling purposes.

E. Han river intrusion:

A standard of low salinity within the inner manned lagoon would be maintained to protect freshwater ecology. River water entering the Magok reservoir via locking operations would be contained within a constructed underwater 'sump' immediately lakeside of the locks to regulate water flow.

F. Migratory fish:

A migratory fish-monitoring programme is set up. Native fish stocks can be monitored and maintained.

G. Aquatic weed management:

Conditions within the wetlands and inner lakes margins are favourable for the growth of aquatic weed. A purpose built amphibious vessel would be deployed for cutting weeds to a maximum depth of 1.5 metres to maintain navigable channels and also allow access to shallow areas for litter control.

H. Wetlands reserve:

Magok Waterfront can be undertaken to further enhancement of the habitats for various fauna in the south and north basin to maximise the potential for roosting and breeding.

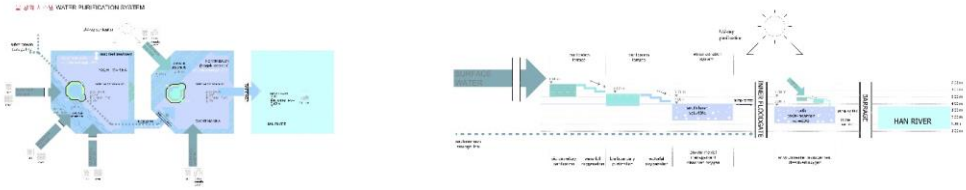



**Figure 2: Water Purification System in Magok Park. Source: P. Henshaw, K. Hong, E. Rovira, C. Suau, M. Tepedino, N. Toribio, C. Zappulla, 2008.**

**Figure 3: Water Treatment in Magok Park. (Source: P. Henshaw, K. Hong, E. Rovira, C. Suau, M. Tepedino, N. Toribio, C. Zappulla, 2008).**

## TRANSPORT STRUCTURES IN MAGOK LAKE PARK

The urban structure responds systematically to the main land-transport network linking Seoul city centre with Gimpo and Incheon international airports. It consists of:

A. Private road system

The core spine is led by expressway supported by a perimeter network of straight and undulating roads, a non-imposing road grid but a scenic by prioritising the natural environment. The scheme reconfigures the Olympic Expressway underground allowing direct visual and pedestrian access to the river front. There is a hierarchy of roads implemented within Magok site and link to existing infrastructure surrounding the site (low-speed streets). The secondary roads that reach water become 'jetty-settlements'. The Magok scheme incorporates a local

network of pedestrian and cycling as part of the low-carbon planning. The Han River frontage offers scenic routes, which are highlighted by attractors such as the cultural zone: development bands; waterbus stops; high-rise towers: and recreational centres.

B. Cycling routes

An integrated cycling network is proposed. The main circuit follows the shoreline of the two lakes linking all programmes. Secondary pathways branch off to connect directly the strategic links within each zone. The scheme envisions an ecological itinerary mainly for resting (like cycling milestones or point) along the central cycling line as a linear public place or corridor in motion between city tissue and marshland. It aims to resolve the current physical disconnections by intertwining wetlands, river and new urban developments. The hard infrastructure consists of info-points (tourist attractions) and pavilion-rotors; public furniture; branding and signage; and line-marking. The soft infrastructure is supported by WIFI tracking; traffic and climatic sensors; and data collectors along the mayor land-transport network; riverside area; and train and airport terminals. The complementarity of hard vs. soft infrastructures allow the programmatic activation of all edge conditions; new capacities and opportunities for smart mobility among every-day residents and tourists. Between the water terracing and islands, a gentle gradients along with varying ecologies from cycling is allocated to connections with major public transport nodes. A rental bike network is implemented in strategic crosses.

C. Public Transport. There are two main internal public transport system:

- Over-ground transport bus service, which follows the internal roads and link with both the train station and the Gimpo and Incheon International airports.

- Waterbus, a central aquatic line connected to bike parking and stops: convention center (south side); old pump station (middle) and the barrage (north side).


**Figure 4: Integrated public land-transport network. (Source: P. Henshaw, K. Hong, E. Rovira, C. Suau, M. Tepedino, N. Toribio, C. Zappulla, 2008).**

## ECO-FORMATIONS

The water phyto-depuration landscape strategy is taking shape through 'eco-formations', eco-cells and wetland terraces. This manned archipelago operates twofold: (1) providing recreation and amenities on site but also (2) performing as ecological catalysts of water purification (biotypes of flora, restored soil and water treatment filtration).

A. Eco-cells

Magok Waterfront is composed of polygonal formations that create a landart topography of convexities and concavities. Each base cell unit creates an evocative place reminiscent of flooding rice fields. They are able to purify the grey water of this new parkland.

B. Wetland terraces

The terracing scheme is connected to the hydro-oxygenation farm system. It serves as a purification and drainage organism. It becomes denser towards the periphery where the 'cracks' terminate.

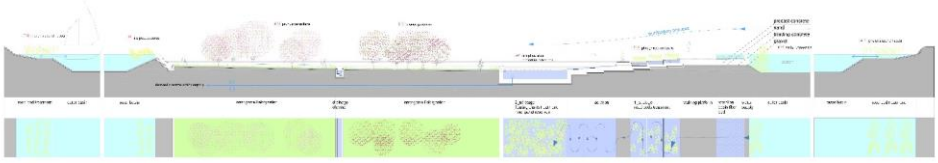


**Figure 5: Details on Eco-formations. (Source: P. Henshaw, K. Hong, E. Rovira, C. Suau, M. Tepedino, N. Toribio, C. Zappulla, 2008).**

## MAGOK LANDSCAPE STRATEGY

The phenomenon of mega-cities worldwide has generated a 'grand paysage' of large derelict voids. If left to fall into neglectfulness and urban inertia, these spaces will have a detrimental effect on local neighbourhoods regarding environmental quality, social health and local economies. Generally the socio-cultural, technologic and economic functions of urban parks offer an improved quality of life; ludic events; enjoyable hobby for relaxation and the deployment of smart landscape technologies. Parklands provide places to play and learn about nature and technologies as well as estimulate people encounters in cities. The implementation of a lagoon supported by a built edge of mixed uses allows a variety of social, environmental and economic benefits. Magok park performs as a catalyst for community actions; produce an improvement in the aesthetics and rebrand stigmatised residual areas; contribute to the green infrastructure of the city; and provide safe public places for future local dwellers. Nonetheless there exist some significant obstacles to developing parks such as the level of soil toxicity in

brownfields. The improvement of water conditions are essential. The amount of specific treated water drained towards the basin contributes to the improvement of environmental water surface and therefore the Han River's ecosystem. The cascading effect of water by gravity originates a diverse terraced waterscape.

A. Water Treatment. It is carried out in three levels: water pre-treatment in upper basin; reed beds (macrophytes) in the both basins and cell purification. The initial water treatment (gravel filter) retains solid materials on water (suspended solids separation); the second water treatment is defined by a system of lagooning separated in diverse channels and reed beds' pools that makes circulate the water slowly. The water oxygenation occurs by cascading the water surface of basins. The third treatment is partly made through the offsetting of nitrogen and phosphorus.

B. Drainage. It is treated and stored in open pools.

C. Vegetation. Native flora has been selected. The plantation array consists of:

- Outer reed beds. In the horizontal flow systems, macrophytes species were chosen (Miscanthus Sacchariflorus; Phalaris Arundinacea; Sparganium Sp. and Typha Orientalis).

- Riparian vegetation: Salix as stabilizers against flood and wind (Gacilistyla; Koreensis; Matsudana; and Purpurea types).

- Inner reed beds: The chosen vegetal filters are Phragmites Australis; Phragmites Japonica and Iris Pseudacorus.

- Drainage vegetation. These species create shaded and fresh corridors: Ulmus Davidiana Japonica (25%); Polulus Euroamericana (60%); Zelkova Serrata (5%); and Sophora Japonica(10%).

- Floating vegetation. Groups of floating vegetation are allocated in all open pools to restored the Nitrogen and Phosphorus balances in major basin.

- Recreational vegetation (gardens). The following aromatic fruit tree species are established in eco-formations: Prunus Avium, Prunus Cerasifera, Prunus Serrulata and Magnolia Grandiflora.

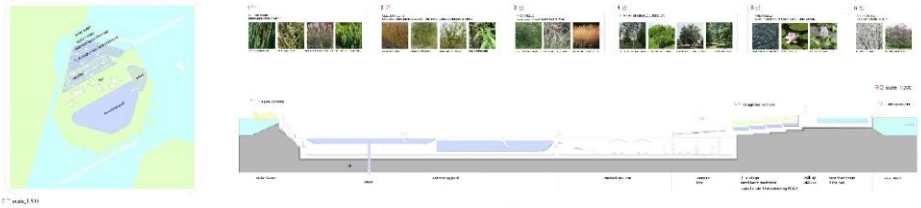
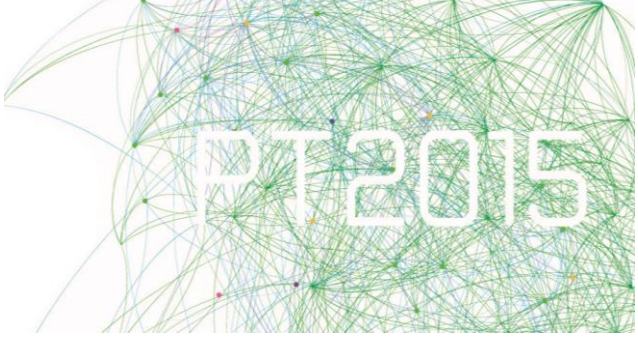


**Figure 6: Magok landscape strategy. (Source: P. Henshaw, K. Hong, E. Rovira, C. Suau, M. Tepedino, N. Toribio, C. Zappulla, 2008).**




## ZONES IN MAGOK LAKE PARK

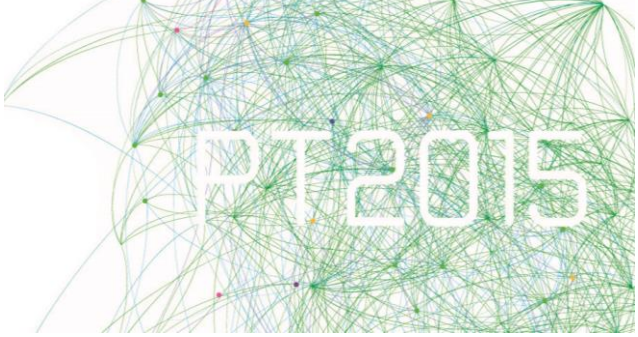
The master plan of Magok Lake Park is divided in five strategic zones:

### Zone A. The barrage (floodgate)

Zone A connect the Magok basin with the Han River. The Han River's highest water level (200 years frequency) is +12.31m, and the Olympic Expressway riverbank is approximately +14.00m. The managed water level of the Magok Waterfront for flood control is about 3.70m - 6.00m. The barrage control the vessels access; and water supply and quality's. management. The sewer lines lain along the Olympic Expressway have been adjusted to 0.5m for the entering of ships. The location, shape, size, and design of the floodgate takes into account urban and nautic communication; flood hazards and landscape amenities. It constitutes a landmark, which provides distinctiveness and symbolism. At ground level (+14.00m), there are an internal road, pedestrian and bicycle paths along the dyke of the Han River. The barrage is able to prevent the backflow of water 3.70m above the normal water level in times of heavy rain and increased water level (vessels are not allowed to operate during heavy rainfall). As result, this master plan offers an altrenative subterranean pass of the Olympic Expressway along the Zone A (the construction of a new pump station on the barrage is required).

### Zone B. Magok reservoir and eco-formations

It consists mainly of new waterways and wetlands established in the north basin (Magok reservoir) well connected to Zone C, the Lake Park. The basin stores circa 200,000M3 of water. The waterway allows waterbus and large-size vessels to navigate along the lake parks allowing an intermediate zone –wetlands- as ecological and recreational formations along the inner shore, which change according to higher or lower water levels resulting from flooding or dry seasons. Magok reservoir is a leisure area, fully accessible by Seoul citizens and marina users. The vegetation of the outer zone of the waterside areas does not interfere with the flow of the water into the reservoir in the event of flooding. Marinas are allocated along jetty settlements. The main waterway -which connect the south side (Metro stations' junction) with the barrage- allows the pass of passenger waterbuses. Three waterbus stops have been purposed: two in Zone C and one in Zone A. The 'eco-formations' –mini wetlands that perform as water purifying buffers- are shallow. They filter all surface water. The Magok reservoir establishes a mutual relationship between the wetland and dockland along the shore, in terms of specific urban interventions; scenic views; and seasonal recreational activities. Its waterfront considers pedestrian and bicycle routes in Zones B and C.




**Zone C. The Lake Park**

The Zone C consists of the Lake park, inner floodgate and development areas. The Lake park is located within Zone C and acts as the core of the Waterfront. The reservoir stores about 130,000M3 of water. The Lake park is an open air space for leisure. It accommodates various activities like water games; cultural follies; sports and recreational pitches; resting points and walking paths.

Inner floodgate: The main waterway for passenger boats and vessels connects the south side (Metrostations' junction) with the inner floodgate and the barrage. The waterway allows waterbus and large-size vessels to navigate along the lake parks allowing an intermediate zone as ecological and recreational formations along the inner basin shore. The Lake park is also a leisure area, fully accessible by residents, visitors and marina users.

The Lake park establishes a mutual relationship between the aquatic programme along the basin shoreline, marinas and dockland as well. Temporary and seasonal outdoor activities (marina club, cafes, and booths) are introduced along the waterfront.

The Development areas contain the built programme along the edge of the Magok Lake park. They are mid-rise continuous bands of retail, recreation and culture programmes, which are adjacent to the main transport nodes. The oeverall programme consists of a convention center; hotels; office development; restaurants; shopping mall; SMSs and retails. They are linked to the exhibition centre of Magok. Buildings allow permeability into the waterscape through green roofs and walkways directly oriented to the Lake park.

**Zone D. The Water Treatment Plant**

Zone D is a part of the existing Seonam Sewage Treatment Plant area. The redevelopment plan of Seonam Sewage Treatment Plant shrank its footage to half area, creating available spaces for new development. The complementary new programme consists of an exhibition hall; museum; office development; restaurants and retails; and aquarium. The vacant water tanks are reconverted to accommodate aquatic fauna and diving training.

**Zone E. Gayang Power Station**

Zone E is the site for energy infrastructure to allocate the Gayang substation, waste incinerators and heat fusion generators. The infrastructural Zone E remains subterranean or semi-sunken and covered by greenfields. The former Yangcheon pump station is a listed building, which has been rehabilitated. The Gayang Substation is to remain in its current location.

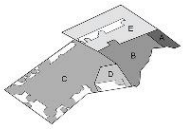
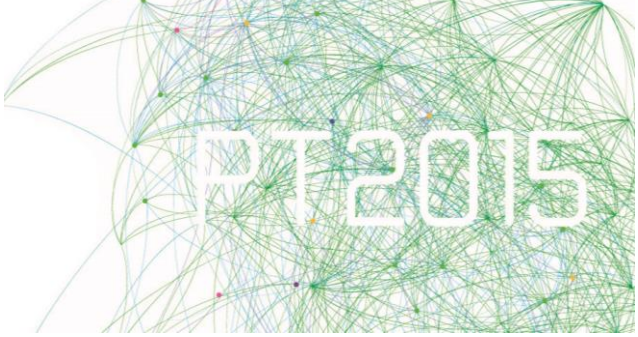



**Figure 7: Zones in Magok Master Plan. (Source: P. Henshaw, K. Hong, E. Rovira, C. Suau, M. Tepedino, N. Toribio, C. Zappulla, 2008).**




## CONCLUSION: SYSTEMATISING LANDSCAPES

Whilst we still consider nature as a 'picturesque' or manned-made detached reality, we will never understand its complexity in-depth. Separating manufacturing production from nature provokes the interruption of a prolific dialogue between human technology and environment in transformation.

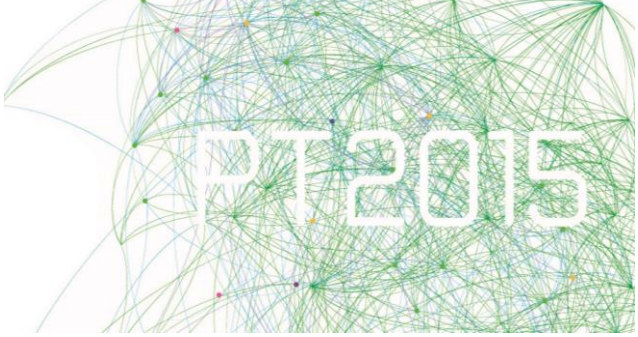
There are many evidences to suggest that humans are changing the ecological and climatic systems, therefore this dialogue is mandatory.

Every place should be seen as a landscape, either natural or artificial. The Magok proposal considers the landscape no longer as a neutral or passive canvas in which artificial objects or architectonic figures are placed. Our proposal aims to form a territory of co-existence between nature and artificiality. We consider landscape as a whole wherein architecture, infrastructure and services interact with all elements and utilizing them in defining a new urban area. In doing so, a new landscape - whose boundaries between artificial and natural are diffuse- has been invented. In the construction of a systemic landscape –geometries and elements in relationship- interact with knowledge exchange and bio-techniques in a multi-disciplinary way: Urban strategy, environmental engineering, ecology and architecture to facilitate the variety of scales within the urban and topographic support. Fractal geometries allow us to integrate all the constitutive elements organically, from the territorial to the local scales. In doing so, the design DNI starts from an octagonal unit cell, throughout processes of repetition, fragmentation, scaling and merging. By generating an adaptable tissue, these proto-structures –ruled by its own internal organisational order, amalgam all key design parameters. The use of constant patterns at different sizes and scales generate self-identity. The tissue is the result of the assemblage of identical cells. Therefore the geometric manipulation of these cell-types forms the systemic landscape by generating the inner shoreline and floating platforms in which all the function are placed. This fractal landscape houses both water purification and management systems constituting a new form of sustainable nature where ecologies –food flows between flora and fauna- are strengthened the recovery of this brownfield basin and the Han River.

## REFERENCES

External Reference Architects, 2008. *Magok Lake Park*, Jarvenpaa, Accessed April 16, 2015.
http://externalreference.com/project/jarvenpaa/
http://externalreference.com/project/magok-lakepark/

Ferrara L. et al. 'The use of aquatic plants in the correction water pollution from chemical agents, absorption of zirconio and cadmium'. *Bollettino della Società Italiana di Biologia Sperimentale.* LXI (9) 1985, 1343-8.




Hamdy, A., and V. Sardo. 2000."Phytodepuration of urban wastewaters: III-infiltrating phytodepurated wastewaters into soil columns: response of soils and waters." *Special session on non-conventional water resources practices and management and Annual Meeting UWRM Sub-Network Partners.*. Mediterranean Agronomic Institute.

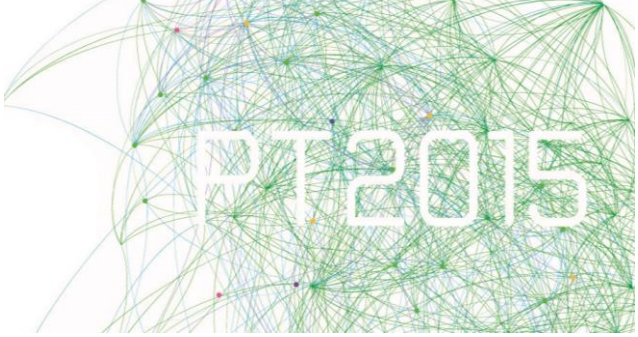
Keddy, P. A. 2010. *Wetland Ecology: Principles and Conservation*. New York: Cambridge University Press.

Manfrinato, E. S., Filho, E. S., Salati, E. 1990."Water supply system utilizing the edaphic-phytodepuration technique." *Constructed Wetlands in Water Pollution Control. Proceedings International Conference on the use of Constructed Wetlands in Water Pollution Control, Cambridge, U. K.*

Mitsch, W. J. et al. 2009. *Wetland Ecosystems*. London: Wiley.

Weinstock, M. 2010. *The Architecture of Emergence: The Evolution of Form in Nature and Civilisation.* London: Wiley.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# ADVANCED SYSTEMS FOR IMPROVING COMMON HEALTH

**Urška Kalčič**
Technical Assistant, University in Ljubljana, Faculty for architecture, Zoisova 12, 1000 Ljubljana, ursa.kalcic@gmail.com

**Janez Peter Grom**
Assistant, University in Ljubljana, Faculty for architecture, Zoisova 12, 1000 Ljubljana, grom.arch@gmail.com

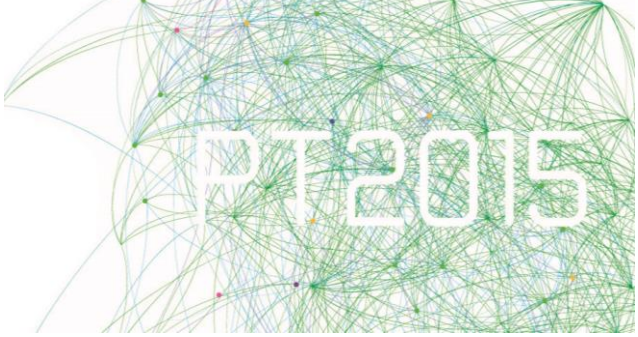
## ABSTRACT

*One of the main problems in the future are the pressures on the planet, as a result of increase in population, increased consumption of energy and other natural resources. In parallel, there will be deterioration in the quality of the biotope (living environment) and for all biocoenosis (living organisms). Qualities of the ecosystems will drastically drop and consequently worsen the health of all living organisms. With the successful coordination of the needs of people, taking into account the requirements of the environment and sustainable development principles the new human interference can be placed unobtrusively, maintaining all the qualities of space without thereby affecting the ecosystem and the image of the environment.*

*The solution is to improve common health with keeping the environment potential full functioning. The thesis on how to achieve this final result is built on the education of future generations and investing into new technologies. The next step is to invest in environmental knowledge for all people, with an emphasis on the awareness of children. The future stands on objects that are technologically advanced and environmentally neutral, and in buildings which provide environmental learning. To be more precise, the future is to invest in the development of laboratories which can explore new technologies and later on provide the development of a system having zero impact on the environment.*

*Advanced technological systems that are progress friendly to the environment, seems to be the solution. One of such approaches imitates the natural cycles of the biosphere the so-called bio cybernetics laws described by Frederic Vester. It is an imitation of natural cycles, projected on anthropogenic processes. The modern term referred to the principles by the C2C - cradle-to-cradle cycle of circulation of substances, which is represented as a waste as food.*

***Keywords:*** *Frederic Vester, cradle to cradle, architecture of laboratory.*



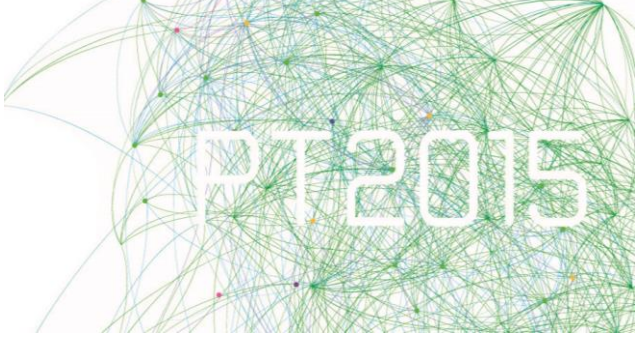

## INTRODUCTION

Most population of western culture tends towards the living of ideas proclaimed through aggressive TV broadcasts. Not knowingly living comfortable live due to the latest technologies. At the same time most of western population forgot what human nature is and what human body really needs for full functioning. The world's economy tends to maximize earnings and quantity of products, to achieve economic success, and forgets about quality products. Economy which tends to exclusively maximize its monetary profit has a negative impact on the user and the environment in which the user lives and the environment in which a product is made.

Every individual, no matter its position in the society, isn't thinking about the common good. The individual comfort and personal benefit is the driving force behind modern ideological standards. Rarely somebody rejects the materialism of our social reality in the singular and mostly isolated hope to make a difference. Global warming, deforestation, water pollution caused by massive oil spills from tankers and oil platforms, these are the problems that are difficult and very reluctant to associate with our own responsibility.

Over millions of years the evolution formed the vibrancy and diversity of the living planet. The result was a perfect balance between biotope (living environment) and biocoenosis (living organisms). Each species has a role and contributes to the harmonious functioning of the Biosphere. We humans are interfering with the complex system of the environment, by the insertion of artificial systems, such as roads, factories, power plants, agricultural cooperatives, villages, artificial lakes and a further myriad of environmentally undated systems. Systems have been roughly inserted into the ecosystem, without understanding the complexity of its functioning and its internal synergies. Artificial systems are rarely based on balanced concepts, respect and equality, because they are almost exclusively subjected optimisation, measurable only by financial perspectives. Despite the first impression that the systems are successful, in the long term, we can notice that the synergies between them do not exist, and each system operates as a predominant parasite to the other. If cross-system symbiosis is not provided than it also cannot create by itself.

The imbalances of natural systems – ecosystems are causing extinction of the biotope and biocoenosis and destroying the natural balance. Vester (1991) think supply ecosystems are supportive ecosystems of life on planet Earth. These supply ecosystems balance the continuous interaction between organisms, population, communities, and their chemical and physical environment. These interactions cause multiple ecological resources and services that are also essential for the preservation of human society. These are services of the environment, such as the circulation of substances and other natural processes, which devalued environment puts back to the original - a quality condition.




Tome and Vrezec (2010) say that today we are faced with a situation where some species are becoming extinct a hundred times faster than in the past. The only culprit for this is caused by anthropogenic changes. The development of technology has led so far that the individual may have a major impact on the environment. Planet had 2 billion people in 1950; we are now 7 billion (UN, Dept. of Economic and Social Affairs). This is a drastic change. With more and more people, there is more and more impact on the environment. Anthropogenic changes are so rapid that biotope cannot adapt.

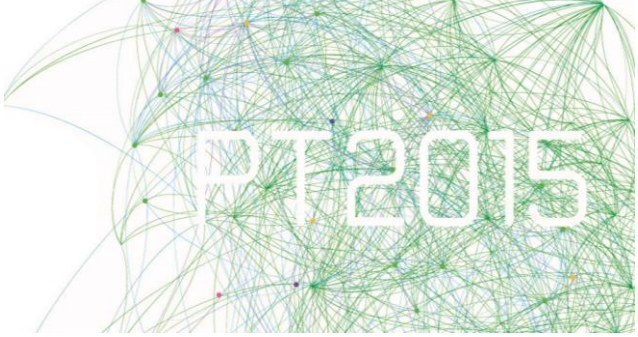
## THE FUNCTIONING OF GEOSPHERE APPLIED ON SUSTAINABLE PROGRESS

Sandifer and Sutton-Grier (2015) write about it has long been recognized that human health is markedly affected by environmental conditions. Nebel and Wright (1998) think the principles of human life should be created through the study of natural ecosystems.

Vester (1991) speaks about it would make sense to approach the laws of nature to achieve a level of human health and well-being (biocybernetics) and include them in the development as desired goals. Taking into account the requirements of the environment and sustainable development principles would be a further step. The concept of sustainability assumes in its principles the improvement of the well-being of individuals and the health of the environment. The concept of sustainability is a form of development or progress that provides for the needs of the present population without compromising the capacity of future generations to satisfy their needs.

Frederic Vester is the father of ideas about the application of natural systems to anthropogenic systems. One of the approaches imitates the natural cycles of the biosphere, the so-called bio cybernetics law. It is an imitation of anthropogenic processes on natural cycles. One of the basic laws is the circulation of substances without waste. His concepts were that linear thinking should move to more complex one. It should be reflected in every design and every system should be designed as cyclic.

William McDonough and Michael Braungart were also involved. Braungart and McDonough (2013) applied the concept of material circulation of substances to production processes and products in construction, building and other built environment and planning specific spatial arrangements. They developed the concept of sustainable design, named "C2C - cradle to cradle", which is based on the emulation of the functioning of natural systems - the circulation of substance in nature. This is a cycle of circulation of substance, which is represented as a waste of food.




**RESULTS**

The aplication of these systems is verified in the master thesis: »Concept project of self-sufficient research and education center in the Triglav National Park«. The project is experimental. It verifyies how a certain type of programme and a midium sized built structures bahave in a fragile natural enviroment and what are the mutual effects.

The master thesis approach to solve the problem is to emulate the natural cycles of the Biosphere. All individual components of the system are included in the cradle to cradle cycle of circulation of substances. The application of the principles of "C2C" reflects in the system for treatment of electricity, system for treatment of water, system for treatment of waste, system for treatment of air and it also reflects in the usage of building materials, furniture, food, etc. All is connected and in mutual cooperation and symbiosis

Some chosen systems are more adequately designed locally and some are more rationally and thus more ecologically developed on the regional level in respect of the location on the shores of the Bohinj lake.

### Energy system

The heating system is connected to a local network. The energy is produced by a BIOMASS COGENERATION (SPTE) system that operates on wood chips. 58% of Slovenia's area is covered by forests (Institute for Forest Certification in Slovenia, Accessed April 5, 2015). Only a small fraction of the annual increment is used. The SPTE technology uses residual wood in the form of wood chips that are converted to gas. This gas powers an internal combustion engine that generates electricity and heat. By using a 100% renewable fuel while only leaving minimal emissions the energy is regarded as green. All surplus energy is shared through the regional electrical system.

The transport of wood chips is transported by a snail or rail system from the silos. It is dosed by a cellular barrier to the gasification chamber to avoid additional air to be induced.

The wood gas is cooled in the first phase, then it is filtered and cooled to air temperature and at last it is induced in the SPTE engine unit. During the operation the residual heat of the engine produces hot water and by a generator that is connected to it electricity as the main product is obtained.

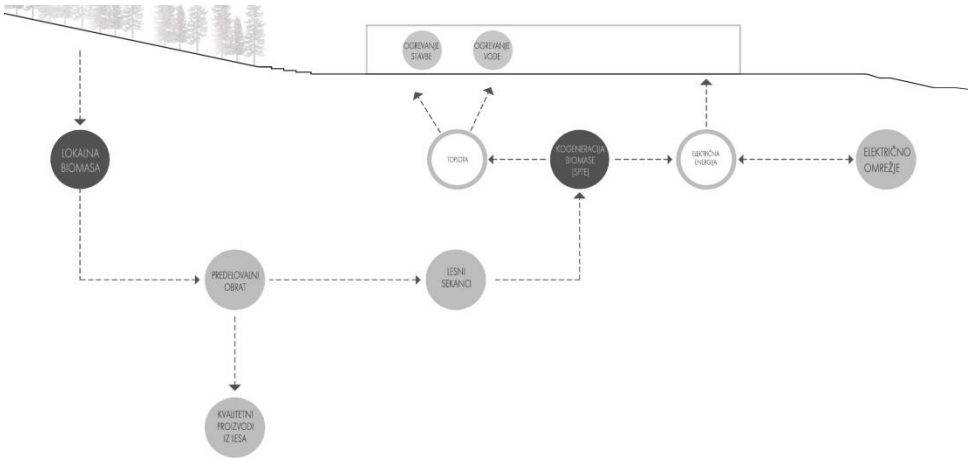



**Figure 1: The process of cogeneration of electricity and heat from wood biomass (SPTE).**

## Water system

The water management system is partially connected to the public network. Non potable water is directly obtained by harvesting rainwater on the roofs of the building. Only primary filtering is adopted here. The water is stored in reservoirs protected from sunlight to avoid the formation of microorganisms. Once used the water is sent to the public sewage system.

## Air system

There is no particular system for the ventilation in the project. Standard solutions are adopted, since there is no need for special filtration. There is the only emphasis on the cooling of the building during the hoot months. This system takes advantage of the basic thermodynamic principles. The buildings are located at the foothill. By positioning a series of air ducts on the slopes of the hill all the way to the top of it, cooled fresh air is harvested through “air catchers” By positioning these air ducts underground where it is cooler; air loses additional speed and gains momentum. It is than directed through regulatory valves and it is additionally manipulated in the engine room where water is added according to need to further cool the air and regulate its humidity.

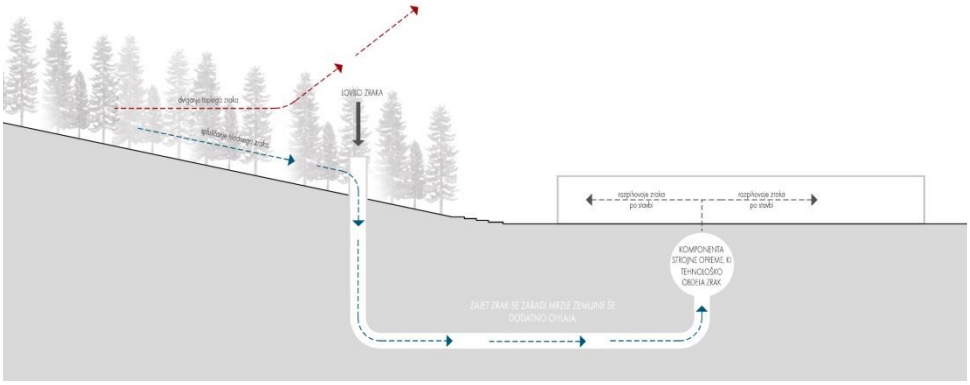



**Figure 2: System of cooling of the building during the hoot months.**

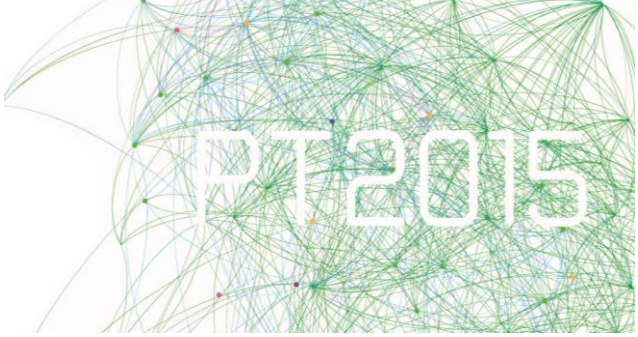
## Waste management

Residual waters are gathered and processed in regional treatment plants. All of the water is returned in the cycle. Solids in this process are used otherwise, as building materials (Cerodit – Bacom technology) or they are sent to incineration plants as energy source. Cerodit is adopted for the facades of the buildings in the project. Residue mud is composted; biogas and fertilizers are produce out of it. Glass, plastics, paper, metals are separated and stored and by adopting the C2C principles are returned to use. Instead of rejecting tools and equipment used in the laboratory work, these is cleaned and processed in autoclaves.

## Materials on facade

Cerodit was chosen as the primary facade material. It is produced by Bacom technology as a zero waste product. 53.700 treatment plants operate within the EU and the EEC. All together they generate 10.042.000 tons of biodegradable muds (Likon, 2009). These muds and sludge are at present deposited in landfills or are burnt or composted or treated to stabilization. All of these technologies have a negative effect on the environment because of the high level of emissions and the low cost effectiveness.

The BACOM technology the biodegradable sludge (obtained from treatment plants) and waste ash are mixed and treated so they can be converted into a cost effective substitute for clay or geo-composite materials suitable to construct watertight layers in building projects. It is possible to cut costs by 90% by the adoption of this technology in the processing of sludge and mud and by 88% in the process of conversion the dry materials. Compared to incineration the greenhouse effect is reduced by 95% (Likon, 2009). The properties of the material can be further improved by adding ashes, cements, lime, mikrosilica, crushed porcelain, casting sand, natural or artificial fibres and different vermikulites. By a careful




selection of additives chemical, geotechnical and hidromechanical properties can be defined according to the future use of the material.

## CONCLUSION

I have understood that only by raising the general wealth being of individuals it is possible to raise the awarnes of the population. Wealthbeing is the base for quality education and health system. Studies indicate that the number of the population will drastically increase in the near future. The needs for food and healty living ambient will be hard to satisfy if changes will not be undertaken. One of the possible answers for a managable future is shown through my project. It is site specific and as such it answers to the energy quenstions of the locum. If such a fragile habitat can be managed that there should be no problem managing less critical enviroments. The tecnologies exist today it is only a matter of combining them and having the will to design the systems and implement them in construction.

## REFERENCES

Braungart, M., McDonough, W. 2013. *Cradle to Cradle: Remaking the Way We Make Things.* New York: North Point Press.

Likon, M. 2009, Bacom, Projekt pretvorbe biorazgradljivih muljev v gradbene kompozite materiale z vmešavanjem alkalnih odpadkov in pepela, http://www.insol.si, Accessed March 15, 2014.

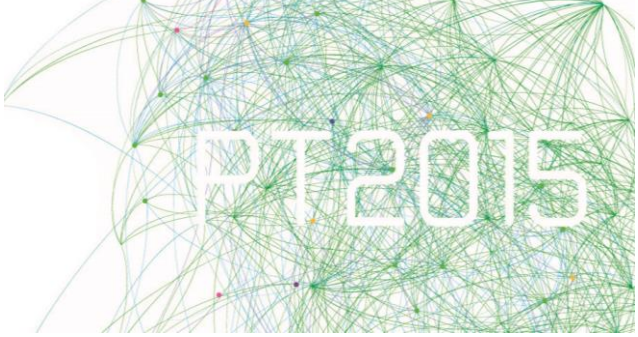
Nebel, B. J., Wright, R. T. 1998. Environmental science: the way the world works. Upper Saddle River: Pearson Education, cop. 2002.

Paul A. A., Sutton-Grier, A.E., Ward, P. B. 2015. Exploring connections among nature, biodiversity, ecosystem services, and human health and well-being: Opportunities to enhance health and biodiversity conservation. *Ecosystem services*, Vol. 12, April 2015, pg. 1-15, doi:10.1016/j.ecoser.2014.12.007.

Tome, D., Vrezec, A. 2010. *Ekologija, Evolucija, biotska pestrost in ekologija, Učbenik za biologijo v programih gimnazijskega izobraževanja.* Ljubljana: Državna založba Slovenije.

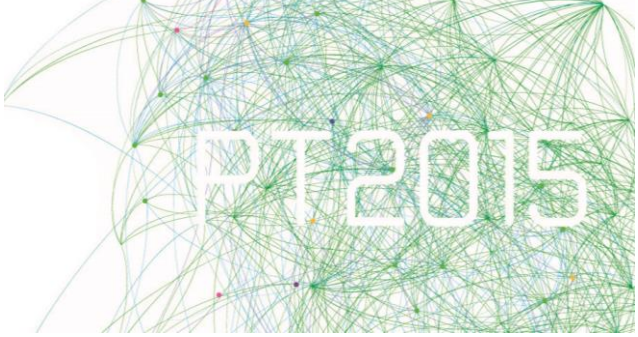
United Nations. *"Report of the World Commission on Environment and Development: Our Common Future - A/42/427 Annex - UN Documents: Gathering a body of global agreements."* Report of the World Commission on Environment and Development: Our Common Future - A/42/427 Annex - UN Documents: Gathering a body of global agreements. http://www.un-documents.net/wced-ocf.htm, Accessed July 18, 2014).

Vester, F. 1991. *Kriza prenaseljenih območij, O razvijanju ekosistemskega razmišljanja*. Ljubljana: Državna založba Slovenije.




Institute for Forest Certification in Slovenia. http://www.pefc.org/component/pefcnationalmembers/?view=pefcnationalmembers&Itemid=48/12-Slovenia, Accessed April 5, 2015.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# INCLUSIVE AND ACCESSIBLE ENVIRONMENT: PLANNING FOR THE FUTURE

**Sankalp Shukla**[1]
Student, Maulana Azad National Institute of Technology, Bhopal, India – 462003
shuklasankalp2@gmail.com

**Apoorva Gangrade**
Student, Maulana Azad National Institute of Technology, Bhopal, India – 462003
apoorvagngrd48@gmail.com

**Anshula Gumber**
Student, Maulana Azad National Institute of Technology, Bhopal, India – 462003
anshulagumber376@yahoo.com

## ABSTRACT

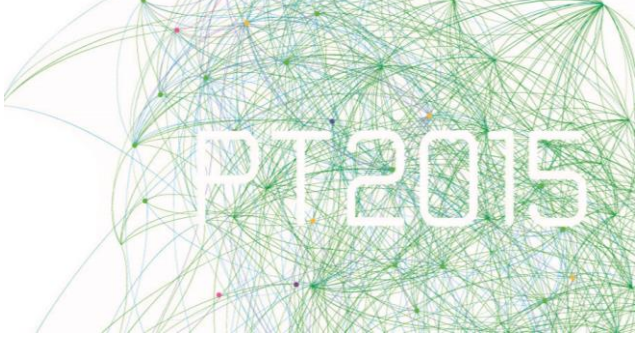
*The dawn of the twenty-first century has been termed as the era of rapid urbanization and population growth. The population is escalating faster than ever before. With the populace reaching the mark of 6.9 billion, about 5% of this aggregate is formed by the persons with disabilities, of which more than 3% percent live in a developing country. It is noteworthy that only one of such fifty persons have access to rehabilitation and appropriate basic services.*

*Society is the basic requirement for all living beings, which originates from the people around us. Each and every organism possesses some unique characteristics, which comply together to form a society. As all parts are necessary for the human body to work, different sections of the society are also required. It is unfortunate that with the growing population, minorities get ignored.*

*The concept of inclusive environment can be considered as a 'unity in diversity'. It involves the creation of an urban structure, which supports the well-being of all the citizens, and gives birth to a sense of belonging in them. Inclusive planning is planning for all sections. It involves the provision of facilities along with their accessibility to the society.*

*The paper enquires about inclusive planning, its significance in the modern world, the need of inclusive planning in growing cities, and tries to analyze how ignorance of facilities can result in serious problems. It discusses about the various segments and practices adopted in them, undertaking cases of cities from across the world. Ultimately, impacts of these practices are evaluated, and suggestive inputs towards policy implications are mentioned.*

[1] Corresponding author




***Keywords**: inclusive planning, accessibility, inclusive environment, practices, policies*

## INTRODUCTION

*An inclusive environment is one in which all users, whatever their abilities, are able to carry out their day to day activities comfortably, effectively and safely without being restricted by the poor design, maintenance or management of the built environment.*

The aim of inclusive planning is to accommodate broadest range of bodily shapes, dimensions and movements. It is the responsibility of the designers and manufacturers that buildings, products and services address the needs of the widest possible audience. A key outcome for inclusive design should therefore be to both alleviate environmental pressure and architectural disability, and also to achieve a greater measure of social equity and justice. However, critics of inclusive design argue that in many cases it is impossible to provide a 'one size fits all' solution. Some people will always get excluded.

**Table 1: An enquiry into the inclusive design.**

| **Special Needs** | **Inclusive Design** |
|---|---|
| Designer client. Persona of a young, fit, active, male, white adult the yardstick for good design | People are individuals, who have different needs and requirements during their life course |
| Older people and people with disabilities are not 'normal' clients | We all have goals/aspirations as well as problems/impairments |
| They have 'special needs' | We share 'generic needs' |
| Micro-environmental approach | Macro-environmental approach |
| Ethos of specialisation and pragmatism | Ethos of normalisation and enablement |
| Tailors the environment so that it is 'just right' for each client group | Extends parameters of design until no one is excluded |
| Telling people what they need | Asking people what they want |
| Does your disability prevent you from using the city centre? | What is it about the design of the city centre that prevents you from using it? |

Benktzon (1993) proposed a 'design pyramid' as a graphic illustration of how to overcome the objection that inclusive design is an unrealisable goal. She divided the population into three broad but unequal bands. At the base of Benktzon's pyramid the large numbers of able-bodied people were placed, the middle layer comprised of people with reduced capabilities and at the top were the small numbers of people with severe impairments, including "people on wheelchairs and people with very limited strength and mobility in their hands and arms". The approach assumes that if products are designed to be used by a particular layer, they will automatically be useable by all those in the lower layers.

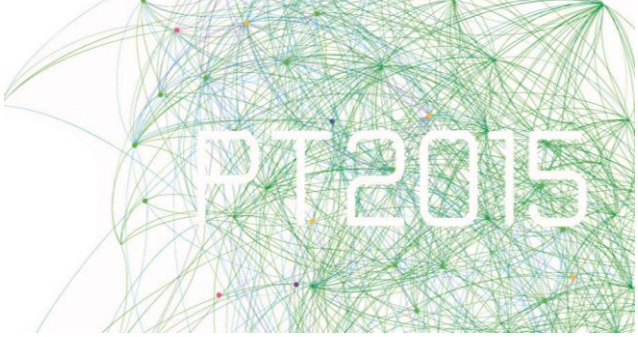



**Table 2: Inclusive vs Non Inclusive designing.**

| Inclusive Approach | General Approach |
|---|---|
| Concern with meaning and context | Concern with style and ornament |
| Participatory | Non-participatory |
| Orientated to people | Orientated to organisations or institutions |
| User-centred design | Owner as exclusive client |
| Low cost | High cost |
| Bottom-up design approach | Top-down design approach |
| Democratic | Authoritarian |
| Seeks to change in design attitudes | Conforming to prevailing attitudes to design |
| Use of appropriate technology | Use of state of the art technology |
| Use of alternative models of the development process | Development process controlled by corporate interests |
| Heterogeneity | Homogeneity |

## PUBLIC TOILETS

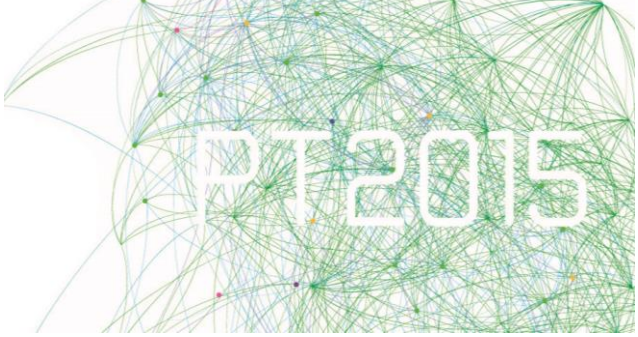
The provision of public toilets is essential. Currently, public toilets are provided only at public spaces or at large scale, for example at railway stations, market places etc. There is need of the same on every kind of space that attracts large amount or comparably large sums of public, like bus stations and also there is need for the provision of public toilets along the bus routes, which are negligible everywhere. There is a need to take action as there is no current policy aimed at addressing the concerns towards inclusive public toilets.

Toilet seats are sometimes too low for the convenience of people who suffer from problem related to the back, knee or hips. People who are ambulant disabled would benefit from grab rails to help them to stay steady, but these rarely form a part of the normal toilet provision.

### Case Study: United Kingdom, 'Public toilets fail to provide easy access'

The service providers in the UK supplemented their ordinary provision by an accessible automatic public convenience (APC). These became unpopular with the general public and their design excluded the disabled. Although, this satisfied the letter of the law, but it was not in the spirit of the legislation.

Purveyors of goods and services to the public who provide a WC for the convenience of their customers will now have to ensure that the disabled customers are also catered for in this respect. This is about to bring a transfer in responsibility for 'away from home' toilet provision from the local authorities to the private sector. Women and disabled people already rely on a 'mental map' of customer




toilets in department stores, supermarkets and shopping centres that afford them privacy, comfort, cleanliness, convenience and dignity.

The existing facilities need to be supplemented by a greater number of accessible toilets, provided and maintained by city centre businesses. In practice, some providers have already adopted a policy of locking their facilities in order to prevent their use by people who are not customers.

## TRANSPORTATION

Transport sector plays a pivotal role in the economic growth of the region. It affects the lives of the people directly. It not only provides connectivity among the areas but also employs a large number of people. Transportation is one of the few facilities harnessed by the people in their day to day life. It is vital for the nation to develop and maintain its transport sector up to the mark for the overall development.

### Case Study: Fukuoka City Subway, Japan

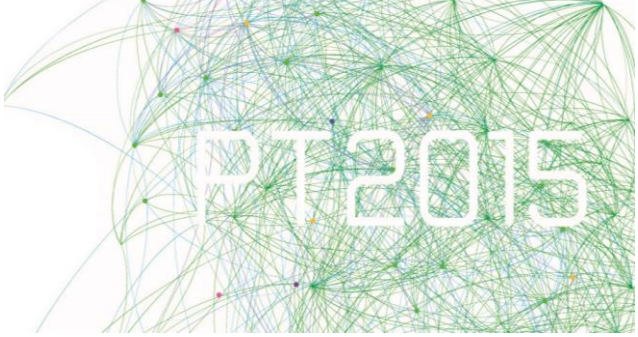
Fukuoka is the capital of Fukuoka prefecture. It is situated on the northern part of the island Kyushu in Japan. According to 2007 data the population of Fukuoka is 1,422,836. This city has the World's first transportation system to be built under the inclusive planning approach. It is considered to be one of the most successful example of inclusive planning in transportation. Not only the physically challenged were considered during the designing, but pregnant women, children, tourists, etc., were also kept in mind.

The measures which were taken included:

- Design of the entrances and exits were deeply worked out. Shortest possible route was selected to reduce the walking time. Escalators or elevators and subway cars were designed at the gates. The difference between the platform and subway cars was reduced to the minimum so that the wheelchair users can climb off easily and safely.

- The height of the ticket machine was kept low so that the wheelchair users could use it easily.

- Doors and elevators are equipped with censors. So that it can be used by the visually impaired. Elevators came automatically and doors are opened automatically because of the censors due to the magnet which is usually on the tip of the cane carried by them.




- Subway was designed in such a way so that its narrowness is not noticeable. Transparent materials were used to bring light and make it visible more spacious.

- Stations were given unique symbols so that everyone could identify them.

- Position of signs were low so that it could be visible to the wheelchair users. Facility of audible signs was also provided.

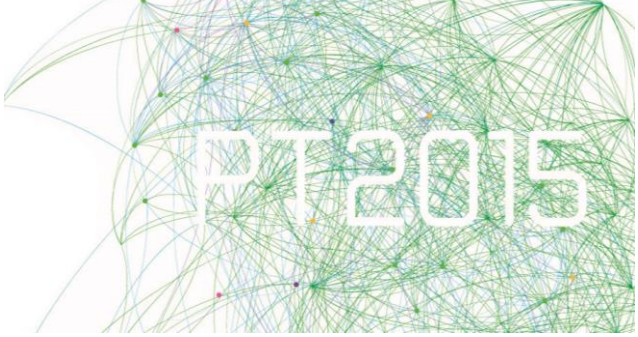
**INCOMPLETE INCLUSIVENESS**

With the twenty – first century coming into wake, the focus has departed from feminism and gender equality towards equality for all. A new wave of inclusiveness can be observed to have struck the entire world. Albeit, inclusiveness is and has been adopted in many cities and countries across the world, a major issue related to it is it's incomplete implementation.

Many cases exist where although inclusiveness has been incorporated, but access to the provided facilities has not been ensured. Examples:

- Indian Railways: Of all the Indian passenger trains running over the tracks, 95% consist of a special coach for the persons with disabilities. This compartment has berths alike any other coach, but larger circulation space and specially designed toilets for the disabled. In spite of the provision of all these facilities, it is extremely difficult for the people to utilize them. The coach is furnished with a regular staircase at the entrance. Hence, a person on a wheel chair is never able to enter into the bogie due to the absence of a ramp. Moreover, insufficient halts at most stations (around a minute or two) make it impossible to access. To add to this, the large of sum of population always keeps the trains packed. The coach for the disabled remains occupied by the normal citizens. Similar situation can be observed in the ladies coach too.

- Public Toilets: In order to improve the sanitation facilities, public toilets are being constructed in many cities across the world. Many a times, they simply disregard the inclusive aspect. In a few cases, even if they adopt inclusiveness, then it is not incorporated properly. The toilets do contain a special section for the disabled, but remain deficit in spaces for mothers with young toddlers and people with heavy luggage. Signage is also not provided towards the use of toilets which should be given for the visually impaired too. Moreover, the toilets have access only through the stairs and absence of ramps. In case for the women, it has been observed that they get forced to pay towards the use whilst the males use the urinals free of cost.




## CONCLUSIONS

According to many, the concept of inclusive cities says that the accessibility of a service must not be denied to the differently abled. Restricting the term just for the disabled neither does extract the real meaning of inclusiveness nor will it be able to provide a real inclusive city to the residents. Inclusive facilities are actually for all whether they are 'normal' persons or 'persons with disabilities'. Inclusiveness in the city provides access of services equally to a child, an old person, a person belonging to the economically weaker section, a person with some physical problem and to a normal citizen, which together constitute the different parts of a city. In this way, the inclusive approach results in the creation of a multi – cultural society.

An inclusive city is a city for all. Demands for such conurbations are rapidly growing in this technological world. With the coming up of the modern era, the dominated mainstream and the other minorities need to be equalized and inclusive planning proves to be a significant step towards this. This study extracts the results for inclusiveness with different parameters in transportation and sanitary facilities. There is still a wide scope of inclusiveness in the other domains too, like housing, education, sports and recreational facilities. There is a serious need to provide an overall access to these facilities so as to make the best use of the given services. Inclusive planning is not demand driven, but is an essential need which must not be ignored. The authorities need to be concerned not only to the provision of services, but also to the provision of accessibility to the same.

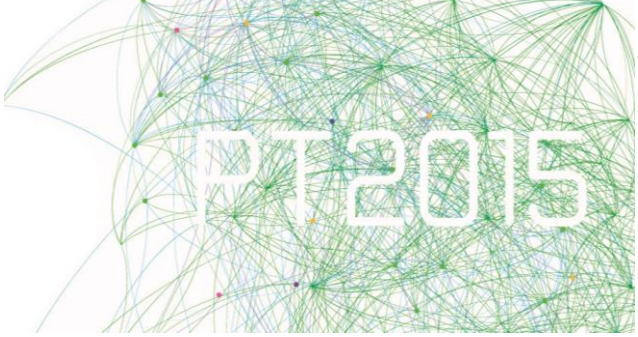
## REFERENCES

Bichard, G. K.-A. (2011). Publicly Accessible Toilets. Royal College of Art . London : Helen Hamlyn Centre for Design .

Case Studies: Inclusive design. (n.d.). Retrieved April 15, 2015, from http://www.inclusivedesign.no/case-studies/transport-fukuoka-city-subway-article150-123.html

Hanson, J. (n.d.). The Inclusive City: delivering a more accessible urban environment through inclusive design. University College London .

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# FACTS4STOPS – USER NEEDS REGARDING PUBLIC TRANSPORT STATIONS AND ENVIRONMENT

**Christine Chaloupka-Risser**[1]
PhD, FACTUM OG, Danhausergasse 6/4, A-1040 Vienna, Austria,
christine.chaloupka@factum.at

**Daniel Bell**
MSc, FACTUM OG, Danhausergasse 6/4, A-1040 Vienna, Austria,
daniel.bell@factum.at

## ABSTRACT

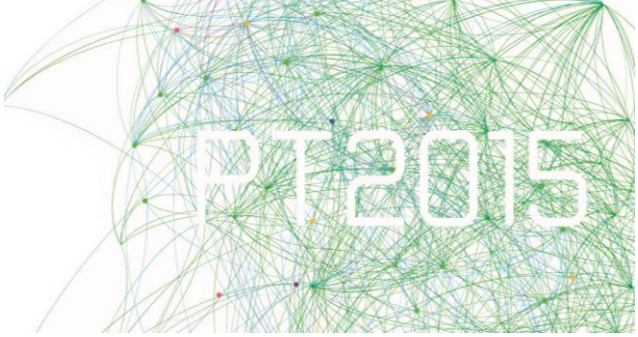
*Within the project FACTS4Stops (**F**acility **A**nd **C**onnec**T**ivity information **S**ervices for public transport **Stops**) an innovative planning tool was developed, which aims on increasing the demand-orientation of public transport stops. Therefore the needs of users within the environment of a stop as well as the local infrastructure (e.g. infrastructure, settlement structure and access paths) are integrated in the identification of measures. These criteria were linked systematically and assessed with Geoinformation-tools. Additionally, it was evaluated, which social media services could be suitable to detect the attractiveness of a stops' environment. Participatory solutions for a cost-efficient quality improvement of future traffic are pointed out.*

***Keywords:*** *public transport stops, barrier-free, demand-orientation, user needs.*

## INTRODUCTION

The public transport share for shopping or private activities in Austria, only 0-4%, is done by public transport. MIV-share, with the exception of urban areas, lies at about 90%. 48% of shopping trips are for shopping only, for more than half of the trips, shopping is a part of a service chain (e.g. part of the working path). To increase the public transport (PT) share in these trip chains the public transport stops have to be analysed with their respective environments and measures to improve the attractiveness for the user (public transport offer, intermodal connectivity, facilities with additional benefits, ...). The settlement structure context of a stop has so far been not taken into account for planning PT stops appropriately.

[1] Corresponding author




Today the development of **demand-oriented** public transport stops for **special user needs (e.g. seniors, handicapped, children, tourists etc.)** is mainly failing due to missing planning tools and a set of information that is not up-to-date.

Traffic planners and transport services require tools to adapt cost-efficient measures for quality enhancement of public transport stops to user demands. Public as well as private facilities need information on how to improve their intermodal **connection** to the public transport system and how to increase attraction for special user groups. Therefore the needs of users within the environment of a stop and also the local infrastructure are integrated in the identification of measures. Intelligent and participatory solutions for a cost-efficient quality improvement of future traffic stops and for new cooperations are going to be pointed out.

Within a project, co-funded by the Austrian Ministry of Transportation in the research-frame of "Mobilität der Zukunft - Mobility of the future", the accessibility of PT stops and the quality of services in the public transport sector have been assessed. Future demographic and spatial developments, mobility requirements as well as barriers and carriage offers in public transport systems have been considered as well.

## OBJECTIVES AND METHODS

In order to **increase the demand-orientation of PT stops** systematically, the aim of FACTS4Stops was an integration of specific user needs and the infrastructure of stops and their environments in information services. FACTS4Stops carried out and evaluated innovative methods and technological components of planning tools for a demand oriented further development of PT stops. By the use of standardized web and social media services the **demand-orientation and accessibility** of PT stops regarding explicitly the environment of a stop was evaluated with a high spatial resolution.

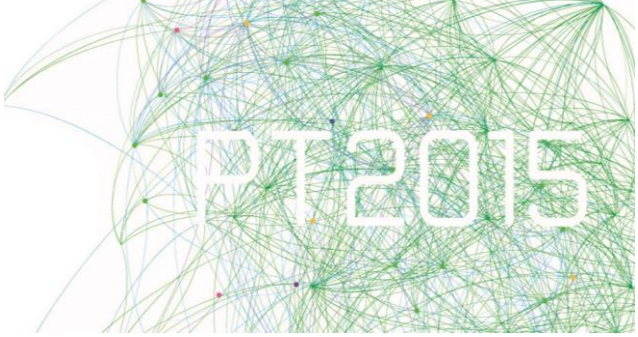
The following innovations were part of FACTS4Stops:

- Integration of the **public transport offering and the environment of stops** in a web-based planning tool,

- Intelligent combination of **spatial requirements** in recommendations on measures,

- Mobile "**PT-community-client"** based on standardized interfaces.

Within the project a specification of various needs for different user groups was developed by using social scientific methods (e.g. focus group interviews, usability tests, interrogations of local people and observations in the field). Furthermore these specifications have been spatially linked by using new analysis and methods




of geographic information processing and joined with data regarding the infrastructure of stops and their environments.

## RESULTS

The integration of social media services broadens the variety of data on infrastructure and keeps it up to date. For the first time integrated planning processes in terms of need-based coordination of infrastructure and public transport are possible.

### User requirements regarding information about PT stops and corresponding environment

To encompass the requirements of different PT user groups appropriately the social environment has been analysed. Therefore relevant user groups have been interrogated in the field in a community close to different PT stops.

The following dimensions have been focussed on regarding user needs considering PT stops and the environment.

- minimum requirements: barrier-free infrastructure, safety, usability; focus on commuters and regular users, reliability of information (e.g. timetable)

- extended benefit: in relation to special purposes of the travel there exist some extended needs regarding amount and content of information (e.g. more POIs,) reliability of information (e.g. time of leave of bus etc.), supply (e.g. food, toilets)

Due to extended benefits there exists the potential to move non-users to try public transport and sustainable affect the modal split even in rural areas with a high level of car availability.

## Assessment criteria for PT environment

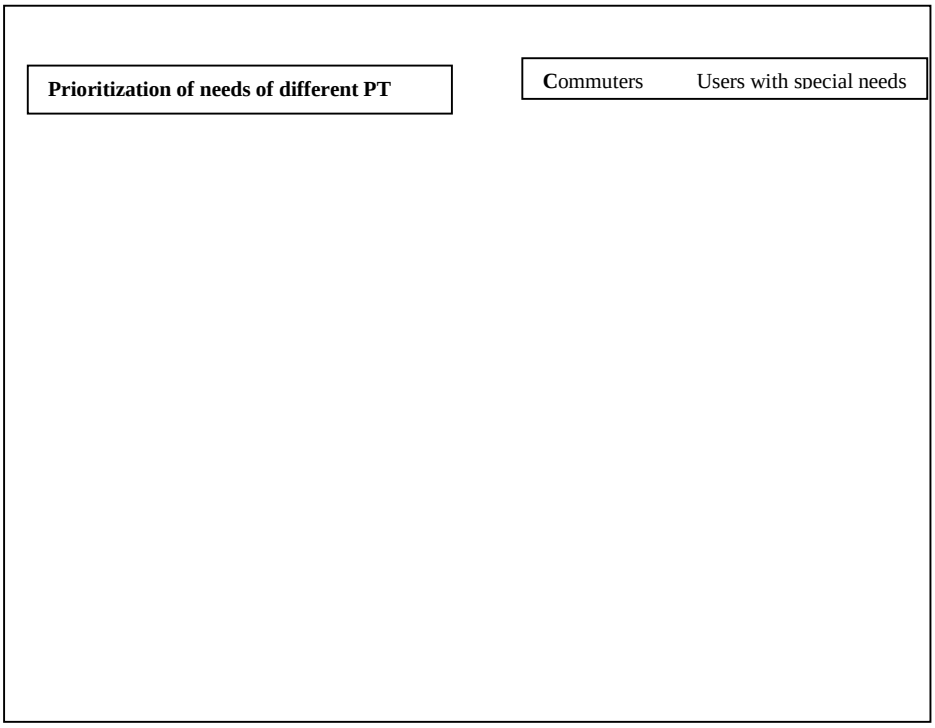



**Figure 1: Scheme of PT environment according to cause of travel and client specific relevance (! … little relevance, !!! … high relevance) (from: Herbst et al. 2014).**

With help of this criteria list an integrated view on the PT stop and the stop environment is possible and allows a user group specific adaptation of the available infrastructure. There could be synergies between standards of facilities at stops as well as infrastructure of the environment, hence providing the potential for residential areas especially in suburban and rural areas to increase the efficiency of providing inhabitants with needed supply services. This also enables cost efficient measures to improve PT connections and information which meet the needs of commuters/ PT-clients. Further on intermodal chains can be improved e.g. because of park & ride places, e-charging stations etc.

## Public transport community client

In FACTS4Stops the suitability of social media services were evaluated to detect the appeal of the stops-environment. In addition, technical integration issues have to be clarified. On the basis of different already existing geoinformations (stops client, Google Places, Facebook Places, OpenStreetMap etc.) a so-called "public transport community client" (PT client) was developed.

The PT community client allows different information e.g. about doctors, ATMs, shops, attractions, special venues to be displayed in the vicinity of PT stops. This information could be evaluated and completed simultaneously by the community.

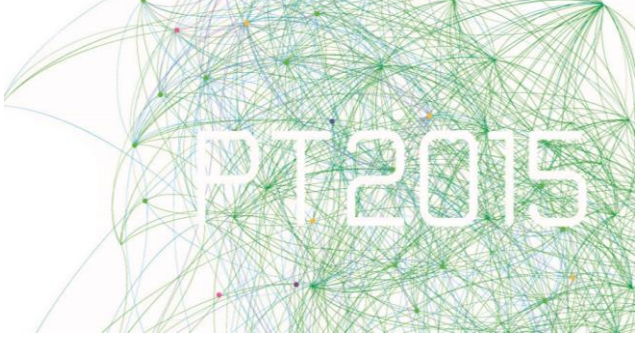
**For example:** If a trip is planned from A to B the screen of a smart phone A) would present the in-time information about busses, leaving a special stop. B) The user of the public means then either could already find some information about the environment of the PT stops (ATM, shop, Café, toilet etc.), how many meters in distance of the stop everything could be found, information about opening hours etc. and as a surplus he/she could give further information and feedback about other shops, POIs or correct the data (e.g. actual opening hours) if not accurate any more.

A) B)


**Figure 2: PT Community-Client (Android), monitor of PT (left) and information (right) related to needs (e.g. eat and drink) in the PT environment (from: Herbst et al. 2014).**

One effect of this PT client has been that commuters could be informed also about not already known facilities in the environment of the stops they use or pass on regular routes and therefore eventually changed their routes or took a break during their trip e.g. to take money from the ATM, go to the toilet (an important aspect for seniors as well as parents with small children). This outlines the potential of such an approach as even frequent travellers on certain routes can be persuaded to increase the efficiency of their trips by utilizing the range of available services.

In addition field tests clearly showed that additional information to regular start departure and arrival times of public transport vehicles are of high relevance especially for specific target groups (e.g. daily commuters, tourists). Moreover older people, younger people and children as well as tourists who have no previous knowledge of an area have needs that do not only relate to the usually provided information (only name of a stop and name of the street, departure time) and in certain scenarios differ considerably from commuters. The ideal public transport stop therefore has to provide a high level of usability and accessibility, support the subjective feeling of safety (unobstructed view and lighting), and provide (weather)




protection and access to reliable and current information. All these further information has to be gathered locally, has to be updated and seems to be useful for gaining new PT user groups. It also can support local dealers because with help of the PT client PT users get more information about shops, cafés, etc. which may be used to overcome waiting times at the PT stop.

## CONCLUSIONS

It is especially important to integrate the needs of all different user groups into both the development and the adaptation process of public transport stops and their immediate surroundings to yield a high level of usability, accessibility and acceptability. By directly involving the different stakeholder groups into the empiric research phase of FACTS4Stops measures to integrate user profiles into information provision services and the potential to change mobility behaviour towards available public transport options have been shown. The results are going to support the integrative planning process of **making public transport more attractive in the sense of meeting the demands**. The project illustrates new, intelligent solutions for a cost-efficient quality enhancement of **PT stops** regarding new possible cooperations (e.g. public planning and local supply).

## REFERENCES

Herry, M. 2005. „Mobilitätsanalyse Stadt Salzburg und Umgebung 2004“. - Wien.

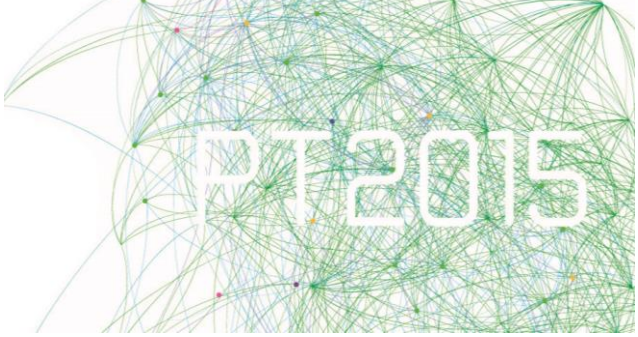
Land Salzburg. 2002. „Leitlinien zur Landesmobilitätspolitik“. Salzburger Landesmobilitätskonzept 2002. - Salzburg.

Land Salzburg 2006. „Mobilität mit Qualität, Salzburger Landesmobilitätskonzept 2006 – 2015“. - Salzburg.

Land Steiermark. 2008. „Das steirische Gesamtverkehrskonzept 2008+ - Wege in die Zukunft“.Steiermark,

Follmer, R., Gruschwitz, D., Jesske, B., Quanst, S., Lenz, B., Nobis, C., Köhler, K., Mehlin, M.. 2010. „Mobilität in Deutschland 2008“. Ergebnisbericht Struktur – Aufkommen – Emissionen – Trends. DLR- Deutsches Zentrum für Luft- und Raumfahrt, Institut für Verkehrsforschung, infas Institut für angewandte Sozialwissenschaft . Bonn, Berlin.

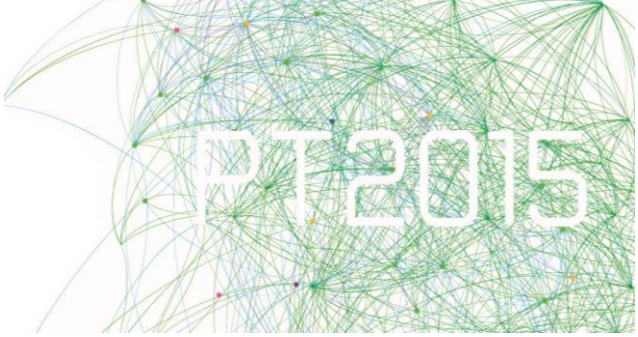
Herbst, S. Bell, D. Zalavari, P. Spitzer, W., Chaloupka-Risser, C., Krampe, S., and Prinz, T. 2014. „FACTS4Stops – Informationsdienste zur bedarfsgerechten Anbindung von ÖV-Haltestelle und Umgebungsinfrastruktur“. Reviewed conference paper. AGIT 2014 – Symposium und Fachmesse Angewandte Geoinformatik; Angewandte Geoinformatik 2014. Salzburg, Austria, 02.07.2014 - 04.07.2014.




# TOPIC VII:

# Environmentally Friendly Transport

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# SHIFTING TO MORE ENVIRONMENTALLY FRIENDLY MODES IN LONG-DISTANCE TRANSPORT

**Aleksandra Nešić**
PhD student, University of Belgrade, Faculty for Transport and Traffic Engineering, Vojvode Stepe 305, 11000 Belgrade, Serbia, aleksandradjordj@gmail.com

**Ivana Čavka**
PhD student, Research and Project Assistant, University of Belgrade, Faculty for Transport and Traffic Engineering, Vojvode Stepe 305, 11000 Belgrade, Serbia, i.cavka@sf.bg.ac.rs

**Olja Čokorilo**[1]
PhD, Assistant Professor, University of Belgrade, Faculty for Transport and Traffic Engineering, Vojvode Stepe 305, 11000 Belgrade, Serbia, oljav@sf.bg.ac.rs

## ABSTRACT

*This paper is focused on environmental pressures from long distance transport. Special attention is given on long distance passenger transport and specific emissions related to modal shares. The paper deals with air transport factors affecting long distance passenger volumes in Europe. Future measures for minimising the environmental pressures of air transport are considered based on ICAO recommendations and EASA regulations. Provided research is based on European improving polices with detailed explanation of three different approaches for measuring emissions in air transport sector. The results and conclusions for the final evaluation are obtained from different environmentally friendly modes.*

***Keywords**: long-distance transport, air transport, modal shares, environmentally friendly*

## INTRODUCTION

Over the last couple of decades all industry segments have been interested in a negative impact it has on the environment, especially transport industry as the biggest polluter. Road transport has been considered as the largest polluter because of a huge number of vehicles. Nevertheless, air transport takes a special place because of its high altitude movement regimes. Since the beginning of the Industrial revolution carbon dioxide concentration has been increased over 30%, natrium oxide for 15% and methane quantity has doubled. According to Kyoto protocol member states are obligated to reduce four gases that are significant for

[1] Corresponding author

greenhouse effect: carbon dioxide, methane, nitrogen oxide and sulphur hexafluoride. Each of the member countries is obligated to submit yearly report with a list of all greenhouse gases, their quantities, sources and reducing measures. Kyoto protocol aims to reduce greenhouse gases emission, to develop appropriate politics and measures by using available mechanisms, to ensure the integrity of Protocol through reporting and auditing and finally to minimize the impact on developing countries.

## LONG DISTANCE PASSENGER TRANSPORT AND MODAL SHARES

Long distance transport occupies a small part in total number of travels in Europe. Long distance traffic includes all transport cases with longitude greater than 300 km. By observing only passenger traffic, it has been found that only 20% of total volume belongs to long distance transport, unlike freight transport where 75% belongs to long distances. Figure 1 shows that majority of rail and road distances are less than 300 km (85%), opposite to aviation and maritime transport (Eurostat, 2000). The number of movements in urban areas is much higher than the number of long distance movements. However, long distance transport (shown in passenger kilometres) constitutes 40% of all transport. Modal share of long distance transport in Europe depends on transport price, travel time and frequency. Despite the fact that for the last four years there is a constant decrease in rail transport demand, in some countries, like Italy, rail transport demand is growing. The economic crisis has enormous influence on air traffic, and as a result air traffic had the record drop in 2009. Since the transport sector is a significant drive force of economic development of each country and that the precondition for that is infrastructure provision, it is important to understand the importance of modal split and environmental preconditions of certain transport mode (Tomić-Petrović, 2012; Galanis and Eliou, 2014).

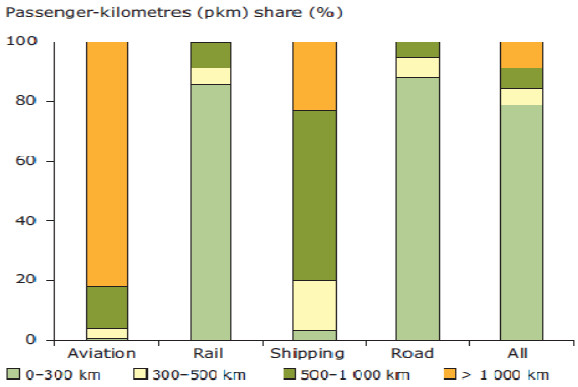



**Figure 1: Passenger kilometres based on mobility surveys in a number of European countries.**

## POLLUTION EMISSION CAUSED BY LONG DISTANCE PASSENGER TRANSPORT

The most frequent air pollutants in transport are $PM_{2.5}$, $SO_x$, $NO_x$, $CO_x$, and NMVOC. In European cities a growing number of diesel vehicles cause $NO_2$ emission and this situation has been caused by favouring diesel over gasoline. Diesel emits larger amounts of $NO_2$ but smaller amounts of CO, NMVOC and PM. For the period from 2005 to 2012, $NO_x$ emissions for long distance passenger transport have decreased by 18% and PM by 15% even though passenger transport increased by 5%. Air transport is only transport mode with 7% increase of $NH_3$ and 9% increase of $SO_x$.

### Predicted pollution emission

For the new vehicle fleet targets are set to reduce $CO_2$ emission. The aim for 2015 is reducing $CO_2$ passenger car emission to 130g $CO_2$/km and 95g $CO_2$/km by 2021. Figure 2 shows specific $CO_2$ emission from passenger transport by mode (EC4MACS, 2013).

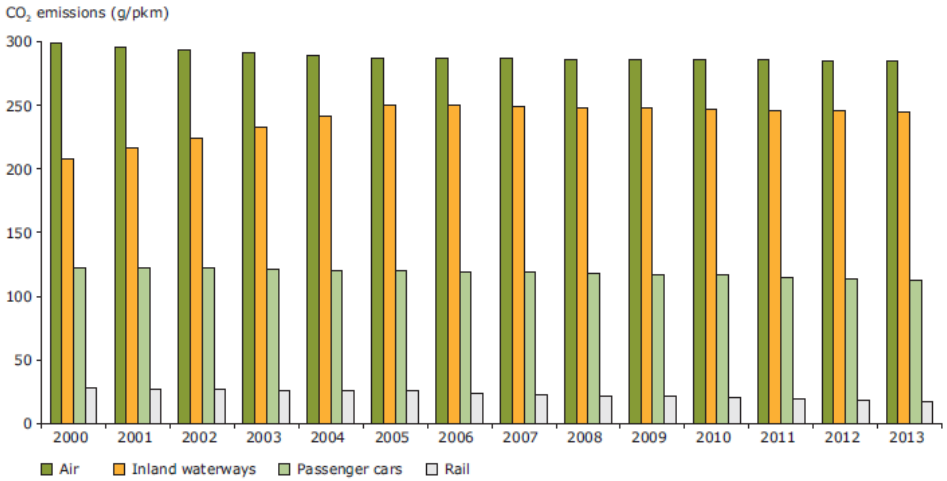



**Figure 2: Specific carbon dioxide emissions from passenger transport modes.**

### Predicted increase in air passenger transport

Factors that have influence on long distance transport, especially air transport, are economic situation, infrastructure availability, population's growth, migrations, transport service development, transport price, technological progress and secondary homes. By (ICAO, 2013), the greatest transport demand is expected in air transport, passenger traffic is expected to grow over the 2010-2030 period at an average annual growth rate of 4.9% (international traffic would grow at 5.1% per

annum and domestic traffic would grow at 4.4% per annum), from 2030 to 2040 the growth is expected to moderate to 4% per annum (Figure 3).

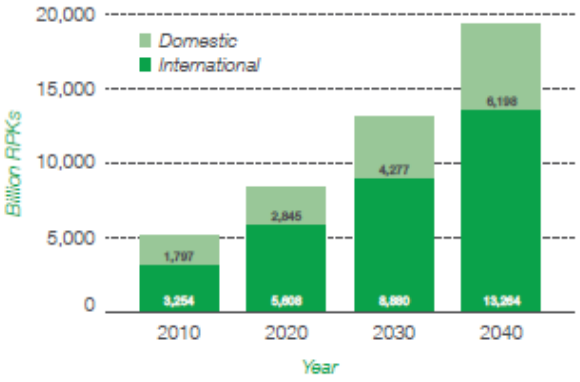



**Figure 3: Passenger Air Traffic Forecast.**

## FUTURE MEASURES FOR MINIMISING THE ENVIRONMENTAL PRESSURES OF AIR TRANSPORT

According to (EEA, 2014) there are three reducing types to minimise the environmental pressures of long-distance transport. *Avoid* measures aiming to reduce the number of travels through regional planning and reducing number and longitude of travel. *Shift* measures aims to transfer traffic form air and road transport to more environmentally friendly modes. *Improve* measures aims to reduce emission of all transport modes by using advanced technologies, modern vehicles and cleaner fuels.

Environmental trends in aviation present the effective and efficient performance of the principal mission of the aviation industry which requires balancing of the numerous challenges, particularly regarding technical, economic and environmental issues, with safety always remaining of the paramount importance (Čavka et al., 2014). The increasing public awareness for future climate changing produces different measures for civil air transport sector pollution mitigation (Mirosavljević et al., 2010b). Contemporary studies are based on developing an air pollution model aiming pollution measuring and monitoring points based on real air traffic (Čokorilo et al., 2010; Mirosavljević et al., 2010a; Mirosavljević et al., 2011a; Mirosavljević et al., 2011b). ICAO deals with Air traffic impact on environment through Annex 16 (ICAO, 1993), defining standards for different aircraft and engine types. There are two groups of regulations, first ICAO and national standards define limits for specific pollution source. ICAO standards and recommended practices refer to aircraft engine requirements related to pollutants emission. National standards define limits for "non-aircraft" pollution sources. Second group of regulations are national regulations referring to allowed pollutant

quantity in local air. (EASA, 2015) recommendations deal with environmental certification of aircraft and related products, parts and appliances, as well as for certification of design and production organisations. All pollution reducing measures could be classified into four groups:

- Regulatory measures (all law and rules required from authorities represent emission standards);
- Technical measures (changing polluters characteristics, vehicles or infrastructure changes);
- Operational measures (measures conducted by operator, airport or Air Transport Company);
- Economic measures (subventions and fees that depend on emitted pollution quantity).

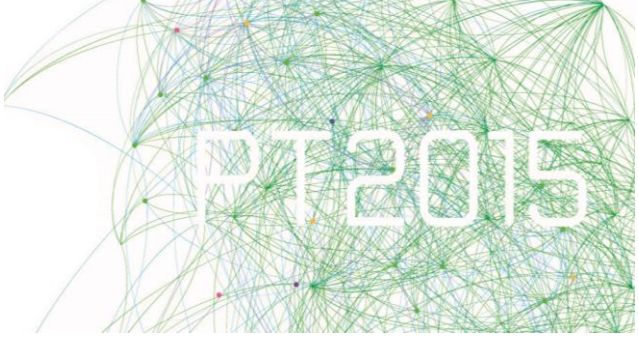
When considering a measure of protection, all the positive and negative sides of these changes must be discussed. The technical feasibility is very important, i.e. that this technology has already been applied somewhere. Therefore it would be of high importance to further develop technology, or make tiny changes, as the economic justification needs to show that these investments will give the expected benefit prior to its implementation. Reducing emission should be contribution to reduction in geographical area and benefits must be evaluated compared to air quality standards. Emission reducing measures could be conflicted with other measure types.

## CONCLUSION

Despite the fact that long distance transport takes small part in total number of travels in Europe, long-distance transport accounts about three-quarters of total GHG emission from all transport. Types and pollutants amounts depend on transport mode. To preserve environment European policy favouring a shift form road transport to rail for medium-distance passenger transport and to rail and waterborne transport for distances exceeding 300 km all EU member states are planning to achieve 10% share in renewable energy by 2020 for all transport modes. There is a plan for transport GHG emission to be reduced for 30% from 2008 level until 2030 and for 60% from level 1990 by 2050. Whether this is going to be achieved depends on multiple factors which define pollution level. Some of these factors are vehicle, vehicle age, fuel quality, infrastructure options, technical achievements, system organization, local and meteorological characteristics.

## REFERENCES

Čavka, I. Čokorilo, O., and Gvozdenović, S. 2014. "Flightpath to an environmental friendly air transport." In *Proceedings of international academic conference on places and technologies*, Belgrade, April 3-4, 2014, pp. 1020-1028.




Čokorilo, O., Gvozdenović, S.,. Vasov, L., and Mirosavljević, P. 2010. "Impact of Aircraft Emissions on the Environment." *Journal of Applied Engineering Science*, 8(3): 123-138.

EASA. 2015. ICAO Aircraft Engine Emissions Databank. Last modified January 2015. Accessed March 1, 2015. http://www.easa.europa.eu/environment/edb/aircraft-engine-emissions.php/.

EC4MACS. 2013. European Consortium for Modelling Air pollution and Climate Strategies. Last modified January 2013. Accessed March 1, 2015. http://www.ec4macs.eu/.

EEA. 2014. *European Environment Agency Report: Focusing on environmental pressures from long-distance transport*. Luxemburg: Office of the European Union. p.108.

Galanis, Athanasios and Eliou, Nikolaos. 2014. "How Future Technology in Road Transportation Could Create a More Sustainable Built Environment?" In *Proceedings of International Conference on Traffic and Transport Engineering*, Belgrade, 27-28 November, pp. 512-516.

ICAO. 1993. *ICAO Annex 16, Volume II Aircraft Engine Emissions*. Montreal: International Civil Aviation Organization. p.65.

ICAO. 2013. *International Civil Aviation Organization Environmental Report: Aviation and Climate Change*. Montreal: International Civil Aviation Organization. p.212.

Mirosavljević, P., Gvozdenović, S., and Čokorilo, O. 2010a. "The Turbo Fan Transport Aircraft Air Pollution Emission Footprint." In *Proceedings of 13th International Conference on Transport Science ICTS 2010*, Portorož, Slovenia, 27-28 May, pp. 1-10.

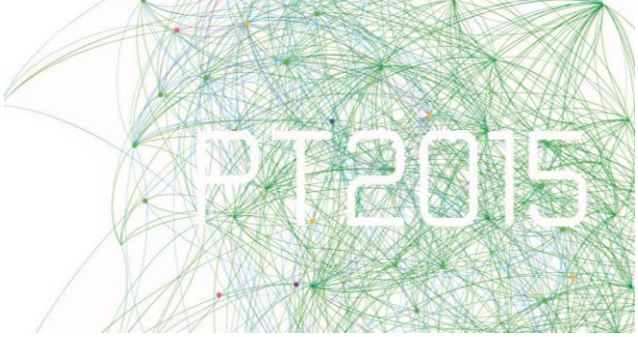
Mirosavljević, P. Gvozdenović, S. and Čokorilo, O. 2010b. "The Transport Aircraft Pollution Cost Reduction Strategy." *FME Transactions*, 38(4): 157-166.

Mirosavljević, P., Gvozdenović, S., and Čokorilo, O. 2011a. "A Model of Air Traffic Assignment as Part of Airport Air Pollution Management System." *Aviation*, 15(4): 92-100.

Mirosavljević, P., Gvozdenović, S., Čokorilo, O. and Vasov, L. 2011b. "The Turbofan Transport Aircraft Pollution Calculation Software." In *Proceedings of the International Conference on Climate Friendly Transport*, Belgrade, Serbia, 16-17 May, pp. 379-396.

Tomić-Petrović, N. 2012. "Transportation and Environmental Protection - Challenge for the Future." In *Proceedings of International Conference on Traffic and Transport Engineering*, Belgrade, 29-30 November, pp. 461-464.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# ASSESSING PUBLIC TRANSPORT EFFICIENCY IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

**Evgenia Yosifova**
BSc Urban Planning, Master student in Urban Planning at HafenCity University, Hamburg, Überseeallee 16, evgenia.yosifova@hotmail.com

## ABSTRACT

*This paper is focused on the urban aspects of the organization of public transport systems and was defended as a Bachelor thesis in 2013 at the University of Architecture, Civil Engineering and Geodesy in Sofia, Bulgaria.*

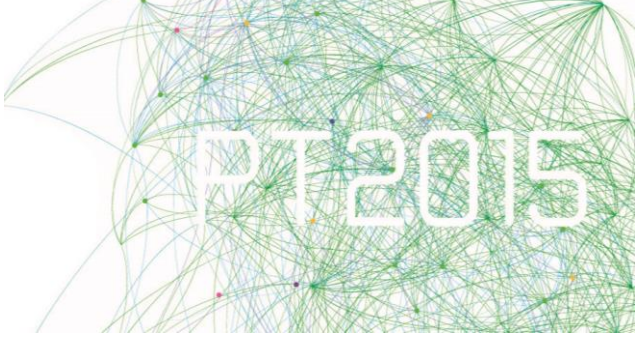
*The negative impact of contemporary transport tendencies on the environment and human health requires taking immediate actions in the direction of sustainable development. Sustainable transport is part of the political agenda of all member states of the European Union and the development of public transport is recognized as an essential instrument for achieving sustainability. In this context appears the need for a methodological approach for assessing the efficiency of public transport systems.*

*Experts in the field of management claim that one cannot manage what cannot be measured. What is measured, how it is measured and how the results are presented affects the way in which problems are evaluated, prioritized and respectively what tools are applied to solve them.*

*Therefore, an initial evaluation of condition and efficiency becomes crucial for the management of public transport systems. The assessment of the public transport system within one of Sofia's districts (taken as a case study) included three main stages: clarifying the goals and objectives of sustainable transport in the context of the particular area, identifying appropriate quantitative indicators and setting benchmarks, measuring the progress of the given public transport system towards sustainability.*

*This methodological approach allows finding the weaknesses of the public transport system within the studied area. Thus, political instruments and financial resources can be directed more effectively towards achieving concrete, quantitatively measureable goals.*

***Keywords**: sustainable development, sustainable transport, public transport efficiency, quantitative indicators.*




## INTRODUCTION

Public transport efficiency is essential for achieving sustainability in European cities. However, in order to increase efficiency, politicians and planners have to be informed about current weaknesses of public transport systems so that they could become the target for future interventions. In this respect, an assessment approach has to be invented. Furthermore, it must be ensured that the three different aspects concerning sustainable development are going to be taken into account – ecological, social and economic. In an effort to come up with such an evaluation method, *Triaditsa*, a district in the city of Sofia, Bulgaria, was taken as a case-study.

## INTEGRATED APPROACH

An integrated approach was adopted in order to analyse various urban aspects of public transport and assess how efficient its organisation in terms of sustainable development is. Table 1 presents these goals and objectives of sustainable public transport, which fall under the professional responsibility of urban planners, whereby they are categorised under the three aspects mentioned above.

**Table 1: Goals, objectives and indicators of sustainable public transport.**

| Goals | Objectives | Indicators |
|---|---|---|
| **Ecological aspect** | | |
| ➢ Prevention of noise pollution | ➢ Limiting exposure of the population to traffic noise | ➢ % of the total population exposed to noise pollution |
| **Social aspect** | | |
| ➢ Social development | ➢ Promoting the use of public transport: | |
| | • accessibility to public transport | ➢ % of the total population living within a radius of 400-500m to a public transport stop [1] |
| | • accessibility to social facilities and recreational areas | ➢ % of the total population with access to social facilities and recreational areas by public transport without the need of transferring |
| **Economic aspect** | | |
| ➢ Economic productivity | ➢ Improving the accessibility to the other districts of Sofia | ➢ % of the total population that can reach the district's exit points by public transport without transferring |

[1] Regulation No. 2/2004 by the Ministry of Regional Development, article 17, paragraph 3

## ANALYSIS AND ASSESSMENT

All of the indicators presented in Table 1 were thoroughly explored in the spatial context of Triaditsa. After the analysis, an overall assessment of public transport efficiency in the studied area was conducted. This allowed to make an informed decision about what type of interventions – spatial and others (e.g. "soft measures") are needed and in what particular regard.

### Noise pollution

The analysis of noise pollution generated by public traffic in Triaditsa was based on data obtained from GIS Sofia (2013). For this purpose as well as for the preparation of the final assessment, the software ArcMap was used. As a result, two analytical maps were created. They presented the levels of daytime (fig. 1) and night time noise pollution, whereby the values were specified for every raster cell with an area of one square meter. In addition, ArcMap allowed to define what the noise pollution within each one of the residential buildings is.

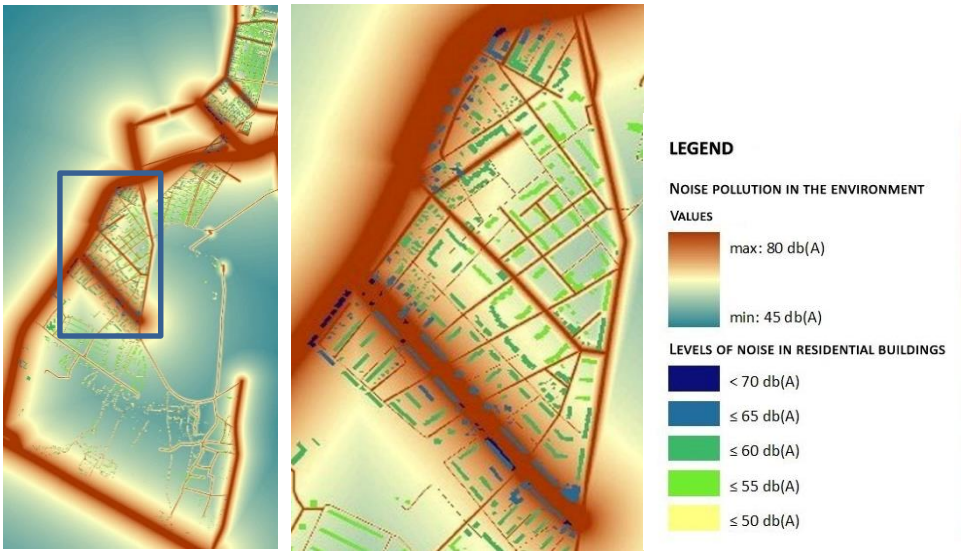



**Figure 1: Levels of daytime noise pollution in the studied area (own elaboration).**

The evaluation of the noise pollution in Triaditsa was based on the maximum allowable values defined by the Bulgarian legislation (Regulation No. 6, 2006). In order to visualize what share of the population is exposed to levels of noise above the regulated norms another map was prepared (fig. 2). The buildings marked in red are the ones where the registered values of noise exceed the allowable maximum, therefore their inhabitants represent the share mentioned above. The rest of the buildings, marked in blue, meet the regulated norms of noise levels.

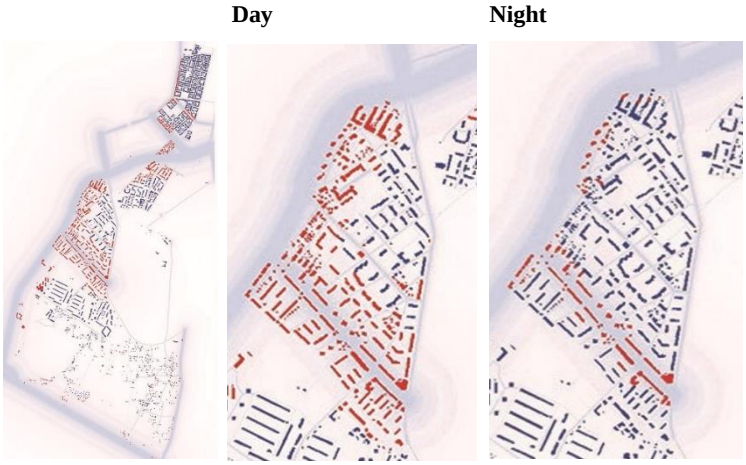



**Figure 2: Assessment of the noise pollution (own elaboration).**

The evaluation proved that over $^1/_3$ of the people in the studied area are exposed to noise levels above the regu–lated norms at daytime. During the night this value is signifi–cantly lower – 9,8%, which is easily explained as there is barely any traffic at night time. Also, public transport in Sofia does not operate between 12 a.m. and 5 a.m.

## Accessibility to public transport

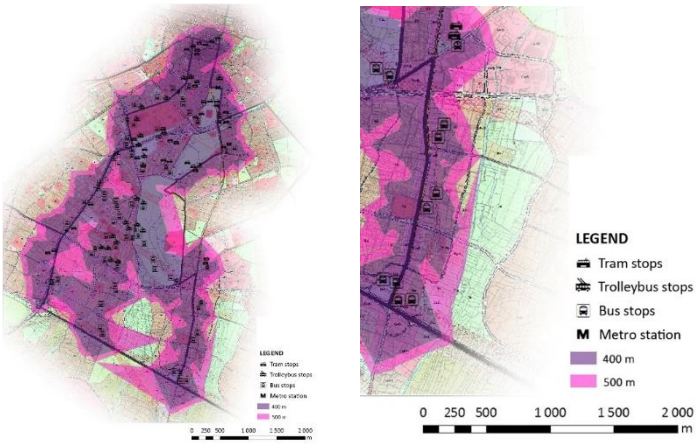
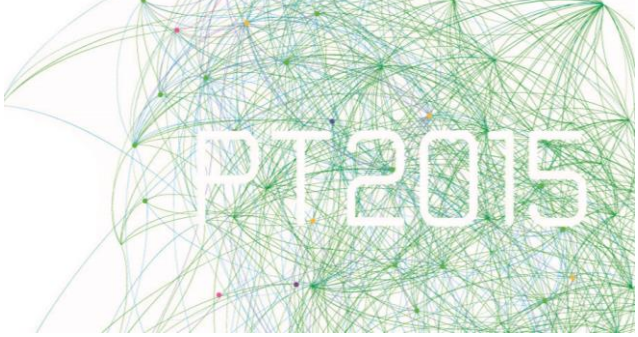



**Figure 3: Evaluation of the accessibility to public transport (own elaboration).**

Figure 3 illustrates what share of the population lives in a pedestrian radius of 400-500 m to a public transport stop[2]. The map was prepared in ArcMap using the Network Analyst toolbox. It allowed for the presentation of the accessibility to public transport within the area more precisely as it follows distances along the streets and not just as buffers around each stop. This is helpful because some buildings actually fall within this particular radius of 400-500m to a stop, but since there is no adequate infrastructure built to link them, the

[2] The selected radius is based on article 17, paragraph 3 of Regulation No. 2 by the Ministry of Regional Development which states that the public transport network and its stops must be planned so that the distance between residential buildings and public transport stops does not exceed 400m. In low-rise residential areas this distance could be increased to 500m.




accessibility to public transport is significantly reduced. Network Analyst provides the opportunity such cases to be taken into account.

The evaluation showed that 99% of Triaditsa's population is served by the public transport system in accordance with Regulation No. 2, therefore the criterion accessibility proved to be one of the strengths of the studied transport system.

### Accessibility to social facilities and recreational areas

The next examined factor was accessibility to social facilities and recreational areas: healthcare, children and educational facilities, parks and public gardens. The choice of a quantitative indicator (tab. 1) was motivated by the hypothesis that more people would use public transport if they do not have to transfer in order to reach the desired destination. Transferring from one line to another generally involves a number of factors which could discourage people from using public transport such as: loss of time, larger costs[3], personal discomfort, etc.

The analysis was carried out in ArcMap via the Network Analyst toolbox similar to the previous example. Unfortunately, there are no available benchmarks for these criteria, however, all percentages exceeded 90%. Therefore, it could be considered that the studied public transport system is efficient enough in this particular context.

### Accessibility to the exit points of the studied area

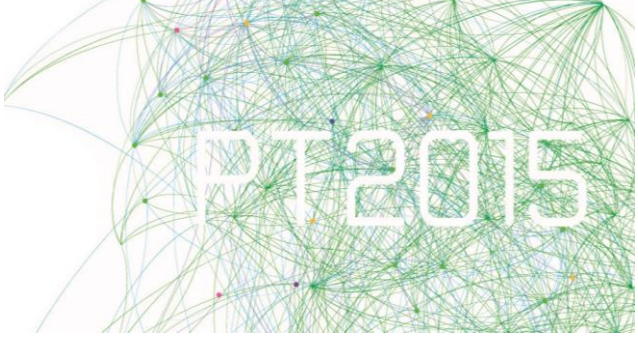
The analysis of this last factor aimed at discovering how many exit points can be accessed by the people living in each building under the specified traveling conditions (tab. 1). The evaluation of this criterion was particularly difficult since despite the fact that most of the population can reach more than half of the exit points directly, this does not mean they would necessarily choose public transport over driving their own car. It is neither realistic, nor cost-effective to propose building more public transport stops or changing vehicles' routes. Rather than that, it has to be considered how to encourage people to use public transport in general.

## INTERVENTION PROPOSALS

### Spatial interventions

In order to decrease noise pollution in the studied area some spatial interventions have to be implemented. Different scenarios were considered, e.g. lowering road level, building noise barriers, constructing bicycle lanes along the busiest boulevards, using special type of "silent" asphalt, etc. However, in order to make the most realistic decision, financial obstacles and other specifications of the studied area had to be taken into consideration. As a result, planting peripheral vegetation proved to be the best possible solution. Since there were already trees

[3] In Bulgaria single tickets are valid for a single trip only, whereby the time of the journey is irrelevant, e.g. if one needs to transfer, he/she has to buy an additional ticket.




planted along the busiest streets, the idea was to combine them with bushes in order to further reduce the noise spread into the area. It was estimated that this particular intervention would decrease the total percentage of the population exposed to noise pollution during the day from 38,8% to 17% and at night - from 9,8% to 1,6%.

### Other interventions

The other type of interventions was in form of "soft measures" which are presented in the tables below.

**Table 2: Proposals aimed at increasing the use of public transport in the studied area.**

| Proposal | Responsible party for the implementation |
|---|---|
| Purchase of new vehicles in order to reduce waiting time intervals and improve passenger comfort | Sofia Municipality |
| Coordination between the passages of vehicles of the different lines | Sofia Urban Mobility Centre |
| Reconstruction of public transport stops and installation of intelligent information boards | Sofia Municipality and Urban Mobility Centre |

**Table 3: Proposals aimed at improving urban mobility conditions in the studied area.**

| Proposal | Responsible party for the implementation |
|---|---|
| Creating a *Carpooling* Portal on Triaditsa's website | Traditsa's administration |
| Installing bicycle racks in public transport vehicles | Sofia Municipality |
| Installing bicycle racks at the busiest public transport stops as well as providing bicycles for rent | Sofia Municipality |
| Planning new routes for construction of bicycle lanes | Sofia Municipality |

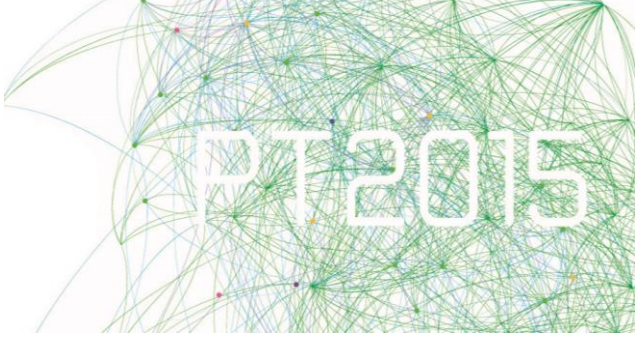
## CONCLUSIONS

Based on the introduced assessment approach the main problems of Triaditsa's public transport system in the context of sustainability were defined. In this particular case noise pollution was identified as a problem deserving immediate attention. The generated quantitative information allowed searching for measures that could lead to the accomplishment of specific results, namely – decreasing the current levels of noise to the regulated maximum allowable values.

This study proved to be a convincing example which demonstrated how the implementation of this integrated evaluation approach could assist in managing public transport systems and turn them into efficient and sustainable.

## REFERENCES

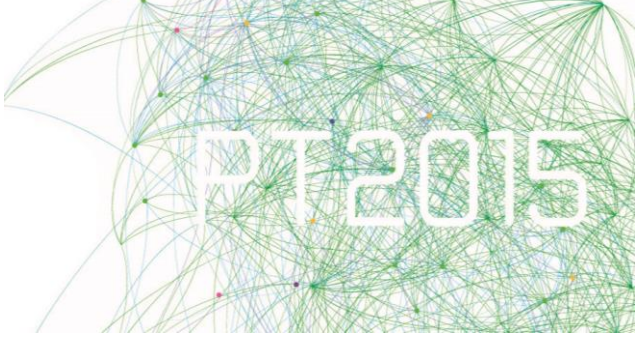
GIS Sofia. 2013. "Strategic noise map of Sofia". Leading projects. Accessed May 26, 2013. http://www.gis-sofia.bg/maps/displayImageNoise.php?folder=ALLSR_SFA0_LDEN.




Ministry of Regional Development. 2004. Regulation No. 2 for planning and constructing of transport systems in urban areas.

Ministry of Healthcare & Ministry of Environment and Water. 2006. Regulation No. 6 about the noise indicators in the environment.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# THE ROLE OF PUBLIC TRANSPORT PRIORITY IN SUSTAINABLE URBAN MOBILITY

**Dino Šojat**[1]
PhD, Research associate, University of Zagreb, Faculty of Transport and Traffic Sciences, Zagreb, Vukelićeva 4, dsojat@fpz.hr

**Davor Brčić**
PhD, Associate professor, University of Zagreb, Faculty of Transport and Traffic Sciences, Zagreb, Vukelićeva 4, dbrcic@fpz.hr

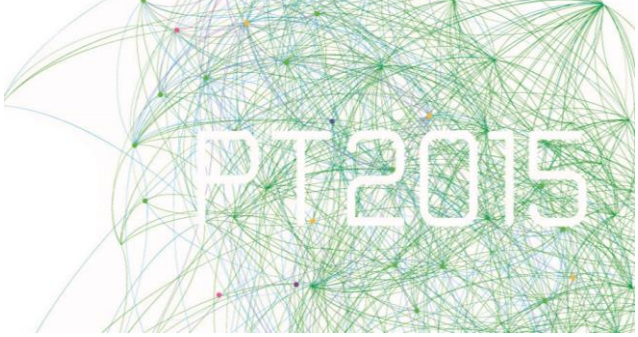
**Marko Slavulj**
PhD, Senior Assistant, University of Zagreb, Faculty of Transport and Traffic Sciences, Zagreb, Vukelićeva 4, mslavulj@fpz.hr

## ABSTRACT

*The continuous urbanisation process in the world has resulted in considering sustainable urban mobility as a top priority. Therefore, the public transport becomes the key element of sustainable urban mobility because of its advantages over the private car (space consumption, energy consumption, impact on the environment) and thus becomes the backbone of sustainable mobility in most cities. Operating speed in public transport is an important characteristic by which users decide whether to make a modal shift of their city trips to public transport. The operating speed is especially important in public surface transport (trams or buses) which is not separated from other traffic, and therefore it constantly interferes with other vehicles sharing the same urban network. Consequently, the influence of other vehicles leads to operating speed reductions and thus the attractiveness of public transport becomes significantly lower. The previous research on the subject concluded that the introduction of public transport priority can lead to a better transport process (considering travel times, network occupancy, and reliability) and other positive effects (considering energy savings, impact on the environment, and reduction of external costs) on the entire urban network. This paper presents an overview of research on the tram priority for the entire tram network in the City of Zagreb done by authors. The analysis of the research conducted in this paper provides conclusions about the significance of introducing priority in surface public transport through both the efficiency and the effectiveness of tram network in the City of Zagreb, which would result in increased attractiveness of public transport and the modal shift in favour of public transport.*

***Keywords**: sustainable urban mobility, public transport, public transport priority, operating speed, City of Zagreb.*

[1] Corresponding author




## INTRODUCTION

The ever-increasing global urbanisation process in the past decades has resulted in high private car usage, which led to traffic congestion in the majority of cities in the world. The build-only approach could not solve this issues, so public transport has become an increasingly significant part in urban mobility because of its advantages over the private car in terms of efficiency. The efficiency is related to less space consumption, less energy consumption and less influence on the environment. Public transport has thus become the backbone of sustainable urban mobility.

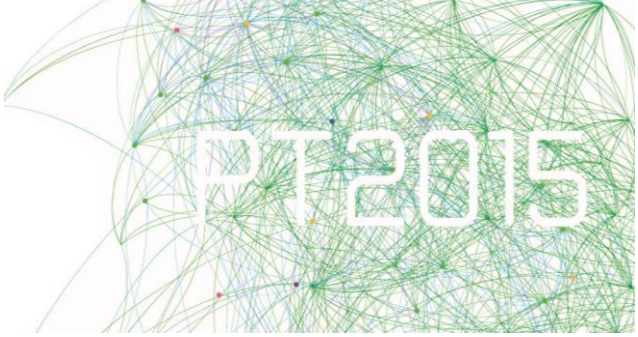
However, in order to make the mobility of the urban areas sustainable, it is necessary to make public transport more attractive by shifting passengers from private cars to public transport, i.e. to change the current modal split of city trips in favour of public transport. In the current legislation, the public transport attractiveness is only possible to improve by increasing the quality of service. The changes of the quality of service can be made in form of the infrastructure or the vehicles, but in the current network state, only the increase in operating speed could bring significant passenger travel time decrease. Also, in the current network state (the current set of public transport lines and the current stops), the increase in operating speed of public surface transport can only be made by introducing public transport priority in the network.

According to the literature, the definition of public transport priority often refers to giving priority at intersections, i.e. making public transport vehicles pass the intersections without stopping at traffic lights. However, the authors define public transport priority in more general terms – public transport priority is a set of measures aimed to approximate the actual vehicle running times to the optimal running times. In other terms, the goal of public transport priority is to eliminate any kind of disturbances on the network so that any change in vehicle speed would be a result of network geometry or dwellings at stops only.

The definition stated by the authors proposes three types of priority:

- Priority by segregation relates to physical separation of public transport lanes from other traffic moving in parallel. It is usually achieved by introducing barriers between the lanes or the road infrastructure unable for other vehicles to enter,

- Priority by legislation is derived from the current legislation as a set of rules for other vehicles to comply with in road portions shared with the public transport – contrary to the priority by segregation, priority by legislation is subject to traffic violations,




- Signal priority refers to giving a clear pass through the intersection or minimizing the waiting time at intersections when the approaching public transport vehicle is detected.

## THE MEASUREMENT OF PUBLIC TRANSPORT PRIORITY

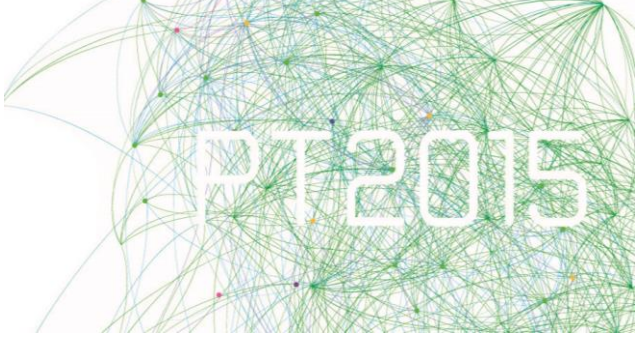
Public transport priority can only be a part of the dynamic aspect of public transport, excluding vehicle dwellings at stops or dwellings at terminals, considering only running times at links. For each link, an optimal running time can be defined from technical specifications of vehicles and the network link geometry. When the actual time for each link is applied, the comparison gives the percentage of the actual speed on the link in the optimal speed, which is a measure of priority effectiveness, named the priority percentage. This can be done for each link, particular portions of the link (e.g. spacings between stops) or the entire network, including the vehicle frequency on each link on the network into consideration.

The actual running times at links are usually obtained a posteriori, due to the complexity of transport process. The optimal running times are usually obtained a priori, considering the network geometry, vehicle specifications, and the legislation framework. For specific links, the optimal running times can be obtained a posteriori, if the conditions on the network allow the optimal time to be measured. Problems with values a priori are usually related to different driving conditions, while problems with values a posteriori are related to inability to fulfil the conditions for optimal running times.

## THE PREVIOUS RESEARCH ON PUBLIC TRANSPORT PRIORITY AND THE CURRENT STATE IN THE CITY OF ZAGREB

In recent times, different kinds of solutions related to priority have been developed in order to increase performance of public transport network. Pyrgidis & Chatziparaskeva (2012) studied signal priority of tram network in Athens and found that it is possible to expect increases in commercial speed between 15 % and 25 % (Pyrgidis, 2012). Within the Civitas project family, many measures related to public transport have been implemented. Such of the measures are: new traffic lights and bus priority in Malmö, bus priority in Prague, public transport priority in Ljubljana, Rotterdam, Kraków and Suceava, bus rapid transit corridors in Toulouse, Lille and San Sebastián, new traffic light regulation in Vitoria-Gasteiz, yellow lane surveillance in Perugia and high-mobility corridor in Genova. All the measures resulted in commercial speed increases, travel time reductions and eventually, passenger satisfaction linked to modal shift (Slavulj, 2012)

The public transport network in the City of Zagreb consists entirely of public surface transport, operated by trams and buses. The bus network is significantly larger, and the buses operate mostly at peripheral areas of the city. The bus network




is almost completely integrated into road network, and with the yellow lane percentage less than 1 % and no signal priority at intersections, it practically lacks priority entirely.

Tram network consists of 120 km of tram lanes, and the network is positioned mainly in the central area of the city. By the mode of segregation, tram lanes can be divided into:

- Green lanes (53 %) – lanes that are segregated completely,
- Yellow lanes (21 %) – lanes exclusively for public transport based on the legislation,
- White lanes (26 %) – lanes completely integrated into road network.

Operating speed on the network has been constantly decreasing from 1999 (15.4 km $h^{-1}$) to 2014 (12.4 km $h^{-1}$), which is a decrease of 19 %. The increased private car usage creates additional problems in peak hours – the most significant is the yellow lane contravention, because the yellow lane enforcement has not been established yet in the City of Zagreb. Additional problems are created by traffic violations involving pedestrians and vehicles at intersections, violations related to car parks near tram lanes, and shorter green time percentages for trams at intersections.

In the City of Zagreb, two projects related to tram priority were implemented. The first was the Civitas-Elan project, with the measure "Giving priority to public transport". Partial signal priority was implemented at three intersections in Savska Street, resulting in 5 % time savings for the entire corridor (Civitas Elan, 2015). The second was a pilot-project which involved yellow lane enforcement by traffic police at the same corridor. Significant time savings of 25 % throughout the corridor were achieved (Hrvatski Autoklub, 2015).

## RESEARCH ON PUBLIC TRANSPORT PRIORITY IN THE CITY OF ZAGREB

The analysis of tram priority in form of yellow lane enforcement was conducted by Brčić, Slavulj and Šojat (2012). The real-time data was collected by the GPS logging units placed in trams on a single line in the network with the highest yellow lane percentage (tram line 4 with 64 % of yellow lanes). The goal was to combine the data obtained for the morning peak period and off-peak period in order to simulate yellow lane contravention in morning peak period. A nonlinear model was developed for the optimization purposes, with the minimisation of the number of transport units as the objective function, such that the constraints were derived from limitations in the network. The optimisation process resulted in operating speed increase of 8 % on the line, and savings of 7 % in the number of vehicles, which was one vehicle (Brčić, 2012).

The analysis of tram priority in form of yellow lane enforcement for the entire tram network was conducted by Brčić, Slavulj and Šojat (2014). For the purpose of data collection for the entire network, the input data was obtained from Brčić, Slavulj and Šojat (2012), and the simple linear model was applied to extrapolate the amount of savings to the entire tram network if yellow lane enforcement was introduced. The assumption of the model was the highest yellow lane percentage on tram line and the fact that the line 4 operates throughout the key sections of the city – such assumption would produce the worst-case scenario results. The analysis resulted in the operating speed increase of 3.6 %, and the savings in the number of vehicles of 3.5 % (Brčić, 2014)

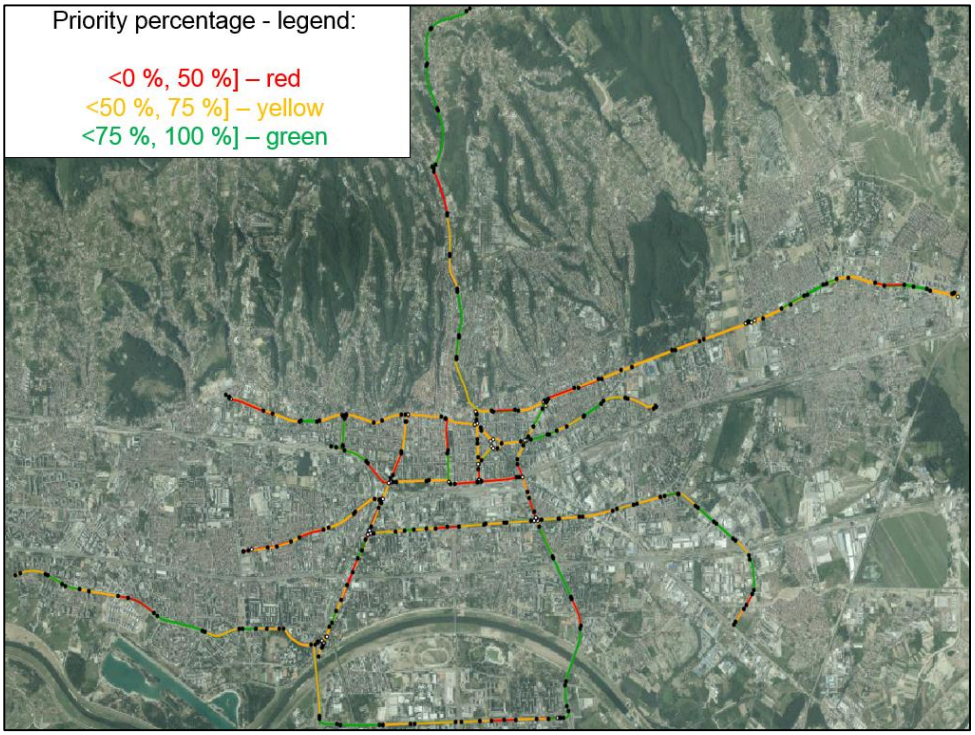
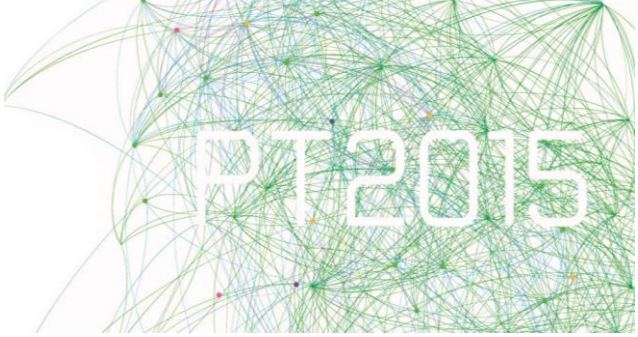



**Figure 2: The Development of Sustainable Urban Mobility Plans - priority percentage on the tram network of the City of Zagreb.**

The research of the tram priority in general was conducted in the scientific research project "The Development of Sustainable Urban Mobility Plans", by the Faculty of Transport and Traffic Sciences in 2014. The data was collected by the GPS logging devices for the morning peak period. The entire tram network was constructed in a geo-referenced software. For the determination of optimal running times, the speed diagram method (a priori) did not produce acceptable results because the data about the entire network was insufficient – instead, the fastest vehicle method (a posteriori) gave more precise information about the optimal running times. For each spacing, the priority percentage was given, shown in Fig. 1.




This allowed the critical spot observation on the network, and the detection of possible causes of priority percentage decrease below 50 %.

## CONCLUSION

The introduction of public transport priority is the key element of quality of service and the public transport attractiveness, responsible for the modal shift from private cars. It brings the reduction of travel times for passengers, reduction of external costs for transit authority and less impact on the environment for the entire community. Public transport priority should be integrated in traffic policy of the City of Zagreb. Authors estimate the operating speed increase up to 30 % if every type of priority was implemented.

The further research of public transport priority in the City of Zagreb should encompass higher level of detail in the network, such that the priority could be analysed from the aspect of each network element (lane type, intersection, pedestrian crossing) with positioning on a geo-referenced map included. The usage of simulation tools could significantly contribute to the optimization and rationalization of transport process.

## REFERENCES

Brčić, D., Slavulj, M., Šojat, D. 2012. "Analysis of tram priority in the City of Zagreb", *32nd Conference on Transportation Systems with International Participation*: 173-176.

Brčić, D., Slavulj, M., Šojat, D. 2014. "The Impact of Public Transport Performance Improvements on Sustainable Urban Mobility – an Example of the City of Zagreb", *3rd International Conference on Road and Rail Infrastructure:* 889-895.

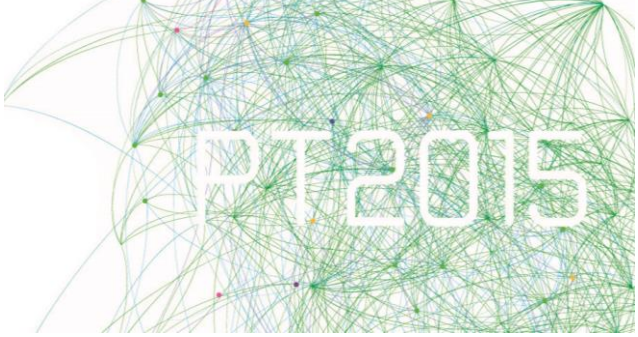
Civitas Elan. 2015. "Dodjela prioriteta tramvajima u Gradu Zagrebu". Last modified April 15. Accessed February 6, 2014. www.civitaszagreb.hr.

Hrvatski Autoklub. 2015. "Javni gradski prijevoz kao element održive urbane mobilnosti". Last modified April 14. Accessed February 6, 2014. www.hak.hr.

Pyrgidis, C., Chatziparaskeva, M. 2012. "The impact of the implementation of green wave in the traffic light system of a tramway line – the case of Athens Tramway", *4th International Conference on Road and Rail Infrastructure*: 891-898.

Slavulj, M., Brčić, D., Ćosić, M. 2012. "Improvement of urban public transport with transportation demand management", *Suvremeni promet: časopis za pitanja teorije i prakse prometa*, no. 32: 355-359.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# APPLICATION OF PV MODULES ON NOISE BARRIERS

**Budimir Sudimac**[1]
Assistant Professor, dipl.ing.arch, Faculty of Architecture, Bulevarkralja Aleksandra 73/II, Belgrade, Serbia, sudimac@arh.bg.ac.rs

**Andjela Dubljević**
Teaching Assistant, dipl.ing.arch, Faculty of Architecture, Bulevarkralja Aleksandra 73/II, Belgrade, Serbia, andjela.dubljevic@arh.bg.ac.rs

## ABSTRACT

*The aim of this research is to consider possibilities for improving the street lighting on the E75 highway, which passes through Serbia, using renewable sources of energy. In this paper, we analyzed the possibilities for installing sound barriers along the highway and integrating photovoltaic (PV) modules, which would generate electrical energy to power the lighting on the section of the highway running through Belgrade. Sound barriers are necessary along the highway running through populated areas, and they are identified as elements on which PV modules for power generation can be installed. The illumination of the highway powered by conventional sources of electricity is very expensive and has negative environmental impact, which is the reason why this paper investigates the connection between sound barriers and electricity generation from renewable energy sources.The paper seeks to show the hybridity of using sustainable technologies in solving environmental issues. This structure solves the problem of noise in populated areas and provides the electricity from renewable source.*

***Keywords****: noise, PV modules, solar energy, sound barriers.*

## INTRODUCTION

This paper presents the possibilities of using solar energy for illuminating the highway running through Belgrade, the capital of Serbia. Serbia has 267 sunny days per year, and each square meter of the earth's surface receives 1000 hours of solar energy. In Serbia there is a potential to generate electricity using solar power because the insolation is 20-30 per cent more than the European average. There is an average of 2096 hours of sunlight per year (which accounts for 45.48 per cent of potential/possible insolation). The highest insolation of about 10 hours per day is in July and August, while December and January are the cloudiest, with insolation of 2 to 2.3 hours per day (Fig. 1). The mean annual number of cloudy

[1] Corresponding author

days is 103.8, most of them during winters. The mean number of clear days per year is 67. The application of photovoltaic (PV) modules for generating the electricity into sound barriers provides the electricity to illuminate the section of the highway using alternative sources.At the same time, the noise level is reduced in a populated area, as well as the level of CO2 in the air.The calculations and computer simulations of PV system for all variants of integrating modules into sound barriers were made in the software PVSYST version 4.37. Standard modules with mono-crystalline cells were used for the calculations.

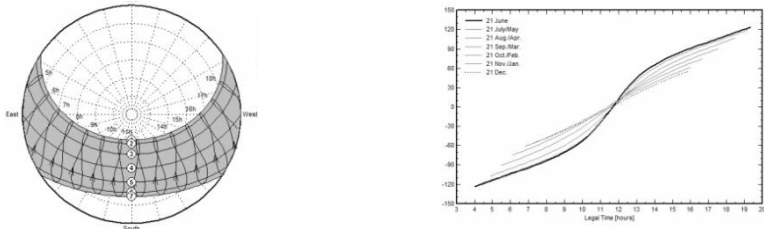


**Figure 1: Annual Solar paths diagram and Sun's azimuth at Belgrade (44.4$^0$N, 20.4$^0$E).**

## Methods

The analysis presented in this paper is hypothetical and it aims to demonstrate the architectural and energy possibilities of using active solar systems by integrating PV modules on noise abatement elements on the section of the highway which runs through Belgrade. The results obtained were comparatively analyzed. Energy efficiency is treated through the consumption of electricity for powering the lighting on the highway using standard light sources – high pressure sodium and new technologies using LED technology.

### NOISE BARRIERS

Reducing the negative impact of traffic noise on the environment can be successfully solved by installing appropriate barriers, structures that prevent direct noise transmission. Noise barriers interrupt the original straight line path of sound waves, thus reducing the noise level (Fig. 2a). The effect of noise reduction is reflected in creating an acoustic shadow behind the barrier and it reduces the sound level coming to the receiver.Traffic noise barriers are solid obstacles installed along the road to absorb, transmit or reflect sound. Barriers reduce the level of noise by 5 to 10 dB, thus reducing the level of traffic noise by as much as half. To effectively reduce the noise coming around the ends of the barrier, it should be 8 times as long as the distance between the receiver and the barrier itself. It is desirable to locate a noise barrier four times its height from settlements and provide landscaping near the barrier to avoid visual dominance. A barrier can achieve a 5dB noise level reduction when the line-of-sight is broken from the highway. After the line-of-sight is broken, the barrier may reduce the noise level by an additional 1.5dB for each one meter of barrier height (Fig. 2b). The level of noise generated

by traffic on the highway through Belgrade is 70-90db. According to the law in Serbia, the maximum allowed noise level in residential areas is 55dB during the day, and 45dB during the night. In Belgrade, there are no noise barriers which meet the standard. The vicinity of the highway and the noise produced is a serious environmental issue for the analyzed area in Belgrade.

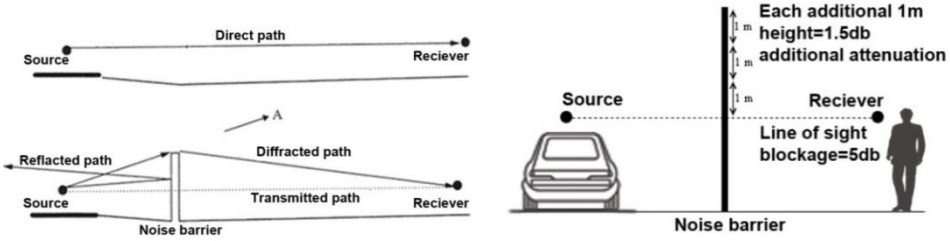



**Figure 2: a) Path of sound waves without and with noise barrier b) High of noise barrier.**

## Illumination of the e75 highway

The E75 highway is the longest international route; class A, running north-south from Norway to Greece. The total length of this highway is 5639 km, and the section running through Serbia spans 239km and it is a part of the Pan-European corridor X. The lighting is provided using high-pressure sodium light sources, of 400W, featured by high luminous efficiency and limited spectrum of radiation peaking in the yellow-orange. The length of the highway running through Belgrade is 25km, and a section, 8.5km long, 2x12m wide, was chosen for detail analysis. This section of the highway is illuminated by 420 light sources mounted on 210 metal poles, each 12m high. The poles are arranged centrally, at the distance between each other of 40m and a slope of $5^0$.

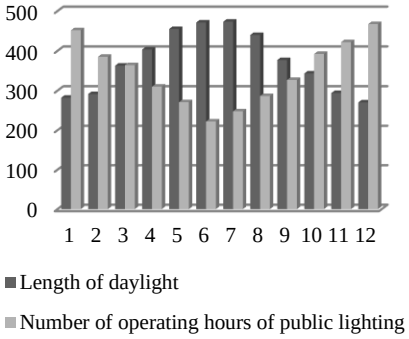
## ANALYSIS OF POWER CONSUMPTION FOR ILLUMINATING

According to the valid calendar for switching public lighting on and off for the city of Belgrade (updated 16 October 2011), the total number of operating hours of public lighting in Belgrade is 4148.23 hours per year.

**Table 1: Length of daylight for Belgrade and operating hours of public lighting of highway.**

| Month | Length of daylight for Belgrade | Operating hours of public lighting | Month | Length of daylight for Belgrade | Operating hours of public lighting |
|---|---|---|---|---|---|
| **1** | 282.32 | 452.00 | **7** | 473.42 | 248.00 |
| **2** | 291.44 | 385.15 | **8** | 439.93 | 286.45 |
| **3** | 362.99 | 364.15 | **9** | 376.96 | 327.00 |
| **4** | 403.52 | 310.13 | **10** | 343.14 | 392.45 |
| **5** | 455.08 | 271.15 | **11** | 294.07 | 422.00 |
| **6** | 471.40 | 222.30 | **12** | 270.56 | 467.45 |

| | | |
|---|---|---|
| **Total** | 4464.8 | 4148.23 |




The shortest number of operating hours of lighting is in June - 222.30 hours, and the highest is in December and it is 467.45 hours. Total length of daylight for Belgrade and total number of operating hours of public lighting of highway by month are shown in Table 1. The existing sodium lamps have 400W installed power/each. The number of lamps on the analyzed section of the highway is 420.The required amount of electricity to power this type of lighting, depending on the number of operating hours of public lighting, is 696902.64 kWh per year. There is a noticeable difference in reducing the electricity consumption by replacing the light source.The rationalization of electricity consumption for street lighting on the section of the highway is possible by replacing the existing 400W sodium lamps with more modern lamps for public lighting, with degree of protection IP66, 279 LED. Comparison of consumption of electricity for sodium lamp 400W and 279W LED lamp are shown in Table 2.

**Table 2: Consumption of electricity for sodium lamp 400W and 279W LED lamp by month.**

| Month | Number of operating hours of lamp | Consumption of 400 W sodium lamp | Consumption of 279W LED lamp | Month | Number of operating hours of lamp | Consumption of 400 W sodium lamp | Consumption of 279W LED lamp |
|---|---|---|---|---|---|---|---|
| **1** | 452 | 75936 | 52965 | **7** | 248 | 41664 | 29060 |
| **2** | 385 | 64705 | 45132 | **8** | 286 | 48123 | 33566 |
| **3** | 364 | 61177 | 42671 | **9** | 327 | 54936 | 38318 |
| **4** | 310 | 52102 | 36341 | **10** | 392 | 65931 | 45987 |
| **5** | 271 | 45553 | 31773 | **11** | 422 | 70896 | 49450 |
| **6** | 222 | 37346 | 26049 | **12** | 467 | 78531 | 54776 |
| **Total** | 4148 | 696902 | 486089 | | | | |

## RESULTS AND DISCUSSION

For a comparative analysis of the integration of photovoltaic modules into sound barriers, different positions of PV modules were proposed giving different results

of total annual electricity generation. For the analysis, 6 variants of positions of photovoltaic modules were adopted (Fig. 3): Variant 1 – PV modules in vertical wall, opaque; Variant 2 – PV modules in vertical wall with sheds disposition; Variant 3 – PV modules in vertical wall with sun-shield disposition; Variant 4 – PV modules in vertical wall, semi-transparent (50%); Variant 5 – PV modules in vertical wall with sheds disposition, semi-transparent (50%); Variant 6 – PV modules in vertical wall with sun-shield disposition, semi-transparent (50%). All the variants of the integration of PV modules into sound barriers were analyzed for the same surface area of the barrier, i.e. 4900 sq.m. Photovoltaic modules integrated into the noise abatement element (Variant 1), covering the total area of 4900 sq.m. monthly generate the amount of electricity ranging from min 24379 kWh in December to max 88147 kWh in July. The total annual electricity production is 698229 kWh in Variant 1. The required electricity to power lighting using sodium lamps is 696902.64 kWh, and for LED lamps 486089.59 kWh.

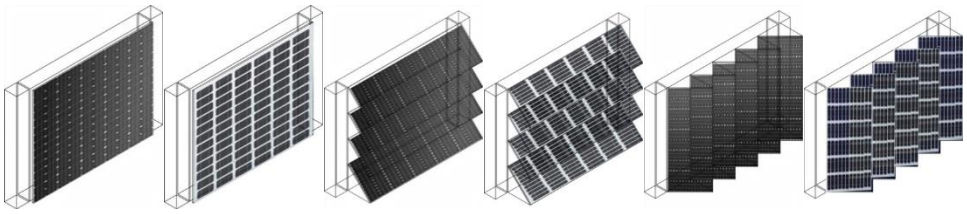


**Figure 3: Design of 6 different variants of integrated PV modules.**

Photovoltaic modules integrated into the noise abatement element (Variant 2), covering the total area of 4900 sq.m., monthly generate the amount of electricity ranging from min 23414 kWh in December to max 86285 kWh in July. Photovoltaic modules integrated into the noise abatement element (Variant 3) monthly generate the amount of electricity ranging from min 20036 kWh in January to max 71073 kWh in August. Photovoltaic modules integrated into the noise abatement element (Variant 4), monthly generate the amount of electricity ranging from min 12190 kWh in January to max 44073 kWh in July. Photovoltaic modules integrated into the noise abatement element (Variant 5), generate monthly the amount of electricity ranging from min 11707 kWh in December to max 43142 kWh in July. Photovoltaic modules integrated into the noise abatement element (Variant 6), monthly generate the amount of electricity ranging from min 10018 kWh in January to max 35537 kWh in August. Comparative review of monthly and annual production of electricity for all 6 variants of PV modules is shown in Table 3.

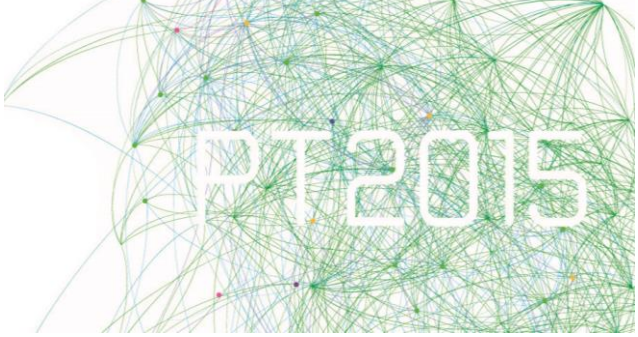
**Table 3: Comparative review of monthly and annual production of electricity for different variants of PV modules.**

| Month | Variant 1 | Variant 2 | Variant 3 | Variant 4 | Variant 5 | Variant 6 |
|---|---|---|---|---|---|---|
| **1** | 24675 | 23869 | 20036 | 12338 | 11934 | 10018 |
| **2** | 37130 | 36280 | 30892 | 18565 | 18140 | 15446 |
| **3** | 57834 | 56565 | 48429 | 28917 | 28282 | 24215 |
| **4** | 67037 | 65494 | 54976 | 33518 | 32747 | 27488 |
| **5** | 81244 | 79402 | 60057 | 40622 | 39701 | 30028 |
| **6** | 81077 | 79215 | 54186 | 40538 | 39607 | 27093 |
| **7** | 88147 | 86285 | 61079 | 44073 | 43142 | 30539 |
| **8** | 86293 | 84640 | 71073 | 43146 | 42320 | 35537 |
| **9** | 69141 | 67800 | 59835 | 34571 | 33900 | 29918 |
| **10** | 52368 | 51327 | 44807 | 26184 | 25663 | 22404 |
| **11** | 28903 | 28103 | 23861 | 14452 | 14051 | 11931 |
| **12** | 24379 | 23414 | 20117 | 12190 | 11707 | 10058 |
| **Total** | 698228 | 682394 | 549348 | 349114 | 341194 | 274675 |

## CONCLUSION

The contribution of renewable sources of energy to electricity production using PV modules was evaluated through comparative analysis of variant solutions for integrating PV modules into noise barriers. Annually, integrated photovoltaic modules can generate the amount of electricity ranging from min 274675 kWh (Variant 6) to max 698228 kWh (Variant 1). The analysis showed that only Variant 1 can generate enough electricity for lighting. The percentage share of obtained electricity from hypothetical models in relation to the annual demand is the following: Variant 1 – 100 per cent, Variant 2 - 97.92 per cent, Variant 3 – 78.83 per cent, Variant 4 – 50.01 per cent, Variant 5 – 48.96%, Variant 6 – 39.41%. It is noted a significant difference in amounts of generated electricity by variants. It may be concluded that standard opaque mono-crystalline PV modules, placed vertically, generate the most electricity. Standard semi-transparent mono-crystalline PV modules with sun-shield disposition are the least efficient.

Adequate orientation, choice and position of PV modules may contribute to their greater energy efficiency. It is necessary to further analyze the combination of individual variants to meet shaping and visual aspects of the application of noise barriers in populated areas. In implementing such systems, the adaption of PV modules to the designed type of noise barrier could pose a problem.




## REFERENCES

Holties, H.A. 1998. "Railway Noise Reduction using Porous Sur- faces and Small Barriers." *Euro Noise*, 98: 301–305.

Johannsen, K. and Möser. M. 2000. "The Influence of the Sur- face of Small Barriers on the Sound Reduction Efficiency of Shroud-Barrier Combinations." *Seventh International Congress on Sound and Vibration*, 2623–2630.

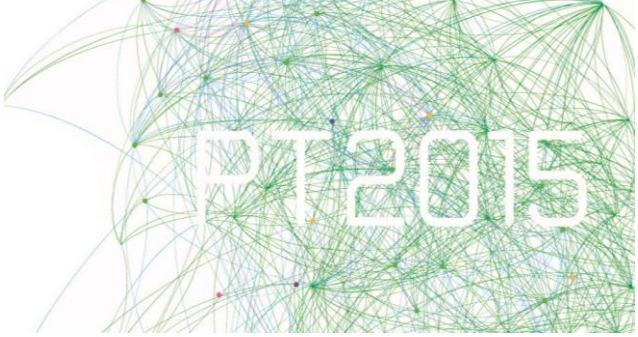
Jones, C.J.C. and Thompson, D.J. 1999. "Application of Numerical Models to a System of Train- and Track-Mounted Acoustic Shields." *Sixth International Congress on Sound and Vibration*, 2661–2668.

Krstic-Furundzic, A. 2007. "PV Integration in Design of New and Refurbishment of Existing Buildings: Educational Aspect." *JAAUBAS-Journal of the Association of Arab Universities for Basic and Applied Sciences*, 4: 135-146.

Möser, M. and Volz., R. 1999. "Improvement of Sound Barriers using Headpieces with Finite Impedance." *JASA*, 106: 3049–3060.

Nordmann, T., Frölich, A., Clavadetscher, L. 1997. "Eight Years of Operation Experience with two 100 kWp PV Soundbarriers." *14 th European Photovoltaic Solar Energy Conference*, Barcelona, Spain.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# PLANNING OF ELECTRIC TRANSPORTATION IN THE KRŠKO REGION

**Ana Tivadar**
B.Sc.G., Geodetski zavod Celje, Ulica XIV. divizije 10, 3000 Celje, ana.tivadar@gz-ce.si

**Stanko Manojlović**
B.Sc.P, NPP Krško, Vrbina 12, 8270 Krško, stankoman@gmail.com

**Simon Podkoritnik**
B.Sc.E.E., Electroinstitute Milan Vidmar, Hajdrihova 2, 1000 Ljubljana, simon.podkoritnik@eimv.si

## ABSTRACT

*A low carbon future demands a drastic change in fossil fuel consumption. Currently the transport sector of light duty vehicles produces 15 % of all carbon emissions, while all transport generates an estimated 25 % of $CO_2$ produced in Europe. The EU commission estimated that by 2020 there will be 14 000 electric vehicles (EV) in Slovenia requiring at least 3000 charging stations. The increased electricity consumption must be compensated from carbon free sources, meaning power plants must be hydroelectric, nuclear, solar, wind …*

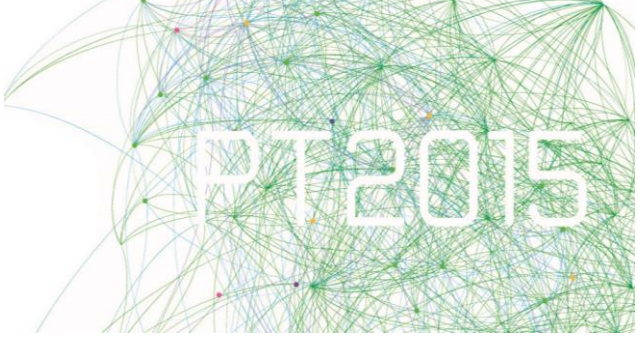
*We will conceptually modernize the current Krško infrastructure and make it a more flexible and EV friendly region. Three different modes of transportation options will be presented and examined of which all can be implemented in parallel or sequentially. Additionally multiple municipality incentives will be presented.*

***Keywords**: electricity, vehicles, planning, Krško, infrastructure, etc.*

## INTRODUCTION

Traffic is one of the main contributors of air pollution in cities and has a significant impact on the environment and human well-being. It is the source of a quarter of all greenhouse gases in the EU (European Commission, 2013a) of which $CO_2$ is the main contributor. Traffic is also the source of the $PM_{10}$, hydrocarbons and $NO_x$ pollutants besides being a significant noise source which harms the activity and balance of human and animal life.

The EU has committed itself in reducing greenhouse gases from traffic for 60 % compared to 1990 (European Commission, 2011). This goal will be achieved with the aid of alternative sustainable sources of fuel and appropriate infrastructure. EU lists as one of the main alternative fuels electric energy (European Parliament and




the Council of the European Union, 2014) which must be produced from low carbon sources such as hydroelectric, nuclear, geothermal, biomass, solar or wind power plants.

The Krško region is in the south-eastern part of Slovenia and is located in the Krško valley which is surrounded by hills. The municipality is of national significance since it accommodates the only nuclear power plant in Slovenia. The NPP Krško produces 21 % of electricity in Slovenia (Ministrstvo za infrastrukturo in prostor, 2014). Nuclear power is the largest low carbon source of electricity in the OECD countries since it produces 18 % of the entire generated electricity (2013) (OECD/IEA and OECD/NEA, 2015). It is also a stable and non-varying source which improves grid stability.

Three different transport options are presented which guarantee a healthy and environment friendly alternative.

## ELECTRIC BICYCLES

Bicycle transportation is an excellent example of sustainable and clean urban mobility. They are an alternative to classical bicycles and provide everyday recreation, maintain vitality and boost activity. Recent studies (Hendriksen, 2008) have shown that with the introduction of electric bicycles the average distance traveled compared to a classical bicycle has increased by 56 %.

There are many types of electric bicycles which offer different benefits. We believe that the most appropriate type of electric bicycle for the Krško region is the so-called pedelec. It offers additional electrical powered motor driven assistance to the driver, which makes it appropriate to a wider population. As mentioned before, the landscape to the north, west and east is very uneven. The motor driven pedal assistance is excellent for overcoming elevation differences and would motivate nearby living people to use bicycles more often. According to the 2002/24/EC directive, the maximal speed a bicycle can provide is 25 km/h and the largest power output allowed is 0.25 kW. Average accessible range for pedelecs is 50 km and compared to other types of electric bikes (such as mopeds, motorcycles…) is cheaper, does not require insurance or registration.

The downsides of electric bicycles are their weight and price. People living in cities have a problem charging, and safekeeping of their electric bicycles. Most commonly electric bicycles have to be carried inside the apartment for safekeeping and charging (Drage, 2014). Pedelecs are therefore more appropriate for rural environments since most people live in houses and have easily accessible electrical outlets. This type of living also minimizes the need for publicly accessible charging stations.

Regular cycling decreases risk for different chronic and cardiovascular diseases. Since the population of the Krško region is ageing; in the last 15 years the percentage of the population over 60 has increased by 10 % and currently represents 23 % of the entire population (SURS, 2015) of the Krško municipality, the concern for health and well-being must be emphasized.

The Krško municipality has a well-developed cycling infrastructure which still needs minimal additional connection routes. The gravitational area of the Krško municipality ranges about 20 km (Sevnica – Krško – Brežice) and therefore does not require charging stations. These routes provide access from different towns about 20 km to Krško.

## ELECTRIC CARS

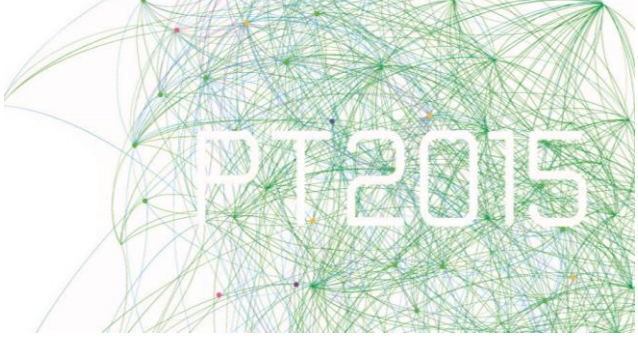
The number of electric vehicles (EV) on Slovenian roads is increasing and the EU Commission estimates that by 2020 (European Commission, 2013b) the number of EV will rise to 14 000 in Slovenia alone. The estimated amount of new charging stations by the EU Commission for Slovenia is 3000 (European Commission, 2013b). According to the number of people currently living in the Krško region there would have to be at least 4 publically accessible charging stations. According to different online sources there are two charging stations on the highway Ljubljana – Zagreb in Zaloke. We recommend at least four more publically accessible charging stations should be implemented in the town of Krško.

The EU Directive 2014/94/EU differentiates two types of charging options. Slow charging stations are defined with power outputs of $\leq$ 22 kW and fast charging with power outputs of more than 22 kW. We have prepared several areas where charging stations could be located as seen on Figure 1. We have defined slow and fast charging stations according to the following conditions: grid availability, vicinity of transformers, charging times and convenience. Additional grid enhancements must also be made.

Slow charging stations are commonly located where people spend from 6-8 hours per day, or more. Common locations are close to hotels, work areas, park and ride systems and other.

Fast charging stations are more common where people spend shorter times (30 min to 4 hours), such as shopping centres, gas stations, restaurants, gym centres, banks, post offices and other locations.

**Figure 1: Green marked areas are slow charging stations, while red areas are for fast charging stations (Map source: ARSO, Atlas okolja).**




## ELECTRIC BUSES

Many municipalities in Slovenia (Velenje, Nova Gorica, Murska Sobota…) offer free public transportation. In Krško this incentive can be taken further. An electric bus provides zero $CO_2$ emissions, low running costs, minimal noise pollution, fast acceleration and enhances social awareness of $CO_2$ emissions. It would be the first Slovenian municipality to offer free electric bus transportation to residents receiving great national media exposure.

## MUNICIPALITY INCENTIVES

The Krško municipality can actively promote usage of EVs in many different ways:

Free weekend rentals of electric bicycles or pedelecs would demystify the usage of electric transportation for many people. Local residents could rent bicycles for the weekend and get accustomed to their characteristics and drivability and motivate them in their purchase. A subsidy could be offered and buying bicycles in bulk would also offer more negotiable prices for local residents. The Vienna municipality in partnership with Wien Energie offers a 30 % subsidy, to the maximal of 300 € for purchasing an EV bicycle (Go Pedelec!, 2012).

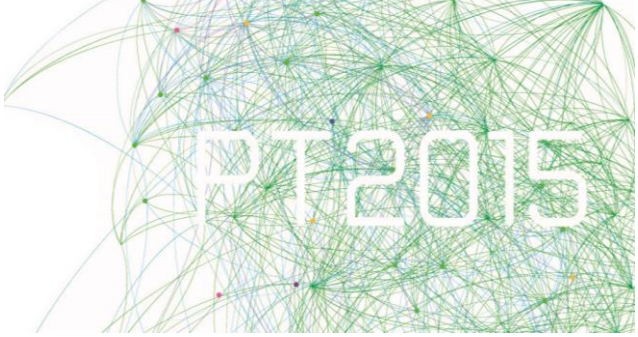
EV charging stations do not require a building permit. They are treated as lamp posts, parking meters and other. The Krško municipality could offer incentives to electric distributers to build additional charging stations in predefined locations.

Different promotional events can be held to increase awareness of $CO_2$ in transportation. Here are some of the possibilities:

Yearly event can be organized where different manufacturers could present the current production of EV. Held at different locations local residents could try EVs and get basic information on the technology and everyday usage of EVs. Krško also locates a race track, where people could try the EVs in a controlled environment.

Current Krško infrastructure also includes a speedway track. Electric speedway races have been held worldwide and provide an additional awareness of the diversity of EV.

Advancing EV can also be introduced to different schools where projects to build or develop an electric bike can be financed or an event organized where schools could compete for the most optimized, cost or range effective bicycle. Introducing EVs to youths would increase interest into technical sciences and energy efficiency. This project could also be expanded nation wise.




## CONCLUSION

Electric vehicles provide a clean transportation alternative. Minimal modifications to the infrastructure must be implemented and incentives taken by the Krško municipality in order to motivate residents in their purchase.

Different options have been presented from which the entire Krško region can benefit. With these incentives the Krško region would become the representative of low carbon emissions in everyday living and would further promote production of sustainable energy.

## REFERENCES

Drage, T. 2014. "Pedelec-test (In Andritz)." Eltis, The urban mobility observatory. Last modified December 12, 2014. Accessed March 5, 2015. http://goo.gl/gf7eEE.

European Commission. 2011. "White Paper, Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system /* COM/2011/0144 final */" EUR-Lex, EUR-Lex - 52011DC0144 - EN.

European Commission. 2013a. "Commission staff working document, Impact assessment, Accompanying the document Proposal for a Directive on the deployment of alternative fuels infrastructure/* SWD/2013/05 final */" EUR-Lex, EUR-Lex - 52013SC0005 - EN.

European Commission. 2013b. "EU launches clean fuel strategy." Press releases database. Last modified January 24, 2013. Accessed February 22, 2015. http://europa.eu/rapid/press-release_IP-13-40_en.htm.

European Parliament and the Council of the European Union. 2014. "Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure (OJ L 307, 28.10.2014, p. 1–20)." EUR-Lex, EUR-Lex - 32014L0094 - EN.

Go Pedelec!. 2012. "Best Practices with Pedelecs." Last modified June 28, 2012. Accessed March 8, 2015. http://goo.gl/zFEPil.

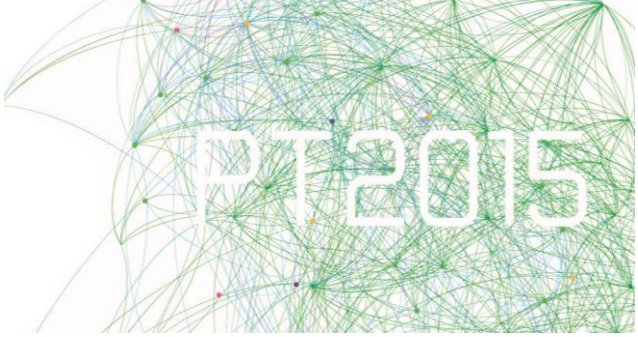
Hendriksen, I. 2008. "Electric bicycles - market research and investigation." Last modified June 2008. Accessed February 24, 2015. http://goo.gl/hN0dpe.

Ministrstvo za infrastrukturo in prostor. 2014. "Energetska bilanca Republike Slovenije za leto 2014." Letna energetska bilanca. Last modified August 2014. Accessed March 7, 2015. http://goo.gl/X7Eukd.

OECD/IEA and OECD/NEA. 2015. "Technology Roadmap: Nuclear Energy." Nuclear publications. Accessed March 7, 2015. http://goo.gl/dll3cM.

SURS. 2015. "Prebivalstvo po velikih in petletnih starostnih skupinah in spolu, občine, Slovenija, polletno." SURS. Last modified February 22, 2015. Accessed February 22, 2015. http://goo.gl/MGjVW8.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# INTELLIGENT TRANSPORT SYSTEMS FOR SMART CITIES

**Bia Mandžuka**[1]
PhD student, University of Zagreb, Faculty of Transport and Traffic Sciences, Zagreb, Vukelićeva 4, 10000 Zagreb, Croatia, bia.mandzuka@gmail.com

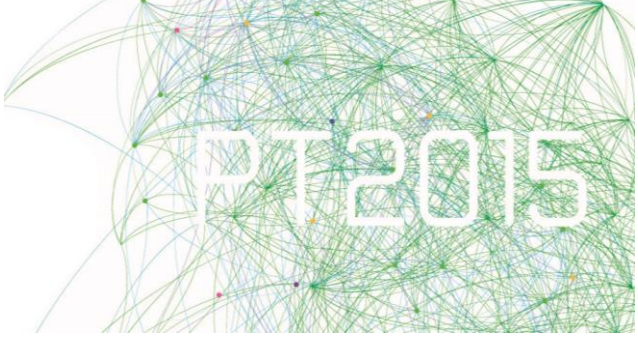
**Ljupko Šimunović**
PhD, Associate Professor, University of Zagreb, Faculty of Transport and Traffic Sciences, Zagreb, Vukelićeva 4, 10000 Zagreb, Croatia, ljupko.simunovic@fpz.hr

**Mario Ćosić**
PhD student, Senior Assistant, University of Zagreb, Faculty of Transport and Traffic Sciences, Zagreb, Vukelićeva 4, 10000 Zagreb, Croatia, mario.cosic@fpz.hr

## ABSTRACT

*In recent times, the increased quality of life, work and education has forced many people to move from rural into urban areas. The population growth is accompanied by the increased mobility and the consumption of energy, water, food and raw materials – all this results in contamination of soil, water and air, high noise, greenhouse gas emissions, heavy traffic and traffic jams. In attempt to optimize the processes in urban areas, the so-called smart cities demand sustainable solutions in order to ensure economic prosperity and social well-being, and on the other hand, to protect the environment and to increase the quality of life. This kind of problem-solving approach demands both the individual and the mutual participation of creative people with their knowledge and ideas, country and city administration, businessman and scientists. In terms of technology solutions, the focus is put on the information and communication technology. The paper will analyse the Intelligent Transport Systems (ITS) and their possibilities to contribute to the smart city development. The application of information and communication technology in the field of transport ensures continuous traffic data collection, analysis and real-time distribution to every stakeholder interested. This also provides new solutions in mobility management, incident management, smart car parking, priority at intersections (ambulance, fire department, police, and public transport), real-time traffic information and others. Smart cities tend to decrease heavy traffic, decrease emissions of $CO_2$ and other greenhouse gasses, and to preserve resources, which in the end decreases costs, enabling other economy activities. The most important is the fact that the large amount of data collections is open-source, so the data is available for citizens, experts, companies, city administration, government, and even available for exchange between countries.*

[1] Corresponding author




***Keywords**: quality of life, smart cities, information and communication technology, intelligent transport systems (ITS), open-source data.*

## INTRODUCTION

Cities are the initiators of further development, centres of connectivity, innovations and creativity. In addition, cities are centre of employment and services for surrounding areas as well as an important factor in the overall and territorial development. Rapid expansion of cities and the development of urbanisation cause a number of problems that affect the quality of life in urban areas.

Global urbanisation began in 20th century with changes at economic and social level, especially in transition countries in Central and Eastern Europe. Today it is estimated that by 2025 more than 60% of the eight billion people will live in towns and cities. The world will then have more than 90 cities with more than five million inhabitants. In 1950 there were only seven. Huge growth in the number of city, in relation to the number of rural residents, was one of the most prominent characteristics of life in the 20th century (Skole, 2013).

The population growth is accompanied by the increased mobility and the consumption of energy, water, food and raw materials – all this results in contamination of soil, water and air, high noise, greenhouse gas emissions, heavy traffic and traffic jams. Consequently, the imbalance of natural cycles has a very impact on human health and quality of life and of course on other living systems. Scientific evidence indicates that today mankind lives without unsustainable lifestyle. The way of sustainable living can be achieved by organizing living conditions - smart cities, repeated assessments of economic sectors (e.g. Permaculture, green building) and by introducing sustainable architecture (Strumfels, 2015).

Smart cities use big data sets, Information and Communication Technologies (ICT) in purpose of providing more efficient and improved "smart services" and to ensure economic prosperity and social well-being. In other words, smart cities create more efficient urban systems capable of solving the challenges of contemporary and urban problems. One of the core components of smart cities is sustainable transport which includes the application of Intelligent Transport Systems (ITS) enabling the full integration of the urban mobility system.

The paper represents a number of established definitions and characteristics (six "smart" dimensions) of smart city - a city that is center of connectivity, innovations and creativity. Third chapter is about implementation of ITS in smart cities and relates intelligent services and applications (integration of collective and private modes of travel, multimodal traveller information, etc.)

## DEFINITION AND CHARACTERISTICS OF SMART CITIES

Nowadays, there is a series of definitions and understandings of smart cities. That is because every city has unique characteristics, but one thing is certain - every definition of smart cities contains a couple of keywords that essentially describes smart cities - integrated (collecting data), ICT, etc. For example, one of the definitions that in a very simple way describes smart cities is - "A smart city is a city which functions in a sustainable and intelligent way, by integrating all its infrastructures and services into a cohesive whole and using intelligent devices for monitoring and control, to ensure sustainability and efficiency" (Hancke, De Carvalho and Hancke Jr. 2013). For comparison, another one definition from the study (RAND Europe) of the European Parliament - "... a city seeking to address public issues via ICT (information and communications technology) -based solutions on the basis of a multi-stakeholder, municipally based partnership." (Manville, 2014) The smart city concept has been developing over time simultaneously with the development of technology and society needs. The smart city concept of today significantly resembles or is interconnected to the concepts such as - Intelligent city, Knowledge city, Sustainable city, Talented city, Wired city, Digital city and Eco-city. (LinkedIn, 2015) Moreover, Smart City includes almost all the characteristics of those concepts. Today's version of smart city model is based on six "smart" dimensions (Fig. 1) - Smart Economy, Smart Mobility, Smart Environment, Smart People, Smart Living and Smart Governance.

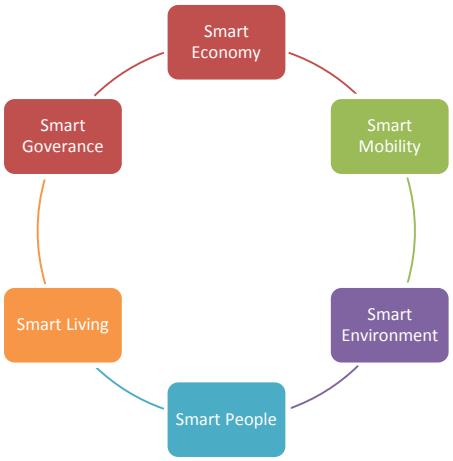



**Figure 1: Smart city model (Smart-cities.eu, 2014).**

Smart Economy includes a scope of activities such as e-business, implies increased productivity, production and services based on ICT, then ICT-enabled innovation as well as new products, new services, and business models. Next dimension is Smart Mobility which implies one of the ways to achieve sustainable urban mobility (integrated transport and logistics, smart car parking, priority at intersections, real-time information - saving costs and reducing $CO_2$) by implement

ting modern technologies in the field of traffic and transport - ITS services. Smart Environment represents another dimension which is a part of "smart" cycle and includes green technologies, green building (or renovation of existing buildings) and green services - intelligent road lighting, waste management, etc. In addition, Smart Environment dimension includes renewable energy sources, control and monitoring of pollution. Furthermore, "smart" cycle consist of - Smart people (level of qualification, lifelong learning, ethnic plurality, open mindedness), Smart living (cultural and education facilities, housing quality, individual security, e-health) and the last one in cycle - Smart Governance that includes public and social services with the main enabling tool - ICT (Smart-cities, 2014), (Manville, 2014).

## IMPLEMENTATION OF ITS IN SMART CITIES

The 21st century is described as "a century of cities ". Driven by global developments, the population in the cities is growing, and it is expected that this trend will continue. Today's mobility in European urban areas does not meet the needs of their citizens. Aside from the constant traffic congestion which is estimated to be around 80 billion euro's, urban areas are the sources of a large share (about 23%) of all $CO_2$ emissions from traffic. (EU COMM, 2013) Transport system faces increased pressure because of increased use of passenger cars - and the product of that is high level of environmental pollution, growing number of traffic accidents and congestion on the roads. Instead of more freedom of movement (which we all aspire), car usage has a large impact on the reduction of mobility in cities. An increasing number of traffic problems in cities were handled with the classical approach - building new capacities (roads) or expanding existing ones (build only approach). Today it is necessary to take another approach to solve traffic problems already accumulated and make cities smart. The most significant results have been achieved by applying ICT in the form of increasing the informational transparency of transport systems in cities (big transparent data sets). The application of ICT to enhances the performance of the transport network in the cities, and at the same time does not exclude further construction of roads and other transport infrastructure (build only + ITS approach). Smart transport (efficient, attractive, sustainable and "green") is an important component of today's version of the smart city (Figure 2). Smart urban mobility in cities is a major challenge and a complex task for traffic experts, planners, and other experts. By applying modern technologies in the field of transport - in particular ITS services, it is possible to develop the concept of smart transport in smart cities. In this regard, the ITS represents new approaches, models and technologies that solve a number of problems in the field of traffic and transport. ITS can be defined as holistic management and ITS upgrade of the classical system of traffic and transportation which achieves substantially better performance of traffic, more efficient transport of passengers and goods, improves traffic safety, comfort and safety of passengers, less environmental pollution, etc. (Bošnjak, 2009) ITS offer a range of applications and services to support problem solving in smart cities, such as - Smart parking (improved ability to locate best available street parking, Smart ticketing (easy

payment for transport services across modes), Real- time Journey Planner (based on cooperative communication, providing real-time information before and during the trip will not only help individuals but will increase the efficiency of the transport system in general), Car sharing service, Priority at intersections, Car2Car and Car2 Infrastructure Communication, etc. (Urban mobility in the Smart City Age, 2014)

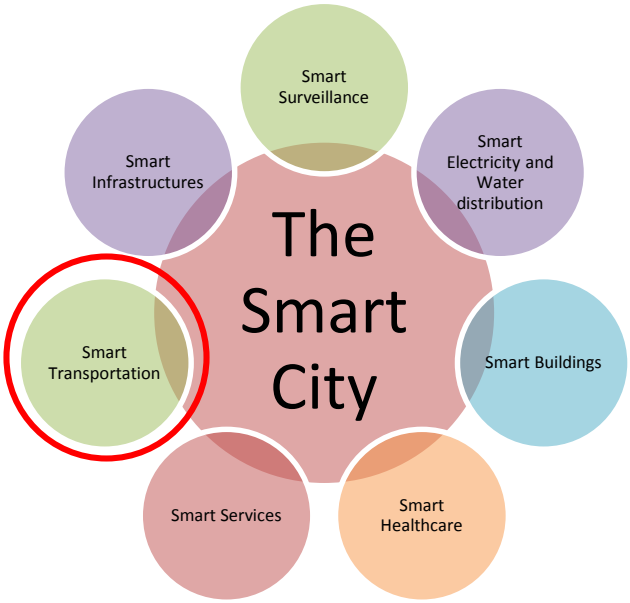
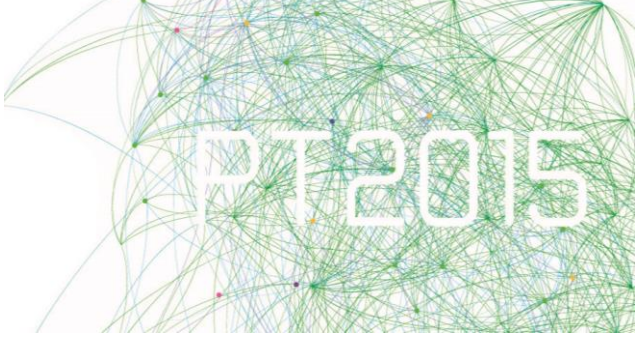



**Figure 2: Smart components of smart cities - Smart Transportation (Hancke, De Carvalho and Hancke Jr. 2013).**

As specified, ITS offers specific solutions to the growing demands of the mobility in order to increase the efficiency and safety of the transport system in smart cities. One of the preconditions for the application of modern ICT technologies in achieving sustainable urban mobility in smart cities is to enable open access of data sets (e.g. traffic and travel data).

Smart transport network, based on big open data set, generate information about destinations (points of interest) of citizens, cities, regions, information about topography of the country and its relation to the transport system, timetables for the various modes of transport, etc. This approach to data offers a range of new services and business opportunities.

One of the services is becoming more necessary for participants in the transport process are a service of advanced passenger information systems in transport. In contrast to the static information system, dynamic systems enable timely decisions in choosing modes and routes of travel. Most European smart cities today have advanced passenger information systems, a product that saves time, less congestion




on the roads, less pollution, increase the level of transport services, etc. Multimodal Journey Planners (MJP) represent the integration of the pre-trip and on-trip services and constitute a key component of the implementation of ITS in smart cities providing a comprehensive range of relevant information that will help in planning "door to door" trips. (Mandžuka, Škorput and Brčić 2014)

## CONCLUSIONS

Smart cities represent sustainable way to achieve public issues caused by globalization - growth of cities (environmental pollution, education, healthcare, education, etc.) with main goal - to take care of modern, society needs, and with the main enabling tool - ICT. The modern version of smart city model is based on six "smart" dimensions - Smart Economy, Smart Mobility, Smart Environment, Smart People, Smart Living and Smart Governance. Smart Mobility implies Smart Transport which is very important component of every smart city. By applying modern technologies in the field of transport - in particular ITS services, it is possible to develop the concept of smart transport in smart cities. In this regard, the ITS represents new approaches, models and technologies that solve a number of problems in the field of traffic and transport. Today, a series of projects and studies have been launched in Europe and the world in the field of developing smart cities. European Commission is funding a series of Smart city projects such as EPIC, Life 2.0, Open cities, PEOPLE, PHERIPHERIA, etc. The highest number of smart city is located in the Nordic countries, UK, Spain and Italy.

## REFERENCES

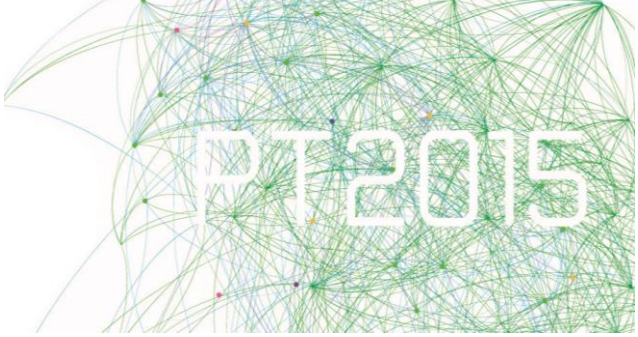
Bošnjak, I. 2009. *Inteligentni transportni sustavi 1*, Fakultet prometnih znanosti, Zagreb,, p:2, University of Zagreb.

Bošnjak, Ivan. 2009. *Inteligentni transportni sustavi.* Zagreb: Fakultet prometnih znanosti.

EU Commission. 2013. "Communication from the commission to the European Parliament, the Council, the European economic and Social Committee and the Committee of the Regions, Together towards competitive and resource-efficient urban mobility", 17 (December): 1-2.

LinkedIn. 2015. "Smart City: Towards Practical Approach-Part 1." Last modified April 7. Accessed April 7, 2015. https://www.linkedin.com/pulse/smart-city-towards-practical-approach-part-1-wael-youssef?trk=seokp_posts_primary_cluster_res_photo.

Mandžuka, B., Škorput, P., and Brčić, D. 2015. "Open data set for Multimodal Journey Planner", ISEP 2015, 23 (March): 1-4.




Manville, C. 2014. "How Smart Are Our European Cities?" The Rand Blog, July 9. Accessed April 6, 2015. http://www.rand.org/blog/2014/07/how-smart-are-our-european-cities.html.

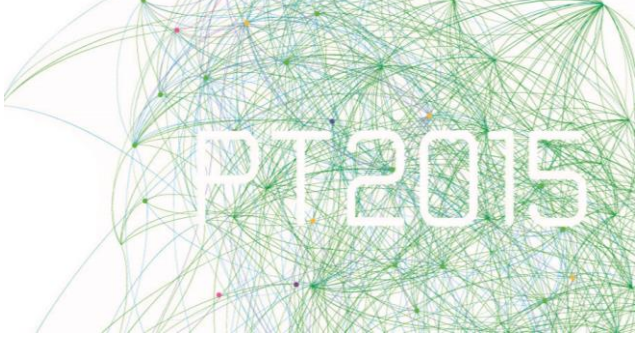
Hancke, P. , De Carvalho, G. e Silva, B., and Hancke, G. Jr. 2012. "The Role of Advanced Sensing in Smart Cities", *Journal Sensors*, no.13 27 (December): 1-3.

Skole 2013. "Urbanizacija (prvi dio)". Last modified August 8. Accessed April 9, 2015. http://www.skole.hr/ucenici/os_visi?news_id=8755.

Smart-cities, 2014. "European Smart Cities 3.0 2014" Last modified 2014. Accessed April 9, 2015. http://www.smart-cities.eu/index.php?cid=-1&ver=3.

Strumfels, D. 2015. "Sustainability" A Medley of Potpourri, February 23. Accessed April 7, 2015. http://amedleyofpotpourri.blogspot.com/2015/02/sustainability_23.html.

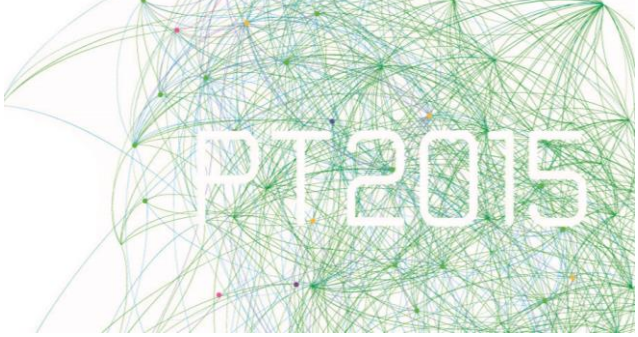
Urban Mobility in the Smart City Age. 2014. Last modified May 2014. Accessed April 4, 2015. http://digital.arup.com/wp-content/uploads/2014/06/Urban-Mobility.pdf.




# TOPIC VIII:

# Building Technologies

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# RETROFITTING OF MULTI-FAMILY BUILDINGS TOWARDS HEALTHIER SETTLEMENTS

**Aleksandra Krstić-Furundžić**[1]
PhD, Full Professor, Faculty of Architecture, University of Belgrade, Bulevar kralja Aleksandra 73/II, 11000 Belgrade, Serbia, e-mail: akrstic@arh.bg.ac.rs

**Aleksandra Đukić**
PhD, Associate Professor, Faculty of Architecture, University of Belgrade, Bulevar kralja Aleksandra 73/II, 11000 Belgrade, Serbia, e-mail: adjukic@afrodita.rcub.bg.ac.rs

## ABSTRACT

*The subject of the paper is retrofitting of suburban multifamily buildings built in the late fifties and early sixties at Karaburma, Belgrade. According to the data collected by Serbia Statistical Office, about 55 percent of the existing housing units in Belgrade were built during the sixties and seventies and they were designed without consideration of energy demands and consumption. The same problem is present in the case of Karaburma settlement. Buildings were in poor condition until the retrofitting in 2009.*

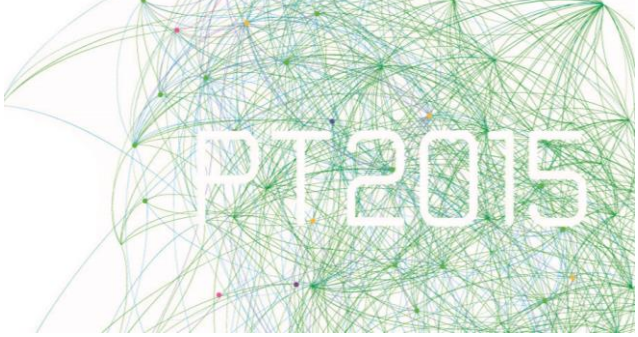
*The retrofitting was carried out on a significant number of buildings and still takes place in the settlement. The main retrofitting objectives are: the identification of housing typologies related to new user's needs, the complying with new technical regulations in terms of energy efficiency and accessibility for disables. The retrofitting concept was aimed to improve living comfort, especially thermal comfort, in order to achieve energy savings and healthier environments.*

*Solutions for the retrofitting are shown in the paper. The improvement of living comfort and building appearance was achieved by annex of attics, addition of balconies as new structures and organized closing (glazing) of balconies, as well as by laying of thermal insulation on the facade surface and it's painting in different colors resulting in housing diversity.*

*The benefits are in improving energy performances of the buildings and living conditions generally. The results show that significant energy savings and reduction of CO2 emissions can be obtained with different and simple retrofitting measures.*

***Keywords**: retrofitting, healthier environment, multi-family building.*

[1] Corresponding author




## INTRODUCTION

Karaburma is one of the largest social settlements in Belgrade. The refurbishment was carried out on a significant number of buildings and still takes place in the settlement. It was started in early 90`s with adding annex attics and extra floors. The area is characterized by various types of multifamily buildings built in late fifties and early sixties of the last century.

The retrofitting of existing buildings in Karaburma has been developed by private investors, building contractors. Through the improvement of the existing buildings investors gain the right to annex the attic or a few floors, which results in construction of new housing units. The investors gain profit by selling flats. Although the main motivation of investors is profit, it can be concluded that the improvement of housing conditions is obtained which promotes the refurbishment of suburban districts affected by social, economic and architectural deterioration.

The main refurbishment objectives are: the identification of housing typologies related to new user's needs, the complying with new technical regulations in terms of accessibility for disables and energy efficiency. The refurbishment concept was aimed to improve living comfort, especially thermal comfort, and building appearance.

## STRATEGIES FOR IMPROVING OF BUILDINGS

### Identifying the main problems

Significant refurbishment of buildings was achieved along the streets: Vojvode Micka, Garsija Lorke, Pere Cetkovic and Uralska. Characteristics of the aforementioned streets are similar rectangular buildings with hipped roofs and poor architectural performances. Generally, most common are two types of multifamily buildings: the type 1 with small dwellings around a central staircase and balconies on all four facades and the type 2 with four dwellings around a central staircase and balconies on two longitudinal facades. The building structural system is a massive with masonry walls and reinforced concrete ribbed floor structure, system often used in social housing construction, which was widespread in the fifties and sixties due to migratory processes. Some social, architectural and technical problems are present, but building decay is the main problem.

The dwellings are homogeneous, repetitious and monotonous. Flats are very small, which adversely affects the development of the families. Due to massive structural system as well as the fact that flats are private property of tenants, building and flats volatility is difficult to achieve during the building life cycle and user needs can hardly be achieved. Spaces are characterized by a low flexibility. Weak purchasing power of tenants results in inertia of the residents in terms of building

maintenance and refurbishment. The fact that buildings were designed without consideration to energy consumption, as well as the building deterioration are the reasons of negative consequences in terms of the poor living conditions and greater wasting of energy.

Old-age and lack of maintenance and poor quality of materials and improper design caused falling-off of facade portions and fissures in facades resulting in poor thermal performance of the building envelope and in inconsistency of thermal resistance. Listed characteristics and degradation concerning envelope, create the following major disadvantages: water and moisture penetration; unfavorable removal of rainwater and snow (due to the fissures and absence of covers); condensation due to thermal bridges and lack in thermal insulation; thermal losses in the winter period; overheating of the building in the summer period, great infiltration losses; losses in the heating system. The disadvantage is the fact that buildings are not connected to district heating. Electricity is mainly used for residential heating.

The following main refurbishment strategies are foreseen: improving of the living comfort, i.e. quality of the dwellings; improving technical performance and energy efficiency of buildings; improvement of visual identity and appearance of buildings and settlement.

**Figure 1: View of the buildings type 1 (in Pere Cetkovic Street) before and after the refurbishment (source: Krstić-Furundžić A., 2012).**

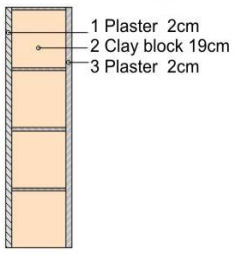
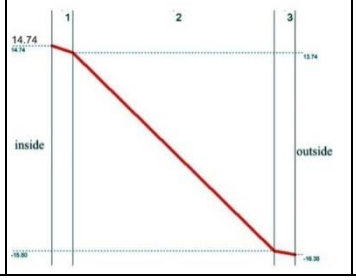
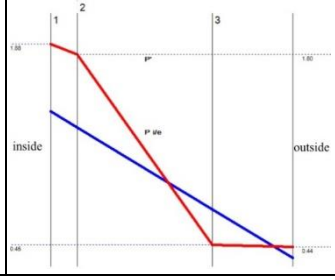
## Strategies for improving quality of dwellings

By annex of attics enlargement of flats underneath and/or construction of new flats was achieved, as well as leaking of the existing roofs prevented resulting in improvement of living conditions on the original top floor and also improvement of technical conditions of the entire building. The addition of balconies is created as the new concrete structures (see Fig. 1). Main interventions can be summarized as follows: the recovery of lodgings with new typology of flats coming from attic annex; creation of improved dwelling typology by addition of new or enlargement of existing balconies; organized closing (glazing) of balconies or glazing options provided in advance creating new living spaces.

## Strategies for improving the energy efficiency of buildings

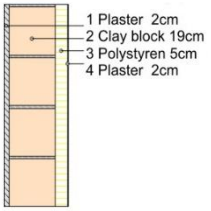
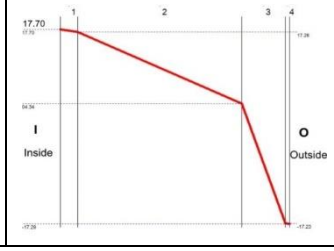
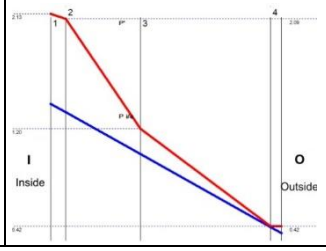
Before refurbishment buildings were characterized by poor energy performance. Facade walls were constructed of clay blocks and plastered on both sides. Heat transmission coefficient of box type windows with float glass (4mm) is unfavorable, U-value=3.5W/m$^2$K. As masonry walls had no thermal insulation, regarding their thermal performances following general conclusions can be made: walls have high thermal transmittance, i.e. U-value=1.06W/m$^2$K (see Table 1); low inner surface temperature is obvious, thermal bridges are present, condensation is present (see Table 1); walls are wet and freezing is possible; mold growth is noticeable. Presence of listed wall properties results in (Krstic-Furundzic and Rajcic, 2000): bad thermal comfort and poor living conditions, badly influencing human health, high heat losses in winter period, which increase conventional fuels consumption and environmental pollution.

**Table 1: Wall thermal properties before refurbishment.**

<table>
<tr><td colspan="3">U-value=1.06W/m$^2$K Umax=0.81W/m$^2$K. Construction doesn't satisfy the requirement. Condensation is present; drying period (27.3 days) satisfies a requirement (90 days).</td></tr>
<tr><td>Wall structure</td><td>Temperature gradient</td><td>Vapour pressure gradient</td></tr>
<tr><td> 
</td><td> 
</td><td> 
</td></tr>
<tr><td colspan="3">Belgrade is in the II climate zone for which, according to previous regulations valid during the refurbishment process, following data were prescribed: a) for calculation of heat transmission coefficient (U-value) external temperature is $t_e$ = –18°C; for calculation of vapour diffusion $t_e$ = –5°C, b) for external walls Umax = 0.9W/m$^2$K in case of district heating and 0.81W/m$^2$K in case of individual heating, c) drying period (for moisture in construction in case of condensation) is 90days; internal $t_i$ = 20°C.</td></tr>
</table>

Improvement of thermal performances of external walls includes laying or improvement of thermal insulation, thermal bridges break and replacement of windows, as essential measures. The refurbishment of the envelopes of existing buildings included: laying of thermal insulation on the facade external surfaces - 5cm of expanded polystyrene is added to masonry 19cm tick walls which provided U-value=0.46W/m$^2$K (see Table 2); replacement of existing wooden windows with double glazed windows (4+12+4), made of three or five-chamber PVC profiles, U-value=2.3W/m$^2$K (subject to consent of the tenant); placing of thermal insulation of 10cm of expanded polystyrene (U=0.171W/m$^2$K) on the new roof structures.

**Table 2. Wall thermal properties after rehabilitation – external insulation.**

<table>
<tr><td colspan="3">U value=0.46W/m$^2$K Umax=0.81W/m$^2$K (“Old regulations”); Umax=0.40W/m$^2$K (“New regulations”). Construction meets the requirement that was valid during the construction. Condensation is not present.</td></tr>
<tr><td>Wall structure</td><td>Temperature gradient</td><td>Vapour pressure gradient</td></tr>
<tr><td> 
</td><td> 
</td><td> 
</td></tr>
<tr><td colspan="3">Current regulations that apply from September 2011, prescribe that Umax=0.40W/m$^2$K have to be achieved by building refurbishment.</td></tr>
</table>

Laying of thermal insulation on external wall surface enables thermal bridges break and provides existing external massive wall to be converted into energy rational structure consisting of three layers: existing solid wall as thermal storage layer, thermal insulation and external protective and final layer as re-cladding (Krstic-Furundzic and Rajcic, 2000). Rehabilitation measure included creation of the second and third layer.

Generally, external protective layer can be made as light and massive structures. In case of refurbishment of residential buildings in Karaburma settlement the light structure is created, plaster layer is added on thermal insulation. Thermal insulation is glutted and mechanically connected to external surface of the existing wall, additionally strengthened by plastic net and covered by thin plaster mortar. This is the cheapest solution and mostly used in case of building refurbishment.

Since the refurbishment takes place over the last five years, it can be noticed that the monitoring period is not long enough. However, by interviewing residents data on energy consumption for heating before and after refurbishment were provided (see Table 3).

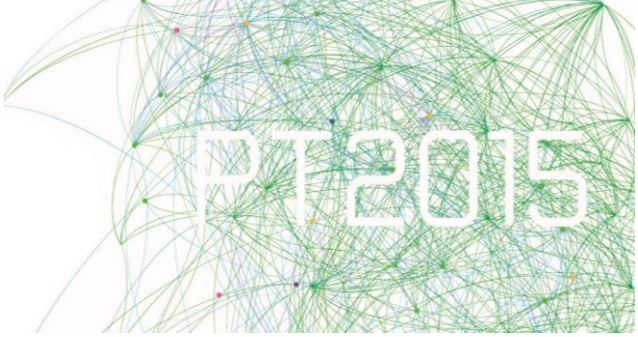



**Table 3: Energy consumption for heating and $CO_2$ emissions before and after refurbishment.**

| | Heated floor area [$m^2$] | Energy consumption for heating | | | $CO_2$ emissions [kg/a] |
|---|---|---|---|---|---|
| | | [kWh/month] | [kWh/a] | [kWh/$m^2$/a] | |
| Before refurbishment | 64 | 1900 | 11400 | 178.12 | 6042 |
| After refurbishment | 69 | 1100 | 6600 | 95.65 | 3498 |
| Savings / $CO_2$ reduction | | 800 | 4800 | 82.47 | 2544 |

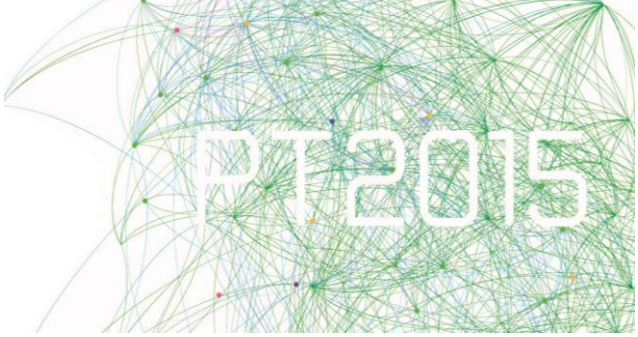
It can be concluded that heating demands are less for about 40 percent compared with heating demands before refurbishment, which means that the energy savings of about 40 percent are achieved. It is evident that building energy performances are significantly improved but with such large interventions should aim at better building energy performances in the design process; buildings had energy class G and after refurbishment energy class D is achieved.

In analysis of $CO_2$ emissions, as the apartments are heated with electrical energy, there were taken into account characteristics of electrical power network of Serbia, indicating that the electrical power network for production of 1 kWh realizes the emissions of 0.53 kgCO2/kWh (According to Serbian Regulations on Building Energy Efficiency).

Application of the described refurbishment measures enabled: improvement of spatial and thermal comfort, higher inner surface temperature, thermal bridges break, reduction in heat losses in winter and overheating in summer, thereby achieving energy savings and reduces consumption of conventional energy sources and environmental pollution. New appearance of buildings and blocks of flats is achieved by balconies and attic annex and variously painted facades.

## CONCLUSIONS

In Belgrade, many of housing settlements dating from the late fifties and the sixties of the 20th century and represent a large percentage of the city's building stock. Most of them are consisted of a numerous of buildings with the same or similar layouts. Up to the seventies the buildings were designed without consideration of energy demands and consumption. Nowadays they are characterized by some social, architectural and technical problems, but building decay is the main problem. Old-age, lack of maintenance, poor quality of materials and improper design cause deterioration of buildings. Improvement of housing settlements is becoming increasingly inevitable. The same characteristics were feature of housing settlement Karaburma until the building refurbishment began in 2009. The improvement of living comfort and building appearance was achieved by annex of attics, addition of balconies as new structures and organized closing (glazing) of balconies, as well as by laying of thermal insulation on the facade surface and it's




painting in different colors resulting in housing diversity as well as improvement of facade thermal performances. It is evident that heating demands are less for about 40 percent compared with heating demands before refurbishment, which means that the energy savings of about 40 percent are achieved and thus reduced environmental pollution. Achieved benefits contribute to other tenants opt for intervention.

## ACKNOWLEDGMENTS

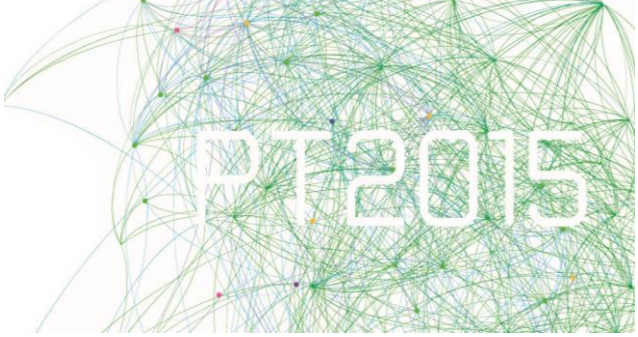
This work has resulted from research within the scientific project: "Spatial, Environmental, Energy and Social Aspects of Developing Settlements and Climate Change – Mutual Impacts" (TP36035), financed within the program Technological Development by the Ministry of Education and Science of the Republic of Serbia.

## REFERENCES

Krstic (Furundzic), A. and Rajcic, A. 2000. "Improvement of thermal performances of external walls aimed to produce energy rational buildings". In *The Proceedings of the 3 International Conference for Teachers of Architecture*, edited by S. Roaf, Oxford, 10-12 July 2000. School of Architecture, Oxford Brooks University: 7.04.

Regulations on Building Energy Efficiency, Official Gazette of the Republic of Serbia no. 61 (2011) 58–59.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# FERROCEMENT ARCHITECTURAL STRUCTURES FROM THE ASPECT OF SOCIAL WELL-BEING

**Aleksandra Nenadović**
PhD, Assistant Professor, University of Belgrade, Faculty of Architecture,
Bulevar kralja Aleksandra 73/II, Belgrade, aleksandra@arh.bg.ac.rs

## ABSTRACT

*The examples of use of ferrocement architectural structures are more numerous in recent years, with the aim to realize efficient and economically viable solutions. This paper analyzes the ferrocement architectural structures from the aspect of social well-being. The ferrocement structures are analyzed as subsystem of the building, whose behavior is directed towards the aim of system – building - ecological quality. The present analysis pointed to the advantages and disadvantages of ferrocement structures from the aspect of social well-being during the use phase of a building, that is, to the necessity of a complex and systemic approach to quality of building structures, in function of achieving the ecological quality of buildings.*

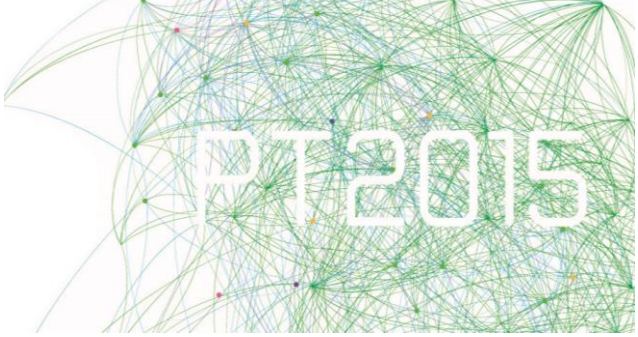
***Keywords**: sustainable building, ecological quality of buildings, ferrocement structures, social well-being.*

## INTRODUCTION

Raising the level of sustainability of building refers to the "reduction of negative environmental impact and resource consumption due to construction, use and dismantling of constructed facilities, with a simultaneous increase in life quality of and health and safety in the built environment"(Working Group for Sustainable Construction, 2001). In this process, it is important to assess the ecological quality of buildings (Nenadović, 2014), which includes quality assessment on the basis of indicators within the criteria of social well-being[1].

The building structure, along with other elements of architectural space, determines the performances of the building. The building structure should be designed and evaluated as a sub-system of the building, whose behavior is directed toward the aim of system-building, which within the criteria of social well-being refers to the realization of building performances that meet the needs and expectations of its users during the use phase of a building (Nenadović, 2014).

[1] The indicators for integrated assessment of ecological quality of building are classified by the interrelated and conditioned sustainability criteria into three groups: indicators within the environmental criteria, indicators within the criteria of social well-being, and indicators within the criteria of economic well-being (Nenadović, 2014).




There are numerous examples of applications of ferrocement architectural structures in recent times in the world, with the aim to realize efficient and economically viable solutions[2]. Ferrocement as a special form of thin-walled reinforced concrete[3], along with the economic viability, offers a wide range of functional and shaping possibilities. Compared to the conventional reinforced concrete, it is characterized by „enhanced elasticity, fine cracks, lower permeability to water vapor and gases, higher ductility and durability"(IFS Committees 10, 2001). Various structures and their elements can be built from ferrocement, including the elements of complex geometry, with the ability to build without formwork. Building the architectural structures in ferocement is not to demanding, from the technological point of view, neither it require special equipment.[4]

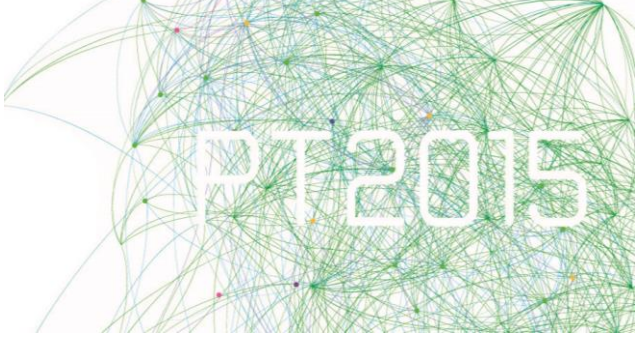
This paper analyzes the ferrocement architectural structures from the aspect of social well-being, on the basis of following indicators: protection and safety; aspects of comfort; electromagnetic field levels; quality of spatial organization; space adaptability; ease of building maintenance; visual aspects.

## FERROCEMENT ARCHITECTURAL STRUCTURES FROM THE ASPECT OF SOCIAL WELL-BEING

### Protection and safety

Ferrocement monolithic structures have proved as reliable and durable, when it comes to the safety of people during the natural disasters. The robustness of this type of construction is based on their continuity and ductility. The limiting factor in the application of this type of structures is limited possibility of precise numerical analysis of the load-bearing capacity for different loading cases, or the necessity of laboratory testing of physical models in order to perceive the behavior of the structure. Ferrocement is noncombustible material that has adequate fire resistance. However, during the fire action the degradation of mechanical properties of ferrocement elements can be observed. On average mechanical resistance to fire of ferrocement load bearing elements, that are not part of the composite assembly, is only 30 minutes, which represents a small fire resistance. Satisfactory values of mechanical resistance to fire can be achieved within the composite and sandwich structures.

[2] Since recently, ferrocement is applied in Serbia in a modest extent (Milinković, 2009). The first technical recommendation for ferrocement in Serbia was published by Federal institution for standardization in 2002.
[3] Ferrocement is made of a thin layer of cement mortar within which there is a high percentage of reinforcement, in form of multiple layers of continuous light network, which is made of closely spaced wires of relatively small diameter. The thickness of the elements is 1-3 cm, which is practically impossible in the case of classical reinforced concrete.
[4] Production of ferrocement elements is challenging in terms of expenditure of labor, which limits the application of this material in countries with high labour cost.




**Aspects of comfort**

Ferrocement surface elements, since they are very thin, have low thermal resistance, so it is necessary to incorporate additional layers of thermal insulation in the area of the building envelope. Monolithic ferrocement structures are favorable in terms of air sealing, minimizing the air leak. In order to ensure an adequate heat capacity and thermal inertia of the entire assembly, it is necessary to incorporate additional layers of materials with appropriate thermal characteristics. Ferrocement has a low permeability for water steam and gases and does not participate in the processes of humidity regulation. When it comes to the internal air quality, ferrocement can be considered as harmless material, practically with no emission of harmful gases, particles and microfibers. Due to the low air permeability of ferrocement, the possibility of air changes through the building envelope is reduced, which increases the risk for moistening the elements and mold growth. Single-layer ferrocement surface elements, given the small thickness, are characterized by high sound conductivity, i.e., a small insulating power. Studies have shown that the sound reduction index of ferrocement thin walls increases with the addition of stiffeners and that it further rises with addition of insulating filling[5]. When it comes to the impact sound insulation, ferrocement ceiling constructions imply additional floor layers, which reduce impact sound trans-mission. Satisfactory sound insulation properties must be ensured through the installation of floating floors which reduce vibration within ceiling element, in addition, through the installation of suspended ceilings, as well as through the adequate design of structural elements' connection details in order to avoid sound leakage, that is, the occurrence of sound bridges. Ferrocement structures and elements are suitable when it comes to the realization of assemblies in accordance with the desired acoustic qualities, since they can be freely shaped. The sound field phenomena: reverberation time, diffusivity and early reflections can be managed by designing the texture and shape of ferrocement elements.

**Electromagnetic field levels**

Ferrocement structural elements, especially those with a high percentage of reinforcement, can create unhealthy environment for users. Ferrocement surface elements can enhance the effect of electromagnetic radiation in the indoor environment, due to reflections and the superposition of electromagnetic waves.

[5] In the case of ferrocement partition made of two layers of ferrocement, between which there is a layer of air or porous absorbent material, the insulating power of partitions is better (for 2db and more) than in the case of solid wall of the same thickness („Award-winning Project: Treelodge@Punggol“, 2012).

## Quality of spatial organization

Ferrocement monolithic structures are suitable from the aspect of their adjustment to the form of space which is required by the social action (Figure 1). Structural elements can be shaped in such way that they occupy only the cross-sectional areas of social spaces, with the aim of creating "the most efficient structure for a given system of space" (Alexander, Ishikawa and Silverstein, 1977). The building structure can be optimized in accordance with the people and their needs (Kiesler, 1939).

**Figure 1: Javier Senosiain, The organic house, Naucalpan, Mexico, 1985. The preliminary sketch and the interior. http://www.arquitecturaorganica.com/casa-orgaacutenica.html**

## Space adaptability

By adequate shaping of ferrocement elements (beam elements of complex cross-section) or the whole structures (ribbed ferrocement shell) and by the formation of composite assemblies made of ferrocement and other construction materials (classical concrete and steel), a long span load bearing structures can be constructed, i.e., the higher net usable surface area can be achieved. This increases the possibility of space functioning for multi-purposes. In addition, important characteristic of ferrocement structures, when it comes to the space adaptability, is their durability and possibility of easy repair and maintenance, based on the application of readily available materials. But, in the case of space reconstruction, ferrocement elements can be limiting, because of the reduced potential for subsequent formation of openings within elements and because of difficulties in achieving the connection between new structural elements and existing structure. However, compared to the much thicker reinforced concrete elements, ferrocement elements can be considered favorable in terms of space adaptability.

## Ease of building maintenance

Ferrocement structures enable effective maintenance over the expected service life, with a minimum investment of human, material and financial resources, provided that they are designed in accordance with specific conditions in the macro and

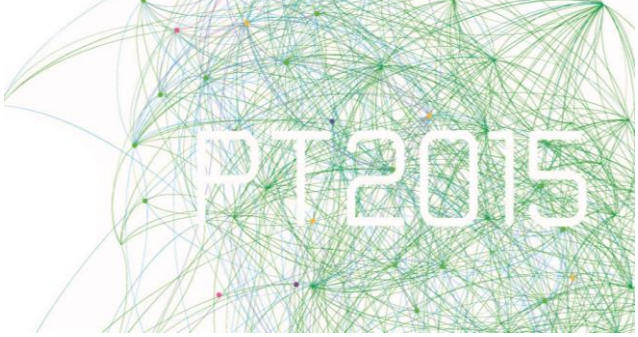
micro environment and properly built. Given the durability of ferrocement, i.e., taking into account that first ferrocement structures, built in mid-nineteenth century, are still in good condition (Pemberton, 1998), it is necessary to avoid the assemblies in which ferrocement is combined with less durable materials if the separation of individual materials is prevented.

### Visual aspects

The ferrocement, as a composite material whose structure, texture and colour are designed and thus the degree of reflection, as well as the ferrocement structures which allow a high degree of freedom in their shaping and in shaping of openings with the aim of light manipulation (Figure 1), can contribute the quality of light in the interior space, that is, affect the level of brightness, propagation of light and light intensity and colour. Ferrocement in its "natural" color ("non-color"), which is determined by the color of cement and aggregate whose base is gray, is assessed as "cold" from a lay person (Rutkin, 2005). On the other hand, if it is made in warm colors it can be perceived significantly different, primarily as "warm" (Benz and Rambow, 2008). Ferrocement structures can take "soft, non-aggressive forms, without sharp edges" that "cause pleasantness of touch and stimulate the subconscious to repeat the same experience" (Božović-Stamenović, 1997). Ferrocement, in the visual sense, can be experienced as a concrete with fine structure or as a rough mortar. In this context, in Europe ferrocement is associated with the mass usage of concrete or mortar within the buildings of different purposes, making it a "neutral" material, suitable for composing the spaces of different associative values. Ubiquity, standardicity, uniformity, availability, simplicity, steadiness, dynamism, freedom...ferrocement can "hide" many ideological backgrounds, i.e., take many meanings (Nenadović, 2014).

## CONCLUSIONS

The paper analysed the ferrocement architectural structures on the basis of indicators of social well-being for users during the use phase of the building. The ferrocement structures were analyzed as subsystem of the building, whose behavior is directed towards the aim of system – building - ecological quality. The analysis pointed to the advantages and disadvantages of ferrocement structures from the aspect of social well-being, that is, to the necessity of a complex and systemic approach to quality of building structures, in function of achieving the ecological quality of buildings. In this context, it is necessary to further develop the legal framework for planning and construction, as well as to further improve the education of designers, by including the complex and systemic assessment of impact of buildings and their subsystems, within the general framework for the assessment of ecological quality.




## REFERENCES

Alexander, C., S. Ishikawa, and M. Silverstein. 1977. *A Pattern Language: Towns, Buildings, Construction*. Oxford University Press.

„Award-winning Project: Treelodge@Punggol.“ 2012. *The Singapore Engineer*, february 2012: 16-20.

Benz, I., and R. Rambow. 2008. „Architects' and Non-Architects' Perception of Exposed Concrete as a Building Material“. Poster presented at the XXIX International Congress of Psychology, ICC, Berlin.

Božović-Stamenović, R. 1997. *O prostorima lečenja – centri dnevne nege*. Beograd: Zadužbina Andrejević.

IFS Committees 10. 2001. *Ferrocement Model Code: Building Code Recommendations for Ferrocement (IFS 10-01)*. Thailand: International Ferrocement Society.

Kandaswamy, S., and A. Ramachandraiah. 2002. „Sound Transmission Performance on Ferrocement Panels.“ *Journal of Ferrocement* 32, no.1: 59-67.

Kiesler, F. 1939. “On Correalism and Biotechnique: A Definition and Test of a New Approach to Building Design.” *Architectural Record* 86, (September): 60–75.

Milinković, M. 2009. "Expirience with prefabricated ferrocement panels for the construction of ferrocement halls“, In *Ferro-9 - Proceeding of the 9th International Symposium on Ferrocement and Thin Reinforced Cement Composites: Green Technology for Housing and Infrastructure Construction*, edited by A. Djausal, F. Alami, and A. E. Naaman, 11-19. Bandar Lampung: The University of Lampung.

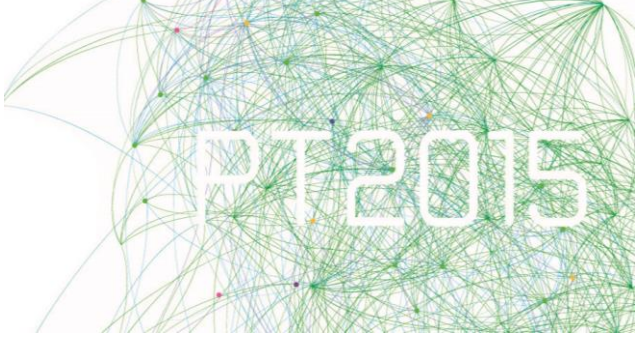
Nenadović, A. 2014. *Integrisano projektovanje konstruktivnih sistema zasnovanih na primeni ferocementa*. Doktorska disertacija. Beograd: Univerzitet u Beogradu.

Pemberton, J.M. 1998. „Ferrocement – An insight and review – So what is new.“ In *Ferrocement 6, Lambot Symposium: Proceedings of the Sixth International Symposium on Ferrocement*, edited by A. E. Naaman, 75-83. Ann Arbor: University of Michigan.

Rutkin, K. 2005. *User Preference Of Interior Design Elements In Hotel Lobby Spaces*. Master Thesis. University of Florida.

Working Group for Sustainable Construction. 2001. "Competitiveness of the Construction Industry: An agenda for sustainable construction in Europe", A report drawn up by the Working Group for Sustainable Construction with participants from the European Commission, Member States and Industry, Brussels. Accessed February 8, 2008. http://www.gci-uicp.eu/Documents/Reports/Sust-con-final.pdf

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# DAYLIGHT ANALYSES OF "READY-MADE" FAÇADES WITH MODULAR OPENINGS - CASE STUDY LOCATION IN PODGORICA

**Sanja Paunović Žarić**
PhD student, Teaching Assistant, University of Montenegro – Faculty of Architecture, bul Dzordza Vasingtona bb 81000 Podgorica Montenegro, sanja.paunovic@ac.me

**Irena Rajković**
PhD student, Teaching Assistant, University of Montenegro – Faculty of Architecture, bul Dzordza Vasingtona bb 81000 Podgorica Montenegro, irena_arhi@yahoo.com

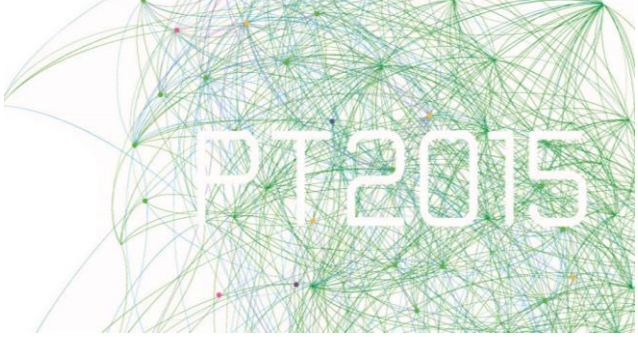
**Marija Bojović**
PhD student, Teaching Assistant, University of Montenegro – Faculty of Architecture, bul Dzordza Vasingtona bb 81000 Podgorica Montenegro, trashandvaudeville@gmail.com

## ABSTRACT

*Requirements for energy efficiency in buildings become higher, as the consequence of the constant temperature increasing. Therefore, the prevention of overheating becomes determinate factor in the design of new buildings and the proper disposition of fenestration basic media, in order to create a productive and stimulating environment. Since facade represents the "face" of the object, proper treatment of openings and selection of the façade envelope should contribute to comfortable working environment.*

*It should be adequately exploited and prioritized in design with respect to artificial lighting. Daylighting as a design principle directly affects the orientation, shape and proportions of the building, interior characteristics and lighting comfort. The daylighting system strategy in buildings can be changed after the construction is completed, but such an adaptation would require significant investments. Therefore, it is very important to perform daylighting analyses in the initial phases of design.*

*In this paper, as a case study the Millennium Office building in Podgorica will be considered. It will be shown that modern, "ready-made" solutions for facades does not appear as a consequence of the study of natural illumination, and that the attractive appearance of the buildings was more in focus than the users comfort. As a consequence, during exploitation of the building it becomes obvious that the daylighting distribution was not taken into account by the design. Namely, since views to the environment and thermal comfort in general were not adequately considered, alternative, mainly expensive adaptations should be undertaken. All of these bioclimatic interventions for revitalization of the existing buildings represent a good approach for obtaining healthy places. Day light should be considered as*




*a "gift of nature", with numerous benefits for users. Sophisticated software tools that enable impact analysis of implementing external static systems for daylighting control were used.*

***Keywords**: daylight factor simulation, "ready-made" façade, perceiving the environment, modular openings, energy-efficiency*

## INTRODUCTION

Nowadays architecture is increasingly orientated toward the treatment of the building envelope as an independent structural element, noting its multifaceted character into meaning and functionality. The paper points to highlight bioclimatic characteristics of the building envelope, treating the envelope of the object as an element of interaction with the environment, "both from a technical, as well as in the semantic sense, a kind of envelope that in modern architecture is a complex multi-layered system that defines and articulates the topics mentioned" (Ćuković2010). In this paper we analysed the use of daylighting system in the adaptation of the façade produced by the use of universal solutions building envelope by utilizing modular division concept, which contribute to changes of character and ecological image of our cities that are not a good approach for obtaining healthy places.

The number of sunshine hours is more than 2000 hours per year in Montenegro. Podgorica is particularly known for its extremely high temperature during the summers, with a maximum annual number of 157 days with temperature above 30°C (Burić2010). This fact justifies particularly interesting conclusions and points the fact that materialization of the object must be result of a complex designing process and technological principles. The design of the façade must connect all the key elements in a single unit, logical structure and context of the object, whose interrelationship is the only requirement for getting quality and contemporary architectural expression (Ćuković2010).

In the case study the office building (Millennium office building) located in Podgorica will be analysed. The daylight factor will be processed regarding to different static shading system applied to the modular openings in order to redirect daylight, with special emphasis on their impact on room shading and possibility for providing view towards the environment in order to archive healthy places.

## THE BASIC PARAMETERS USED FOR DAYLIGHTING ANALYSIS

Two rooms of the same geometry will show different results by manipulating the size and location of the openings. According to the criteria, if the working place is not strictly defined, the lighting is calculated at 1 meter above the floor with the external horizontal illumination of 3000 lux (Rakočević1989).

Designing and modelling of static daylighting systems in offices is primary element of plastic of building envelope. Exterior static shading devices have influence on determining room height and influence to building exterior. By combining horizontal and vertical exterior static daylighting systems, fixed screens and different fenestration, their influence to the room shading will we analysed according to the example given in Figure 1. The results shown in Figure 1, are obtained for window oriented toward east, on 30th of April at 8:15 hours, The window width is 3.4m, the height is 2m, the height of the parapet is 0.85m, while the working place is at axes of the office at 1m distance from the window. In order to obtain better visibility of shadings, shading masks are oriented toward south (Olgyay1978). The elements that enable views toward exterior are shown in perspective view, in order to demonstrate disabling of view toward environment.

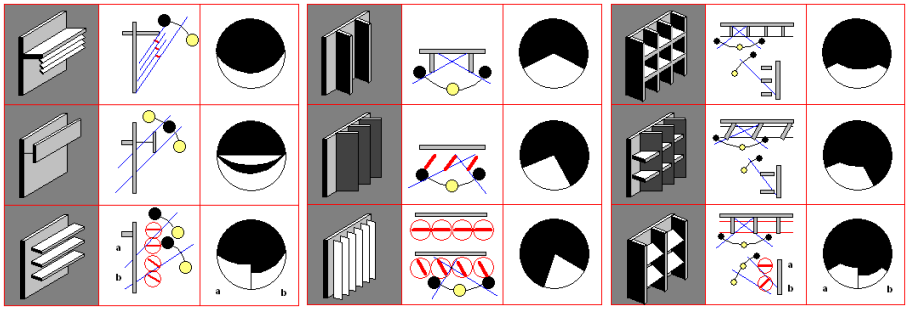


**Figure 1: Vertical, lateral and combined solar protection devices (Olgyay1978).**

The analysis concept used in (Olgyay1978) is the base for case study analysis of Millennium Office building. In order to determine the relevant parameters (thermal zones) related to the exact period for which the exterior shading devices should be optimized analysis of solar radiation are displayed by thermal zones simulation through EcoTect Analysis software. Weather data are taken from Meteonorm27 database, in TMY2 format. Implementation of static shading devices would imply building envelope adjustment with the goal to prevent overheating and glare. Descriptions and analysis for a case study will be given as numerical indicators of daylight factors in relation to the implemented static shading systems, depending on the Sun angle for 9th of May and 21st of September at noon. By definition, daylight factor is calculated in the case of cloudy sky by International Commission on Illumination [CIE] [Tregenza2011], which is crucial in understanding of final simulation results. During the cloudy sky the direct daylight that penetrate interior of the office is not taken into account, and the changes in orientation of the office (north, south, east or west) will not change the calculations significantly (Krygiel2012). The same daylight factor value for different geographical locations does not mean that the level of daily illumination is the same. It will depend on the average daily illumination (in lux) under a cloudy sky for the given location. That value for Podgorica is 7754 lux.

## CASE STUDY OFFICE BUILDING MILLENNIUM IN PODGORICA (MNE)

In this chapter the potential solutions and suggestions for bioclimatic interventions for revitalization of the existing buildings are considered. Interventions are response to the perceived problems of existing buildings in order to improve their energy situation, daylight factor and view toward environment.

The considered object is located at the geographic coordinates: latitude 42.444129 and longitude 19.259663. New office building is east-west oriented. The floor has been designed in two tracts with atrium on the east side. Atrium is designed to improve better quality of sun light and aeration in the central zone and corridors. Tract depth and storey height are not the same per floor. A typical south oriented work unit will be taken into simulation.

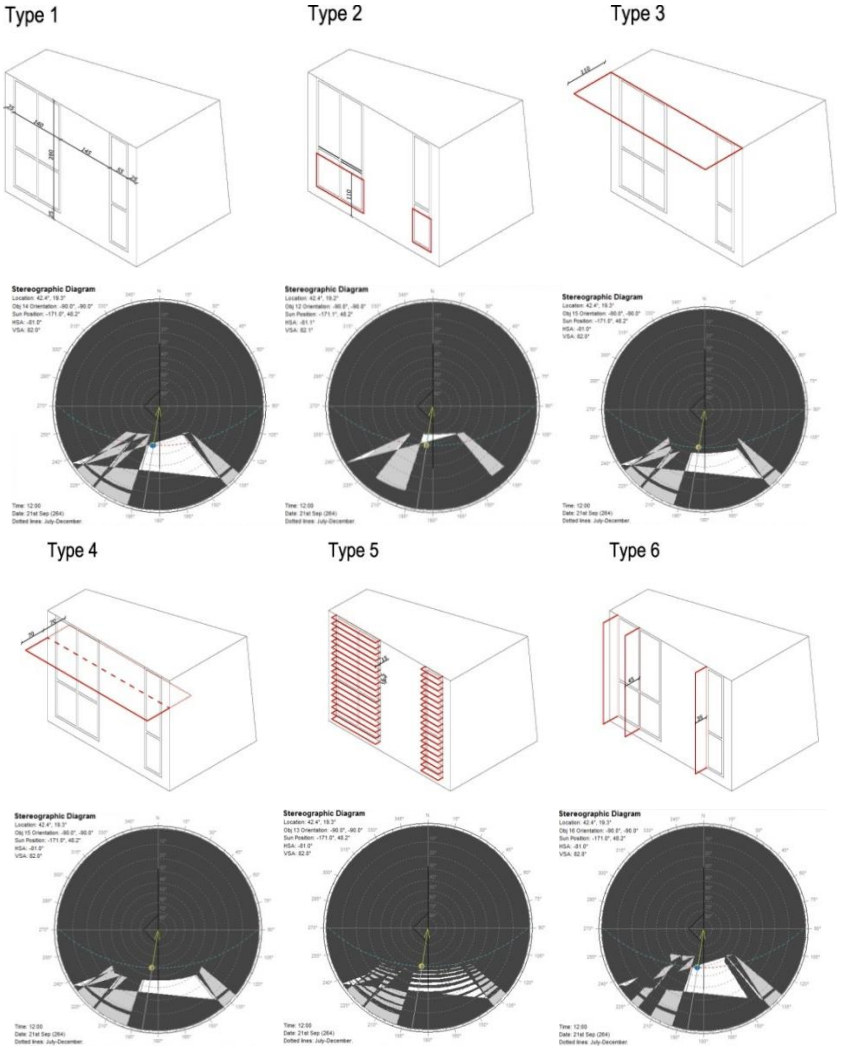


**Figure 2: Overview of the openings disposition and 5 different implemented static shading devices. Daylighting factor calculation is shown for each implemented system. It is also verified views towards environment and the position of shade into the office (room) volume.**

By using the relevant angle of daylight penetration, which is 67.36º for the 9th of May at noon and 47.86º for the 21st of September at noon, a series of solutions to reduce excessive daily illumination and room overheating are given. Consequently five typical cases are defined: Type 1 - the current situation; Type 2 - forming window parapets at 1m height; Type 3 - exterior light shelves of length 1.1m; Type 4 - a combination of external and internal light shelves, 0.70m length on both sides of the opening; Type 5 - horizontal brise-soleil of length 0.15m, at a distance of 0.16m; Type 6 - vertical wings relative to the side angle of daylight penetration. Calculation is done for all considered cases. Shade in the interior volume and perspectives to the environment are considered with respect to the work place position located on the axis of the room, at 1m distance from the window (workplace height is 0.80m). The typical office unit with the width of 3.9m and length of 5.5m is observed. The ceiling height is 3.43m, while the window height is 2.80m (parapet height is 0.25m).

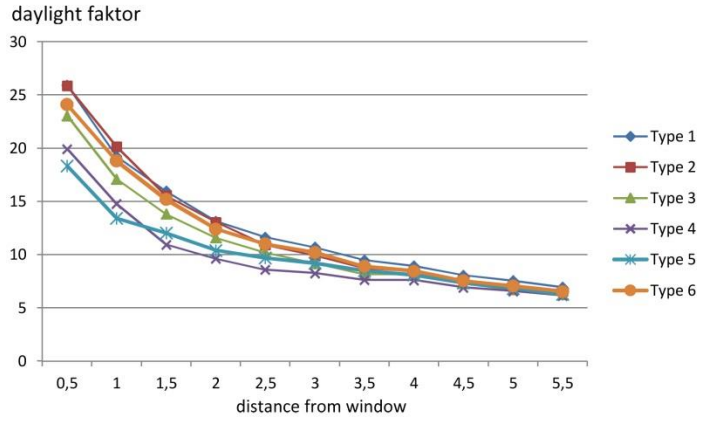



**Figure 3: Curve presents relation between daylight factor and distribution of daily illumination by office depth, for five different cases of implemented static shading device.**

Note that the distribution of daily illumination trough the office depth for Type 1, Type 2 and Type 6 is almost identical (Figure 3). Type 2 has the least inequality in terms of shadow spreading, while the vertical wings are ineffective (Type 3). Brise-soleils (Type 5) are the most appropriate for incorporation in the existing building structure and give the most uniform distribution of daily illumination trough the office depth. The lack of brise-soleil is that their use mostly distorts perspective and users connection with the exterior. It is noted that opposite to horizontal static daylight devices, the vertical one does not have influence to the reduction and correction of the daylight factor by increasing room depth. Horizontal overhangs and combined exterior-interior light shelves reduce view toward the sky. Horizontal fins (louvers) almost completely block environment perception. The

choice of an adequate shading system depends on the structure design characteristics and ability to implement new shading systems to the existing facade layer and building regulations.

## CONCLUSIONS

The windows are important elements of the building envelope that should arise as response to local climate and site conditions. In order to accelerate constructing, architects implement "quick" and ready-made façade solutions into their design that are not bioclimatic response to the local climate. The paper has proven that contemporary, "ready-made" facades solutions are not created as natural illumination study and local climate parameters. It is result of contemporary solutions that is not in conjunction with the requirements of indoor comfort. "Ready-made" façade solution does not take into account possibility of perceiving view toward surrounding. It is shown that there are not possibilities of view perception toward environment by using external daylighting systems, because it has been already mainly disturbed by using the "ready-made" façades solution with modular divided openings.

Improving the characteristics of daylight factors and achieving better energy efficiency, is based on understanding of the importance of software support implementation in the designing process. Because of differences related to the context, geographic coordinates, building orientation and shape, it is shown how the software packages and technologies can be used in the adaptation of the old office building and designing of the new facilities.

By proper strategies, the use of energy for lighting can be reduced up to 80%. Static shading systems control the brightness of daily illuminance and offer a great potential in the formal and energy fields related to the adaptation of old and energy inefficient buildings. The paper has proven the importance of the use of natural lighting studies in the early stages of designing. New approaches in shading devise design and using of new materials are fruitful areas for new research.

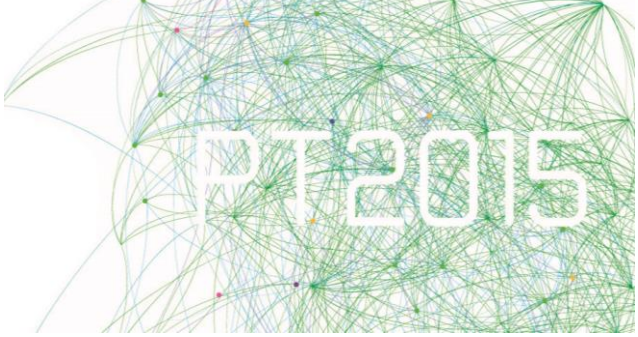
## REFERENCES

Burić M., Micev B. and Mitrovi, L. 2010. *Atlas klime Crne Gore*. Beograd: Publikum doo.

CIE – International Commission on Illumination. www.cie.co.at.

Ćuković-Ignjatović, N. 2010. *Fasada – adaptacije i transformacije*. Beograd: Zadužbina Andrejević.

Ecology in Architecture Design / Energy in the building design process. www.unige.ch/cuepe/virtual_campus/module_building/_principes/page_03_english.htm.



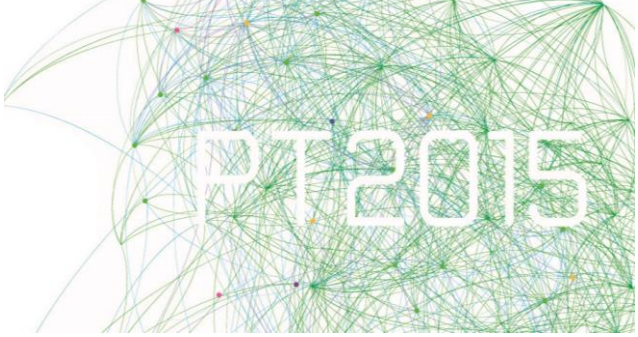

Krygiel, E. et al. 2012. Architectural Daylighting Analysis: *Daylighting Analysis with Autodesk Revit 2013 and Autodesk 3DS Max Design 2013 by James Vandezande, Phil Read and Eddy Krygiel*. E-book.

Olgyay,V. 1978. *Design with climate: Bioclimatic approach to architectural regionalism*. New Jersey: Princeton University Press.

Rakočević, M. 1989. *Arhitektonska fizika – dnevni osvjetljaj*. Beograd: Naučna knjiga.

Tregenza, P. and Wilson, M. 2011. *Daylighting: Architecture and Lighting Design*. New York: Routledge.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# ACTIVE SOLAR SYSTEMS – STUDY OF POTENTIAL FOR APPLICATION IN THE MATERIALIZATION OF TOURIST FACILITIES IN MONTENEGRO

**Irena Rajković** [1]
PhD student, Teaching Assistant, University of Montenegro – Faculty of Architecture, bul.DzordzaVasingtona bb 81000 Podgorica Montenegro, irena_arhi@yahoo.com

**Sanja Paunović Žarić**
PhD student, Teaching Assistant, University of Montenegro – Faculty of Architecture, bul.DzordzaVasingtona bb 81000 Podgorica Montenegro, paunovicsanja@gmail.com

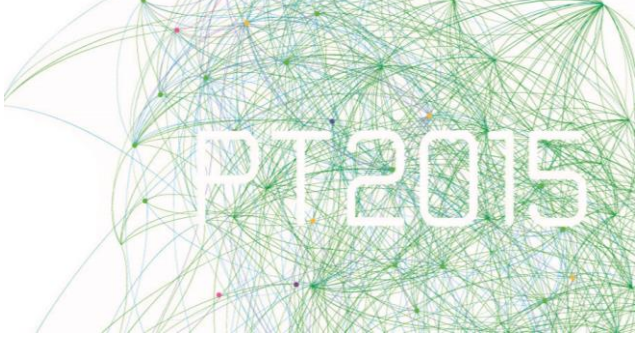
**Marija Bojović**
PhD student, Teaching Assistant, University of Montenegro – Faculty of Architecture, bul.DzordzaVasingtona bb 81000 Podgorica Montenegro, trashandvaudeville@gmail.com

## ABSTRACT

*Solar energy, as a renewable energy resource has great potential for application related to achieving energy efficiency of buildings. Therefore, this paper studies the characteristics and applications of active solar systems: photovoltaic systems and solar collectors. In order to maximize the utilization of solar energy and to achieve energy efficiency in buildings, technical solutions for using these systems in buildings envelope materialization are considered.*
*Montenegro, with 1500 to 2000 hours of sunshine annually and the quantity of incoming solar radiation from 1600 to 1800 kwh/m2 has exceptionally favourable climatic and geographic conditions for the exploitation of solar energy. Despite the existence of such conditions, solar energy has not been adequately exploited. Therefore, Montenegro as an ecological country should be more oriented to the use of solar energy, especially in the touristic industry, and that is what this paper aims to highlight.*
*In order to emphasize the importance and needs for the application of active solar systems in tourist facilities in Montenegro, climatic conditions and characteristics, electrical energy consumption and water heating energy requirements are analyzed. The paper examines the aspects relevant for the active solar systems usage in tourist facilities, both for construction of new buildings and the reconstruction of the existing ones, with respect of preserving the environment, energy-efficiency and sustainable development in general.*

***Keywords:*** *solar energy, active solar systems, materialization of building envelope, tourist facilities, energy-efficiency.*

[1] Corresponding author




## INTRODUCTION

Solar energy is a resource, which is much higher than the actual human needs, while people mainly used it to a very limited extent. However, environmental pollution, increasing energy demands, as well as increase in prices of fossil fuels, have led to the increased popularity of solar energy and a variety of other options both in highly developed as well as developing countries.

Today's solar architecture develops heavily influenced by two technological facts: a very rapid development of computer technology and development of construction components and modern systems of materialization of building envelope (Kosorić, 2008).

Solar facilities in terms of manner of solar energy utilization can be classified into passive and active ones, and they both use different systems for conversion of solar energy.

Today's solar architecture is developing towards achieving energy efficiency and energy savings, economic viability, and towards providing a comfort inside buildings in the broadest sense (Kosorić, 2008). Modern design principles emphasize the need and importance of sustainable architecture, energy efficiency of buildings, environmental protection, by using modern technological solutions. Application of modern systems through active utilization of solar energy aims to achieve a high degree of sustainable engineering and improve overall energy balance of buildings, especially in tourism. In order to achieve the best possible results, energy and water heating requirements in tourist facilities are analysed here, as well as characteristics of their locations and architectural elements of a building. Thanks to the climate, number and requirements of tourist facilities in Montenegro, this sector has a significant potential for active utilization of solar energy.

## POSSIBILITIES OF SOLAR ENERGY UTILIZATION IN TOURIST FACILITIES IN MONTENEGRO

The tourism sector in Montenegro is one of the key sectors for economic development of the country and has the best chance to initiate development of civil engineering and human resources in other fields, particularly in the area of renewable energy sources. This is confirmed by the data that millions of tourists visit Montenegro each year, which represents approximately eight million overnight stays. Currently, use of modern approaches and technologies on buildings in the tourism sector is not at a satisfactory level, although there are a large number of facilities in Montenegro where it would be possible to significantly reduce electricity consumption.

According to the data from the MONSTAT - Statistical Office of Montenegro, basic accommodation capacities (apart from hotels these are: motels, inns, hostels, resorts and inns) participate with 24.88% (hotels with 16.18% or a total of 26 907 beds) in total accommodation capacities.

Out of the total number of hotels, seventy are categorized as 5-star and 4-star (4 and 66 hotels, respectively), which is almost one third of registered rooms (370 in the category of 5-star and 3667 in the category of 4-star, Fig. 1.).

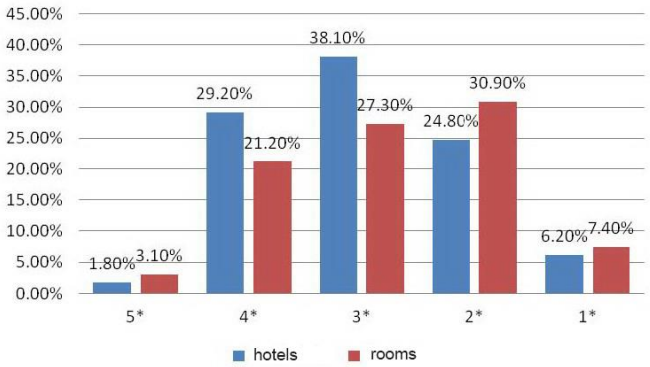



**Figure 1: Structure of accommodation capacities in Montenegro by category (Source: the MONSTAT - Statistical Office of Montenegro).**

Number of hotels and similar accommodation facilities in Montenegro is about 266 and is in ratio of 21:79 with complementary accommodation. The average capacity of a hotel is 58 rooms, and it is important to point out that 96.26% of total accommodation capacities in Montenegro is located in the southern region, only 1.59% in the central region and 2.16% in the northern region, so the coast with the most favourable features has at the same time the greatest potential for application of active systems.

On the basis of available capacities of the hotel sector - hotels and similar facilities, together with apartment capacities bring about in total over 1.3 million arrivals during the year, and 8,357,624 overnight stays and it can be predicted that the average energy requirements for hot water in the hotel sector is 50.6 GWh per annum calculated on the basis of a standard hot water consumption of 100liters/per day/per person. If 70% of the total energy requirements for sanitary hot water is provided by solar collectors, around 35 GWh of thermal energy would be produced per year, which would largely reduce the energy deficit for 30% in the summer months and replace consumption of electricity, and partly fuel oil used for sanitary water heating, and allow for reduction of carbon dioxide emissions by 0.2 million tons per year. The energy that the sun emitts during the year on 1 m² of roof in Montenegro is equal to the energy obtained from burning 143 litres of fuel oil - and at the same time this energy can be use indefinitely after installing the necessary systems (Vujošević, 2011).

Possibilities for utilization of solar energy are determined by the amount of expressed solar radiation during the year. The energy of solar radiation is sufficient to produce an average of 1,700 kWh of electricity per year per square meter of soil, and the greater radiation at a site, the higher the generated electricity is. According to meteorological data Montenegro has 1500-2500 hours of sunshine per year and global annual radiation in a substantial part of the territory is over 1500 kWh/m² (Fig. 2.). Because of the relatively small territory of Montenegro, no big difference can be noticed in the average values of solar radiation at ground level, and therefore Montenegro shows great potential for introduction of active systems for utilization of solar energy, especially in the central region and along the coastline.

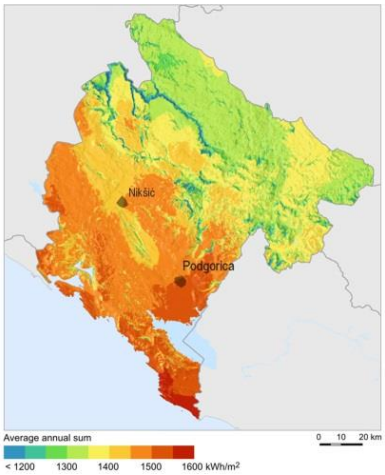



**Figure 2: Global solar radiation for Montenegro. (http://solargis.info/doc/_pics/freemaps/1000px/ghi/SolarGIS-Solar-map-Montenegro-en.png)**

Assessment of solar energy potential regarding the tourism sector is done on the basis of assessment of water consumption (seasonal, annual, medium-specific), then investment costs, maintenance costs, term of profitability, and the most attention is dedicated to the coastal area, because of the highest rates of attendance during the summer.

Cost price of solar collectors is negligible for the tourism sector, considering the savings that would be achieved by application of solar water heating systems as one of the most important items in terms of total costs. Solar collectors could fully meet the heating requirements during the summer. With proper positioning, 1 m² of solar collector achieves saving of 500kWh per year, according to data obtained from the statistical analysis. Considering application of solar energy by using solar collectors on the coast the conditions are excellent from early spring to late fall. The share of hot water for heating ranges from 13-15%, which for hotels with a large number of beds means significant item (Maksin, 2009).

Determining which active systems should be used depends on a number of factors, which are primarily related to the parameters of location, climate, urban conditions,

economy of system, design requirements, technical regulations, and legislation and so on.

Application of solar energy in tourist facilities is possible if all the necessary micro-climatic conditions are met, both natural (insolation, site characteristics, configuration of terrain, vegetation, climate) as well as created (optimal orientation of facility, type of facility, distance between facilities, land development level, etc.). Advantages of utilization of solar energy in tourist facilities are huge, if we take into account how much energy is needed for water heating (heating water for showering, swimming pools, spas, hotel services - food preparation, washing, etc.). The share of water heating ranges from 13-15%, which represents a significant item for hotels with a large number of beds. On average, these systems reduce the consumption of fuel oil or other sources of energy by 60-70%.

On the basis of calculations of energy generated from photovoltaic devices assuming average statistical data on solar radiation and ideal conditions for installation of these devices, we get the energy image according to which the energy potential of photovoltaic devices in the Balkans ranges from 150-200 kWh/mkWh/m². Photovoltaic systems have great potential, but due to the current high market prices they are still not a profitable investment, despite a number of advantages of this system, such as low maintenance and long lifetime (up to 20 years) (Stamenić, 2009). Considering that the overall economy of Montenegro is largely based on the tourism industry, utilization of solar energy in the tourism sector of Montenegro would have multiple benefits, and in addition to energy savings it would provide a great contribution to environmental protection.

## ACTIVE BUILDING-INTEGRATED SOLAR SYSTEMS

Solar energy systems are generally divided into two groups: passive and active solar systems. Active use of solar energy means meeting the needs and demands for hot water through the use of solar collectors, as well as generation of electrical power through photovoltaic cells. One of the more promising ways of application of active systems is a building integrated solar system. There are integrated photovoltaic systems (BIPV), integrated solar systems (BIST), and the combined thermal and photovoltaic systems (BIPVT). (Nikolić 2014) Photovoltaic systems are one of the most promising systems for generating electrical power, by converting solar radiation, with the possibility to be integrated into a building envelope and without environmental pollution (Fig. 3.). Together with integrated photovoltaic systems it is also possible to integrate solar thermal collectors and thus produce both thermal and electric energy.

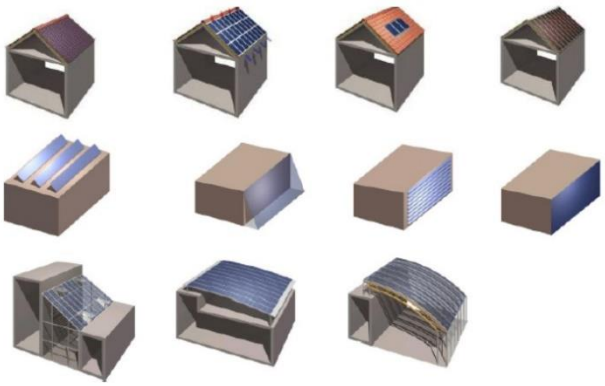


**Figure 3: Typical application of integrated photovoltaic systems. (https://firstgreenconsulting.files.wordpress.com/2013/07/bipv-application.jpg).**

## EXAMPLES OF UTILIZATION OF SOLAR ENERGY THROUGH ACTIVE SYSTEMS ON TOURIST FACILITIES

Although utilization of solar energy and other forms of renewable energy sources in Montenegro is not at a satisfactory level, in the recent years significant positive developments were made in this field, especially by large tourism companies. However, there are a number of tourist facilities in the world, whose energy use is based on utilization of solar energy, through application of active solar systems.
Hotel Solar Valley Micro-E Hotel, in Dezhou City, China (Fig. 4.) is the largest solar-powered hotel in the world. The building has an area of about 75,000 m² and solar panels make up a large part of the design of materialization of the facility itself, and almost the entire entrance area is covered with solar panels. Large area solar panels cover about 70% of energy requirements of the hotel, both for water heating and air conditioning.

**Figure 4: Solar Valley Micro-E hotel, Dezhou City, China. (http://2greenenergy.com/2013/04/17/solar-energy-hotels/).**

Proximity Hotel (Figure 5.) is a hotel with 147 rooms and 10 suites and has the largest solar system for sanitary water heating in the United States. It is the first

hotel with platinum LEED certificate in the United States. The idea for this system came from the need to reduce fossil fuel consumption. It was achieved in a way that this hotel has 40% less energy consumption and 30% less consumption for water heating compared to hotels of similar capacity. The hotel includes about 70 different sustainable systems, within which 100 solar collectors are installed on the roof of the hotel.


**Figure 5: Proximity Hotel, USA. (http://ecowatch.com/2015/01/22/eco-friendly-destinations/).**

Application of active solar systems in Montenegro on tourist facilities, in relation to their great potential is sporadic. One of the most important examples of application of solar collectors is the apartment settlement *Slovenska plaža* in Budva, which was constructed in 1983 (Fig. 6.). The tourist settlement *Slovenska plaža* is intended for accommodation of tourists all year round, except in winter. The facility can accommodate 2700 guests. Due to the diverse use of the building, energy needs are large because the following should be provided: 600,000 litres of sanitary hot water per day, 1010/405 kW of heating/cooling and 475 kW for heating of water in swimming pools.

Installation of solar collectors and heat pumps is designed for heating and cooling of space and sanitary water heating. It consists of solar collectors with a total area of about 2500 m2 and three heat pumps. At that time, it was one of the largest composite systems in Europe, with unique technical solutions, which is why the UNESCO/FAO working group, which held a meeting from 21 - 23 August 1985 in Dubrovnik, decided to adopt the thermo-technical installation of *Slovenska plaža* as a basic system for performance analysis within the long-term program of monitoring behaviour of large solar systems.

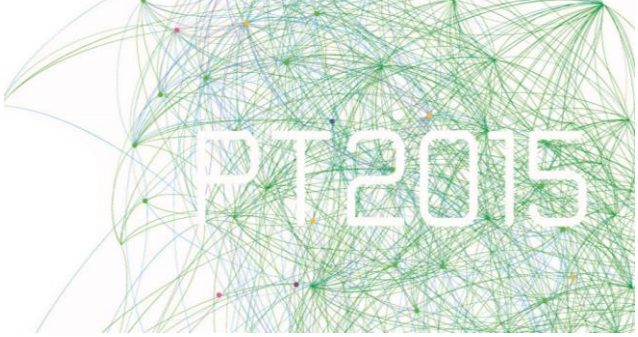
**Figure 6: Solar collectors, Tourist settlement *Slovenska plaža* in Budva (Pejaković S., Image of installations with heat pumps produced in Serbia in the period from 1983 to 1985 that are still in operation).**

## CONCLUSION

By analyzing solar energy potentials in Montenegro, as well as characteristics of photovoltaic systems and solar collectors, this paper highlights the possibilities of application of active solar systems in the materialization of facilities, both during reconstruction and improvement of energy efficiency of existing facilities and with the newly designed facilities, especially in the tourism sector. Despite favorable conditions and potentials which exist in Montenegro, solar energy has not been sufficiently used so far. Montenegro as an ecological state, with emphasis on development of the tourism industry, and in accordance with the principles of sustainable development and energy efficiency must work on creation of favorable conditions for the application of active solar systems. In order to enable broader use of solar thermal installations in tourist facilities in Montenegro, and taking into account current market price of electricity, it is necessary to provide adequate state subsidies for generating energy from renewable sources, and therefore the solar energy.

Application of photovoltaic systems and solar collectors in buildings emphasizes the concept of utilization of solar energy in order to achieve energy efficiency in buildings, and for this reason it is necessary to think about their application in the materialization of envelopes of tourist, and other types of facilities.

Development of the tourism industry is crucial for economic development of Montenegro. For this reason, energy efficiency, and in this sense utilization of solar energy in the tourism industry is of great interest for Montenegro. Moreover, the possibilities for achieving energy independence from the national distribution network through apllication of active solar systems, are a very important aspect when it comes to tourist facilities. Thereby, in addition to positive economic effects, environmental objectives in environmental protection are achieved as well. By meeting these conditions a favorable basis is created for strengthening the tourism industry, better and more quality offer and therefore also for affecting the country's economic development and verification of sustainable tourism, as a strategic commitment and objective of Montenegro.




## REFERENCES

Kosorić, V. 2008. *Aktivni solarni sistemi-primjena u materijalizaciji omotača energetski efikasnih zgrada*; Građevinska knjiga, Beograd, p.7.

Kosorić, V. 2008. *Ekološka kuća*, Gradjevinska knjiga, Beograd, p.42.

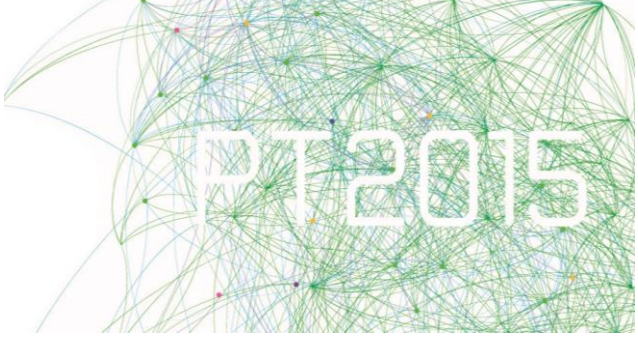
Maksin, Pucar, Korać, Miljić. 2009. *Management of natural and cultural resources in tourism*, Singidunum University, Faculty of Tourism and Hospitality Management, Beograd, p.97.

Nikolić, Tanić, Stanković, Kondić, Milošević, Kostić, Petrov, Pilipetc. 2014. "Implementation of solar energy systems and power efficiency increase for preschool facilities in city of Niš (Republic of Serbia)", *Consturction of unique Buildings and Structure,* ISSN 2304-6295. 4 (19). 2014. 21-33, p. 23.

Stamenić, L. 2009. *The utilization of solar photovoltaic energy in Serbia*, Jefferson institute, p.3.

Vujošević, Ivančević, Radonjić, Govedarica, Rajković, 2011. Montenegrin center for Energy Efficiency, GIZ, *The Solar energy in the tourism sector in Montenegro* p.32-33.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# PREFABRICATED PASSIVE HOUSE VENTILATED FAÇADE PANEL SYSTEM WITH RECYCLED CONCRETE

**Ljubomir Miščević**
PhD, Professor, University of Zagreb, Faculty of Architecture
Fra A. Kačića Miošića 26, HR-10000 Zagreb, Croatia, miscevic@arhitekt.hr

**Ivana Banjad Pečur**
PhD, Professor, University of Zagreb, Faculty of Civil Engineering
Fra A. Kačića Miošića 26, HR-10000 Zagreb, Croatia, banjadi@grad.hr

**Bojan Milovanović**
PhD, Mag.ing.aedif, University of Zagreb, Faculty of Civil Engineering
Fra A. Kačića Miošića 26, HR-10000 Zagreb, Croatia, bmilovanovic@grad.hr

## ABSTRACT

*Presented prefabricated façade system is possibility for affordable, cost effective, healthy and sustainable solution that is implemented on the three various architectural designs that are in different phases of design development. This ventilated prefabricated wall panel system that is called ECO-SANDWICH® is energy efficient, recycled concrete sandwich facade panel. It is R&D project that was funded by the European Commission within the framework of CIP-EIP-Eco-Innovation 2011 Programme. Encourage the re-use and recycling of construction and demolition waste (CDW) in order to shift CDW management from disposal to recycling and reduce utilisation of natural resources thus preventing landscape degradation. Three priorities of the EU Eco-innovation call are incorporated; it uses recycled material to create innovative sustainable building product which contributes to healthy building, it represents a significant improvement over the existing prefabricated wall panel products, aligning itself with the mandatory targets of EPBD, its Recast EPBD II and with EU Waste Framework Directive.*
*The system is affordable solution both for the new construction and renovation up to "factor 10" and it is marked as "the green revolution in construction". The very first three projects designed by architect Lj. Miščević based on this façade system are presented. The Central Building of the University Campus, the reuse renovation project for the University library and the type family house for social housing standard all in the town of Koprivnica. Energy concept for all of them is nearly zero energy building (nZEB). More precise, it is passive house energy standard (A+) with active renewable energy systems. It is affordable in social housing in Croatia as it is proved in the three realized multi-family buildings.*

***Keywords****: prefabricated façade panels 1, eco-innovation 2, energy efficiency 3, nearly zero energy buildings 4, new buildings and efficient refurbishment 5.*

## INTRODUCTION

The concept incorporates three priorities of the eco-innovation call; it uses recycled material to create innovative sustainable building product which contributes to greening the business of SMEs through decreasing their environmental impact accompanied by the use of less non-renewable or natural resources, and energy efficiency to Nearly zero energy building (nZEB). ECO-SANDWICH project encourages the re-use and recycling of construction and demolition waste (CDW) in order to shift CDW management from disposal to recycling and reduces utilisation of natural resources.

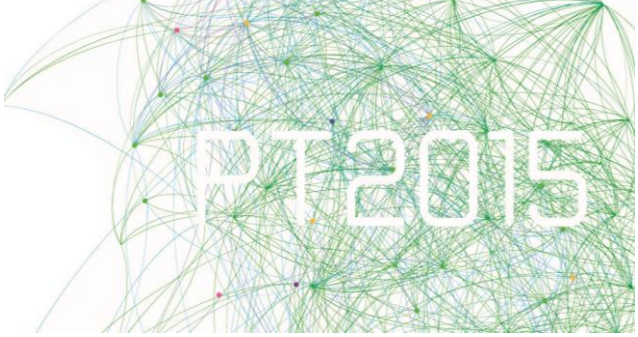
Therefore this way prevents landscape degradation, promotes the substitution of conventional thermal insulation materials by mineral wool produced using innovative and sustainable technology, leading to a reduced environmental impact. It also promotes the implementation of prefabricated, energy efficient products in order to enable reduction of primary energy consumption in residential and commercial buildings and reduce embodied energy, embodied carbon and production of by-product wastes. Therefore this way prevents landscape degradation, promotes the substitution of conventional thermal insulation materials by mineral wool produced using innovative and sustainable technology, leading to a reduced environmental impact.

## ENVIRONMENTAL, TECHNICAL AND TECHNOLOGICAL CHARACTERISTICS


**Figure 1: European key messages tackled by the ECO-SANDWICH project, 3D model and real section.**

## SUSTAINABILITY CONSIDERATIONS

Innovative concreting solution of outer layer distinguishes prefabricated ECO-SANDWICH (ES) wall panels from similar products and makes it unique on the




market. This façade panels system represents improvement of existing prefabricated wall panel products, aligning itself with the mandatory targets of EPBD and EPBD II. thus tackling the 20-20-20 targets (20% reduction in EU greenhouse gas emissions from 1990 levels; raising the share of EU energy consumption produced from renewable resources to 20%; 20% improvement in the EU's energy efficiency), and represents a possible technological solution for fast construction of very low energy or passive house standard (A+) buildings on a large scale. The ES tackles three major environmental problems; reducing greenhouse gas emission by enhancing energy efficiency of buildings, increased resource efficiency through the use of construction and demolition waste (50% of total aggregates is obtained from recycled aggregate) in panel manufacturing and minimising the use of regulated chemicals like phenol and formaldehyde from the insulation material production process. The embodied energy of the ES is 33.8% lower than that of lightweight composite insulation panels such as those made of aluminium or galvanized sheets and polyurethane insulation. Moreover, the ES wall system has greater thermal mass. ES wall panels are both reusable and fully recyclable. Abiding by the credo that "the best energy is saved energy", the ECO-SANDWICH achieves sustainable, healthier environment and living ambient for occupants. Taking into account that mechanical recycling and crushing of CDW consumes only small amount of energy and is an environmentally friendly process, the ES, by using recycled CDW in combination with mineral wool produced with Ecose® Technology, constitutes an innovative product whose embodied energy payback time is 22 months due to savings during exploitation.

## ENERGY EFFICIENCY

Buildings are one of the greatest consumers of energy, thus having a great environmental impact, apart from the energy consumption but because of the significant impact of construction materials to the environment during production, manifesting through its embodied energy, and disposal. The present condition of the existing building stock in EU is deeply unsatisfactory. Most buildings are 'sub-standard' in terms of energy efficiency, comfort and health. In EU buildings consume around 40 % of energy needs and account for 36 % of EU's $CO_2$ emissions. Therefore, these countries have decided to implement plans to increase energy efficiency in their national energy strategies and to develop legal framework for the implementation of these plans.

Thermal conductivity of the concrete made by using the recycled concrete and recycled brick as aggregates are 36 % and 45 % lower, respectively, in comparison with the thermal conductivities of concrete using aggregates form nature. Thermal transmittance of the ES wall panels is $U<0,20\ W/m^2K$

## CIP ECO-INNOVATIONS

Project "Energy Efficient, Recycled Concrete Sandwich Facade Panel – ECO-SANDWICH" has been recognized, and is being financed within the framework of CIP-EIP-Eco-Innovation 2011 programme. It has been accepted for financing together with 47 other projects among 280 proposals, in total. Launched in 2008, the Eco-innovation initiative is part of the EU's Entrepreneurship and Innovation Programme (EIP), set up to support innovation among SMEs and to improve their competitiveness. It is included in the EIP's annual work programmes.

The Eco-innovation initiative bridges the gap between research and the market. By co-funding 50% of the projects, European commission helps good ideas for innovative products, services and processes that protect the environment become fully-fledged commercial prospects, ready for use by business and industry. In doing so the initiative not only helps the EU meet its environmental objectives but also boosts economic growth.

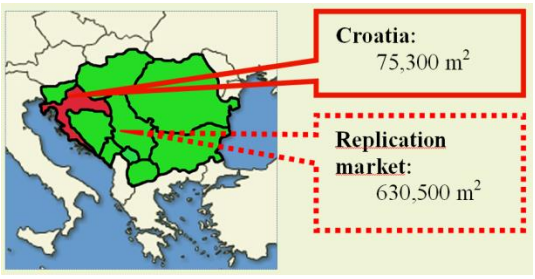



**Figure 2: Potential market size for uptake of the ECO-SANDWICH wall system.**

## THE FIRST PROJECTS FOR IMPLEMENTATION

By implementing ECO-SANDWICH wall panel system, new business possibilities are emerging, together with promoting innovative and green economy, for building new or refurbishing existing various architectural functional types as apartment buildings, family houses, office buildings, schools, hospitals, production and storage facilities, farms etc.

The first projects for this façade system implementation are designed for Central building as new building and one reuse refurbishment for University and public library both in the University campus in the town of Koprivnica in Croatia. The very last one that is now in the process of Main project is for the first family house from the Social housing program (POS) in the same town. All projects are designed on the passive house standard (A+). Author of those projects is architect Ljubomir Miščević.

**Figure 3: Project for the Central building of the University campus in Koprivnica, Croatia. 3D models of the view from south-east and north-east. North-west elevation. Author: Lj. Miščević, 2013.**

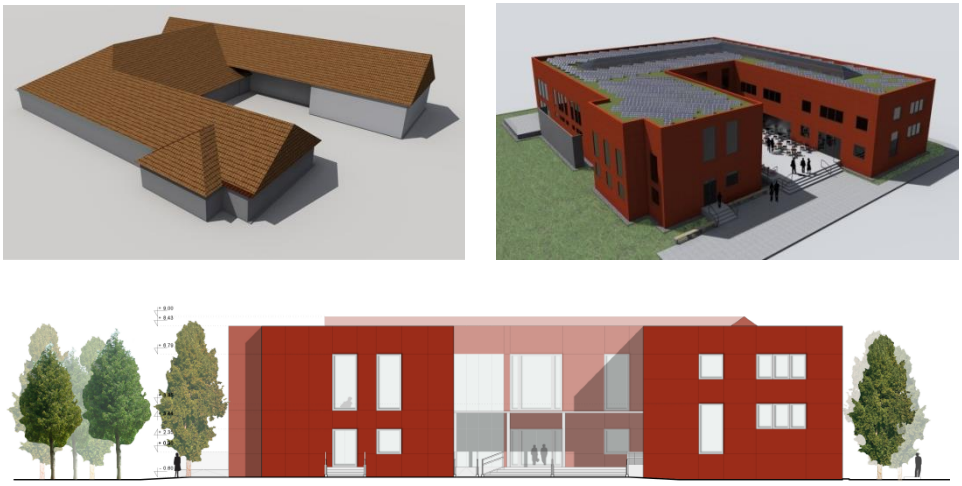


**Figure 4: University and public library in University campus in Koprivnica, Croatia. Idea project for reuse and reconstruction. Author Lj. Miščević, 2013. 3D models of existing state and Idea project. South and east elevation. Energy eff. renovation up to "factor 10".**

**Figure 5: Project for the first family house from the Social housing program (POS) in Koprivnica, Croatia, 2015 . Energy certificate for A+ class. Author: Lj. Miščević.**

## CONCLUSIONS

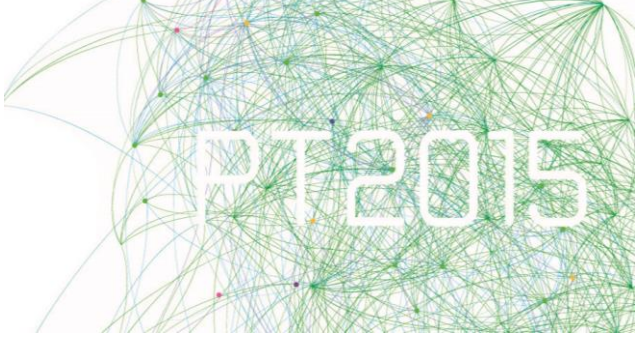
Ventilated prefabricated wall panel presented in this paper utilises recycled construction and demolition waste (CDW) and mineral wool produced using innovative and sustainable technology for reduction of primary energy consumption in building stock. The results of EU Eco-innovation research project titled ECO-SANDWICH represents a significant improvement over the existing prefabricated wall panel products, aligning itself with the mandatory targets of the EU; Energy Performance of Buildings Directive - EPBD, its Recast EPBD II. and Waste Framework Directive targets. Presented projects for the first implementations are more better in energy efficiency than it is defined as national nearly zero energy level (nZEB). They are A+ passive house so they figure pilot projects for the new platform of social, affordable, energy efficient and sustainable building referent for creation of passive healthy cities and regions.

## REFERENCES

Milovanović, B., Štirmer, N.; Miličević, I. 2012. The Sustainable Prefabricated Wall Panel System Made of Recycled Aggregates // Proceedings of the International Symposium on Life Cycle Assessment and Construction. Nantes, France: IFSTTAR.

Banjad Pečur, I., Štirmer, N., Milovanović, B. Bijelić, N. Eco-Sandwich Wall Panel System, the Sustainable Prefabricated Wall Panel System Made of Recycled Aggregates / *Conference Proceedings of CIB W115 Green Design Conference* / Durmisevic, Elma; Pasic, Adnan (ur.). Sarajevo : International Council for Research and Innovation in Building and Construction (CIB), 2012. 39-42.

Miščević, Lj. 2007. Passive houses in Croatia – projects and realizations, 11th International Conference on Passive Houses 2007, Conf. Proceed., Bregenz, Passivhaus Institut, Darmstadt, pg 295-300.



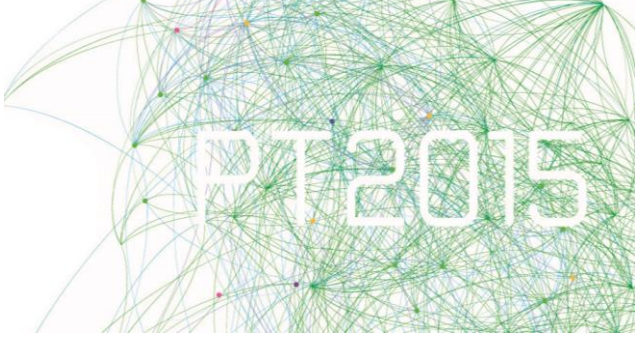

Miščević, Lj. 2009. Experience in architectural design, construction and utilization of passive houses and a start of PASS-NET IEE project in Croatia, 13th International Passive House Conference 2009, Frankfurt, PHI, Darmstadt, 2009, 978-3-00-027511-1, pg 221-226.

Miščević, Lj. 2010. Passive house in South-Central Europe, 14th International Passive House Conference 2010, Dresden, PHI, Darmstadt, 2010, ISBN: 978-3-00-031174-1, pg 321-328.

Miščević, Lj. 2013. Passive House and ECO-SANDWICH EU Eco-innovation Project for Façade Panels, 17th International Passive House Conference 2013, Frankfurt, Passivhaus Institut, Darmstadt, 2013 , ISBN: 978-3-00-041346-9, pg 517-518.

Miščević, Lj. 2014. The first twenty passive houses in Croatia, 18th International Passive House Conference 2014, Aachen, PHI, Darmstadt, 2014, ISBN: 978-3-00-045216-1, pg 503-508.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# POTENTIAL ANALYSIS OF DYNAMIC, THERMAL BUILDING SIMULATIONS AND DEVELOPMENT OF MEASUREMENT AIDED SIMULATION TECHNIQUE

**István Kistelegdi** [1]
PhD, Professor, University of Pécs, Faculty of Engineeing and Information Technology, Boszotkány Street 2, 7624 Pécs, Hungary

**Bálint Baranyai**
University of Pécs, Faculty of Engineeing and Information Technology, Boszotkány Street 2, 7624 Pécs, Hungary

**Bálint Bachmann**
PhD, Professor, University of Pécs, Faculty of Engineeing and Information Technology, Boszotkány Street 2, 7624 Pécs, Hungary

## ABSTRACT

*The reliability and accuracy of dynamic thermal building simulation methods have empirically been proved only in smaller units of engineering and parts of buildings not in complex buildings, or very rarely in a non-representative number of cases. The aim is to research the potential of such simulation design methods, to validate their adaptability to complex buildings, based on measured data and to develop an accurate generalized simulation design method for divers building types. The limitations and inaccuracies uncovered during the usage of complex building simulation software while continually comparing the results to actual measured values and data, highlight the need for further research and development in the field of complex, zone based building simulation software. Through a research agreement with one of the developers of the software IDA ICE (EQUA Solutions / Lucerne University of Applied Sciences and Arts, Switzerland) we have been given the opportunity to test the latest 4.7.1 beta version of the program, which enables us to give firsthand feedback to help optimise the program.*

***Keywords**: building, energy, simulation, measurement, validation.*

## AIMS OF RESEARCH

Based on the current national and international practice theoretical building energy calculations show substantial inaccuracies compared to the measured energy consumptions of the actual buildings. Presently dynamic, thermal building simulations are the most effective design aid tools, which if integrated into the

[1] Corresponding author

design process help accurately meet the intended target values. According to previous research results, the reliability and accuracy of such simulation methods have empirically been proved only in smaller units of engineering and parts of buildings not in complex buildings, or very rarely in a non-representative number of cases. The essential aim is to research the potential of such simulation design methods, to validate their adaptability to complex buildings, based on measured data and to develop an accurate generalized simulation design method for divers building types.

## THERMAL BUILDING SIMULATIONS IN DIFFERENT PLANNING PHASES

Throughout the design process (draft, authority permit and construction plan, operation, renovation) the blueprints can be supported by the data based on the physical characteristics of buildings in numerical value as a result of dynamic, energetic and climatic building simulations of different degrees. As a reference, the industry and office building of Rati Ltd. in Komló, Hungary was chosen, because it serves besides regular industrial operation, as a monitoring demonstration building for the University of Pécs, Energiadesign research group. During the investigations it could be established that in draft phase, when the simplified simulations serve as a means of comparing the different concept variations, these simulations can predict with an accuracy of 45-50% the energetic output of the planned building variations compared to the measured data gained from the actual building after its completion. In the permit phase the simulations provide 65%, in the construction phase 80%, and in the realisation phase 90% accuracy in terms of energetic prognosis.

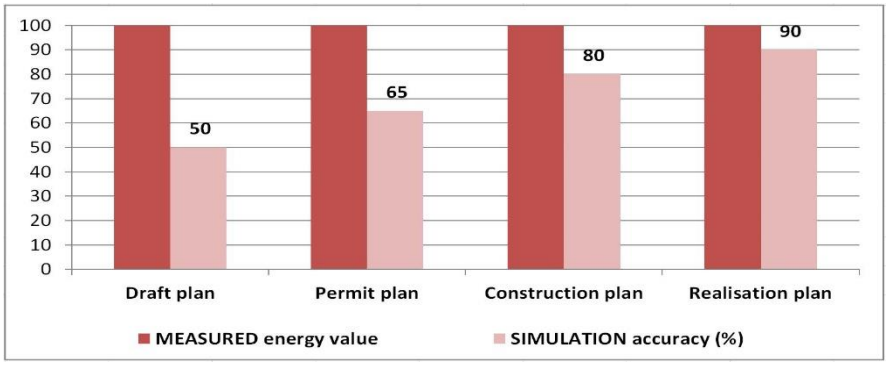



**Figure 1: Accuracies of simulation building models on the level of diverse planning phases in comparison to the implemented building's energy consumption measurement value (100%).**

## OPTIMIZATION OF THERMAL BUILDING SIMULATIONS

The reference building (Rati Ltd., Komló) was investigated in order to achieve optimized relation to geometrical modelling and calculation time. Based on the

simulation experiments it can be established that using the own developed geometrical rational model method, by reducing the number of room zones, a faster rate of calculations can be reached by up to 80 % compared to blocks of building parts (building bodies) with a result difference of below 5%.

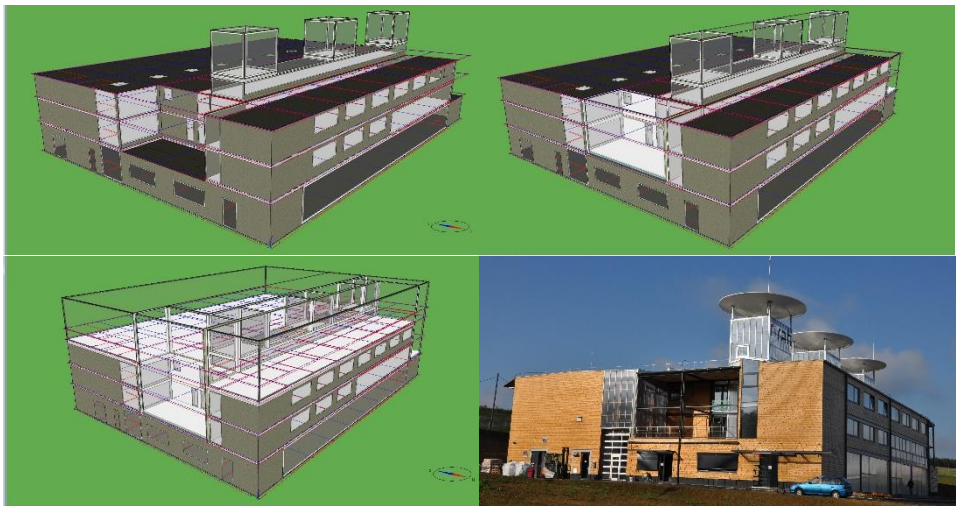


**Figure 2: Model_01 (top left): 6 Building Body + 7 Zone. Model_02 (top right): 2 Building Body + 11 Zone. Model_03 (bottom): 1 Building Body + 12 Zone.**

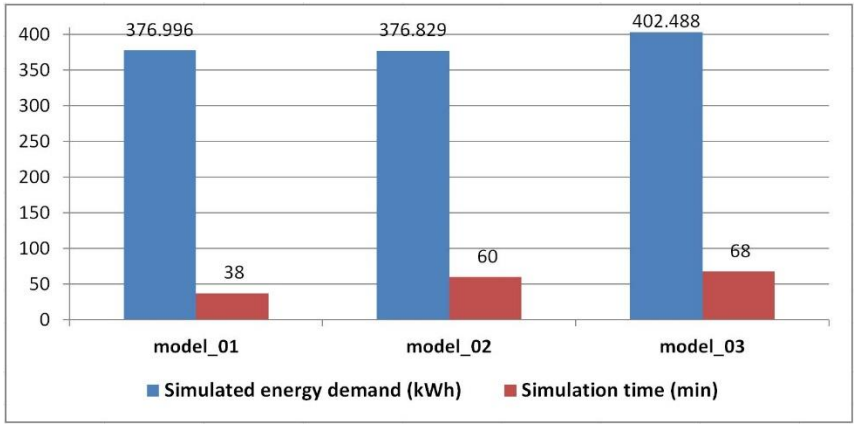
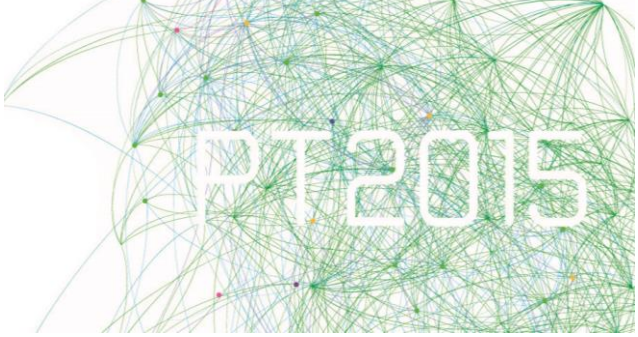



**Figure 3: Simulation modeling techniques – comparison of the three model variations according to simulation results and calculation duration**

In addition it could be also established that using the geometrical and mechanical rational model method (with contraction), the substantial length of time needed for running simulations can be further reduced by 50 – 60% if the structure and geometry of the room zones along with the HVAC technology of these zones well be simplified, while the accuracy of the energy demand calculations remains




reliable (< 5%). So instead of taking the 'as accurately as possible' model approach developing the 'as accurately as necessary' building physics model method it is possible to simulate buildings which are far more complex.

## VALIDATION OF THERMAL SIMULATIONS THROUGH MEASUREMENTS

The accuracy of a dynamic, thermal building simulation model depending on the functional, geometrical, structural, mechanical complexity of the building is determined not only by the settings of the model, but the model method interpreting the reality best, which can only based on and validated by actual measurements.. In case of more complex office or public buildings, besides the planned and conscious user behaviour, a self-regulatory building management system (BMS), based on its own measurements and data, is needed. This BMS system consists of 150 measurement points in the HVAC and passive ventilation-opening systems that were extended by further 250 measurement points (MMS, mobile monitoring system). Comparing the results of these real measurements with the operation of the natural ventilation openings, HVAC systems, electrical systems, occupants and their clothing, metabolic rate, time schedules, the equipment and its schedules can be modelled and parameterized.

**Table 2: Simulation calibration data**

| | |
|---|---|
| **Room air temperature setpoints** | **°C** |
| **Active facade openings' schedule** | **Time** |
| **AHU's schedule and operation intensity** | **%** |
| **Real indoor illuminance values** | **lx** |
| **Air-earth heat exchanger supply air temperatures** | **°C** |
| **Active facade openings' schedule** | **Time** |
| **Airflow in offices** | **$m^3/h$** |
| **Heat recovery in the AHU system** | **%** |
| **External air temperatures** | **°C** |
| **Relative air humidity** | **%** |
| **Wind direction and velocity** | **°, m/s** |
| **Heating/cooling circulation systems heat flow volume** | **GJ** |
| **Geothermal earth probes' primary circulation heat flow volume** | **GJ** |
| **Solar thermal collector system heat flow volume** | **GJ** |
| **Electrical energy consumption** | **kWh** |
| **Room operative air temperature (hourly resolution)** | **°C** |
| **Geothermal earth probes' delivered temperatures** | **°C** |

By editing the above mentioned monitoring data into the simulation model and by adjusting the model to the real operation processes the calculated results could be compared with the real measurements. A typical heating model (January) and a typical cooling model (August) was verified with approx. 90% accuracy rate. The most effective way to operate a building management system optimally is through calibrated building simulations. The developed true to reality simulation method

can then be used generally to different industry and office buildings with alternating structures, forms, dimensions, materials, orientation and location (climate) when designing low energy buildings both in the aided design of new buildings and in the renovation of existing buildings.

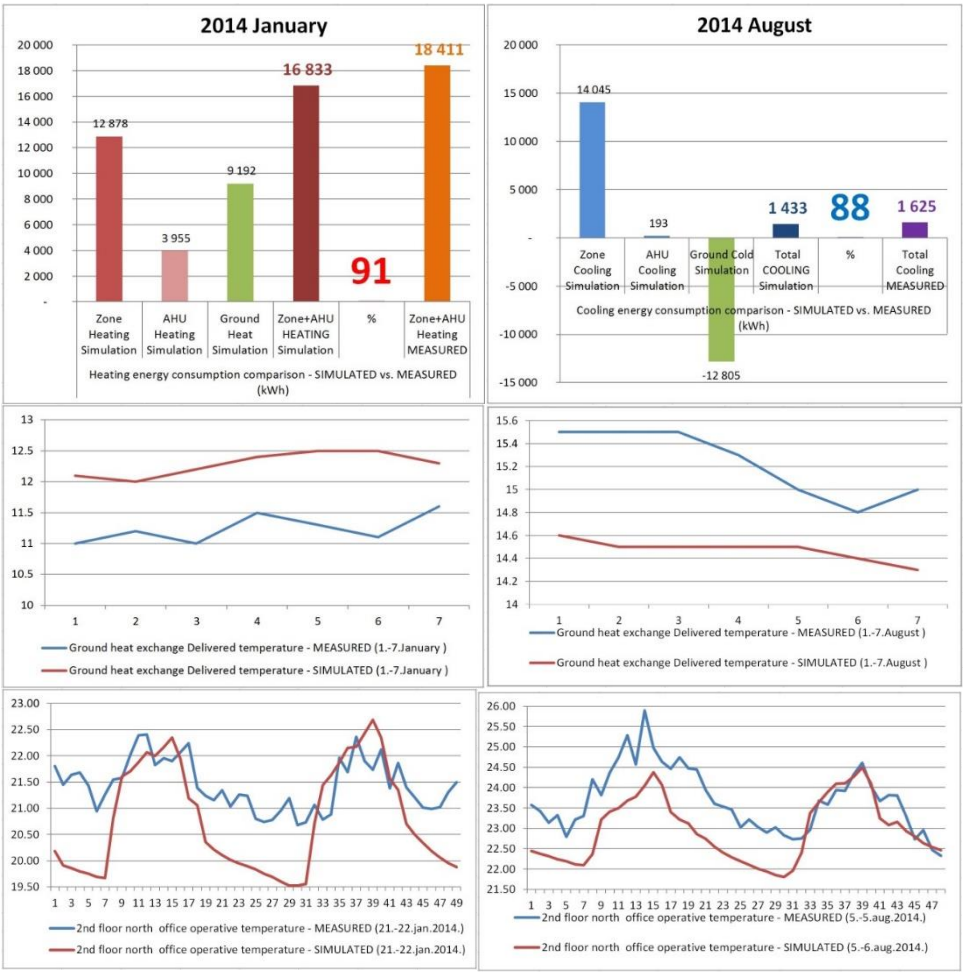
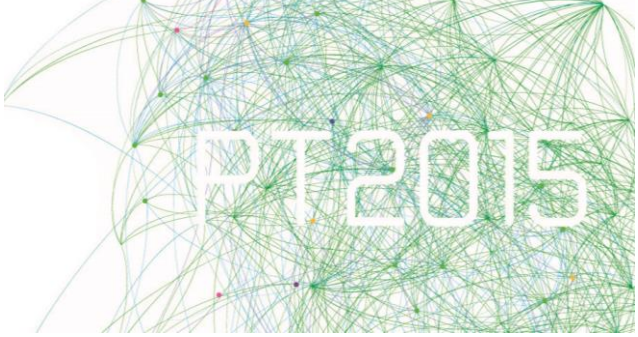



**Figure 4: Comparison of measured vs. simulated results - heating and cooling energy demand (top right/left), Ground heat delivered temperature (middle right/left), operative temperatures in office (bottom right/left).**

## CONCLUSIONS

The accuracy level of thermal simulations in different planning phases was quantified in order to demonstrate the design potential dynamic building energy calculations. Through the development of optimized simulation modelling techniques significant calculation (solver) time can be conserved while keeping the




energy results of the simulations at almost the same accuracy level. By fine tuning the settings – approaching the reality virtually and developing the programmes – the results of the simulations increasingly correlate with the actually measured values, this way helping the justification and reliability of the simulation method, and enabling the development of the special ENERGIA DESIGN® planning method (that was developed at the University of Pécs, Department of Enrgiadesign) and operational concepts. The research provides perspective based on the analogy of the observed buildings for further research on different types of buildings and a more detailed study of the functions examined (office, educational and industrial buildings). Consequently it has become possible to investigate the possibilities for optimising the comfort and energy level of all existing buildings, providing a basis for smart cities and long-term energy strategies for different parts of the country.

In an ongoing research program thermal mass of the building structures can be examined and quantified in monitoring supported thermal simulations, in order to determine the - so far in detailed resolution - unknown characteristic of thermal mass energy efficiency qualities. In the same investigation program electrical last management of buildings will be developed with the intention regenerative electrical energy to store in buildings thermal mass structures and HVAC systems. For this purpose measurement based thermal simulations are required. It is also necessary to investigate different HVAC systems using high-resolution building monitoring technology, in order to validate and calibrate thermal building simulation models with all possible building services systems. In this way possibilities are given to develop besides the reference building's particular HVAC system all technical systems, as well as completely new HVAC building systems.

## REFERENCES

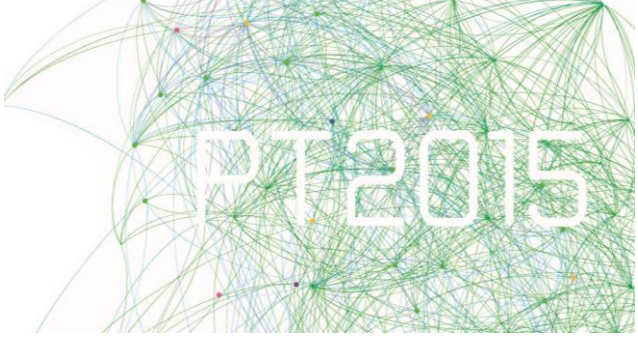
Dr. habil Kistelegdi István DLA 2013,: „Pluszenergia potenciál egy ipari és irodaépületben (Energy-plus potential in an industry and office building)", Ph.D. Thesis, University of Pécs, Pollack Mihály Faculty of Engineering and Information Technology.

Google. 2015. Accessed March 10, 2015. http://www.tandfonline.com/action/doSearch?quickLinkJournal=&journalText=&AllField=validation&publication=40001457

Google. 2015. Accessed March 05, 2015. http://www.ibpsa.org/?page_id=292

István Kistelegdi, 2010: „Roadmap für einen Climadesign Entwurf", Masters'Thesis, ClimaDesign MSc, Technische Universität München, Department of Buildung Climatics and Building Services Systems, Prof. Dr. Gerhard Hausladen..

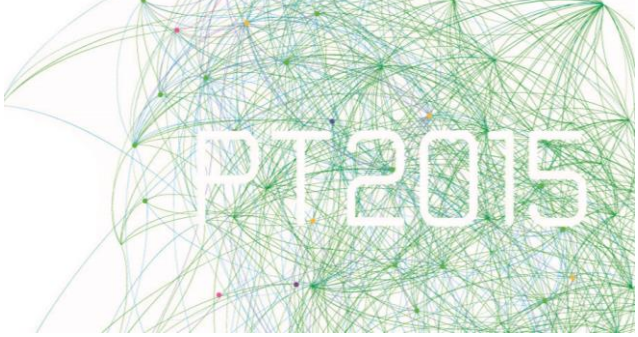
Jan L. M. Hensen, Roberto Lamberts, 2011: "Building Performance Simulation for Design and Operation", p. 3, Spon Press.




# TOPIC IX:

# Adaptive Reuse and Urban Renewal

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# COMPARISON OF THE SUSTAINABILITY OF DIFFERENT TECHNIQUES FOR THE STRENGTHENING OF REINFORCED CONCRETE SLABS

**Tanya Chardakova** [1]
PhD student, University of Architecture, Civil Engineering and Geodesy, Bulgaria, Sofia 1046, 1 Hristo Smirnenski Blvd., office 431, e-mail tanq_chardakova@abv.bg

**Marina Traykova**
PhD, Professor, University of Architecture, Civil Engineering and Geodesy, Bulgaria, Sofia 1046, 1 Hristo Smirnenski Blvd., office 431, e-mail marina5261@abv.bg

## ABSTRACT

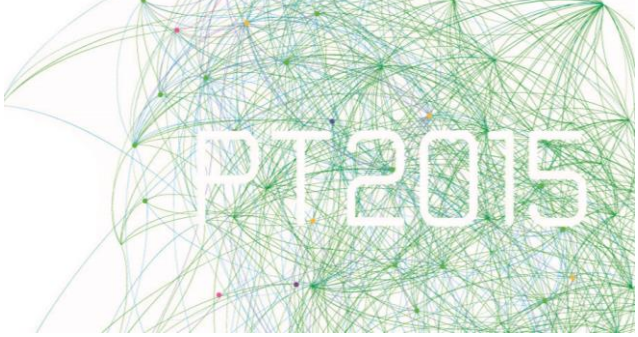
*The comparison of the sustainability of different techniques for the strengthening of reinforced concrete slabs is made first qualitatively by discussing the pros and cons of the different techniques, and then quantitatively by a numerical example. Two slabs are considered in the example: a one-way rectangular slab and a two-way rectangular slab, both simply supported at all four sides. The considered strengthening techniques are: by adding concrete layer at the upper side of the slab, by shotcreting at the bottom side of the slab and by fibre reinforced polymer on the bottom side of the slab. The techniques are compared by their environmental impact and by the improvement of the comfort of occupation. For the environmental impact are considered: green house gasses, water consumption, energy consumption and self-weight of the strengthening (as this may cause additional strengthening of the substructure). For the improvement of the occupational comfort are considered the insulation properties of the slab, the deformation of the slab and the architectural impact of the strengthening. Based on the comparison of the results, some general conclusions are made.*

***Keywords**: retrofitting, environmental impact, occupational comfort.*

## INTRODUCTION

The sustainable retrofitting of existing structures is an important step towards ensuring sustainable environment. The retrofitting of an existing structure can elongate the service life of a building several times, while also amending the occupational comfort and reducing the environmental impact. A major part of the built environment is relaying on a reinforced concrete structures. As slabs are a

[1] Corresponding author




main part of the structure of buildings, the techniques, used for their strengthening must be sustainable, in order to achieve sustainability of the retrofitting process. The sustainability of the strengthening techniques can be evaluated in terms of: embodied energy of the interventions, durability and maintenance energy, emission of green house gasses, effectiveness of the different techniques, social impact, cost. Strengthening of reinforced concrete (RC) structures is frequently required due to inadequate maintenance, excessive loading, change in use or in code of practice, and/or exposure to adverse environmental conditions. Slabs are subjected directly to different loads during the exploitation and usually they are more vulnerable to damages than the other structural elements.

## QUALITATIVE COMPARISON OF DIFFERENT TECHNIQUES FOR THE STRENGTHENING OF REINFORCED CONCRETE SLABS

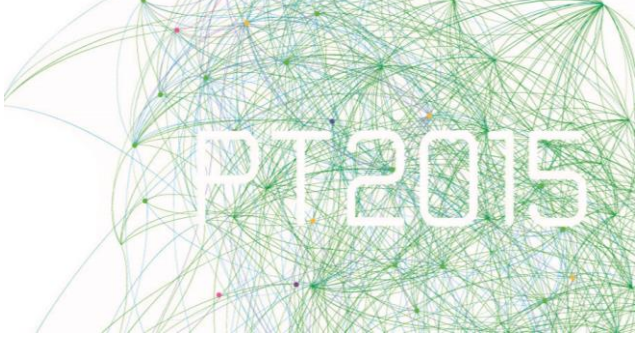
The choice of correct technical approach for the retrofit is the main purpose of the design of the program for rehabilitation and strengthening. The knowledge of the pros and cons of the different techniques for rehabilitation and strengthening is very important for the final solution. Three general considerations are important for the final decision: social and economic; technical; architectural. Three of the most popular techniques for strengthening of RC slabs are considered in this paper: adding concrete layer at the upper side of the slab; shotcreting at the bottom side of the slab; adding nonmetal (FRP) reinforcement at the bottom side of the slab. All of these techniques are very effective in increasing the element's carrying capacity or at least restoring the structural performance of the RC slabs before deterioration. The selection of the most appropriate method to use will depend on several factors, such as the amount of strengthening required, the location where strengthening is required, architectural requirements, simplicity and speed of application, sustainability of the design solution and total cost of the interventions. This paper is focused on the sustainability of the strengthening techniques.

Pros of strengthening by adding concrete layer at the upper side of the slab:

- no design reinforcement is required, as this is usually the compression zone;
- the old-new concrete connection can be ensured only by appropriate treatment of the contact surface;
- the slab stiffness increases significantly, thus deflection decreases;
- the added concrete layer improves the insulation properties of the slab.

Cons of strengthening by adding concrete layer at the upper side of the slab:

- the added layer is usually quite thick and large quantity of concrete is needed for the strengthening;
- because of its large self-weight the added load for the substructure can be significant; this may lead to the necessity of strengthening of beams, columns and foundations;
- before the strengthening the flooring should be removed and replaced after it;




- the thresholds should be uplifted, which means either decreasing the door height, or uplifting the lintels, too;
- the clear height of the rooms is decreased.

Pros of strengthening by shotcreting at the bottom side of the slab:
- the existing cracks are partially filled, the concrete cover of the existing reinforcement is increased several times, thus the durability of the slab is increased;
- the insulation properties and the stiffness of the slab are increased; the thickness of the shotcrete is usually 5-6cm, so the increasing would be more significant for thin slabs and not as effective as with additional concrete layer at the upper side of the slab;
- the existing flooring, thresholds and lintels may be left intact.

Cons of strengthening by shotcreting at the bottom side of the slab:
- application of either mechanical or chemical dowels is required to ensure the old-new concrete connection; this increases the quantity of the used materials, as well as the energy needed for the interventions;
- the self weight of the strengthening material cannot be neglected, so there is an increase of the load of the substructure;
- the clear height of the rooms is decreased, although not by much;
- the shotcreting technique is quite energy consuming one.

Pros of strengthening by fibre reinforced polymer:
- as the material is very effective, very small quantities are sufficient for the strengthening;
- the self-weight of the strengthening material is insignificant, so there is no additional load for the substructure;
- the architectural impact is minimal - there is practically no change of the clear height and the existing flooring, thresholds and lintels may be left intact.

Cons of strengthening by fibre reinforced polymer:
- the green houses emissions and the embodied energy of a unit of the material are much larger than those of concrete or steel;
- the increase of the slab stiffness after strengthening is insignificant;
- there is no increase of the insulation properties of the slab after strengthening.

## QUANTITATIVE COMPARISON

For the quantitatively comparison two slabs are considered: a one-way and a two-way slab, both simply supported. The one-way slab is with clear dimensions in plan 270cm/600cm and height 12cm with reinforcement Φ8/10cm. The two way slab is with clear dimensions in plan 510cm/510cm and height 14cm with reinforcement Φ10/15cm at both directions. The concrete for the two slab is equal to C12/15 and

the reinforcement's characteristic yielding stress is 235MPa. The concrete cover is 15mm. The characteristic permanent load of the slabs is 3kN/m$^2$ plus their self-weight and the characteristic variable load is 3kN/m$^2$.

The capacity of the slabs for bending is insufficient, so strengthening is needed. For the design of the strengthening initial loading equal to the self-weight of the slab is considered. The strengthening materials are: concrete C25/30; reinforcement B420; plates of carbon fibre in epoxy matrix (in 0,68:0,32 ratio) with elastic modulus 170GPa, tensile strength 3100MPa and density 1,61g/cm$^3$.

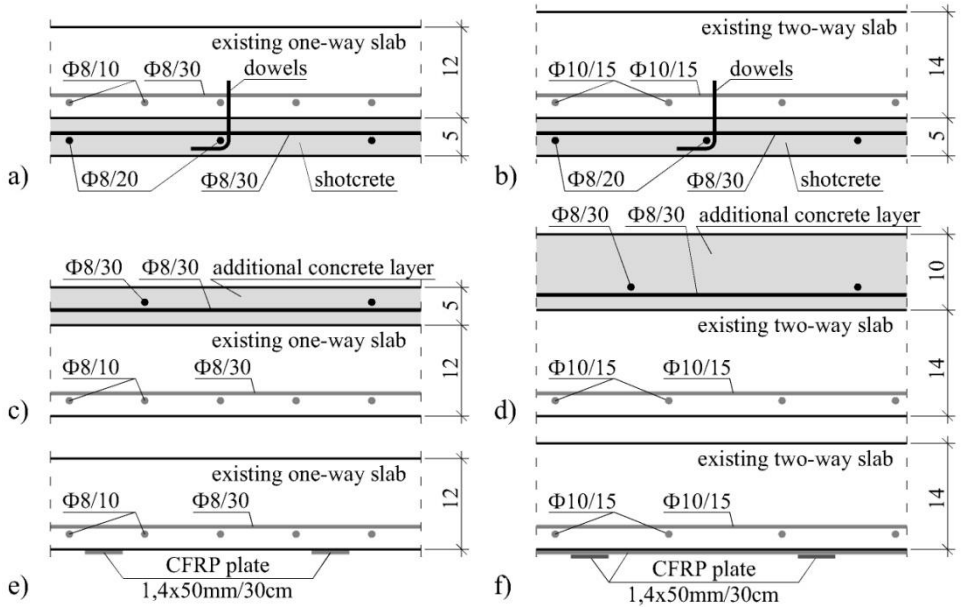
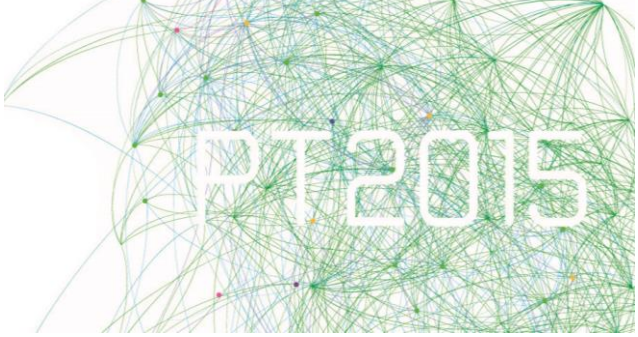



**Figure 1: Cross-sections of the strengthened slabs: a) one-way slab with shotcrete; b) two-way slab with shorcrete; c) one-way slab with additional concrete layer; d) two-way slab with additional concrete layer; e) one-way slab with carbon fibre reinforced polymer; f) two-way slab with carbon fibre reinforced polymer.**

According to the design of the strengthening, the following quantities of the materials are needed for 1m$^2$ of the slab (Figure 1):

- for the shotcreting: concrete 0,05m$^3$/m$^2$ for both slabs (corresponding to 5cm layer), reinforcement 4,16kg/m$^2$ for the one-way slab and 5,11kg/m$^2$ for the two-way slab (corresponding to Φ8/20cm design reinforcement - at one or two directions respectively, Φ8/40cm staggered dowels and Φ8/30cm distribution reinforcement for the one-way-slab);
- for the added concrete layer: concrete 0,05m$^3$/m$^2$ (5cm layer) for the one-way slab and 0,10m$^3$/m$^2$ (10cm layer) for the two-way slab; reinforcement 2,76kg/m$^2$ for the one-way slab and 2,67kg/m$^2$ for the two-way slab (corresponding to Φ8/30cm at two directions reinforcement for shrinkage);




- for the FRP strengthening: 0,339kg/m$^2$ for the one-way slab and 0,709kg/m$^2$ for the two-way slab (corresponding to 3 plates/m' with thickness 1,4mm and width 50mm at one or two directions respectively).

For the comparison of the ecological footprint of the techniques the following parameters are considered (the unit values for the embodied energy and the $CO_2$ emissions are according to [1], [2], [3]):

- embodied energy of the materials (EE) - 1,11MJ/kg concrete, 24,6MJ/kg reinforcement steel, 218,8MJ/kg FRP;
- $CO_2$ emissions - 0,159kg$CO_2$/kg concrete, 1,71kg$CO_2$/kg reinforcement steel, 5kg$CO_2$/kg FRP;
- water (W), directly consumed for the interventions (water, needed for the production of the material components is not considered) - 200l/m$^3$ concrete';
- the added weight of the strengthening (M).

An ecological footprint factor $K_{EF,i}$ of the $i^{th}$ technique is introduced, adopting equal importance of the considered parameters (Table 1):

$$K_{EF,i} = \frac{EE_i}{\sum EE_i} + \frac{CO_{2,i}}{\sum CO_{2,i}} + \frac{W_i}{\sum W_i} + \frac{M_i}{\sum M_i}$$

For the comparison of the occupational comfort of the techniques the following parameters are considered:

- insulation properties $IP_i$ of the strengthened slab with final thickness $h_{f,i}$;
- deformation of the slab $D_i$, evaluated indirectly by the effective length $l_{eff}$ to reduced height of the strengthened slab $h_{red,i}$ ratio;
- architectural impact of the strengthening $AI_i$, evaluated by subjective factor $k_{AI,i}$ (assuming larger values for larger impact)

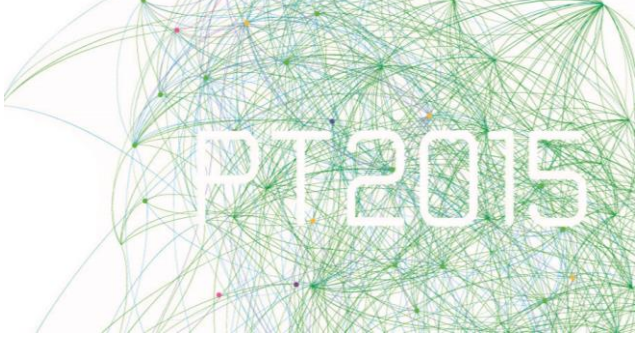
An occupational comfort factor $K_{OC,i}$ of the $i^{th}$ technique is introduced, accounting for the importance of the considered parameters (Table 1):

$$K_{OC,i} = \frac{3}{6} \cdot \frac{IP_i}{\sum IP_i} + \frac{2}{6} \cdot \frac{D_i}{\sum D_i} + \frac{1}{6} \cdot \frac{AI_i}{\sum AI_i}, \text{ where:}$$

$$IP_i = \frac{1}{h_{f,i}} : \sum \frac{1}{h_{f,i}}; \; D_i = \frac{l_{eff,i}}{h_{red,i}} : \sum \frac{l_{eff,i}}{h_{red,i}}; \; AI_i = k_{AI,i} : \sum k_{AI,i};$$

$$h_{red,i} = h_{f,i} \cdot \frac{A_i}{A_{concrete} + A_{steel} \cdot \frac{E_{steel}}{E_{concrete}} + A_{FRP} \cdot \frac{E_{FRP}}{E_{concrete}}}$$

The smaller the factors are, the more sustainable the strengthening technique is. The final sustainability factor $K_{S,i}$ is calculated as follows (Table 1):




$$K_{S,i} = \frac{3}{4} \cdot \frac{K_{EF,i}}{\sum K_{EF,i}} + \frac{1}{4} \cdot \frac{K_{OC,i}}{\sum K_{OC,i}}$$

**Table 1: Calculation of sustainability factor of the different strengthening techniques.**

| Slab | Strengthening technique | EE MJ/m² | $CO_2$ kg/m² | W l/m² | M kg/m² | $K_{EF}$ | IP | D | AI | $K_{OC}$ | $K_S$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| one-way | concrete layer | 196 | 23,0 | 10 | 118 | 0,462 | 0,293 | 0,296 | 0,571 | 0,340 | 0,431 |
| | shot-crete | 230 | 25,4 | 10 | 119 | 0,492 | 0,293 | 0,293 | 0,357 | 0,303 | 0,445 |
| | FRP | 74 | 1,7 | 0 | 0,3 | 0,046 | 0,415 | 0,412 | 0,071 | 0,356 | 0,124 |
| two-way | concrete layer | 321 | 41,1 | 20 | 233 | 0,576 | 0,251 | 0,254 | 0,625 | 0,315 | 0,517 |
| | shot-crete | 253 | 27,0 | 10 | 120 | 0,342 | 0,318 | 0,317 | 0,313 | 0,317 | 0,341 |
| | FRP | 219 | 3,5 | 0 | 0,7 | 0,082 | 0,431 | 0,428 | 0,063 | 0,369 | 0,142 |

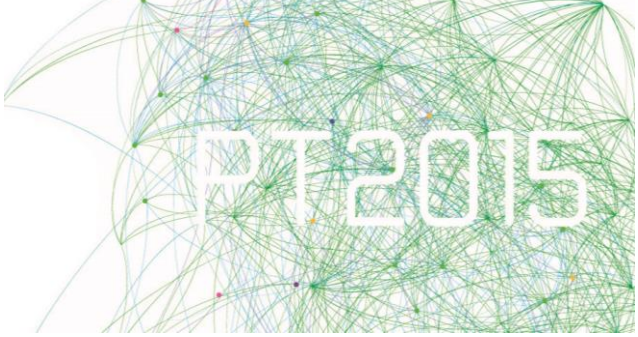
## CONCLUSIONS

The numerical example solved in this paper shows that the strengthening of slabs with FRP has much smaller ecological footprint than the strengthening with reinforced concrete. In some cases the shotcreting at the bottom side of the slab may prove to be more sustainable in that sense than the additional concrete layer at the upper side of the slab. In terms of occupational comfort the three techniques are comparable with slight preponderance of the shotcreting and the FRP being the most unfavourable. As a whole, not accounting for the economical parameters, the FRP strengthening proves to be the most sustainable by far. For the strengthening with reinforced concrete, the sustainability of the different techniques needs to be checked for every individual case in the practice.

## REFERENCES

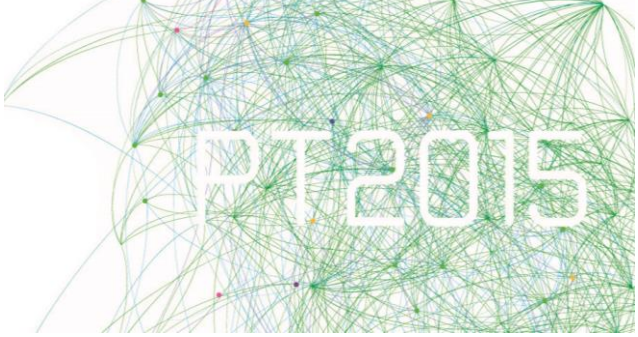
Hammond, G., and Jones, J. 2008. *Inventory of Carbon & Energy (ICE) Version 1.6a*. Sustainable Energy Research Team, Department of Mechanical Engineering, University of Bath, UK.

Mara, V., Haghani, R., and Harryson, P. 2014. "Bridge Decks of Fibre Reinforced Polymer (FRP): A Sustainable Solution" *Construction and Building Materials* 50: 190-199.




Suzuki, T., and Takahashi, J. 2005. "Prediction of Energy Intensity of Carbon Fiber Reinforced Plastics for Mass-Produced Passenger Cars" *The Ninth Japan International SAMPE Symposium* Nov.29 - Dec.2: 14-19.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# SYSTEMS FOR THE REQUALIFICATION OF NON-LISTED ARCHITECTURE: THE "*ADAPTIVE EXOSKELETON*"

**Francesca Guidolin**
Ph.D. Candidate, Università Iuav di Venezia, School of Doctorate Studies, Palazzo Badoer, San Polo 2468, 30125 Venezia, arch.francesca.guidolin@gmail.com

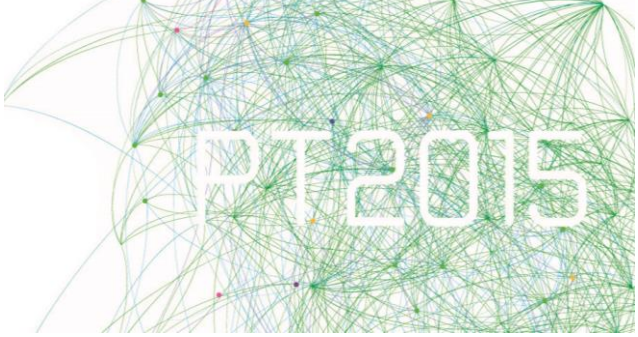
## ABSTRACT

*The architecture developed starting from the 40s is obsolete from different points of view: energetic, structural but also functional and social.*
*Therefore, the field of rehabilitation acquires a strategic relevance concerning future objectives (Directives 2002/91/CE, 2010/31/EU).*
*Among the systems for an appropriate requalification of the non-listed buildings there is the addition of external independent structures, fragmented or continuous, that are identified with the term "adaptive exoskeleton".*
*This system consists in a three-dimensional structure, independent from the building it envelopes, which generates functional spaces as addictions and/or elevations.*
*The analysis of the scientific literature and of case studies shows that the use of the exoskeleton implies as a regenerative practice. It allows:*

- *the installation of elevation systems which provide accessibility according to the principles of inclusive design, therefore appropriate for the evacuation in emergency situations;*
- *the enlargement of the housing units and the improvement of living spaces and of domestic work, even in terms of inclusive design;*
- *the addition of new, common, encounter spaces for the creation of a housing micro-unity;*
- *the improvement of the internal micro-climate (with the constitution of an internal/external buffer zone, spaces for the installation of new systems and devices;*
- *the anti-seismic requalification, by creating a structural grid.*

*Starting from the examination of the operational technological possibilities in the market, the aim of the paper is to analyse the role of the exoskeleton in renewal and functional architectural requalification of buildings. Said analysis shall be carried on not only from a technological point of view but also from a social one. As a socio-technical device, this system provides the application of participative practices for inclusion and appropriation of spaces by its own users. The intention is to suggest a classification of the exoskeleton types through the examination of case studies.*

***Keywords**: adaptive requalification, inclusive systems, exoskeleton, socio-technical devices.*




## INTRODUCTION

The declared material and functional obsolescence of the Italian built heritage, built from the '40s to today, led to estimate the sector of the architectural renewal as one of the most important for the achievement of the objectives set by the European Community. In fact, according to the CRESME data (2014), the amount of the costs for the requalification is estimate as 115.1 billion of euros of the 173.5 billion of the whole building production (66.4%). Investments in the renewal sector increased by 55.4% of the total construction sector in 2005 and up to 66.4% in 2013, instead those of new construction declined from 44.3% to 29.3%. Infact, working on the energy efficiency of only 20% of the residential building, according to the principles of the European directives (2010/31/EU, 2012/27/UE), it could be possible to bring down the total consumption of the built of the 12.6%.

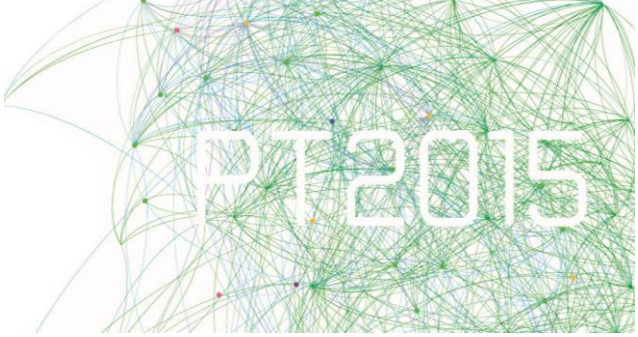
Social needs define also other deficiencies: for instance, the upgrade of the supply of housing to the demand implies the adaption of new housing types (Malighetti, 2004. Delera, 2009). This is due to demographic changes and different needs of new households (single-parents families, city users, multicultural families and students/workers abroad). Further attention is required by social and physical inclusiveness and the development of virtuous mechanisms that could inhibit the processes of social degradation.

These problems lead to the consideration that the re-qualification should be an integrated intervention.

The practice development of re-qualification leads to the adoption of different methods of intervention morphologically and constructively identifiable as addition, subtraction, or replacement of parts. Among the methods of intervention on the non-listed architecture there is in particular a system of volumetric addition, that is today called "*adaptive exoskeleton*" (Montuori, 2014). This device is identified as an external independent structure, which allows the integrated regeneration of the building from different points of view.

## THE DEFINITION OF A SYSTEM: *EXOSKELETON*, A BIOMIMETIC DEVICE

The term *exoskeleton* (from the Greek *exo- outside*, *skeletòs*, *dried* implied *soma*, body), defines the external structure of some arthropods and vertebrates. The exoskeleton has mechanical properties that confer stiffness. It contains the nerve endings; it has isolation and protection functions, chemical inertness and impermeability. The processes of technology transfer from different disciplines have always been the basis of the technological innovation, not only in architecture. The biomimetic approach let to transfer the features of this natural inspiration device to the artificial world, firstly to the military field - with the creation of exoskeletons for lifting and transporting heavy weights; then in medical design -




with the introduction of robotic exoskeletons for assisted walking of people with disabilities – and finally in architecture.

So far, the application of the exoskeleton for the architectural upgrading occurred only in cases of rehabilitation of residential buildings, multi-storey block, with availability of external space. These buildings have concrete framed structure, or often prefabricated systems structure (eg. *banches-tables* or *tunnel* building systems), that were typical of the years of post-war reconstruction. They have compact and linear fronts, regular fenestration and medium height. In these cases, the positioning of the external volumes can solve certain problems, but the future development of this system could lead to solve a higher number of architectural deficiencies in an integrated manner. In fact, having an independent structure at a distance from the building that is functional for the location of additional services, gives the opportunity to upgrade the façade from an architectonical point of view. The façade becomes a spatial device: a modular interface between interior and exterior, based on the needs of its inhabitant. The additional volume can increase the surface of the housing unit, it can implement the functionality of the living area, or can create a functional buffer spaces. Moreover, it allows the adaptation of the interior spaces, according to the principles of Inclusive Design. Recent studies demonstrate the possibility to use the *exoskeleton* for structural seismic upgrading, interpreted as a shell structure, a strengthening grid that allows the stiffening against the horizontal actions of the seismic event. This aim can be achieved with the application of external bracing, or use of dissipative connections. For energy efficiency, the *exoskeleton* as a three-dimensional structure that acts like a double-skin, it reduces the transmittance of the external closures, with the consequent improvement of the internal microclimate.

The *exoskeleton* also allows inclusive re-qualification and social upgrading. The accessibility to the housing is improved by the increased surface area inside the housing unit, and by the possibility to locate spaces and technologies for the vertical connective (such as elevators, lifts, access ramps, etc.).

There is moreover an interesting use of this device for social re-qualification.

The provision of an external structure, which increases the volume of the building, can become an opportunity for involvement of the dweller in the management, design and maintenance of these spaces. The development of a sense of space ownership by the inhabitants could be useful for the regeneration of neighbourhood from a social point of view.

The involvement of the dweller is carried through participation, from the earlier phases – the mapping of needs – to the project phase (eg. the personalized functional, formal and material configuration of the addition). Users are involved also during the construction phase, through the possibility to conduct works on site without their displacement. Alternatively, it is possible to use elevation units

located in the top of the building as temporary housing. Once the construction site ends, these units can be sold to cover part of the costs of intervention.

Due to the coexistence of these instances, the *exoskeleton* could be seen as a real example of *socio-technical device* (Vermaas et al., 2011). This kind of system is not just a *technical artefact* for the physical requalification of a building, but it is also a *social device*, that is capable of triggering integrated and sustainable mechanisms of management by the inhabitants.

## THE ROLE OF THE *EXOSKELETON* IN THE REQUALIFICATION OF NON-LISTED BUILDINGS.

From a technological point of view, the methods of building re-qualification can be classified in synoptic diagrams, by the intersection of morphological/ constructive data with the functions they respond to (Zambelli, 2004). The most common strategies for upgrading are those of *integration*, *replacement* and *addition*. Such interventions may be morphologically and structurally localized in a continuous or discontinuous way, and constructively differentiable between *two-dimensional* (as functional layers) or *three-dimensional* (spatial additions).

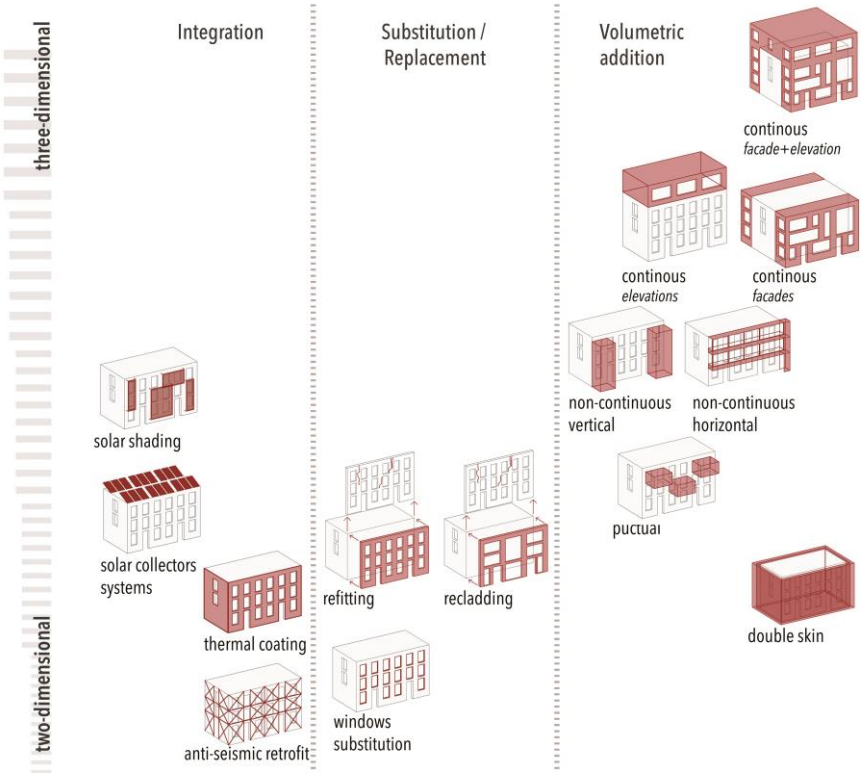
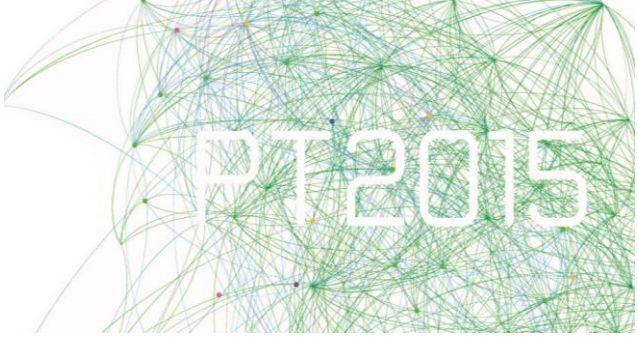



**Figure 1: The taxonomy of re-qualification methods, synoptic diagram.**

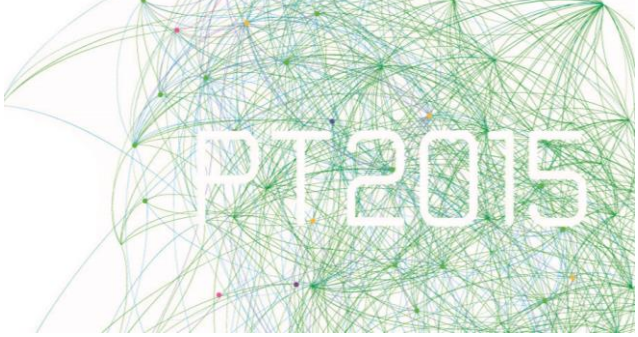



The requalification by the use of additions offers a series of methodologies and tools that are wider than others, because it combines the presence of multiple systems responding to a broader spectrum of needs. In this classification of methods for retrofit, the *exoskeleton system* is located in the field of maximum invasiveness and maximum functionality. Even the re-qualification with *exoskeletons* can be classified into different types, based on the structural and constructive system, on the morphology, and functional changes it brings. It is however to be pointed out that this device has not yet found a wide range of case studies. *Exoskeleton* as a re-qualification method is a technology that is still object of study and improvement for its integrated potentialities. Among the studies, the PRIN study in 2009 "*New design practices for the sustainable redevelopment of social housing complexes in Italy*" developed by the University of Brescia (M.Montuori), Naples (P.Belfiore), Salerno (R.Vanacore) and Bologna (V.Balducci) could be mentioned.

Examples of renewal by volumetric addition can be identified in the *Bois Le Pretre Tower*, (Lacaton & Vassal). Even if it is not a totally integrated system, it can be considered an initial prototype of *exoskeleton*. The project involves the expansions in front of the building with a semi-independent anchored structure which allows the energy, architectural and functional upgrading, besides the typological adaptation of the housing. Some of the proposals for the European research SuRE-FIT (*Sustainable Roof Extension Retrofit for High Rise Social Housign in Europe*) can also be identified as *exoskeletons*. Among these, we could mention the Leeuw van Vlaanderen intervention, by Heren 5 Architecten in Amsterdam (NL) (2007) and the redevelopment Westerpark, in Tilburg (NL), led by Van Hoogmoed Architecten (2008). This one consists in façades expansions: punctual in the North façade that contains the vertical accessible connective; continue in the south façade to update the typology of housing with a gallery that allows two entrances. The steel structure is semi-independent and anchored to the existing building and has its own foundations. However, the most significant example for the application of *the exoskeleton device* as defined, is given by the Ipostudio Architects' research for *Le Piagge* in Florence (2007-2008). The project involves the creation of a modular skeleton, completely independent from a structural point of view, alongside the existing façade and over the top as an elevation. This system potentially offers the inhabitant a total freedom concerning the functional (use classification), morphological and material choice of the additional volume. The Ipostudio's proposal is the most complete example of *exoskeleton*, because it looks like a double covering global building, maximizing energetic functional and structural performances.

## CONCLUSIONS

The D.M. 14/01/2008 identifies in about 50 years the minimum life of the structures, for ordinary buildings. Data show that in 2020 in Italy, buildings with




over 60 years will be about 11 million, 3.7 million of which concentrated in cities. In this context, it is necessary to provide an appropriate refurbishment process: a methodology to integrate structural, formal and functional upgrade of the non-listed buildings. The analysis drew on the different strategies of re-qualification and identifies the *exoskeleton* system as good refurbishment practice for those buildings that have certain characteristics: non-listed, with unitary façades and medium heights. As an integrated system, it firstly provides the opportunity to physical rehabilitation from many points of view: architectural and formal, energetic, seismic and structural, functional and inclusive. Secondly, as a *socio-technical system*, it can initiate processes of social regeneration, developing a sense of belonging and responsibility towards the renewal process. Through the functional, constructive and formal choice, and participatory management of the construction site, users could then be involved in the renewal process of their building.

## REFERENCES

Delera A. (a cura di). 2009. *Ripensare l'abitare. Politiche progetti tecnologie verso l'housing sociale*. Milano: Hoepli Editore.

Druot, F., Lacaton, A., Vassal, J.-P.. 2007. *Plus, la vivienda collectiva. Territorio de excepción*, Barcelona: Gustavo Gili,.

Ipostudio Architetti Associati. 2006. *Sure-Fit: Sustainable Roof Extension Retrofit for High-Rise Social Housing in Europe, Intelligent Energy* – Europe (IEE) Reasearch Project.

Malighetti, L. 2004. *Recupero edilizio e sostenibilità*. Milano: il Sole 24 Ore.

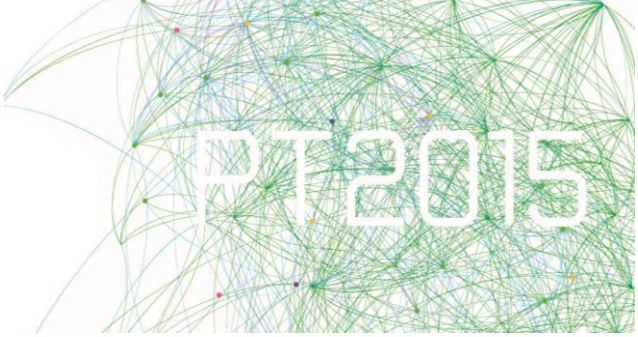
Montuor, M. 2014. "Eutopia urbana, buone pratiche per la rigenerazione integrata degli edifici*"*. In *Ecoquartieri: strategie e tecniche di rigenerazione urbana in Europa*. Venezia: Marsilio.

Servizio Studi-Dipartimento Ambiente della Camera dei Deputati, CRESME. 24 febbraio 2014. *Estratto della ricerca CRESME, ristrutturazione edilizia riqualificazione energetica rigenerazione urbana*.

Vermaas, P., Kroes, P., Van de Poel, I., Franssen, M., Houkes, W. 2011. *A philosophy of Technology, From Technical Artefacts to Sociotechnical Systems*. Morgan&Claypool Publishers, Series Editor: Caroline Baillie, University of Western Australia.

Zambelli, E. 2004. *Ristrutturazione e trasformazione del costruito, tecnologie per la rifunzionalizzazione e la riorganizzazione architettonica degli spazi*. Milano: il Sole 24 Ore.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# RECONSTRUCTION AND REVITALIZATION OF THE COMPLEX SENARA, WITHIN THE MONASTERY HILANDAR, IN ORDER TO ADAPT TO MODERN TRENDS AND SOCIAL CHANGES

**Jelena Ivanović-Šekularac**[1]
PhD, Associate Professor, University of Belgrade, Faculty of Architecture, Belgrade, Bulevar kralja Aleksandra 73/II, Serbia, e-mail: jelenais@orion.rs

**Jasna Čikić-Tovarović**
PhD, Assistant Professor, University of Belgrade, Faculty of Architecture, Belgrade, Bulevar kralja Aleksandra 73/II, Serbia, e-mail: cikic.tovarovic@gmail.com

**Nenad Šekularac**
PhD, Associate Professor, University of Belgrade, Faculty of Architecture, Belgrade, Bulevar kralja Aleksandra 73/II, Serbia, e-mail: nseki@orion.rs

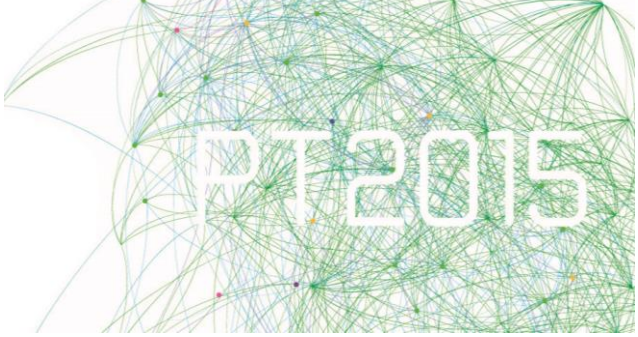
## ABSTRACT

*The Holy Mount Athos is the cultural heritage of mankind. Until the mid-20th century the Holy Mount Athos had been visited only by rare pilgrims. Strict rules of monastic communities limited the number of potential followers. The monastery complex provided the accommodation for all visiting pilgrims. Modern life and significant social changes have increased the number of the people interested in visiting this monastic land. The endless flow of visitors and their frequent visits eventually began to disturb the lives of monks. That was one of the reasons that led to creating new accommodation capacities outside the monastery complex in order to provide the neccesary peace for the monks.*

*The Monastery Hilandar, the fourth monastery in the hierarchy of the Holy Mount Athos monasteries and one of the most significant spiritual and cultural center of the Serbian people, was founded in 1198. In the immediate vicinity of the monastery of Hilandar walls there are abandoned and demolished facilities: stable, mulekeepers' house and heybarn. These facilities were built in the beginning of the 19th century. Ten years ago, the reconstruction of the facilities started in order to restore the buildings and provide them with additional accommodation space for potential visitors.*

*This paper presents the methods of reconstruction through a multidisciplinary approach based on architectural solutions and the aspects of comfort as well as the aspects of psychological and sociological mutual influence between two groups – the monks and the visitors. In this way, the carried out reconstruction revived the*

[1] Corresponding author




*old facilities and gave them a new function that is adaptable to modern trends and social changes.*

***Keywords**: cultural heritage, reconstruction, revitalization, social changes*

## INTRODUCTION

The name Holy Mount originated in the world of eastern Christianity, when Athos began to create the most significant community of monasticism. The Holy Mount of Athos has been the crucial center of spirituality and knowledge for the entire Orthodox Eastern countries for more than one thousand years. It is included in the UNESCO World Heritage Sites list. The Holy Mountain is the unique monastic state in the world.

The Holy Mount is located on virtually inacessible peninsula, with no travel overland routes to the rest of the world. The journey across the sea in boats was a great obstacle for the arrival of visitors. The road network on the Holy Mount of Athos used to be unfavorable for centuries; narrow cobblestone paths were all the traffic there and the only means of transport were mules. The strict rules imposed by the monastic community were limiting the number of potential pilgrims who were allowed to enter the Holy Mount.

The second part of the 20th century brought some social changes in the world. These changes significantly affected the life on the Holy Mount of Athos. For the first time the systems of water supply, sewerage and electric energy were installed. Over the last few years, electricity has been obtained by generators or solar panels. The road network was built in order to ease the traffic flow carried out by terrain vehicles. The Holy Mount is accessible only by boats, across the sea. There is no land connection between the Holy Mount and its surroundings, there are no roads and it is impossible to approch the land by cars. It is of crucial importance to point out that the strict rules are still applied and they have been unaltered since the very beginning: only men are permitted to visit the Holy Mount. Over the last decade of the 20th century there has been an increasing number of pilgrims. The accomodation for visitors is provided inside the walls of monastery complex.

Modern trends of social development have increased the number of visitors. There are so many people all over the world who want to visit this unique monastic land. Constant visits and an enormously increasing number of visitors have affected the peaceful way of life among the monks who are used to living in accordance with strict rules and principles regarding religion and prayers. Therefore, it was necessary to build some additional accommodation capacities outside the walls of monastery complex.

## THE RECONSTRUCTION OF SENARA COMPLEX, WITHIN THE MONASTERY OF HILANDAR

The monastery of Hilandar is the fourth monastery in importance and influence and the second largest monastery out of twenty monasteries belonging to the Holy Mountain. The monastic brotherhood, mainly from Serbia, lives in Hilandar. Inside its walls, the complex is a real medieval town.

Near the access road leading to the monastery, along the edge of the garden, there was a complex that had been used for keeping the animals and their food (hay). These abandoned and dilapidated facilities were built in the first half of the 19th century, outside the monastery walls. The complex consisting of the abandoned facilities used to include: the barn – the facility accommodating the mules (Shtala); the facility accommodating the mulekeepers – the people who were taking care of the mules (Mulekeepers' House) as well as a large facility used as a storage space for hay (Heybarn). The whole complex was named Senara, after the haybarn (Figure 1.) (Nenadović, 1997).

**Figure 1: Complex Senara: a. former appearance, b. the appearance after the reconstruction.**

The lack of accommodation capacities for potential visitors and pilgrims led to the idea of reconstruction in order to turn these facilities into accommodation capacities for visitors. The adaptation and reconstruction of these facilities enabled the visitors to come and attend the monastery service hours – services of worship. This means that the monks are able to lead their lives without any disturbance caused by the guests.

The reconstruction project was supposed to remove all the demolished parts of the facilities, the ones that were not structurally stable. It was planned to rebuild the damaged walls using the existing stone – since the stone was originally used as the material for their construction, but this time adding a new binding material. i.e. (lime-cement) mortar, instead of the previous binding material (mud or lime mortar). The existing walls, as well as the recently built ones, are now covered with appropriate thermal insulation and bricks. Rendering was applied to exterior wall structure and this kind of sandwich walls provide a proper thermal insulation in winter periods as well as a summer stability during warm summer periods. Thermal

insulation and air-flows within the roof layers, thermal insulation within the groundfloors and the installation of wooden window frames with insulating window glazing provide the atmosphere of thermal comfort and pleasant stay in these facilities.

**The reconstruction of the stable for housing the mules - Shtala**

The longitudinal walls of this building used to be made of stone, about 70cm thick. There were only few window openings, in accordance with the purpose of the building - only small amounts of light were allowed to penetrate, in order to protect the health of the animals by avoiding the so-called donkey blindness.

The reconstruction preserved the original appearance of the facade walls – the face of both interior and exterior facade walls is made of stone. Small windows remained on the facade, just like it used to be and roof dormers remained where they used to be placed as well, thus achieving the authentic form of the new facility. The reconstruction of the building Shtala (barn) is of great importance since this reconstruction kept a very interesting roof structure made of timber in its original form. This roof structure is a part of the interior space meant for visitors' accommodation (Figure 2c). Sheating was installed over the existing roof structure. New rafters were added and thermal insulation was placed between them. These new rafters are now covered with sheating, back-up water proofing system and ridge-tile as the original roof covering.

The reconstruction provided this building with a completely new function. The reconstructed facility Shtala contains a large guest room, bathroom and laundry.

**The reconstruction of the Mulekeepers' House**

The facility consists of the ground floor and first floor. There used to be a barn on the ground floor, and the first floor used to accommodate the people taking care of the mules – they were called mulekeepers. The external walls were made of stone, built in lime mortar, 65 cm thick. The face of interior ground floor walls was made of stone. The first floor walls were plastered and painted white. The ceiling of the ground floor had visible joists, the planks on the upper side.

The reconstruction of this facility kept the appearance of interior ground floor wall, made of stone, and the facade stone wall on the first floor got the interior thermal insulation, plastered and covered with bricks. This type of sandwich facade wall meets the requirements of modern thermal comfort. In this way, the original appearance of the external wall is kept. After the reconstruction and roof construction, the building was covered with the authentic roof structure consisting of stone plates. Roof covering with stone plates was carried out over the sheating substructure, back-up water proofing system and in accordance with all modern principles of wind-resistant roof. This type of modern wind-resistant roof with the

final covering made of stone was first applied during the reconstruction of the monastery complex of Hilandar (Šekularac, Ivanović-Šekularac, Čikić-Tovarović, 2012).

Nowadays, the reconstructed ground floor of the Mulekeepers' House contains the room for receiving guests, kitchenette and toilet. The first floor contains the living room with a fireplace, three bedrooms and a bathroom. The room for receiving guests retained its authentic appearance – the walls are made of stone and the ceiling is covered with wooden beams.

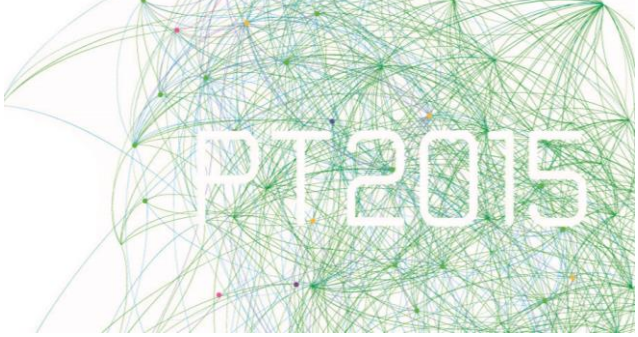
### The reconstruction of the facility meant for hay storage - Senara

This tall building used to be the single space for hay storage. It was made of stone and mud mortar. The Heybarn Complex Senara consisted of extremelly high peripheral stone walls and it was dilapidated, which means that it was not possible to keep these walls and perform the reconstruction of the facility (Figure 2a). Deconstruction was inevitable. It was planned to build a completely new facility. The new building was built in the system of massive walls; the facade face was made of stone and thermal insulation was installed. The new facility is horizontally divided into three floors by two mezzanine ceilings (Figure 2b). The facility retained it authentic ambient due to the form and the selection of material: the stone facade walls with wooden frames, the wooden roof structure and stone plates as the roof covering. The facility was turned into the guest house. This three-storey building consists of bedrooms and bathrooms.

**Figure 2: Complex Senara: a. Senara - before the reconstruction, b. Senara after the reconstruction, c. interior of the Shtala after the reconstruction.**

## THE REVITALIZATION OF THE HEYBARN COMPLEX "SENARA"

The basic intervention principles carried out on the complex Senara were: preserving the authenticity of the structure and material, preserving the complete authentic ambient of both exterior and interior appearance whenever possible, depending on the function of the facility, and preserving all decorative elements that represent the historical construction phases. The reconstruction of the existing, partially demolished and dilapidated buildings, provided new accommodation




capacities meant for visitors. These new rooms meet all the comfort requirements: spatial, thermal, light and air comfort. The fulfillment of the mentioned comfort requirements means that all the health requirements regarding the accommodation are also met. The visitors are provided with the possibility to spend time in the reconstructed and hygienic rooms, without disturbing the monks and their living principles. In this way, the revitalization of the Heybarn Complex Senara was carried out and the buildings were given a new function and purpose. From the sociological point of view, the visitors of the monastery usually spend one or more nights, which means that their presence and curiosity might unintentionally disturb the quiet life of the monks living in this community. In this way, the visitors are enabled to stay at the monastery complex, visit the buildings and contact the monks during certain periods of a day, and then leave the monastery complex and return to their accommodation premises Senara, where they could spend the rest of the day and night without disturbing the daily routines and duties of the monks.

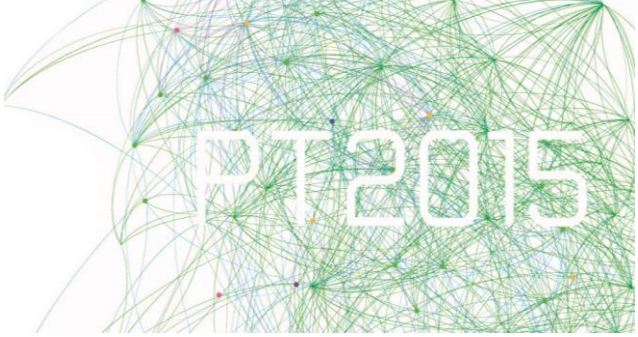
## CONCLUSION

The unique case of the monastic state of the Holy Mount of Athos certainly brings to light the different concepts of healthy places, as a result of different lifestyles, beliefs and values.The increasing need for providing the accommodation for the growing number of visitors makes the complex Senara the unique example of reconstruction and revitalization of the abandoned and dilapidated heybarn, stable and Mulekeepers' House.

This paper presents different principles of reconstruction and revitalization of the abandoned and partially demolished facilities through the multidisciplinary approach, based on constructive and functional solutions, preservation principles, authenticity principles, comfort requirements and psychological and sociological aspects of mutual influence between two groups – monks and visitors. In this way, the reconstruction and revitalization of the Heybarn Complex Senara, in accordance with the modern requirements and application of contemporary technological and technical solutions, a new life was given to the old facilities. These buildings were provided with a new function that adapts to the modern trends and social changes. This is how the formation of the complex Senara contributed to the connection of cultural heritage and the past with contemporary needs and social changes in order to improve healthy places.

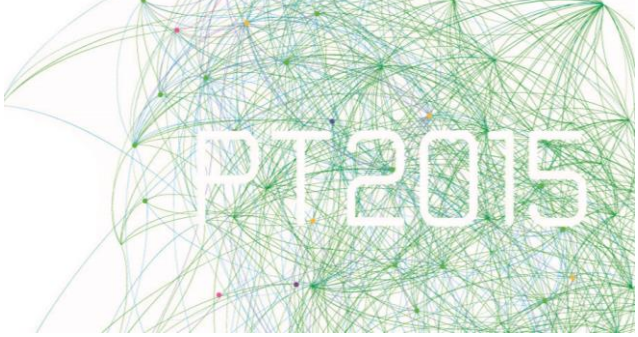
## REFERENCES

Nenadović, S. 1997. *Osam vekova Hilandara – građenje i građevine*. Beograd: Republički zavod za zaštitu spomenika kulture, The Institute for the Protection of Cultural Monuments.




Šekularac, N., Ivanović-Šekularac, J. Čikić-Tovarović, J. 2012. "Application of stone as a roofing in the reconstruction and construction." *Journal of Civil Engineering and Architecture*, Volume 6, No. 7 (Serial No.56) (July): 919-924.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# RENEWAL OF JUGOMONT PREFABRICATED RESIDENTIAL BUILDINGS JU-61

**Ivan Mlinar**[1]
PhD, Professor, University of Zagreb, Faculty of Architecture, Kačićeva 26, 10000 Zagreb, Croatia, ivan.mlinar@arhitekt.hr

**Lea Petrović Krajnik**
PhD, Senior Teaching and Research Assistant, University of Zagreb, Faculty of Architecture, Kačićeva 26, 10000 Zagreb, Croatia, lpetrov@arhitekt.hr

**Tamara Marić**
Research and Teaching Assistant, University of Zagreb, Faculty of Architecture, Kačićeva 26, 10000 Zagreb, Croatia, tmaric@arhitekt.hr

## ABSTRACT

*Jugomont was company from Zagreb engaged in the construction of prefabricated buildings from 1955 until 1976. Jugomont developed and applied several systems of prefabrication, among which JU-61 stands out due to the architectural, structural and technological improvements and enhancements over its previous prefabricated systems. Jugomont prefabricated residential buildings JU-61 were built since 1961 in a series of housing developments in Zagreb and in other cities of the former state. The large number of unmaintained or partially and inadequately renovated residential buildings JU-61 reduces the urban and architectural value of housing developments and quality of housing for residents. Systematic renewal of residential buildings JU-61 would increase the quality of housing for numerous residents as well as actualized out the topic of economical construction of prefabricated housing buildings. The aim of this research is the affirmation of the applicable model for renovation of residential buildings JU-61, that corresponds with the applied prefabricated system and the contemporary living standards.*

***Keywords**: Zagreb, prefabricated building, Jugomont, renewal.*

[1] Corresponding author

**Figure 1: Jugomont's residential buildings JU-61 in Remetinečki Gaj (Žilić, 1965).**

## INTRODUCTION – JUGOMONT

Jugomont was company from Zagreb engaged in the construction of prefabricated buildings from 1955 until 1976. For 21 years the company was building mostly residential buildings in Zagreb and in other cities and towns of the former Yugoslavia. Jugomont's prefabricated residential buildings are characterized by continuous architectural, structural and technological improvements and enhancements which intended to improve the overall quality of housing, and to create healthy places for inhabitants. Besides prefabricated residential buildings Jugomont was also building prefabricated kindergartens, schools, health care and public buildings, tourist bungalows, garages and industrial halls. In 1969 Jugomont expanded its production range with the infrastructure buildings after merging with Jugobeton that fell into business difficulties. In 1974 Jugomont started building in Iraq where certain circumstances led to business difficulties, which resulted with the integration of Jugomont into Industrogradnja company.

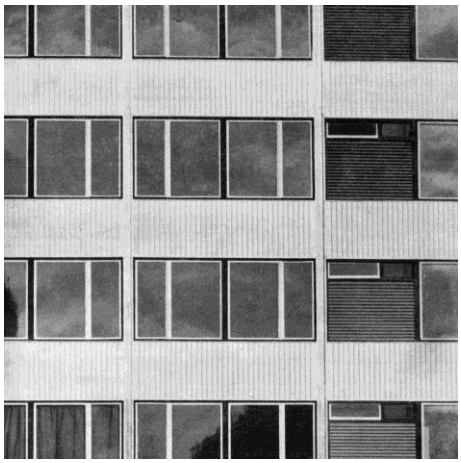


**Figure 2: Front of Jugomont's residential building JU-61 (*** 1962).**

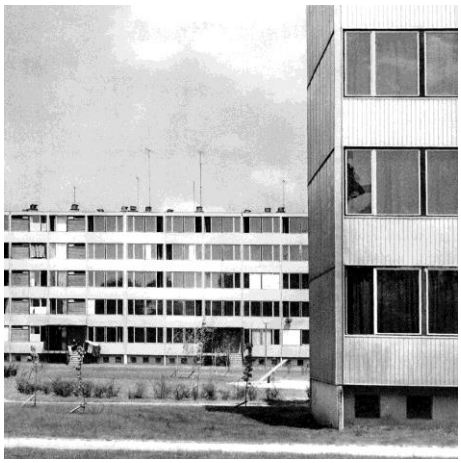


**Figure 3: Jugomont's residential buildings JU-61 in Remetinečki Gaj (Žilić, 1965).**

## JU-61 SYSTEMS OF PREFABRICATION

Jugomont developed and applied several systems of prefabrication, among which JU-61 stands out due to the architectural, structural and technological improvements and enhancements regarding to its previous prefabricated systems. Authors of prefabricated system JU-61 were Bogdan Budimirov, Željko Solar and Dragutin Stilinović. Prefabricated system JU-61 belongs to the middle panel prefabrication and consists of supporting, non-supporting and lining elements. Supporting elements are not finalized, unlike the non-supporting which are finalized. Vertical and horizontal structural panels of middle format are made of concrete, and they reflect the circumstance in which the construction machinery was expensive and the human labour cheap. The wall panels are 0.12 x 1.20 x 2.60 meters in size. The ceiling panels are 0.12 x 1.20 x 3.60 meters in size. Lining facade elements are made of perforated aluminium panels beneath which is set inorganic insulating material – mineral wool. Transportation and mounting of elements are aligned to avoid depositing the elements on the construction site. Prefabricated system JU-61 was used for the construction of six-storey buildings. The license for the prefabricated system JU-61 was bought by the companies from Ljubljana, Maribor, Celje, Sarajevo, Čačak and Priština.

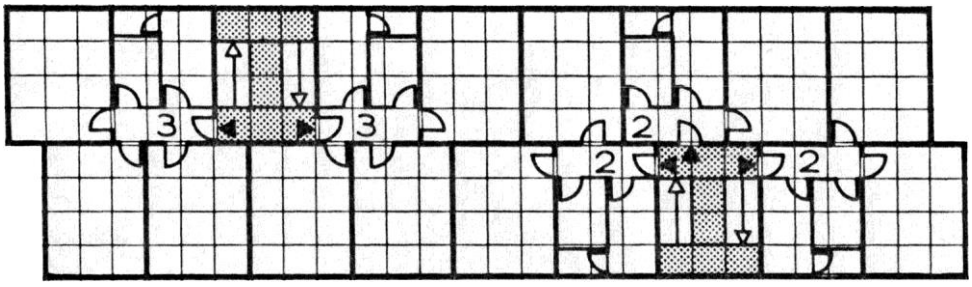
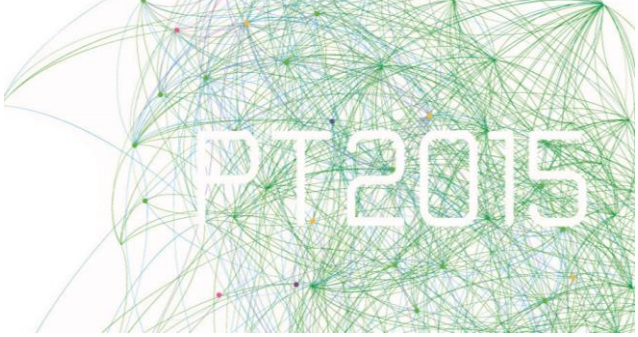



**Figure 4: The ground plan of Jugomont's residential building JU-61 (Mirković, 1980: 146).**

## PREFABRICATED RESIDENTIAL BUILDINGS JU-61

Jugomont's prefabricated residential buildings JU-61 were designed in 1960 and built from 1961 in a series of Housing Developments in Zagreb, as well as in other cities of the former state. The first prefabricated residential building JU-61 was completed in 1962 in Remetinečki Gaj, Novi Zagreb. Author of the ground plan, with its parallel yet shifted construction units of the size of 3.60 x 4.80 meters, was Đuro Mirković. The modular units, simultaneously shifted for a third in the ground plan, allow connection to the staircase unit with the entrance unit of the apartment, which links one to three rooms. The entrance unit of apartment contained the hall, the kitchen, the pantry and the bathroom. Prefabricated apartment buildings JU-61 have five residential storeys and service rooms on the lowest storey. At first, the building were constructed with service rooms in the lowered basement, main entrance on the ground level and raised rear entrance on the level of the elevated




first residential storey. Later, the buildings were constructed with service rooms on the ground floor and only with one elevated entrance. The concrete stairs with metal railings leads to the elevated entrances. In the first buildings with a lowered basement, the entrances are covered with concrete shelters with steel supports . Above the main entrance the facade is covered with corrugated translucent plastic or glass. The facade of the lowest storey is concrete with small windows on the longitudinal parts. The facade of the residential storeys is modular, and alternating aluminium panels, glass, metal shades, and the verticals of construction walls, that divide the building into the units. The facade of the room units consist of four windows and a parapet covered in aluminium panels, whereas that of the kitchen unit has a half of the window section covered with metal shades, with windows above. The side facades are shifted in accordance with the ground floor and covered in aluminium panels.

## PRESENT STATE OF RESIDENTIAL BUILDINGS JU-61

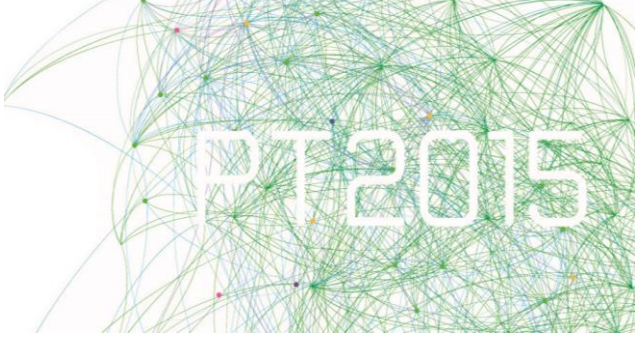
The most visible problem, that reduces the urban and architectural value of residential buildings and housing developments, is a large number of unmaintained or partially and inadequately renovated facades of the residential buildings JU-61. The windows are usually not maintained or partially and inadequately renovated. Some of the vertical facade strip above the main or only entrance are inappropriate renovated with glass replaced corrugated translucent plastic. The aluminium panels on the lowest residential storey facade have visible dents and other damages. Worn out and inadequate thermal insulation is also a problem that has an influence on the quality of housing, which it is not visible until unprofessional renovation happens that affects on the facade lining with ribbed aluminium panels. Roof insulation is also in some cases worn out. Mainly common and service rooms are not maintained and in some cases they are devastated. In apartments the flooring and bathroom equipment are mostly worn out or are inappropriately replaced. The installations inside the buildings are partly worn out that reduces the quality and safety of building using.

**Figure 5: Inadequately renovated facade of Jugomont's residential building JU-61.**

**Figure 6: Present state of facade of Jugomont's residential building JU-61 (Mlinar, 2014: 177).**

## RENOVATION OF RESIDENTIAL BUILDINGS JU-61

Renovation of residential buildings JU-61 should be organized and planned through the joint funds of the building and under the supervision of representatives of tenants, building managers and building inspection. Renovation projects should be standardized and aligned with applied prefabricated construction system. Elaboration of the standardized project should be entrusted to the professional maker familiar with prefabricated system JU-61. In the process of developing the standardized project of renovation, makers should be controlled by the reference institutions and should consult with available authors and other participants related to the construction and maintenance of buildings and with potential manufacturers or suppliers. Renovation should be cost effective and in line with modern architectural standards and methods, as was the construction of residential buildings JU-61. Due to the large number and scope of necessary interventions the assortment of some producers and product prices could be adjusted. Renovation would include the replacement of worn out window, door and vertical facade strip above the main or only entrance, as well as the isolation of the facade and roof. Dents in the aluminum covering of the facades would be leveled, and in a case of significant damage covering is to be replaced. Common and service rooms, as well as the installation should be renewed in accordance with the standardized project of renovation. Floor coverings and bathroom equipment in apartments can be left to the creativity and possibilities of the tenants.. Implemented partial renovations should be verified weather they meet functional and design criteria prescribed by the standardized project of renovation. If the already implemented renovation is not in accordance with the standardized project, the renovation should be redone, according to the renovation plan and program.




## CONCLUSIONS

Jugomont's prefabricated residential buildings JU-61 are part of the modern urban and architectural heritage that should be protected with the possibility of adequate renovation. The renovation of residential buildings JU-61 should be systematic, controlled and adjusted to modern standards of housing as well as residential construction. Systematic renewal of residential buildings JU-61 would increase the quality of housing for numerous residents as well as actualized out the topic of economical construction of prefabricated housing buildings.

## REFERENCES

Budimirov, B. 2007. *U prvom licu*, Zagreb: UPI-2M plus.

Knežević, G., and Kordiš, I. 1987. *Stambene i javne zgrade*, Zagreb: Tehnička knjiga.

Mirković, Đ. 1980. *Tehnološki uvjeti arhitektonskom projektiranju*, Zagreb: Arhitektonski fakultet Sveučilišta u Zagrebu.

Mlinar, I. 2014. *Remetinečki Gaj: The Beginning of a Systematic Urbanization of Novi Zagreb*, Zagreb: Centar za kulturu Novi Zagreb, and Sveučilište u Zagrebu, Arhitektonski fakultet.

Radović, D. 1989. "Bogdan Budimirov." *Čovjek i prostor* 36, 6 (435): 18-19.

Radović, D. 1989. "Bogdan Budimirov (2)." *Čovjek i prostor* 36, 7-8 (436-437): 25, Zagreb.

Žilić, F. 1965. *Remetinec 1955 - 1965*, Zagreb: Općinski odbor SSRN Remetinec.

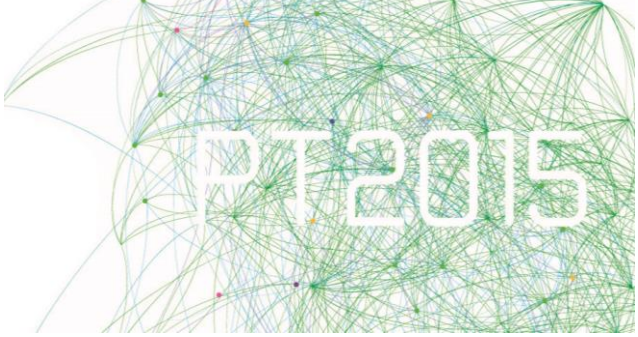
*** 1962. "***." *Jugomont - List za probleme industrijalizacije građevinarstva* 2, no. 6: n.p.

*** 2001. "Bogdan Budimirov - Organizacija i kontrola su osnova svega." *Čovjek i prostor* 48, 10-12 (569-571): 60-62.

*** 2001. "Tekstovi o Bogdanu Budimirovu." *Čovjek i prostor* 48, 10-12 (569-571): 66-67.

This research is a part of the scientific project *Heritage Urbanism - Urban and Spatial Planning Models for Revival and Enhancement of Cultural Heritage* (2032) financed by the Croatian Science Foundation, which is being carried out at the Faculty of Architecture, University of Zagreb, under the project leadership of the academic Mladen Obad Šćitaroci.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# BROWNFIELDS AS PLACES AND RENEWABLE ENERGY SYSTEMS AS TECHNOLOGIES: POTENTIALS AND RISKS IN CASE OF SERBIA

**Anita Stoilkov-Koneski**[1]
PhD student, University of Belgrade, Faculty of Architecture, anitastoilkov@gmail.com

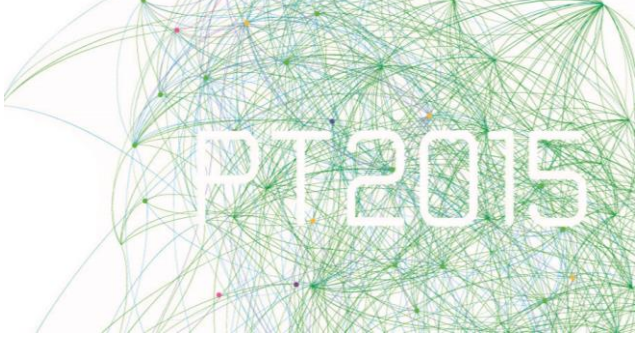
**Zoran Koneski**
PhD student, University of Belgrade, Faculty of Civil Engineering,
koneskizoran@gmail.com

## ABSTRACT

*Brownfields are often defined as derelict or underused areas causing problems in the urban renewal that many cities are facing with. In last few decades brownfields stopped being seen only as problems, but as potentials in modern urban planning. A great step toward solving brownfield problems has been made when brownfield regeneration has been recognized as one of the most important objective of sustainable urban development by science and many government policies. Many authors agree that the reason why brownfields happened are new technologies that left behind old ways of industrial production. The question we can ask is: what brownfield potentials would be if brownfields could cope with new technologies? The brownfield regeneration in that case does not necessary has to mean applying new technologies in industrial production; there are many ways of dealing with new technologies, especially with renewable energy systems, that could be applied in each brownfield case, depending on the context. The paper deals with brownfields as places, and renewable energy systems as technologies, especially solar energy generation, seen from the angle of sustainable urban development. A methodology for examinations of the potentials and risks of solar energy technologies installation on brownfield sites has been conducted in the context of Serbia, outlining basic steps for such brownfield regeneration activities.*

***Keywords****: brownfields, solar energy technologies, brightfields, Serbia.*

[1] Corresponding author




## INTRODUCTION

One of the most important strategies for achieving sustainable development in the 21st century in Europe is the efficient urban land use, due to the fact that urban areas are increasingly faced with a shortage of construction land. An important component of the problem of unsustainable land use is the existence and the constant increase of brownfield sites, as well as numerous difficulties on the way to their regeneration (CABERNET, 2007).

Brownfield land is both a lost opportunity and a problem. Regenerating brownfields can stimulate opportunities at numerous levels to improve urban quality of life, enhancing urban competitiveness, and reducing urban sprawl (CABERNET, 2007). It gained significant attention in recent years due to political, social, environmental, and financial reasons (Hartmann et al., 2014), but redeveloping brownfield land is still a complex issue. Although numerous initiatives of sustainable brownfield regeneration can be observed, the integration of sustainability indicators is in most cases partial or superficial (Laprise et al. 2015). Besides considering economic, environmental and social dimensions of the brownfield problem, it also means dealing with a wide range of technical and legal issues and the different interests of a variety of stakeholders. Brownfield regeneration therefore is not only one of the most important, but also one of the most difficult challenges for urban planning and development today (CABERNET, 2007). A special field of brownfield redevelopment is, when the investor aims to reutilise the property for energy generation purposes (Hartmann et al., 2014). There are big opportunities to regenerate brownfield sites by using renewable energy systems, which may increase the value and the attractiveness of a brownfield site, giving the brownfield a huge initial step towards sustainability.

## RENEWABLE ENERGY SYSTEMS AS SOLUTIONS TO PROBLEMATIC BROWNFIELDS

Brownfields with low potential for commercial usability (brownfields of category C in the CABERNET (2007) A-B-C conceptual model of brownfields), usually do not attract private investors and consequently continue to deteriorate. Their regeneration depends much on the decisions of the public sector (Klusaček et al., 2014). The primary barrier to brownfield redevelopment is that the cost necessary to bring these sites to beneficial use in many cases is higher than the land would be worth after redevelopment (Adelaja et al., 2010). One of the alternatives to overcome cost barriers of low usable brownfields is their possible use for the development of alternative energy sources. Construction of, for example solar power plants, on a brownfield land appears to be an ideal solution for increasing the economic value of the land (Klusaček et al., 2014). In this context, it is important to mention that the European Union obligates member and candidate countries to increase their share of renewable energy sources to cover certain percentage of final energy consumption. This has resulted in growth of solar power

plants. Unfortunately, these energy facilities have been built on greenfields, usually on arable land, which is one of the main reasons for criticism of solar energy development among European stakeholders (Klusaček et al., 2014).

Many negative aspects of brownfield land that are reducing regeneration opportunities can be diminished by identifying renewable energy production possibilities and redeveloping it into solar power generating facilities which, in this context, are called brightfields (Hough et al., 2012). Solar power generation on brownfield land has public interest for several reasons: (a) it offers a new use for brownfields with regeneration challenges, (b) it supports renewable energy development, and (c) it improves the public image of renewable energy sources, unlike power generation projects on greenfields (Klusaček et al., 2014). In order to achieve long term regeneration sustainability using solar power technologies, the aim of brownfield regeneration projects should not only be revitalizing abandoned property led by financial motivator, but also to take other sustainability objectives into consideration, such as social and environmental. There are many studies proposing methods for brownfield regeneration based on different renewable energy technologies (solar, wind, hydro, biomass, geothermal, waste) with consideration of different sustainability indicators of the regeneration process (Hartman et al., 2014; Adelaja et al., 2010; Ribeiro, 2007; etc.). In this paper the focus is on solar power potentials for brownfield regeneration in Serbia, prioritizing financial and environmental aspects, based on the methodology conducted by literature review in this area.

## BROWNFIELDS AND SOLAR ENERGY GENERATION IN SERBIA – PROBLEMS WITH POTENTIALS

Serbia is a country with significant legacy of brownfields. The severity of brownfield problem in Serbia is inversely proportional to the activities undertaken in its solution (SKGO, 2011). Despite the negative effect brownfields are causing, there is lack of systematic and organized approach from the state level to solving brownfield problem in Serbia, including the lack of legislative framework. The first step towards systematic action to brownfield regeneration must be identifying brownfields in terms of area, state, ownership structure, contamination, etc. There is no unique database in Serbia that includes all brownfield land by type. There is some partial data as part of the process of privatization and data of the military and Ministry of Defence (SKGO, 2011). In this kind of situation, there were several attempts to identify brownfield legacy by organizations which recognized the size of the problem. One of those attempts was project conducted by SIEPA (Serbia Investment and Export Protection Agency) in 2009, which resulted with a database of investments that beside greenfield locations includes information on brownfield investment locations (Figure 1).

When the solar energy is concerned, average solar radiation in Serbia (Figure 2) is about 40% higher that the European average (Stamenić, 2009). Nevertheless,

similar to the brownfield trends, use of solar energy to produce electricity is far behind the European level. Serbia still needs to demonstrate its commitment to renewable energy and to complete the legislative framework in this area. After the ratification of the Kyoto protocol in 2007, determination of national goal is needed – the percentage of renewable energy sources share in the production of electricity. By signing the Contract on Energy Community JIE 2006, Serbia pledged to standardize its energy legislation with the EU Directive 2001/77/EC which promotes electrical energy production from renewable sources (Đereg et al., 2008), which has not been signed by Serbia.

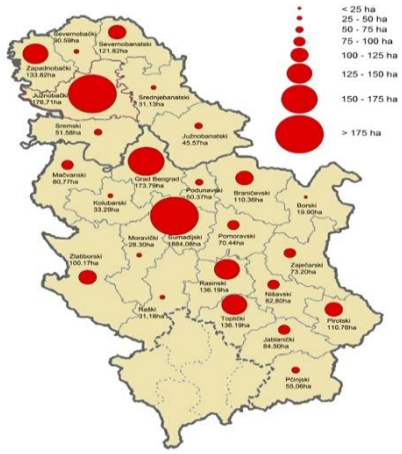



**Figure 1: Brownfields in Serbia – author's own processing according to SIEPA (2009) database.**

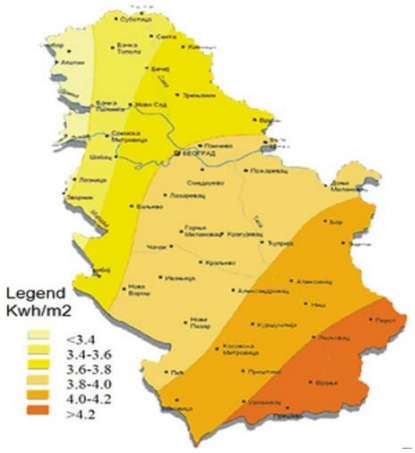
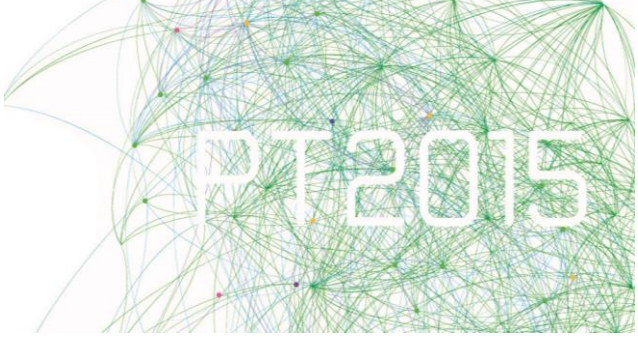



**Figure 2: Annual average solar radiation in Serbia – (Solaris Energy, 2011)**

From the stated above, a conclusion could be made that both brownfield regeneration and solar energy generation in Serbia are areas of investment with huge potential, but with lack of legislative framework and enough public awareness. In such environment private investors in solar energy field are being careful with their investment on brownfield land. The term brightfield is still new in Serbia. If we focus on positive potentials that Serbia has, there is possibility to apply certain methodologies to assess the potentials and risks of solar investments on brownfields. The next chapter deals with such methodology, developed by Hungarian authors Hartmann et al. (2014), but in the context of Serbia.



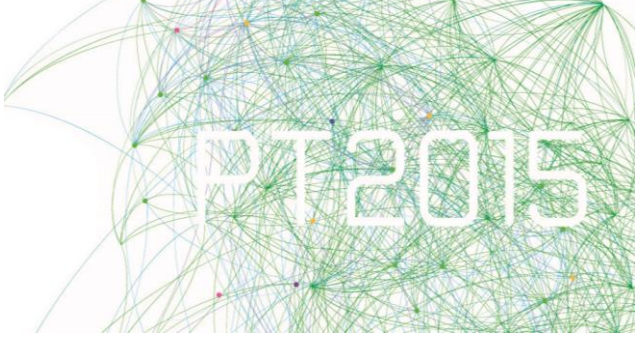

## MULTI-OBJECTIVE METHOD FOR SOLAR ENERGY PURPOSE BROWNFIELD REGENERATION IN SERBIA

In order to introduce the idea of brightfields in Serbia, extensive analysis has to be performed. Steps of the methodology described below are qualitative basis for future extent analysis that brownfield regeneration with solar energy technologies requires, conducted by literature review and adapted to Serbian context.

1. Assessing initial conditions. The first step includes collection of all available information on the history of a brownfield site (Hartmann et al., 2014) – maps, former operational licenses, the nature of the activity held on the brownfield, possible contamination, and information on ownership structure which in Serbian case could be one of the most problematic issues. The next phase would be on-site measurements and observations which should provide data on current conditions, contamination issues, state of existing infrastructure, inner transportation, energy utilities, etc. (Hartmann et al., 2014).

2. Evaluation of solar energy generation potential. Each renewable energy technology is limited by technology-specific criteria including minimum resource intensity (slope, land cover, average solar radiation, orientation of the existing structures, etc.). This criteria primary represent technical resource potential, but also includes some economic criteria, which influences a site's capacity factor and cost of energy (Milbrandt et al., 2014). This step includes the estimation of the electricity generation potential according to various capacities and technologies the investor may select. The one universal precondition for solar redevelopment is access to sunlight, and there are many conditions that may affect this access. In general, latitude and regional climate dictate the gross quantity and quality of sunlight available to a certain parcel. Also, on-site or nearby topographic features, trees, and buildings can limit the amount of sunlight available at a specific location (APA, 2013). This step should also have the flexibility to accept new ideas, innovative solutions, or reinterpretation of existing functions or operations (Hartmann et al., 2014).

3. Risk assessment. Having in mind that there are no two same brownfields (CABERNET, 2007), different risk assessment procedures are hard to standardize. In this paper only few examples of qualitative risk factors are given based on the study of Hartmann (2014): (a) network access – to the distribution or the transmission network, (b) lack of information on the past utilization of the site – significant additional costs may rise due to this problem, (c) licensing – in Serbia investors are often faced with complicated and long procedure for building permits, (d) high initial investment cost, (e) intermittent production –due to sudden and fast changes of output power such technologies need to supply a power system on their own, (f) aesthetics – community concern is the effect of new power plant on the landscape, (g) water management –artificial cooling of the system is required to reach high efficiency. Technical issues as risk factors are usually easier to describe




and the risk assessment is usually simpler than in case of economic, political, or social issues, where positive and negative factors on decision making are harder to distinguish.

4. Boundary conditions set by national energy policies. The final step of the examination is the analysis of legislative and political boundary conditions, like permitting, financing, and energy policy goals, which all affect the long term feasibility of the project (Hartmann et al., 2014). As already mentioned, legislative framework in Serbia in this area is either complicated or incomplete. Nevertheless, the climate of legal documents in an indirect way is beneficial for activities related to sustainable brownfield regeneration (SKGO, 2011). In this context, the most important official documents in Serbia are: Planning and Constriction Law (2015), Privatization Law (2001), Bankruptcy Law (2009), Regulation on direct investments (2012), Law on Public-Private Partnership and Concessions (2011), and official documents from the Sector for energy efficiency and renewable energy sources of the Ministry of Mining and Energy.

## CONCLUSIONS

Solar energy generation on brownfield land is a great opportunity for Serbia towards sustainable urban development. It offers the possibility to solve both brownfield regeneration and renewable energy production issues with a single action. On its way towards sustainability, Serbia still needs to establish legal framework that supports these kind of activities, to enhance public awareness on this matter, and to ensure safe environment for private or public-private investments.

## REFERENCES

Adelaja, S. et al. 2010. "Renewable Energy Potential on Brownfield Sites: A Case Study of Michigan." *Energy Policy* 38: 7021-30.

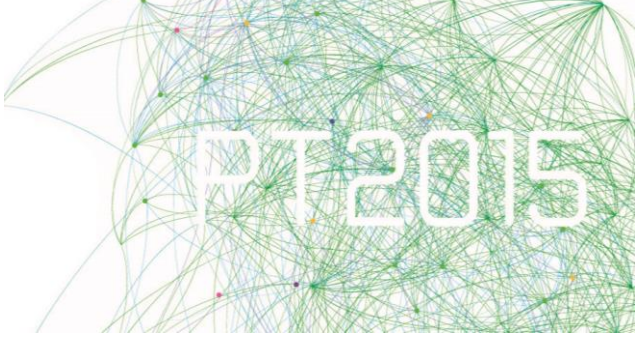
APA. 2013. "Recycling Land for Solar Energy Development." *American Planning Association's Solar Briefing Papers*.

CABERNET. 2007. *Sustainable brownfield regeneration: CABERNET network report*. University of Nottingham.

Đereg, N., et al. 2008. *Obnovljivi izvori energije u Srbiji, preporuke, potencijali i kriterijumi*. Subotica: Centar za ekologiju i održivi razvoj.

Hartmann, B., et al. 2014. "Multi-objective Method for Energy Purpose Redevelopment of Brownfield Sites." *Journal of Cleaner Production* 82: 202-12.

Hough, G., et al. 2012. "Brownfield to Brightfield Initiative in Oak Ridge, TN." *WM2012 Conference, Phoenix, Arizona, USA* (February 26-March 1).




Klusaček, P., et al. 2014. "From Wasted Land to Megawatts: How to Convert Brownfields into Solar Power Plants (the Case of the Czech Republic)." *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis* 62(3): 517-28.

Laprise, M., et al. 2015. "An Indicator System for the Assessment of Sustainability Integrated into the Project Dynamics of Regeneration of Disused Urban Areas*." Building and Environment* 86: 29-38.

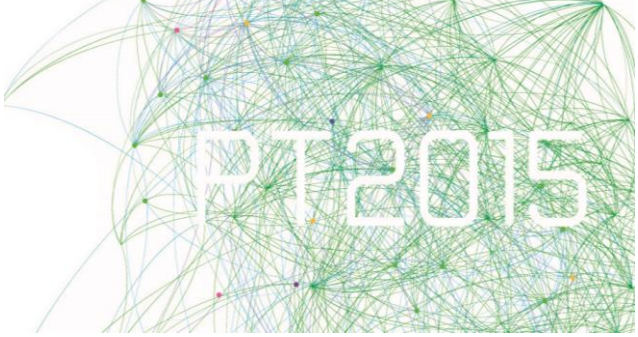
Milbrandt, A. R., et al. 2014. "Renewable Energy Potential on Marginal Lands in the United States." *Renewable and Sustainable Energy Reviews* 29: 473-81.

Ribeiro, L.. 2007. "Waste to Watts: a Brightfield Installation has the Potential to Bring Renewed Life to a Brownfield Site." *Refocus* 8: 46-49.

SKGO. 2011. *Reaktiviranje braunfilda u Srbiji: Sistematski pristup ili ad hoc rešenje?* Beograd.

Stamenić, L.. 2009. *Korišćenje solarne fotonaponske energije u Srbiji*. Jefferson Institute.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# LANDFILL JAKUŠEVEC IN ZAGREB – POTENTIAL FOR NEW SPACE IDENTITY AND ENHANCEMENT OF QUALITY OF LIFE

**Lea Petrović Krajnik**[1]
PhD, Senior Teaching and Research Assistant, Faculty of Architecture, University of Zagreb, Kačićeva 26, 10 000 Zagreb, Croatia, lea.petrovic@arhitekt.hr

**Damir Krajnik**
PhD, Professor, Faculty of Architecture, University of Zagreb, Kačićeva 26, 10 000 Zagreb, Croatia, damir.krajnik@arhitekt.hr

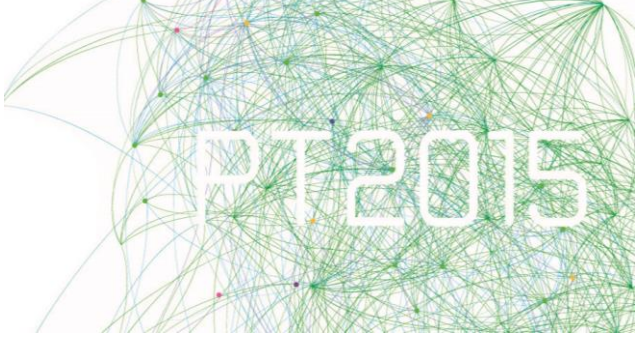
**Ivan Mlinar**
PhD, Professor, Faculty of Architecture, University of Zagreb, Kačićeva 26, 10 000 Zagreb, Croatia, ivan.mlinar@arhitekt.hr

## ABSTRACT

*We are witnesses of constant changes at all levels that occur in complex systems such as the city and its region. City as a complex urban fabric is gradually extending to its region occupying new areas. Over the time, facilities that once were planned and subsequently built on the very peripheral areas of the city due to their characteristics, are gradually becoming integral part of the urban fabric. The necessity for the gradual conversion and transformation of certain areas for the purpose of new needs of their users is becoming more obvious. Awareness of the consequences of insufficient or partially conceived actions in space led to the adoption of guidelines for planning and acting in accordance with sustainable development (taking into account environmental, economic and social aspects of sustainability) at the end of the 20th century. Considering potential areas of conversion in Zagreb which in the same time represent the environmental problem, the area of Jakuševec landfill was selected as one of the most interesting examples. For the purpose of this research the world examples of remediation and reuse of landfills were analysed. The aim of this paper is to point out the possibilities of landfill conversion from an area representing ecological, economic and social problem into an area with a new identity and new use which contributes to quality of life of the residents in wider context.*

***Keywords**: sustainable development, Zagreb, landfill Jakuševec, new identity, quality of life.*

[1] Corresponding author
This research is a part of the scientific project *Heritage Urbanism - Urban and Spatial Planning Models for Revival and Enhancement of Cultural Heritage (2032)* financed by Croatian Science Foundation, which is being carried out at the Faculty of Architecture, University of Zagreb, under the project leadership of academic Mladen Obad Šćitaroci.




## INTRODUCTION

We are witnesses of constant changes at all levels that occur in complex systems such as the city and its region. City as a complex urban fabric is gradually extending to its region occupying new areas. Over the time, facilities that once were planned and subsequently built on the very peripheral areas of the city due to their characteristics, are gradually becoming integral part of the urban fabric. The necessity for the gradual conversion and transformation of certain areas for the purpose of new needs of their users is becoming more obvious. Awareness of the consequences of insufficient or partially conceived actions in space led to the adoption of guidelines for planning and acting in accordance with sustainable development (taking into account environmental, economic and social aspects of sustainability) at the end of the 20th century. Landfills are one of specific use of the area that were once located on periphery, and today due to the expansion of existing structures are becoming a part of it. They represent a specific spatial problem, but also a challenge for the conception of a location as a new spatial potential. The rapid technological development of the 20th century brings new changes in attitudes towards the exploitation of the landscape. Movement *Land-reclamation* from 1960's, has been recognized as a valuable initiative in the USA, which have been one of the largest projects of landscape remediation. The project "Earthworks: Land Reclamation as Sculpture" engaged numerous artists to transform large spatial problems, such as landfills, quarries, abandoned airports, military bases and others. (Gašparović, Mrđa, Petrović, 2009)

The aim of this paper is to point out the possibilities of a landfill conversion from an area representing ecological, economic and social problem into an area with new identity and new use which contributes to quality of life of the residents in wider context. The intention of this paper is not to discuss about technological solutions of landfill remediation, but to perceive the overall vision of space and its sustainable development.

## REMEDIATION AND REUSE OF LANDFILLS - WORLD EXAMPLES

In order to consider the possibility of landscape recovery and different possibilities of landfill conversion and subsequent use, three international examples, which were published in professional architectural revues and architectural internet resources are analysed. Examples are analysed according to the following parameters: surface of disposal site, location in relation to the wider context, characteristics of the area before landfill use, planned or new way of using former landfills, and their specifics.

**Figure 1: International Examples of Landfills - La Vall d'en Joan (1), Fresh Kills Park (2), Sang-Am Millenium Park (3). (Source: Google Earth, 2015).**

**La Vall d'en Joan**, (Batlle i Roig Arquitectes, Enric Batlle, Joan Roig, architects / Teresa Galí-Izard, agricultural engineer) is located in the Natural Park of Garraf, in Begues and Gavà. The landfill covered the area of 70 hectares. From 1974 until 1999 the area has been the destination of most of the urban waste produced by Barcelona and its metropolitan area. Due to specific use, a new artificial topography formed by terraces, slopes and ziz-zag ramps was created. The main aim of the landfill restoration project (2002) was to create a new place that could be used as a park and to construct a new landscape by integrating the former landfill into Garraf Natural Park. The terraces and slopes were replanted in order to regenerate the soil with native species. The biogas collected at the site is turned into electrical energy into the nearby transformation plant. In the park there is an information centre and a series of gabion walls filled with recycled waste or soil next to the entrance from Gavà as witnesses of the former use of the site. (Bravo Bordas, 2002)

**Fresh Kills Park** (Field Operations, James Corner) is located at Staten Island, New York and covers the area of 890 hectares. Once the area was a fertile landscape with tidal creeks and coastal marsh. From 1948 until 2001 the area was used as a principal landfill for household garbage collected in New York City. During its operation four landfill mounds were made up of approximately 150 million tons of solid waste collected on site. According to James Corner a long-term strategy based on natural processes, agricultural practice and plant life cycles will help to rehabilitate severely degraded land of the Staten Island over the next 30 years, and transform the site into a huge public park. The development plan foresaw six stages of the remediation, which will enable creation of a diverse parkland for wildlife, cultural and social activities and recreation. The vast landscape is organized in three layers which create a framework for the park that is planned as coherent and durable in order to shape the park but also flexible enough to allow changes over time. There are different locations for activities (event areas and facilities), circulation (roads and paths) and new habitats (landscape).

Sang-Am Millennium Park (Oikos, Yoo Kerl Architects; Cho Byeong Su Architects, Prof. Jon Lang) is located on the fringe of Seoul and it covers the area of 363 hectares. The area of Nanjido was once a small island filled with rich

biodiversity, numerous plants such as orchids and other flowers, famous for its shallow and clean brooks and various aquatic flora and fauna. From 1978 until 1993 the Nanjido was used as a landfill due to a rapid urbanization of Seoul. After its closure there was 92 million tons of garbage stacked in two 90-meter-high mountains of garbage. After its closure, the city designated the site as an "ecology park". The World Cup 2002 was an incentive for the remediation of Nanjido as an eco-friendly area. The area has been developed as a part of the Sang-Am Millennium City, which consists of Digital Media City, an Environment-friendly residential area, a world cup stadium with shopping mall, and Millenium Park (five different theme parks.) connected with environment-friendly and pollution-free transportation system and high-tech communication network (Jae Seung, 2008). The whole project of landfill recovery focused on four areas of development: top soil levelling and soil-recovery, leachate treatment, extraction and recycling of landfill gas (providing heating to the World Cup Stadium and the surrounding residential district), and slope stabilisation. A land stabilization process is expected to be completed by the year 2020.

## LANDFILL JAKUŠEVEC IN ZAGREB – PROBLEMS AND POTENTIALS

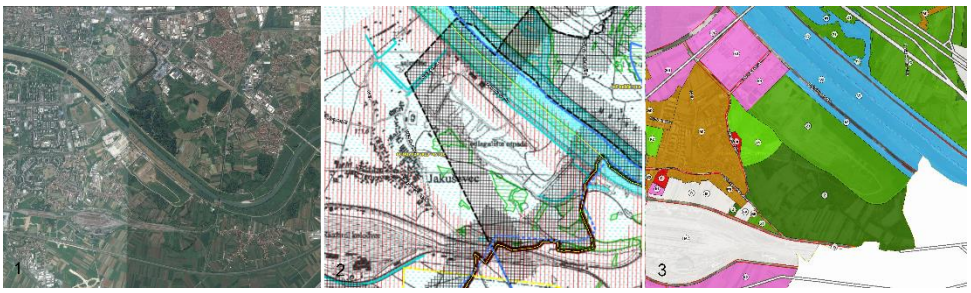
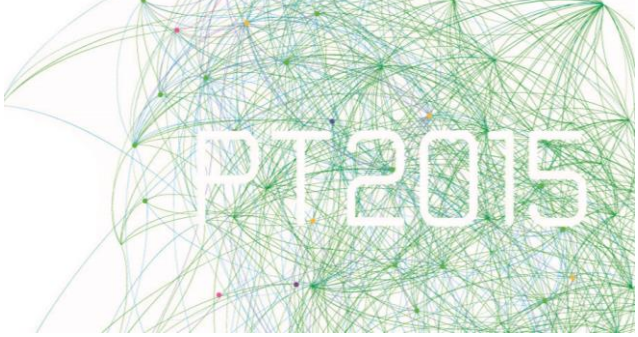



**Figure 2: Landfill Jakuševec in Zagreb – Position (1), Zagreb Physical Plan (2), Zagreb Master Plan (3), (Source: Google Earth & ZgGeopotal, 2015).**

Jakuševec landfill - Prudinec (80 ha) is landfill of household, non-hazardous and industrial waste of the City of Zagreb. It is located 6 km (air distance) from the centre of Zagreb in the southeastern part directly on the right bank of the River Sava. In the mid 1960's uncontrolled waste disposal started in the area of today's landfill, and by 2000 the volume of landfilled waste has reached 8 million m3, thus becoming the largest unregulated landfill in the southeastern part of Europe (Nakić, Prce, Posavec, 2007). Once on the outskirts of the city, during the years the urban structure expansion led to the fact that the residential building in Jakuševec are located only 400 m from the landfill site. At the beginning of the 21st century the remediation project of Jakuševec was implemented, as well as construction of regulated landfill Prudinec. The landfill emergency pumping system, the leachate purification device of and gas station were installed. (Grad Zagreb, 2015).




The main aim of remediation was protection of groundwater and arrangement of volume of collected waste by rearranging on the impervious surface. Ground analyses have shown that there is a need for decontamination of pollution of the groundwater caused by previous use. (Nikolić, 2008)

The Jakuševec landfill and its immediate environment are defined by Master Plan of the City of Zagreb (2007) as particularly sensitive area, and the units in which the environment is endangered. The landfill is planned as theme park (Z3), and the obligation of making *Urban Development Plan for Sava Park East - Sanitary Landfill Jakuševec* is set. By Spatial Plan for the City of Zagreb (2009), the deadline for disposal of waste on Jakuševec landfill was planned for 2010. According to the capacity estimation of the landfill Prudinec in Jakuševec and technical possibilities of waste disposal, there are conditions for disposal on the newly arranged working surfaces until the end of 2018. (Grad Zagreb, 2015)

Conceiving of a comprehensive concept of the area around the River Sava with its contact zones has been ongoing since the late 19th century when regulation work has started (Matković, Obad Šćitaroci, 2012). Here we point out some events related to the topic from the beginning of the 21st century such as survey urban-architectural competition of conceiving the River Save in the area from Podsused to Ivanja Reka (2002), Scientific Conference *Zagreb Development* (2008) and workshop *Zagreb on the Sava* (2013). On the student workshop *Zagreb on the Sava* students working in interdisciplinary teams proposed development concepts for banks of the River Sava and its contact zones. For the Jakuševec area students proposed: linking the landfill with ornithological reserve Savišće in a unique theme park; converting the area into a theme park and solar power plant as a counterpart to the thermal heating plant nearby; greening slopes and transformation of the landfill in "active green zone" that would include motocross tracks, cycle paths, climbing, running and walking paths; converting into a technology park with light prefabricated buildings intended for research centre, plant for methane exploitation, where southern slopes are used to generate electricity.

The potential of Jakuševec area is quite large. It is well connected by public and private transport with wider city area, located along the River Sava and forms a part of a network of recreational areas of Zagreb. It is also located close to the ornithological reserve with which it can be linked to form a larger spatial unit. The area is characterized by a specific topography created by waste disposal which provides new views and gives possibilities for specific new way of use.

## CONCLUSIONS

The analyses of the world's landfills examples show how appropriate interventions enable environmental, social and economic problem in a certain area, to become a new attractive space potential that creates a new identity of place. Its new way of use enhances the quality of life of residents and users of the wider context. The

concept of the Jakuševec landfill reuse is necessary to articulate in the context of a comprehensive proposal for the whole area along the Sava River. While making decision about an appropriate way of use for Jakuševec the need of future users should be identified. The specific topographic and environmental characteristics of the area should also be taken into consideration since they contribute to the overall city image. The long-term plan of conversion should enable the future changes as well as phase construction. Planning of a new use, remediation and conversion of Jakuševec landfill must meet all three aspects of sustainability - environmental, economic and social.

## REFERENCES

Bravo Bordas, D. 2002. "Restauracio paisatgistica del diposit controlat de la Vall d'en Joan".Accessed March 24, 2015. http://www.publicspace.org/en/works/c057-restauracio-paisatgistica-del-diposit-controlat-de-la-vall-d-en-joan-1a-i-2a-fase

Gašparović, S., Mrđa, A., Petrović, L. 2009. „Modeli pejsažne sanacije i prenamjene kamenoloma - Oporavak pejsaža / Landscape Models of Reclamationand Conversion of Quarries - Recovering Landscapes." *Prostor* 20(2012) 1(43): 372-85.

Grad Zagreb. 2015. "Saniranje Jakuševca / Remediation of Jakuševec", Accessed March 19, 2015. http://web1.zagreb.hr/default.aspx?id=34183.

Jae Seung, L. 2008. "Post-Landfill Parks - Sang-Am Millennium Park, Seoul & Fresh Kills Park, New York", Accessed March 24, 2015.

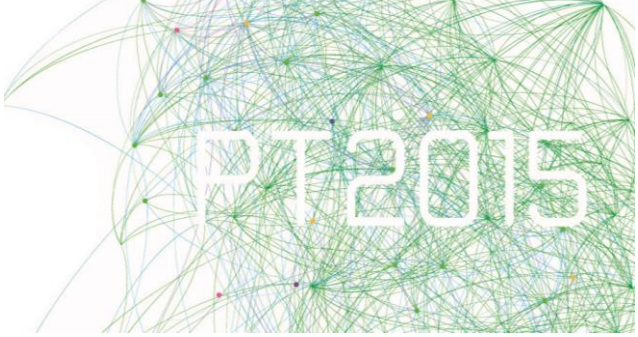
Matković, I., Obad Šćitaroci, M. 2012. "Rijeka Sava s priobaljem u Zagrebu – prijedlozi za uređivanje obala Save 1899.-2010. / The Sava River and its Banks in Zagreb – Development Proposals for Sava banks between 1899 and 2010." *Prostor* 17(2009) 2(38): 46-58.

Nakić, Z., Prce, M., Posavec, K. 2007. " Utjecaj odlališta otpada Jakuševec – Prdinec na kakvoću podzemne vode / Impact of the Jakuševec – Prudinec wast disposal site on groundwater quality." *Rudarsko-geološko-naftni zbornik*, vol.19: 35-45.

Nikolić, S. 2008. "Ekološki problem Zagreba / Ecological problem of Zagreb." *Zbornik radova konferencije Razvitak Zagreba (Radić, Jure ed.)*: 139-46.

Generalni urbanistički plan grada Zagreba (2007), izmjene i dopune. 2013. Zavod za prostorno uređenje Grada Zagreba, Accessed March 19, 2015. http://www.zagreb.hr/default.aspx?id=29486

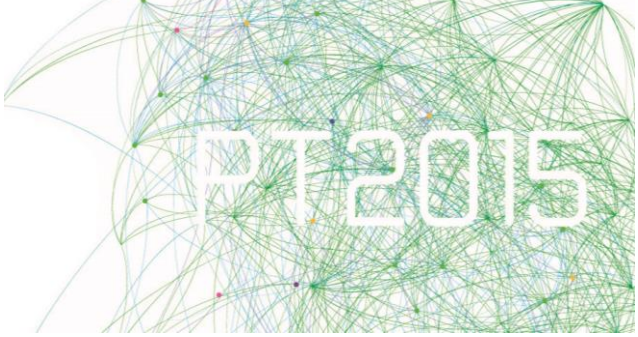
Prostorni plan Grada Zagreba (2009), izmjene i dopune. 2014. Zavod za prostorno uređenje Grada Zagreba, Accessed March 19, 2015. http://www.zagreb.hr/default.aspx?id=25182




# TOPIC X:

# Active Living and Health

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# OPEN PUBLIC SPACES FOR HEALTHIER CITIES

**Aleksandra Stupar**
PhD, Associate Professor, University of Belgrade, Faculty of Architecture, Bulevar kralja Aleksandra 73/II, 11000 Belgrade, Serbia, stupar@afrodita.rcub.bg.ac.rs

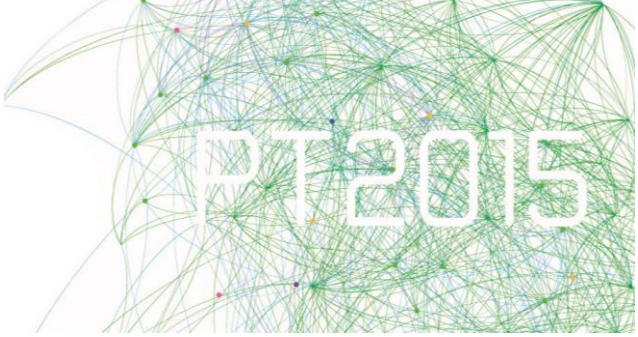
**Aleksandra Đukić**
PhD, Associate Professor, University of Belgrade, Faculty of Architecture, Bulevar kralja Aleksandra 73/II, 11000 Belgrade, Serbia, adjukic@afrodita.rcub.bg.ac.rs

## ABSTRACT

*Public spaces represent essential elements of healthy, functional, eco and smart cities. Being attractive, safe, comfortable, active and inclusive they play the main role in revitalizing communities, supporting their sense of identity and culture and triggering their economic development. The process of globalization, facilitated by the increasing number of ICT networks, imposes a number of new trends which should be followed by professionals. Their aim is to provide an updated setting for public life, which nowadays encompasses both private and public realms, material and virtual reality. Unfortunately, the contemporary lifestyle has caused numerous mental and physical health problems, including chronic diseases, toxic exposure and injuries resulting from uncontrolled violence. Therefore, well-conceived and managed public spaces can influence the health of citizens because their performances could encourage an intensive use of outdoor facilities. Public spaces where users feel safe to play and relax can relieve stress, especially when people live in multi-family apartments or in crowded parts of a city.*

*Considering all these trends and demands, the role of ICT becomes more important in the process of design and use of public spaces. This paper will present and analyse the connection which is established and intensified between users and open spaces via information networks. The emphasis will be on two main groups of applications aiming at (1) citizen participation (e.g. 'crowdsourcing' or 'participatory sensing' applications related to mapping and monitoring of pollution, health risks and patterns) or (2) individuals' health consciousness (e.g. applications enabling surveillance of urban spaces and personal life habits).*

***Keywords**: open public spaces, ICT, health.*




## INTRODUCTION

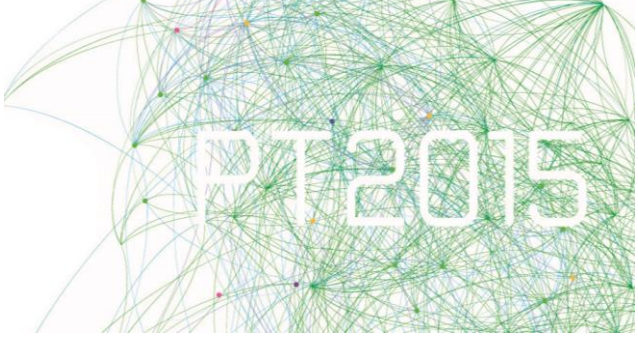
Open public spaces represent focal points of community life, linking nodes of activities and events, simulating experiences and memories and responding to various expectations of users (Crouch, 1998; Crawford, 2000). Providing a spatial framework for different kinds of gathering and multileveled interaction, open spaces nowadays also include virtual flows, stimulating merging of physical and digital reality. The importance of data-exchange is increasing and its intensity becomes a significant characteristic of urban environment (Vidler, 1992) and its 'visibility'. Pervading all aspects of contemporary life, information networks influence our behaviour, modify urban form, activities and habits, and create hybridized landscapes with blurred boundaries (Souza e Silva, 2006). Simultaneously, the performances of digital networks could create a special kind of virtual freedom and safety, within preferred 'groups' and their established confines.

Due to continuous technological improvements, the diversity and speed of information flows are increasing enabling better perception of environment, providing higher efficiency of urban systems and facilitating all levels and scales of communication and movement. Although digital networks certainly support more advanced comprehension of reality, urban processes and their consequences, they challenge traditional definition of 'belonging' - both in spatial and social sense. Therefore, the overlapping of material and digital features also influences modelling of open public spaces, which - more than ever - have to provide a safe and secure environment for spontaneous manifestations of social life (Rossi, 1982). They should support integration of users, while preventing possible uncontrolled violence.

Another important problem, which should be considered during the design processes of open public spaces, is related to numerous environmental threats which have been generated by the carbon-intensive life in cities and the phenomenon of global warming. In this case, the role of ICT could be recognized on two levels - as a tool for sensing the environment and users' needs (by detecting, mapping and monitoring) and a channel for increasing the environmental and health consciousness (via knowledge exchange and promotion of healthy and environmentally friendly habits).

## TOWARDS A HEALTHY LIFE: URBAN CHALLENGES

The process of globalization is followed by an unprecedented pace of urbanisation which reflects on the general condition of the environment, saturated by artificial features. At the same time, the level of biodiversity is decreasing, challenging sustainability of newly created or modified areas and causing a number of negative effects on space(s) and people. However, the latest environmental trends, instigated by the fear of climate change and its already visible effects, promote ecologically



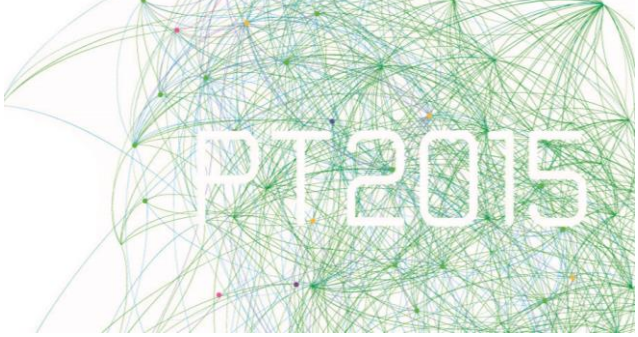

conscious behaviour and impose new demands for management and development of urban spaces targeting higher environmental quality.

The successful planning and design of open urban spaces and their complementing urban systems not only improve overall quality of life and increase attractiveness of spaces, but also act as possible tools for integrated approach toward prevention of weather extremes, disastrous situations or environmental hazards - high temperatures/heat islands, floods, storms, rains or other environmental accidents. Their role in reducing climate changes and GHG emissions is also emphasized, because their green elements, especially trees, provide the greatest airborne particulate sequestration.

The other aspect, frequently tackled in remodelling of open public spaces, is related to the social dimension of sustainability, particularly in sensitive urban contexts facing general poverty, inequality or different kinds of segregation. Healthy and safe environment in this case has a two-fold role - as a trigger for economic development and as a focal point of community integration which also reflects newly established identity. The necessity of physical activities has been recognized in both cases due to increased number of mental and physical problems (including obesity and different chronic diseases) caused by the contemporary (passive) life styles. The important element also represents the accessibility of open public spaces, especially in the case of potentially vulnerable groups - children, older people or urban poor living in distant areas with limited number of recreational facilities. Therefore, one of essential features of new/remodeled public spaces is related to physical activities which should be adjusted to various groups of users.

The link between a higher percentage of total park area, a number of recreational facilities and the increased physical activity within a community has been confirmed by some studies (Li et al., 2005; Rosenberger et al., 2005), as well as the relationship between active involvement of users and the esthetical appearance of open spaces/parks (Active Living Research, 2015). Furthermore, open spaces are more successful if a part of their activities is organized, allowing higher level of (directed) interaction among people. Living in a green environment or having an easy access to nature certainly has numerous benefits for health and our stressful everyday life, reducing aggression or anxiety (Grahn and Stigsdotter, 2003; Kaplan, 1995; Stilgoe, 2001). However, some authors underline that indicators relating the use of green spaces and health are better for less educated people (de Vries et al., 2003), although, in general, stress reduction is achieved in all groups of users (Grahn and Stigsdotter, 2003).

In spite of numerous benefits, the use of open public spaces has some limitations caused by the level of safety and the fear of crime, which is especially noticeable in sensitive and potentially conflicting environments with low security. Additionally, some authors (Lyman, 2000; Steingraber, 2002) also argue on




negative effects of certain fertilizers and GHG emissions originating from mechanisation used for maintenance of green surfaces (lawns).

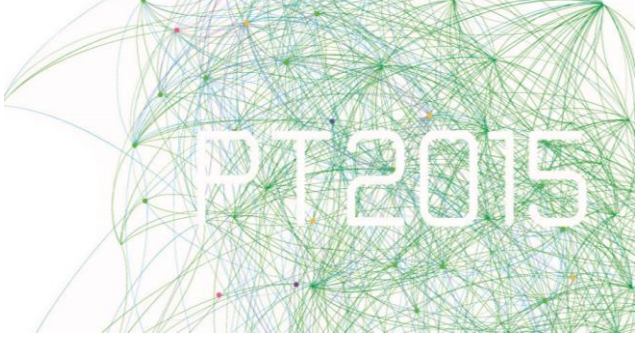
## OPEN PUBLIC SPACE VS. TECHNOLOGY

The application of new technologies constantly redefines our perception of space and its tangible three-dimensional realm. Nowadays, it is enriched and pervaded by multiplying ICT flows, augmented and overlapped with increasing number of information layers which upgrade our experiences and interaction - both with other people and with the surrounding (Aurigi and De Cindio, 2008; Brewer, Dourish, 2008; Graham at al., 2012). The generated flexible spatiality (Liao and Humphreys, 2014) also influences human behaviour, creating a new level of expression and empowerment via different interfaces which allow us to virtually modify, change and emphasise certain elements in urban space. The possibility of active participation is increasing, while technology becomes a vital ingredient of urban culture and urban spaces. The established interaction between city, society and technology also stimulates urban and technological innovations, which are later implemented in different spheres of our urban(ized) life. Therefore, it could be said that new technologies have an important role in connecting social, technological and natural systems by different media, tracing the path toward smarter cities with low carbon economy and healthier life.

The merging of ICT and urban environment is very important for open public spaces, because they represent nodes of social life which are nowadays blending digital and material spheres of interaction. Currently, the role of ICT flows and networks could be recognized in a number of applications dealing with the main challenges of the anticipated climate-friendly development and a general improvement of the environmental conditions. Therefore, they are mostly focused on activities related to changes of human behaviour and ecological awareness, which could be achieved spontaneously/individually, or through organized programs and projects.

The ICT networks have also an important role in detecting and collecting environmental data and increasing their visibility. The link between environment and users is usually established through personal and public interfaces providing easy access to information related to places, processes and activities which could be used for moderation of our life styles and consumption patterns, management of resources, or as a notification/alarm related to social, ecological or health issues. This type of information networks can also include real-time interaction with users enabling their active participation in detecting urban problems.

For example, the concept of Cyber Parks clearly demonstrates all the benefits and problems generated by the integration of ICT into process of design and use of open spaces and their public facilities. It represents an open public space covered with ICT networks where people spend their free time and have a possibility of

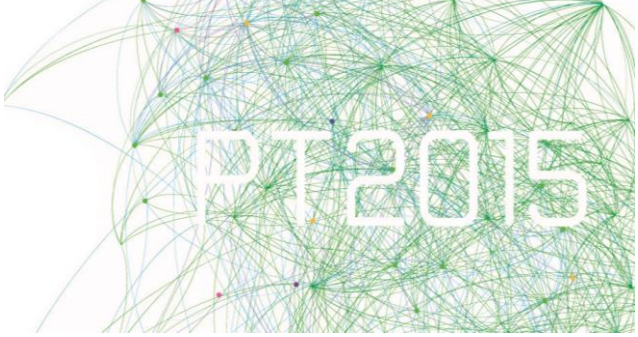



participating in numerous social interactions. However, although it provides a new mode of interactive landscape, which is 'responsive' to users' needs, it should simultaneously encourage active use of the environment and its 'green' features, as well as a social networking in real space and time. As a result, the intelligent environment provided by Cyber parks should be designed as a space in which sensors and computers are seamlessly embedded to enhance ordinary park activities, and where the landscape itself might respond to people moving through it. The installation Hylozoic Ground (by Philip Beesley) represents one of these examples in which an interactive environment, based on artificial intelligence, synthetic biology and interactive technology, moves and breathes around its viewers.

## DIGITAL UPGRADING VS. PUBLIC HEALTH

The intensive merging of material and digital flows, as well as the increased speed of information exchange, definitely redefine our (re)action to accumulating environmental challenges and health risks. Although it improves urban performances by efficiently detecting, collecting, analyzing and processing different kinds of data, total digitalization cannot replace comprehensive actions in real space and time, especially in areas without sufficient technological support. Currently, we can identify two major trends targeting overlapping of open public spaces, their users and information networks which should have a direct impact on environmental quality and the health of urban population. The first one is focused on stimulation of citizen participation via technological upgrading enabled by crowdsourcing or participatory sensing, while the second one triggers the individuals' health consciousness via emerging applications which provide efficient surveillance of urban spaces and personal life habits.

For example, recent studies reveal numerous possibilities developed by the intensified use of Sensor Web, citizen sensing and ‘human-in-the-loop sensing’, as well as the new approached brought by Semantic Web technology or 3-D visualisation of surveillance, which could have a significant role in a domain of environmental and public health (Kamel Boulos et al., 2011). Furthermore, there is an increasing number of commercial applications developed for smartphones and tablets which enable monitoring and verification of health indicators and related data (e.g. detecting heartbeat, body temperature, calculating calories, number of kilometres run etc.). These information could be used during everyday activities - as a record, reminder, instant check up or simply for comparison (for personalized use), or for collecting health data within programs launched by special monitoring groups or government. Therefore, it could be noticed that application of ICT in open public spaces runs on informal and formal level, merging individual and public information networks. However, in spite of their obvious benefits for medical and health promotion and general improvement of the environmental situation and health condition of citizens, there are some moral and ethical issues




related to the privacy of information, the level of surveillance or the approach toward promotion of certain habits (Lupton, 2012).

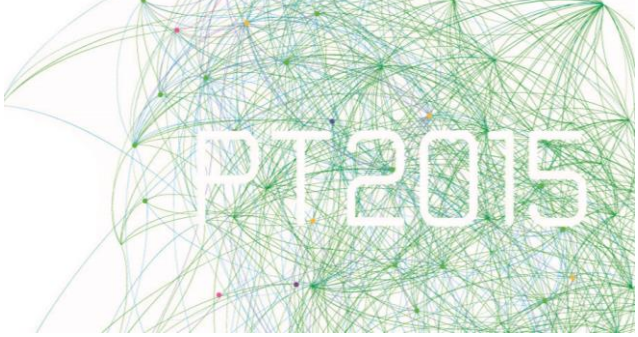
## CONCLUSION

The contemporary city and its open public spaces have been exposed to numerous environmental challenges which influence the condition of environment (both built and natural) and general public health. However, the latest trends of technological upgrading have introduced numerous possibilities for detecting environmental and health data (via sensors), making them immediately available (via networks) and efficiently responding to identified problems. Due to the emerging trends of Open Network Environment, Internet of Things (IoT), Cloud Computing, Open Data and Big Data concepts the overlapping and interlinking of physical and digital environment is provided, stimulating adjustment of our perception, actions and decisions toward new life styles and behavioural changes.

The uneven development of technological support, as well as numerous ethical and moral doubts which follow its use, influence further integration of ICT into physical space. However, the introduction of simple, affordable and user-friendly platforms and applications should be stimulated, allowing a higher level of privacy, while simultaneously providing an adequate selection of information. The attention of professionals (architects, designers and engineers) should be also focused on benefits of horizontal communication since it enables immediacy and accuracy of information within a user group. Ensuring the flexibility of content and the highest possible level of accessibility, it will be gradually adjusted to the technological competence of users.

Although digital flows could certainly upgrade performances and intensify use of open public space, its genuine role in a community life should not be forgotten. Therefore, a proper balance of material and virtual elements, nodes and flows should be achieved in order to stimulate active participation of users which will increase their connection with the surrounding. It will provide better understanding of natural and social processes, but, above all, it will reinforce the transition of our habits toward healthier life based on the sustainable consumption of our individual and global resources.

**Acknowledgement:** *The paper is realized as part of the project "Studying climate change and its influence on the environment: impacts, adaptation and mitigation" (43007), within the framework of integrated and interdisciplinary research, and the project "Spatial, Environmental, Energy and Social Aspects of Developing Settlements and Climate Change – Mutual Impacts" (TR36035), within the program Technological Development, both financed by the Ministry of Education and Science of the Republic of Serbia (2011-2015).*




## REFERENCES

Active Living Research. 2015. Accessed April 13, 2015. http://activelivingresearch.org/

Aurigi, A., and De Cindio, F. (eds.). 2008. Augmented Urban Spaces. London: Ashgate.

Brewer, J., and Dourish, P.. 2008. "Storied spaces: cultural accounts of mobility, technology and environmental knowing". International Journal of Human-Computer Studies 66(12): 963-76.

Crawford, M., 1992. "The World in a Shopping Mall", In Variations on a Theme Park: The New American City and the End of Public Space, edited by Michael Sorkin, 3-30. New York: Hill and Wang.

Crouch, D. 1998. "The Street in the Making of Popular Geographical Knowledge", In Images of the Streets, edited by Nicholas R. Fyfe, 160-175. London and New York: Routledge.

De Souza e Silva, A. 2006. "From cyber to hybrid: Mobile technologies as interface of hybrid spaces". Space and Culture 9(3): 261-79.

De Vries, S., R. Verheij, Groenewegen, H., Spreeuwenberg, P. 2003. "Natural Environments — Healthy Environments? An Exploratory Analysis of the Relationship between Green Space and Health". Environment and Planning 35(10): 1717–31.

Google. 2012. “Privacy Policy.” Google Policies & Principles. Last modified July 27. Accessed January 3, 2013. http://www.google.com/policies/privacy/.

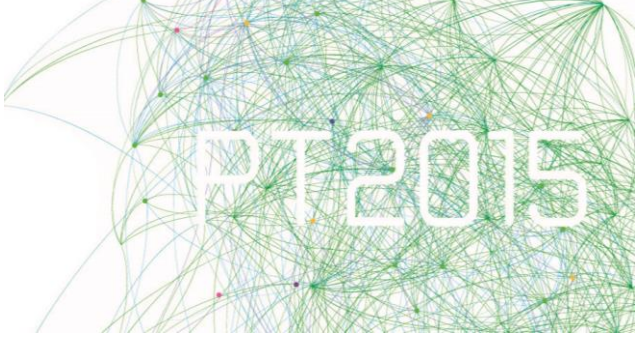
Graham, M., Zook, M., Boulton, A. 2012. "Augmented reality in urban places: contested content and the duplicity of code". Transactions of the Institute of British Geographers, 38 (3): 464-479.

Grahn, Patrik, and Ulrika Stigsdotter. 2003. "Landscape Planning and Stress". Urban Forestry and Urban Greening 2: 1–18.

Kamel Boulos, M. N, Resch, B., Crowley, D. N. 2011. “Crowdsourcing, citizen sensing and sensor web technologies for public and environmental health surveillance and crisis management: trends, OGC standards and application examples.“ International Journal of Health Geographics, 10 (67): 1-29.

Kaplan, S. 1995. "The Restorative Benefits of Nature: Toward an Integrative Framework". Journal of Environmental Psychology 15: 169–82.

Li, F., Fisher, J., Brownson, R. et al. 2005. "Multilevel Modeling of Built Environment Characteristics Related to Neighborhood Walking Activity in Older Adults". Journal of Epidemiology and Community Health, 59: 558–64.




Liao, T. and Humphreys, L. 2014. "Layer-ed places: Using mobile augmented reality to tactically reengage, reproduce and reappropriate public space". *New Media and Society*, 2014: 1-18.

Lupton, D. 2012. "M-health and health promotion: The digital cyborg and surveillance society." *Social Theory & Health*, 10 (2): 229–44.

Lyman, F. 2000. *Smog Engulfs Downtown Los Angeles*. MSNBC Report, 23 May.
Rosenberger, R.S., Y. Sneh, T. Phipps, and R. Gurvitch. 2005. "A Spatial Analysis of Linkages between Health Care Expenditures, Physical Inactivity, Obesity and Recreation Supply". *Journal of Leisure Research* 37(2): 216–35.

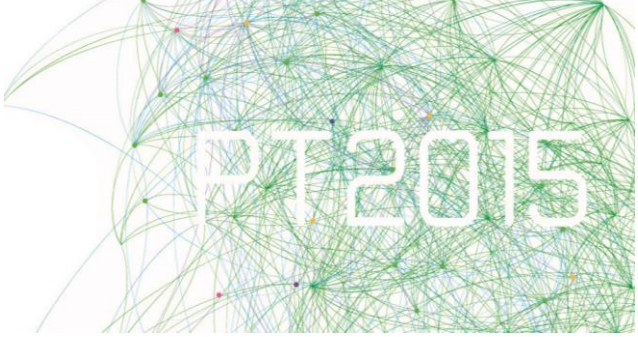
Rossi, A. 1982. *The Architecture of the City*, Cambridge, MA: MIT Press.

Steingraber, S. 2002. "Exquisite Communion: the body, landscape and toxic exposures". In *Ecology and Design: Frameworks for Learning*, edited by Johnson, B.R. and K. Hill, 192-202. Washington D.C.: Island Press.

Stilgoe, J R. 2001. "Gone Barefoot Lately?" *American Journal of Preventive Medicine* 20: 243–44.

Vidler, A. 1992. *The architectural uncanny: Essays in the modern unhomely*, Cambridge, MA: MIT Press.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# RESPONSIBILITY TO THE EMPLOYEES' HEALTH UNAVOIDABLE IN THE CREATIVE AND INNOVATIVE DESIGN OF OFFICE SPACES

**Nikola Z. Furundžić**[1]
Dentist, Dental practice "Furundzic ordinacija", Belgrade, Serbia,
stomordinacija227@gmail.com

**Dijana P. Furundžić**
Dentist, Dental practice "Furundzic ordinacija", Belgrade, Serbia,
diananikola@gmail.com

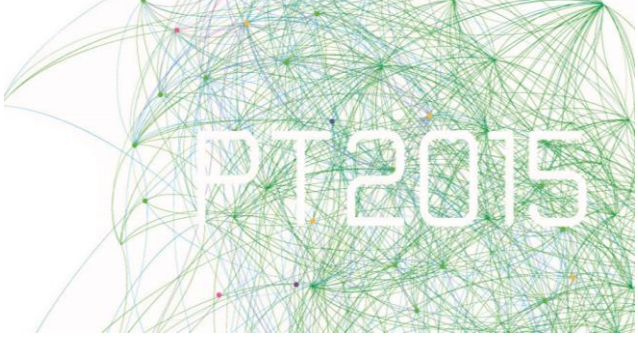
**Aleksandra Krstić-Furundžić**
PhD, Full professor, Faculty of Architecture, University of Belgrade, Bulevar kralja Aleksandra 73/II, 11000 Belgrade, Serbia, eakrstic@arh.bg.ac.rs

## ABSTRACT

*Office space should be designed to provide better productivity and creativity of employees, while preserving their health. Majority of the employees spend most of the day in the office. Workspaces greatly affect the psychological well-being and activities and abilities of employees. Health of employees, which directly affects productivity, is conditioned by the office type. The main objective of this paper is to show the influence of innovative office space design on the employees' health and to highlight the harmful environmental factors that affect human health. The findings of this study show that office design is very vital in terms of causing or preventing physiological and psychological reactions. Functional features of various types of offices have a different effect on the employee's ability to perform the personal control. In the case of different types of offices, there are different perceptions of stress in men and women. Some negative health outcomes, like stress, decreasing ability of personal control and TMD-related symptoms are considered.*

***Keywords**: office types, employees' health, office harmful environmental factors, TMD-related symptoms.*

[1] Corresponding author




## INTRODUCTION

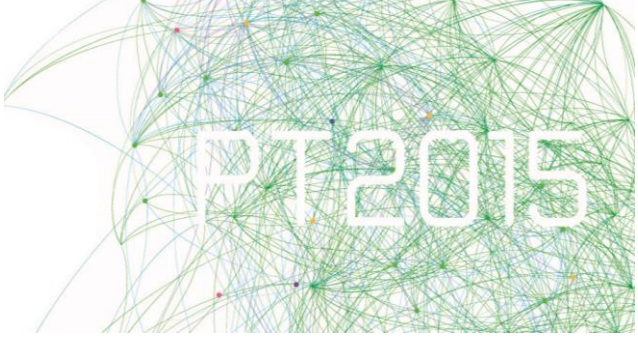
Humans are subject to constant change as a result of adaptation to changing environmental conditions to which they affect more and more. The term Environment of Evolutionary Adaptation is used to denote the qualities of the environment humans are adapted to live in (Crawford and Krebs, 1997; Irons, 1998). This also applies to office space or working environment. Office space has been evolved with the progress of new technologies and grows of corporate culture. The new architectural and interior design is dynamic process and it should be updated. Buildings as objects become intelligent in the moment of gaining computer ability (Sherbini and Krawczyk, 2004). Sherbini and Krawczyk remark that the first intelligent building used technology to provide a comfortable, secure, and energy-conscious environment and that the intelligent building concept offers the connection and integration of HVAC, access, lighting, security, monitoring, management, and telecommunication. On the other hand, just like the architectural remains of past civilisations, office buildings can be regarded as artefacts and their interiors, layout and architecture tell something about the social structure and social relationships of their inhabitants (Voordt et al., 2003). In some literature office buildings are considered as artefacts of corporate culture (Voordt et al., 2003).

New technology and design can be generators of stress for employees in offices. The main objective of this paper is to show the influence of innovative office space design on the employees' health and to highlight the harmful environmental factors that affect human health. Some negative health outcomes, like stress, decreasing ability of personal control and TMD-related symptoms are considered. Methodological approach includes the review and comparative analysis of the relevant literature and linking the various research results.

## OFFICE TYPES AND EMPLOYEES' HEALTH

Majority of the employees spend most of the day in the office. Workspaces greatly affect the psychological well-being and activities and abilities of employees. When it comes to office buildings can be noted that the impacts relate to the type of office. A space in the office may contain several different activities, either simultaneous or sequential, and its boundary may be more or less substantial, varying from a solid wall to a line in the carpet (Raymond and Cunliffe, 1997). Organization and division of space depends on the needs of companies.

The office type can reinforce or thwart personal control by its architectural and functional features (Danielsson, 2010). This means that architectural features such as size, location and permeability of interior rooms has an impact due to its influence on the degree of social control, interaction and privacy (see review in Evans, 2003). But also functional features such as ability to work flexible and support feelings of autonomy and confidence at work at an individual and group level has an impact on personal control (Danielsson, 2010). Conventional and



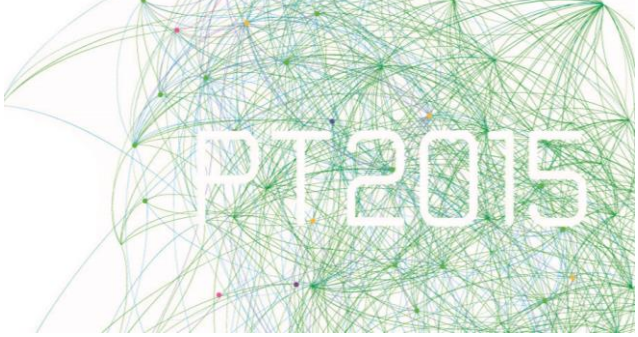

innovative office concepts can be described according to three dimensions (Croon et al., 2005): (1) the office location (e.g. telework office versus conventional office); (2) the office lay-out (e.g. open lay-out versus cellular office); and (3) the office use (e.g. fixed versus shared workplaces). There is not a strict special definition of combi-office; in some combi-offices the employees have individual rooms in others they have an individual workstation in an open plan office layout (Danielsson, 2008). However, the major explanation for the high stress level among combi-office employees is probably not found in the features of the office type, but within the field of leadership and management as employees in combi-offices reported significantly lower job satisfaction compared to other employees (Danielsson and Bodin, 2008). According to the research of Danielsson and Bodin, it can be noted that the adaptation to office type is different for men and women when taken into account the perception of stress. These authors point that men prefer cell-office type (4-9 people in room) and women prefer open space office. Their conclusion is that the level of stress in many cases is related to the type of office and gender.

## OFFICE HARMFUL ENVIRONMENTAL FACTORS

Light, noise, air quality, person-environment (P-E) should be considered as generators of stress in office space. Stress factors are divided into physical factors and social factors. The design of office space should consider all mentioned factors in order to make working environment healthier.

Light is essential that people perform their daily activities, both in the home and at work. The presence of windows in the workplace and access to daylight has been linked with increased satisfaction with the work environment (Boyce, Hunter and Howlett, 2003). Lighting has an influence on our psychological wellbeing and the perceptual qualities of light are the ones stimulating spatial experiences and sensations such as satisfaction, safety, comfort, relaxation and stress, etc. (Flynn, 1977). It is important to provide daylight along with opportunity to control glare and lighting levels (Boyce, Hunter and Howlett, 2003). Contemporary office is characterized by the use of VDU - Visual Display Unites, which imposes a specific spatial organization in order to avoid reflections on the monitors and to achieve working comfort.

Air quality is associated with ventilation. Ventilation systems should be designed so as to provide thermal and air comfort, and therefore the health of people. For thermal comfort ventilation, indoor spaces must receive a sufficient quantity of outdoor air that is warmed or cooled to satisfy human thermal comfort needs (Hedge, 1996). Hedge notes that for health ventilation, indoor spaces must receive air that is free from hazardous chemical or microbiological contaminants. Temperature and air quality in offices affect positively or negatively on employee satisfaction (BOSTI, 1981).



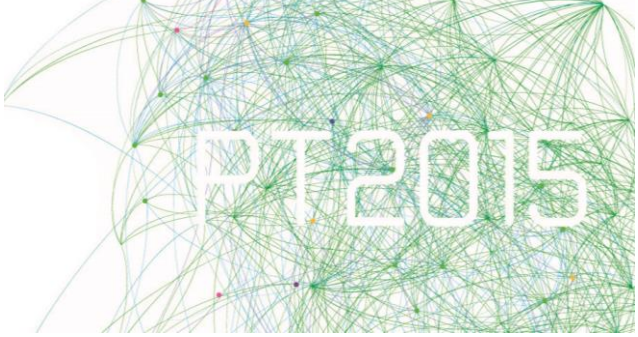

Noise is unwanted sound and represents the environmental stressor within the office space. Noise is the most important environmental factor in office environments since it is: a) the single most common reason for complaints in offices with open plan layouts, and b) it correlates with office employees' environmental dissatisfaction (Nemecek and Grandjean, 1973). Computers, printers, copiers, heating and air conditioning units, telephones and conversations of employees cause noise in the office environment. As the technology develops in the offices will be more gadgets that will produce more noise.

Person-environment (PE) fit theory is a method for understanding the process of adjustment between employees and their work environments. With a reduced degree of personal enclosure, open-plan layout often fails to isolate the occupants from unwanted sound (i.e. sound privacy) and unwanted observation (i.e. visual privacy), resulting in the overall feeling of loss of privacy and personal control over their workspace (Danielsson and Bodin, 2009; Kim and Dear, 2013). Consequently, occupants experience excessive uncontrolled social contact and interruptions due to close proximity to others and perceived loss of privacy, known as overstimulation, which leads to occupants' overall negative reactions toward their office environment (Maher and Hippel, 2005; Kim and Dear, 2013).

## HEALTH PROBLEMS - RESPONSE TO ENVIRONMENTAL STRESSORS

According to Esch and Jones stress is now used as an umbrella term that summarizes the effects of psychosocial and environmental factors on physical or mental well-being (Esch, 2002; Jones et al., 2001; Esch et al., 2002). The same authors noted that stress may cause or exacerbate disease processes depending on the type of stressor involved (e.g. physical, chemical, biological, mental, social, etc.) and/or the duration of its influence on an organism.

There is a correlation between stress and bruxism as a problem in orofacial region (Wieckiewicz et al. 2014). According to The International Classification of Sleep Disorders, sleep bruxism (SB) is defined as a 'stereotyped movement disorder characterized by grinding or clenching of the teeth during sleep' (AASM, 2005). During sleep bruxism, both clenching and tooth-grinding are observed and it can cause tooth destruction, temporomandibular dysfunction (TMD) (e.g., jaw pain or movement limitation), occasional headaches, and the disruption of the bed partner's sleep due to the grinding sounds according to these authors (Bader and Lavigne, 2000). Studies that were conducted in Japan related to TMD (Nishiyama et al. 2012) report that the prevalence of TMD-related symptoms (TRS) was higher in working population (approximately 17–18%) than in the general population (5–12%). They point out psychological irritation resulting from duties in the workplace, changes in the work environment, interpersonal relations and an achievement-oriented climate. They also indicate the necessity of investigating the associations (correlation) between TRS and the work environment, business hours, amount of sleep, and other related factors. Research of Nishiyama et al. shows that




the PC use time was longer for the high-TRS subjects than for the low-TRS subjects and that each additional 2 h of a subject's mean PC use time increased the subject's TRS morbidity 2.23-fold, e.g., subjects who used PCs 4 h per day had 2.23-fold higher rates of TRS than subjects who used PCs 2 h per day (Nishiyama et al., 2012).

## CONCLUSION

New technology and design can be generators of stress for people who work in office space. Technology cannot be isolated from the modern lifestyle, which should be kept in mind during the design of commercial buildings and office interiors. Big challenge is to combine intelligent building concept, corporate culture in architecture and healthy environment. In that sense, the paper pointed out harmful environmental factors which are generators of stress in office spaces. Focus is given to bruxism and TMD as stress-related illnesses.

To reduce the incidence of stress-related illnesses, it is necessary to mitigate the impact of stressors in office space and to implement new features to control the stress. Some studies point out that the visual environment is important for stress recovery and stress reduction is faster in Nature compared to urban environments (Ulrich, 1999). A theoretical examination of aesthetic values points towards the importance of elements reflecting Nature; such as complexity, choice of colours, perspective and balance (Grinde, 1996).

## REFERENCES

AASM. 2005. *The International Classification of Sleep Disorders*, Revised: Diagnostic and coding manual Westchester, IL: American Academy of Sleep Medicine, 2.

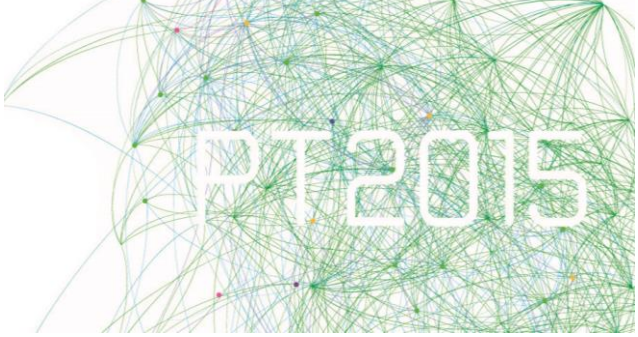
Bader G., Lavigne, G.. 2000. "Sleep bruxism: overview of an oromandibular sleep movement disorder". *Sleep Med Rev*, 4:27-43.

Boyce, P., Hunter, C. and Howlet,O. 2003. *The benefits of daylight through windows.* Troy, NY: Rensselaer Polytechnic Institute.

BOSTI. 1981. *The Impact of Office Environment on Productivity and Quality of Working Life: Comprehensive Findings*. Buffalo, NY: Buffalo Organization for Social and Technological Innovation.

Crawford, C., Krebs, D.. 1997. *Handbook of Evolutionary Psychology: Ideas, Issues and Applications*. LEA, New York, NY, USA.

Croon, E. M., de Sluiter, J.K., Paul, P., Kuijer, F.M., Frings-Dresen, M.H.W.. 2005. "The effect of office concepts on worker health and performance: a systematic review of the literature". *Ergonomics*, Vol. 48, No. 2: 119 – 134.




Danielsson, C. B. 2008. "Differences in perception of noise and privacy in different office types". In *The Proceedings of the 20th International Congress of Acoustics '08*. Paris, France, pp. 531-536.

Danielsson, C. B. 2010. *The office, an explorative study, Architectural Design's Impact on Health, Job Satisfaction & Well-being*. KTH School of Architecture and Built Environment, School of Architecture, Royal Institute of Technology.

Danielsson, C. B., Lennart, B.. 2008. "Office type in relation to health, well-being and job satisfaction among employees". *Environment & Behavior*, 40(5): 636-668.

Danielsson, C. B, Lennart, B.. 2009. "Difference in satisfaction with office environment among employees in different office types". *Journal of Architectural and Planning Research*, 26(3): 241-257.

Esch, T. 2002. "Health in Stress: Change in the Stress Concept and its Significance for Prevention, Health and Life Style". *Gesundheitswesen*, 64: 73-81.

Esch, T, George B. Stefano, Gregory L. Fricchione and Herbert Benson. 2002. "An Overview of Stress and Its Impact in Immunological Diseases". *Modern Aspects of Immunobiology*, 01/2002; 2(4):187-192.

Evans, W. G. 2003. "Built Environment and Mental Health". *Journal of Urban Health*: *Bulletin of the New York Academy of Medicine*, 80(4): 536-555.

Flynn, J. 1977. "A study of subjective responses to low energy and nonuniform lighting systems". *Lighting Design & Application*, February: 6-14.

Grinde, B. 1996. "The biology of visual aesthetics". *J. Soc. Evol. Systems*, 19: 31-40.

Hedge, A. 1996. "Addressing the psychological aspects of indoor air quality". In *The Proceedings of the1st Asian Indoor Air Quality Seminar*, BAT, Urumqi, China, IX/22-23.

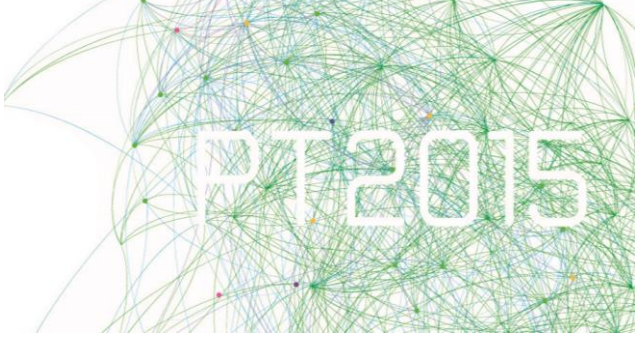
Irons, W. 1998. "Adaptively relevant environments versus the environment of evolutionary adaptedness". *Evololutionary Anthropology*, 6(6): 194-204.

Jones, F, Bright, J., Clow, A. 2001. *Stress: Myth, Theory and Research*. Prentice Hall, New York.

Kim, J., de Dear, R. 2013. "Workspace satisfaction: The privacy-communication trade-off in open-plan offices". *Journal of Environmental Psychology,* 36 (2013) 18-26.

Maher, A, von Hippel, c.. 2005. "Individual differences in employee reactions to open-plan offices". *Journal of Environmental Psychology*, 25(2): 219-229.

Nemecek, J., Etienne, G. (1973). "Results of an ergonomic investigation of large-space offices". *Human Factors*, 15(2), 111-124.




Nishiyama, A., Kino, K., Sugisaki, M., Tsukagoshi, K. 2012. "A survey of influence of work environment on temporomandibular disorders-related symptoms in Japan". *Head & Face Medicine*, 8:24.

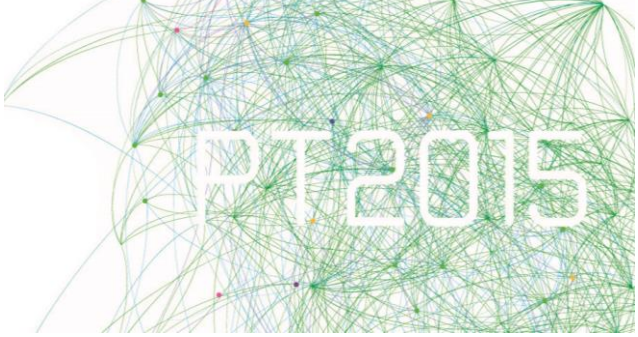
Raymond, S., Cunliffe, R. 1997. *Tommorow's Office*. London: E & FN Spon.

Sherbini, K., Krawczyk, R. 2004. "Overview of intelligent architecture". In the *Proceedings of the 1st ASCAAD International Conference, e-Design in Architecture* KFUPM, Dhahran, Saudi Arabia, pp. 137-152.

Ulrich, R. S. 1999. "Effects of gardens on health outcomes: Theory and research". In *Healing Gardens: Therapeutic Benefits and Design Recommendations*, Cooper, M.C., Barnes, M., Eds.; John Wiley & Sons: New York, NY, USA, pp. 27-86.

Voordt, T. JM van der, van Meel, J., Smulders, F., Teurlings, S. 2003. "Corporate Culture and Design". *Environments by DESIGN*. Vol. 4 no. 2, winter 2002/2003: 23-43.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# HEALTHY PLACES, ACTIVE PEOPLE

**Katarina Ana Lestan**[1]
u.d.i.k.a., Researcher, University of Ljubljana, Biotechnical Faculty, Department for Landscape Architecture, Jamnikarjeva 101, Ljubljana 1000, Slovenia, katarinaana.lestan@bf.uni-lj.si

**Ivan Eržen**
PhD, MD, Professor, National Institute of Public Health, Trubarjeva 2, 1000 Ljubljana, Slovenia; Medical Faculty, University of Ljubljana, Vrazov trg 2, Ljubljana 1104, Slovenia, ivan.erzen@mf.uni-lj.si

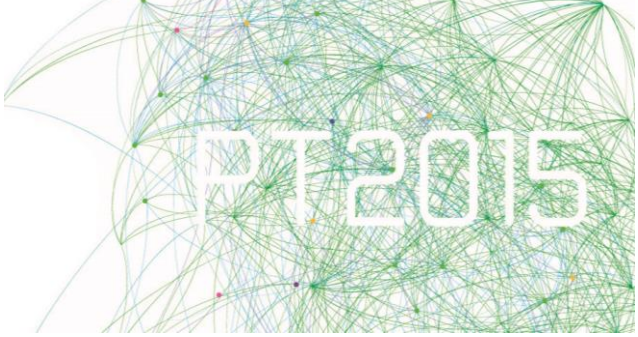
**Mojca Golobič**
PhD, Professor, Head of department, University of Ljubljana, Biotechnical Faculty, Department for Landscape Architecture, Jamnikarjeva 101, Ljubljana 1000, Slovenia, mojca.golobic@bf.uni-lj.si

## ABSTRACT

*The research literature provides ample evidence that physical activity has an impact on human health and well-being. The "urban densification" paradigm, prevailing in urban planning policies since the beginning of the millennium resulted in poorly equipped open and green space in collective housing environments. The aim of this research was to explore the linkages between the outdoor space in contemporary collective housing areas in Ljubljana and the lifestyle adopted by the inhabitants. The research questions addressed the quality of residential area urban design, activities of inhabitants in the residential open spaces and their perception of their living environment. The study revealed that the relatively positive perception of the quality of their living environment is mainly related to the residents' strong economic status, high level of completed education, and lower average age. User groups with such characteristics can compensate for poor outdoor space by using infrastructure elsewhere. On the other hand, the quality of life in new residential areas is inadequate for other users such as children and the elderly. The immediate environment of contemporary collective housing, which is not stimulating spending time outdoors, walking to services, playing and socializing, does not provide conditions for healthy childhood and active aging in the long term.*

***Keywords****: health related lifestyle, urban planning, vulnerable user groups, green areas, neighborhoods.*

[1] Corresponding author




## INTRODUCTION

There is a growing concern for physical environmental factors in facilitating behaviours conducive to health. Evidence from the literature indicates an association between the built environment and levels of physical activity (Holt et al, 2008, Kaczynski et al, 2007), which is of importance especially for children and elderly in residential areas. Both groups are considered vulnerable in terms of their dependency on open space close to their homes. People living in the environment, which does not stimulate everyday outdoor activity, including walking to services, playing and socializing, are likely to develop a less healthy lifestyle (Spencer et al, 2006, Barton et al, 2011). Sedentary lifestyle is a key risk of premature morbidity and mortality among older people (Takano, 2003), and to maintain a healthy population, it is important to prevent such lifestyle in childhood, as the habit of regular exercise is formed during childhood and lasts a lifetime (Telama et al., 2005). Apart from the impact on physical health, the psychological effects of spending time outdoors are also important. Wellbeing of elderly people depends on physical activity as well as on socialization (Berger B., G. 1988, Sugiyama et al., 2008). Both are leading to healthy aging, the importance of which is increasing along with rapid ageing of the population (NIJZ, 2014). The lifestyle choice depends also on the way the residential areas and the surrounding neighbourhood are shaped (Barton et al, 2011). In the case of collective residential developments from post-transition period in Slovenia, this choice is limited due to the lack and poor quality of open/green space (Gazvoda, 2006). The aim of this research is to gain empirical evidence for the role of quality open space in the neighborhoods for physical activity of vulnerable groups to contribute to better designed open space and consequently to healthier growing-up and active ageing. It is assumed that ageing is healthier in the neighborhoods from 1960 -1980, where among all accompanying services (childcare facilities, schools, community centres), communal playgrounds and sports facilities, as well as vast open green areas for socialization, relaxation and recreation are provided.

## METHODS

The research was designed in three phases, each exploring one layer of residential open space: its physical qualities, behavioural-social aspects and perceptive layer. The quality of residential area according to urban design standards, the activities of inhabitants in the residential open spaces and the perception of their living environment were explored by three corresponding methods. The first phase involved inventory, description and evaluation of open space design according to spatial, demographic and socio-economic criteria. Spatial parameters used for the assessment of open space quality were, inter alia, floor space index, site coverage, surface area of children's playgrounds, sports facilities and functional areas, which exclude private groundfloor atrium gardens, roads and external car park areas. The second phase of the research involved the behavioural observations and mapping, a commonly used method in the research of urban open spaces (Goličnik et al, 2002).

The field observations obtained during 30 observatory sessions within three weeks were followed by data transfer into a Geographical Information System (ArcView GIS 3.3 for Windows) and classified within the parameter categories, such as gender, age, type of activity, category of activity, duration, and meta data i.e. hour, day, weather conditions. The third methodological phase involved survey of residents, which was conducted in the spring 2013. Questionnaire included questions regarding the life styles and the residential area. All three methodological phases were performed in five residential areas, four of which were built recenty : Nova Grbina (1999), Viška Sončava (2007–2009), Celovški Dvori (2010) and Mesarska (2007), and the one, which was used as good practice example and belong to the older generation of residential estates: Bonifacija (1972–1981).

## RESULTS AND DISCUSSION

For this presentation the results are limited only on those referring to the elderly, based on the findings of behavioural observations and mapping. As an illustration, three residential estates, Bonifacija, Viška sončava and Mesarska are shown in details. Numbers of users aged over 65 spotted during the observation were 20 in Bonifacija, 2 in Viška sončava, 6 in Mesarska, 5 in Nova grbina and 0 in Celovški dvori. Due to small number of residents aged over 65 living in recently built estates (SURS, 2011), it is impossible to describe observation results in statistical terms. Although the numbers of residents aged over 65 identified during observations do not reveal exact situation, they can indicate whether certain space attracts people to stop and stay or not and what they are inclined to do there. From the graphical representation of the observations results it is evident, that in Mesarska the elderly were only sitting on the benches on the south side of the estate area, while the rest of open space in this estate is not in use, people are just passing by. Similarly elderly in Viška sončava nearly don't use open space, while in Bonifacija on the other side with a lot of benches, tables and tree shade, there were more elderly using open areas, distributed across all neighbourhood (Figure 1).

All users in this age group are classified in the category of activity "passive in space". This category includes activities such as minding children while they play, sitting on a bench, chatting, socializing, etc. It is increasingly recognized that the social aspect of open areas is of utmost importance for mental health of older people, with the same impact on quality of life as physical activity has (Berger, 1988). According to the literature, living at home with high accessibility of parks and green streets around the house conditions the amount of walking, which can increase the life expectancy up to five years (Takano, 2003). On the other side open green space has social and community influences. Local networks of mutual support and friendships are affected by the existence of common activities and meeting places such as save streets, parks, etc. This does not mean, that urban planning can "create" communities, but has an impact on the opportunities people have to choose (Barton, et al, 2011). From the graphical results of observations and behavioural mapping it is evident that older people have more options for

socializing in Bonifacija as they have in Mesarska and Viška sončava estate (Figure 1).

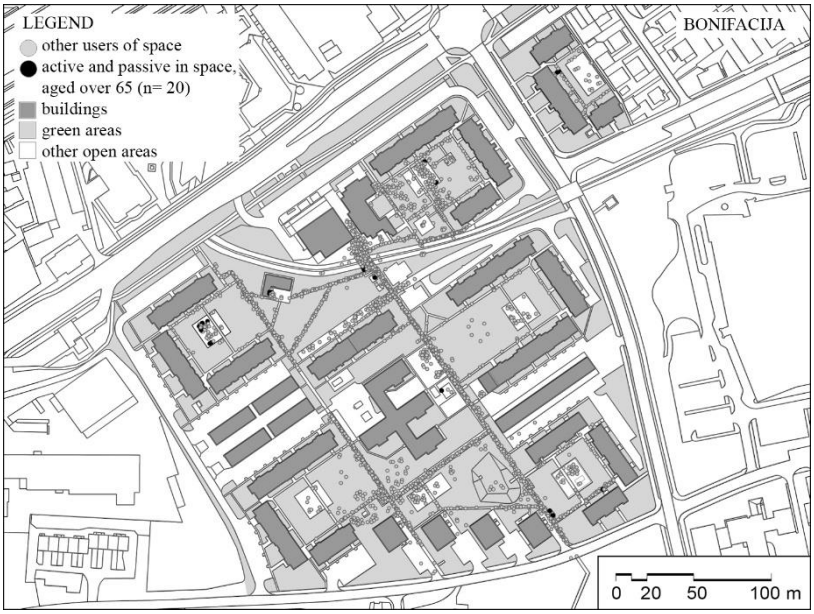



**Figure 1a.**

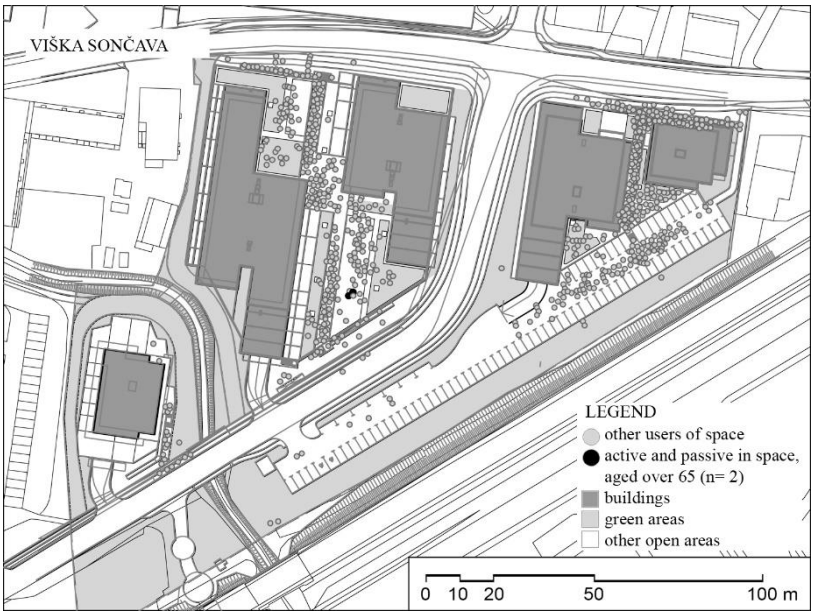



**Figure 1b.**

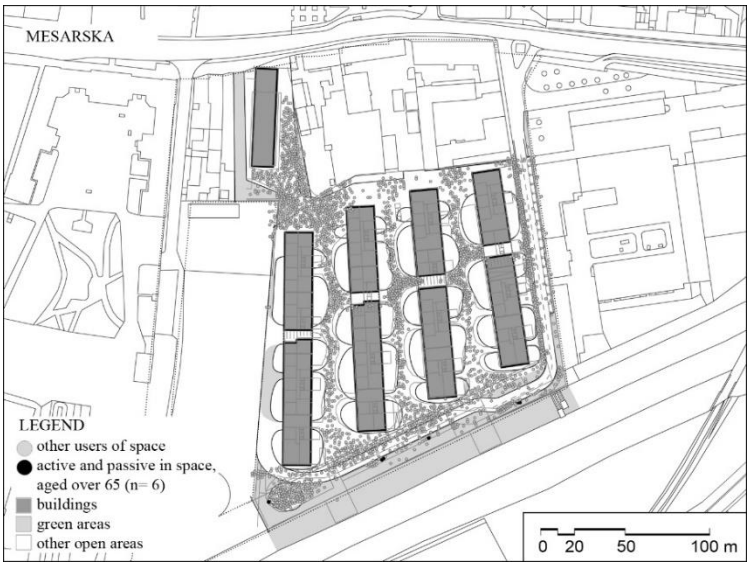


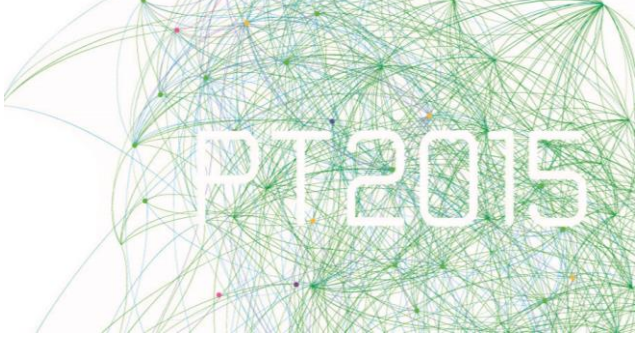

**Figure 1c.**

**Figure 1: Results of the observations and behavioural mapping in Bonifacija (Fig. 1a), Viška sončava (Fig. 1b) and Mesarska (Fig. 1c) estate illustrating the category of activity 'active in space' and 'passive in space' filtered to show age groups 7 (above 65 years) in relation to other activities observed in the same time (Source: ArcGIS).**

Residents' general satisfaction, their self-assessed health and assessment of their living environment are closely correlated with socio-economic factors, such as age, income and education. Due to these factors residents of Mesarska and Viška sončava estate are currently more satisfied than residents of Bonifacija (Lestan et al, 2013). Socio-economic characteristics of the neighbourhoods are bound to change. Once people are older and their income is lower, their living surrounding should take a more important role for their well-being.

## CONCLUSIONS

There are not many elderly currently living in new residential estates. However, taking into account the changing demographic structure, spatial factors, which would enable older residents of Mesarska and Viška sončava estate to create and maintain social contacts with their neighbours are not provided. In the open space of both estates there are only vast paved surfaces and playgrounds for the youngest children with no tree shades, no sport facilities and meeting places for other users groups. In these residential estates there is a risk for decreased life quality of older people, while in Bonifacija with a lot of tables and benches for socializing and landscape elements, such as trees, bushes, a lawn, a hill, and opportunities for active and healthy aging are sufficient, which also means that this neighbourhood is more sustainable in the long term.




## REFERENCES

Barton, H., Tsourou, C. 2011. *Healthy Urban Planning. A WHO Guide to Planning for People.* New York: Routledge.

Berger, B. G. 1988. "The role of physical activtiy in the life quality of older adults." *National Academy of Kinesiology, Physical Activity and Life Quality*: 42 – 58.

Gazvoda, D. 2006. "Vpliv programa oziroma strukture stanovanj ter tehničnih omejitev gradnje na oblikovanje odprtega prostora naselij." *Stanovanjske Krajine, Trendi in Perspektive*, Biotechnical Faculty, Department of Landscape Architecture, Ljubljana, Slovenia: 42 – 47.

Goličnik, B., Thompson W., C. 2002. "Opazovanje in vedenjski zemljevidi. Metoda raziskovanja javnega odprtega prostora v mestu". *Urbani izziv*, 12, 82–89.

Holt, N.L., Spence, J.C., Sehn, Z.L., Cutumisu, N. 2008. "Neighborhood and developmental differences in children's perceptions of opportunities for play and physical activity". *Health and Place*. 14, 1: 2–14.

Kaczynski, A.T., Henderson, K.A. 2007. "Environmental correlates of physical activity: A review of evidence about parks and recreation". *Leisure Sciences*. 29, 4: 315–354.

Lestan, K.A., Eržen, I. and Golobič, M. 2013. "The role of open space in urban neighbourhoods for health-related lifestyle". *International Journal of Environmental Research and Public Health*. 11, 6: 6547-6570.

NIJZ, National Institute for Public Health RS. 2014. "AHA.SI - Aktivno in zdravo staranje v Sloveniji". Last modified September 04. Accessed April 14, 2015. http://www.nijz.si/aktivno-in-zdravo-staranje-v-sloveniji-ahasi.

Spencer, C., Blades, M. 2006. *Children and Their Environments. Learning, Using and Designing Spaces.* Cambridge, UK: Cambridge University Press.

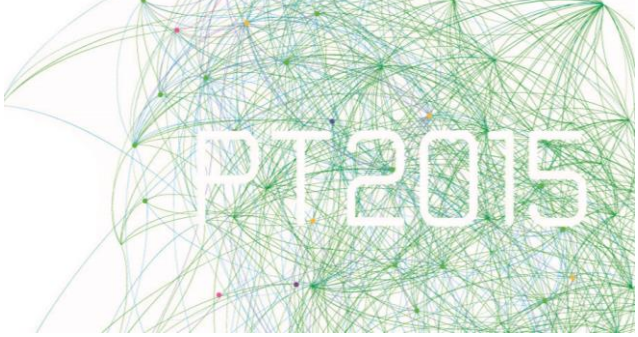
SURS, Statistical office RS. 2011. Ordered data.

Sugiyama, T., Leslie, E., Giles-Corti, B., Owen, N. 2008. "Associations of neighbourhood greenness with physical and mental health: do walking, social coherence and local social interaction explain the relationships?" *Journal of Epidemiology and Community Health*. 62, 5: e9. doi: 10.1136/jech.2007.064287.

Takano, T. 2003. "Examples of research activities for Healthy Cities. Example 2, The importance of walkable green-filled surroundings in urban planning". In *Healthy cities and Urban Policy Research*, edited by Takano Takehito, 170-175. London: Spon Press, Taylor& Francis Group.

Telama, R., Yang, X., Viikari, J., Välimäki, I., Wanne, O., Raitakari, O. 2005. "Physical activity from childhood to adulthood: a 21-year tracking study". *American Journal of Preventive Medicine.* 28, 3: 267-273.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# THE IMPACT OF QUALITY OF PEDESTRIAN SPACES ON WALKING AS A MODERATE PHYSICAL ACTIVITY

**Milena Vukmirović**[1]
PhD, Research Associate, University of Belgrade - Faculty of Architecture, Blvd. Kralja Aleksandra 73/II, milena.vukmirovic@urbanlab.org.rs

**Eva Vaništa Lazarević**
PhD, Professor, University of Belgrade - Faculty of Architecture, Blvd. Kralja Aleksandra 73/II, eva.vanistalazarevic@gmail.com

## ABSTRACT

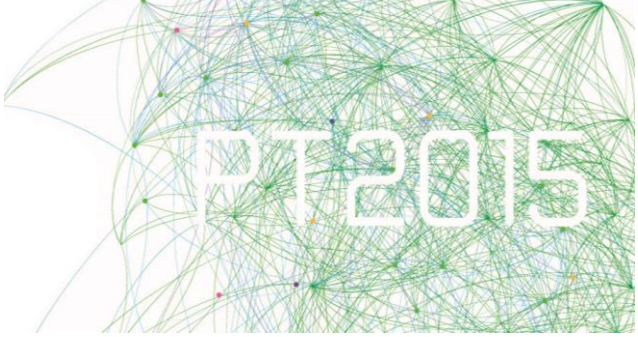
*One of the objectives of quality of pedestrian spaces improvement is to encourage walking in the way to become a natural part of everyday patterns in urban activity. This would also have implications on the reduction of public health issues since the majority of urban population has become sedentary. The stated objectives and relationships were analysed through the interpretation of the results obtained in the direct survey of citizens in the central part of the City of Belgrade. Citizens were asked to assess the quality of the pedestrian environment of the research territory by using a specific questionnaire designed on the basis of the professional tool for the evaluation of the quality of pedestrian spaces. The results have shown that citizens of Belgrade still consider walking mainly as a recreational activity, but that they would walk more if the quality of pedestrian environment were improved.*

***Keywords****: quality of pedestrian spaces, walking, moderate physical activity, Belgrade.*

## INTRODUCTION

The creation of liveable, safe, sustainable and healthy cities is possible by increasing the concern for pedestrians, cyclists and city life in general (Gehl 2010). Liveable city potential is getting stronger when a large number of people are attracted to walk, ride a bike and spend time in open public spaces. Safety of the city could be generally increased when a large number of people move in and stay in the outdoors, because a city that invites people to walk has cohesive structure that offers short distances, attractive open spaces and various urban facilities. Sustainable city is established when the most of the urban traffic system belongs

[1] Corresponding author




to the green mobility, which is related to walking, cycling or using public transport as the primary forms of movement in cities.

The current demographic and economic trends have resulted in an increase of interest to determine the effects of responsible traffic and transport planning in public health improvement. Research shows (Litman 2010, Lee and Buchanner 2008) that investing in the improvement of public transport is one of the most cost-effective ways to generate positive objectives in the field of public health, i.e. public health improvement is among the biggest advantages offered by high quality public transport and traffic oriented development (TOD). Given that, the healthy city is achieved when walking and cycling become a natural part of everyday urban activity patterns (Vukmirovic and Vukmirovic 2014). In this way it can impact on the public health problem solving by reducing the proportion of sedentary population, which is caused by the large use of cars for urban mobility.

Physical inactivity is seen as a significant problem in the domain of public health[2] that can't be solved by a simple promotion of a healthy lifestyle (Kahlmeier et all. 2011). Considering this it was observed that the promotion of active transportation - pedestrian and bicycle movement – as an appropriate approach, not only promotes a healthy way of movement in cities, but also brings positive effects on the urban environment. Researches (Lee and Buchner) provide clear evidence that physical activity, including walking, significantly influence the improvement of health. Walking as a healthy form of physical activity gained importance in early 90s due to new recommendations that emphasized the benefits of moderate physical activity. Walking at the speed of 5km/h[3] (Centres for Disease Control and Prevention 2003) is seen as a key example of moderate physical activity since 1995. An easy walk can lead to certain effects for example person of 91 kg weight could burn 114 calories when walk 1500 m (C3 Collaborating for Health 2012). Physical activity is every movement of the body that leads to the waste of energy. On the other hand, physically inactive persons are those who lead sedentary lifestyle, or those that do not have any form of physical activity in their leisure time. Physical inactivity is considered to be fourth identified risk factor affecting the mortality of the world population (WHO 2009).

Given the high proportion of diseases attributable to the risk factors that can be avoided, it is necessary to insist on the implementation of the strategies and programs both at the individual and societal levels that would have goals of reducing these risks. From the standpoint of urban design and planning, it is necessary to establish and implement positive measures that would aim to increase the intensity of pedestrian movement, and thus improve public health and quality of life in cities.

[2] The World Health Organization (WHO).
[3] That could be reached by the most adults.

## FACTORS OF URBAN ENVIRONMENT THAT AFFECTS WALKING

Pikora at all (2003) offered a framework that includes four groups of factors that affect the intensity of walking in the local environment: functional, safety, aesthetic and destination. Functional factors cover physical attributes of streets and paths (type and width of the street, intensity, speed and type of traffic and path directness related to specific destination) that define the fundamental structural elements of the local environment. Safety of the urban environment includes two features: safety of an individual (such as the presence of adequate lighting and level of passive surveillance) and road safety (such as the existence of appropriate crossing). Factor of aesthetic represents an urban environment that affects walking through entering in interesting and pleasant outdoors. Destination, as a characteristic of the physical environment refers to the availability of public and commercial facilities in the local area.

Sallis at all (1997) conducted a study of individual perceptions of the local environment. The study included the occurrence of the local environment like pleasantness of the scene and pedestrian flows, safety, characteristics of the neighbourhood such as predominant presence of housing, predominant presence of commercial contents or combination of commercial facilities and housing. Their colleague Bauman has concluded that the most important environmental factors are spaces that are safe during the day, an attractive local environment that is comfortable for walking, presence of other facilities including shops, parks and beaches and reduced noise level from other forms of transport.

NAPRAVI KORAK UNAPREDI OKRUŽENJE

**QUESTIONNAIRE**

**GENERAL DATA**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Gender | ☐Male | ☐Female | | | | | |
| Age | ☐0-14 | ☐15-19 | ☐20-29 | ☐30-39 | ☐40-55 | ☐56-64 | ☐over 65 |
| Profession | ☐Pupil | ☐Student | ☐Employed | ☐ Employed with high education | | ☐Pensioner | |
| Do you live in Vracar? | ☐Yes | ☐No | Where you live (which municipality)? | | | | |
| Character of road users | | | | | | | |
| Do you have a private car? | | | ☐Yes | ☐No | | | |
| How often do you use your private car? | | | ☐Always | ☐When I go to work | ☐Few times a week | ☐When I travel out of town | |
| What distances do you cross by car? | | | ☐I don't pay attention, I always use car | | ☐over 500m | ☐over 1000m | |
| How much time you spend in searching for a parking place? | | | ☐I have my own | ☐less than 10min | ☐10-20min | ☐over 20min | |
| Could you give up driving a private car in favor of walking for crossing a distances of less than 500m? | | | ☐No | ☐Depends on the situation. Specify? | ☐Yes | ☐Didn't think about it | |
| Do you walk? | | | ☐Yes | ☐Sometimes | ☐No | | |
| On what occasion do you walk? | | | 1. When doing bussines near my place of residence<br>2. When going to work, which is near my place of residence<br>3. When I take children/grandchildren to school<br>4. When I recreate/go for a walk<br>5. When I go shopping | | | | |
| Do you consider walking as a mode of transport or recreation? | | | ☐Transport | ☐Transport and recreation | ☐Recreation | | |

**Figure 1: Example of the questionnaire (this table was done in accordance with Gerlach 2010).**

Gerlach (2010), member of the Management Committee of the COST Action *Pedestrian Quality Needs*, has proposed three sets of criteria that correspond to different categories of pedestrian requirements (first, second and third). The structure and hierarchy of established demands has resulted in identifying the

criteria for the evaluation of walking and pedestrian environment. Featured evaluative criteria include the following aspects design of the pedestrian environment that belongs to the first order requirements, traffic rules and flows that belong to the second order requirements and the aspect of traffic participants' behaviour that belong to the third order requirements. In addition, for each of the selected values is determined the relevance that corresponds to one of three aspects of the quality of immediate pedestrian environment - safety, comfort and attractiveness, as well as an interest group to which it relates. By overlapping pedestrian needs, pedestrian environment quality criteria and identified groups of stakeholders, the framework for evaluation of the quality of pedestrian environment has been created. Named "Walkability checklist", it was defined as a professional tool.

All of the above examples indicate that the achievement of expected level of walking in urban environment is necessary to attain accomplish three criteria of quality pedestrian space as follows: 1) safety, 2) comfort, and 3) attractiveness. The first criterion is considered as a prerequisite for occurrence of any activity in a given area, while the other two can be seen as a precondition for motivating more people to walk or spend time in the outdoors.

Bearing in mind the necessity of introducing an anthropo-social factor (Neidhart 1997), i.e. inclusion of direct space users in planning and designing process, this evaluating apparatus was used as the basis for the creation of a questionnaire (see Figure 1). In this way, citizens would be placed in the position of "expert". Such treatment of a professional tool and its immediate application in the form of questionnaire aimed at forming the relevant framework information, based on who could be identified specific deficiencies and proposals for improving pedestrian movement and environment in the selected polygon - territory.

## METHODOLOGY AND MATERIAL

As previously stated, a professional tool for evaluation of the quality of pedestrian movement and direct pedestrian environment is used as a basis for defining the questionnaire (Vukmirovic 2010). Following six groups of issues were established: General information on the respondent (4 issues) - used to determine the characteristics of pedestrians on the observed territory; Character of traffic participants (7 issues) - to determine the obtuseness of using private cars; Design in relation to the function/ rank of the road (3 issues) – to determine the intensity of pedestrian movement in relation to the main and secondary flows on the study territory and evaluating the quality of these flows; Sidewalks / walkways / paths (14 issues) - to determine the quality of direct pedestrian environment; Traffic flows (6 issues) - to determine the possibility of overlap with other modes of transport and The walking quality and climate (6 issues) - to determine the attitude of citizens in terms of pedestrian movement, its improvement and intensity incensement.

The survey was conducted during the March 2015 under the academic elected course "Network of pedestrian flows in the function of urban redesign"[4] on Bachelor and Master Academic Studies at University of Belgrade – Faculty of Architecture. The aim of research is to examine the quality of pedestrian movement and its environment at the territory that belongs to the Central part of the City of Belgrade.


**Figure 2: Central part of the City of Belgrade. Research territory.**


**Figure 3: Concept for spreading the pedestrian zone in the Centre of the City of Belgrade developed by the Office of the Director for Urban Planning of the City of Belgrade, 2014.**

[4] Lead by Associate Professor Dr Aleksandra Djukić.

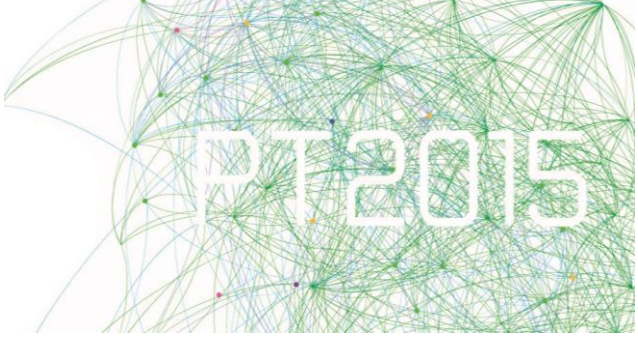
Territorial framework in which research was conducted includes the territory that belongs to the central part of The City of Belgrade and encompasses the site that starches from Vasina Street to the Danube's waterfront, known as Upper and Lower Dorcol (see Figure 2). The importance of this territory can be viewed through the framework defined by the "Project for spreading the pedestrian zone in the Centre of the City of Belgrade"[5] (Knez Mihajlova Street, see Figure 3) and the concept of connecting the central core of the City with Sava's and Danube's waterfronts seen as the areas of the strategic importance for the City of Belgrade. The size of the subject territory corresponds to the surface of the circle of diameter 1.5 km that could generally be accepted as pedestrian manageable site. Lack of perceived territory is in the terrain topography, i.e. major ups and downs in certain locations.

The research was conducted in the form of direct questioning of citizens in the most important areas that belongs to the research territory: Republic Square, Students' Square, entrance to the Kalemegdan's park in Uzun Mirkova Street, along the Francuska Street, along the Cara Dusana Street, along the Strahinjca Bana Street and at Bajlonijeva Market.

The survey was conducted on the sample of 251 people and the study included five groups of respondents by age, as follows: 117 people aged 20 to 29 years, 30 people aged 30 to 39 years, 35 people aged 40 to 55 years, 12 people aged 55 to 64 and 16 people aged over 65 years. The sample population has a random character and does not correspond to the actual representation of age groups in relation to the total population. Practically, this sample is representation of people in the streets of the research territory. In relation to the employment status of respondents five groups are included. In accordance with this the structure of the respondents is as follows 11 high school pupils, 108 students, 40 employed people, 47 unemployed people and 22 retired persons. Similar to the age of the population, this is a sample that represents the number of people seen on the streets of the study area. In relation to the place of living, the sample comprised those 98 correspondents who live in the research area and 133 who live in other parts of Belgrade.

The following paper will present the research results, with special emphasis on those related to individual aspects of safety, comfort and attractiveness of the pedestrian environment, because of their property as a prerequisite for walking.

[5] "Project for spreading the pedestrian zone in the Centre of the City of Belgrade" is defined as a subproject of the Project IME: Identity _ Mobility _ Environment of the City of Belgrade initiated by the Office of the Director for Urban Planning of the City of Belgrade, Mr Milutin Folic and adopted by the Belgrade City Council in April 2015. Project IME consists of 18 subproject that aimed to improve the identity of the City and the quality of life of its citizens, following the main goals of the City of Belgrade Development Strategy.




## RESULTS

The results of this research are presented in accordance with the structure determined by establishing a different set of questions.

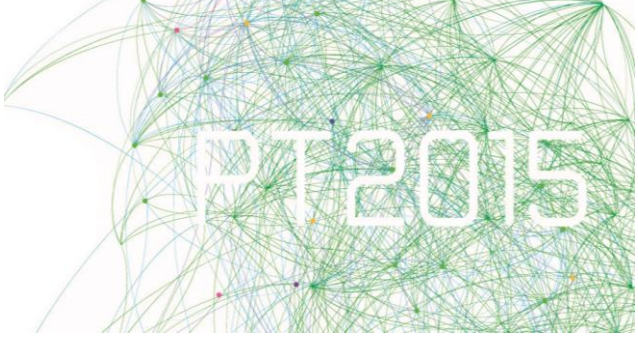
### Character of road users

This group of questions aimed to determine the representation of the private cars' usage on the observed territory. This information could be used as a base and comparative sample for the results, which would be obtained by evaluating the situation after conducted promotional campaigns and other activities related to improving pedestrian movement and its environment.

**Table 1: Character of road users of the study territory.**

| Questions' group | Question | Answers | No. | Positive/ negative trend |
|---|---|---|---|---|
| Character of road users | Representation of the respondents who own a private car | Yes | 112 | ○ |
| | | No | 118 | |
| | The intensity of private cars' usage | Always | 50 | ⊗ |
| | | When I go to work | 15 | |
| | | Few times a week | 25 | |
| | | When I travel out of town | 22 | |
| | Path length that exceeds with the private car | Do not pay attention | 58 | ⊗ |
| | | Over 500m | 41 | |
| | | Over 1000m | 13 | |
| | Duration of the search for a parking lot | I have my own parking space | 25 | ⊗ |
| | | Up to 10 min. | 39 | |
| | | 10-20 min. | 29 | |
| | | Over 20 min. | 19 | |
| | Driving by private car *versus* pedestrian movement at distances less than 500m | No | 9 | ⊕ |
| | | Depends on the situation | 20 | |
| | | Yes | 80 | |
| | | Didn't thought about that | 13 | |
| | Walking or not | Yes | 176 | ⊕ |
| | | Sometimes | 38 | |
| | | No | 8 | |
| | Pedestrian movement: transport or recreation | Transport and recreation | 172 | ⊕ |
| | | Recreation | 46 | |
| | | Transport | 13 | |

Considering the obtained results we could conclude that the most of the correspondents belongs to the population from 20 to 29 years old, i.e. students. On the other side the number of those who have its own car and who have not is approximately equal. Although these results can be positively characterized, the




high level of those who always use their car (one-fifth of the respondents), regardless of the reason for that, indicates a significant negative trend. In relation to the path length that citizens exceed by car, the majorities of respondents use their cars at distances that are pedestrian characterized, i.e. distances maximum between 500 and 1000 meters. Additional argument for promotion and improvement of walking and pedestrian environment can be searched in the fact that this is the central area of the City of Belgrade and, as consequence, has a problem with parking. This is supported with these results, which show that drivers spend some time (from 10 to 20 minutes) in search for parking, although pedestrian cross 500 meters for 6 minutes. This is further supported by the positive responses to the quaestions that could influence a change in habits of the population like choice between driving and walking at a distance of 500 m, walking or not and treatment of walking as transportation and as recreation, not only as leisure activitiy.

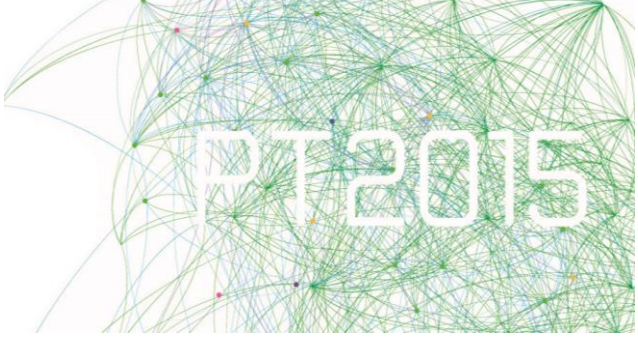
## Design in relation to the function / rank of the road

The third part of the research was aimed to determine citizens' attitude towards the quality of pedestrian flows in the central part of the city. Having that in mind, we asked citizens whether they are satisfied with the size of pedestrian flows and sidewalks along the main and secondary routes (see Table 2). Besides their positive or negative expression about it, we asked respondents to tell us the reason why they negatively characterized certain routes.

**Table 2: Design in relation to the function / rank of the road.**

| Group of questions | Question | Answers | % | Positive/ negative trend | Safety | Comfort | Attractiveness |
|---|---|---|---|---|---|---|---|
| **Design in relation to the function / rank of the road** | The citizens attitude related to the size of pedestrian paths on the main routes | Positive | 70 | ⊕ | ⊕ | ⊕ | ⊕ |
| | | Negative | 30 | | | | |
| | The citizens attitude in relation to the secondary streets | Positive | 75 | ⊕ | ⊕ | ⊕ | ⊕ |
| | | Negative | 25 | | | | |

The first part of this research was related to the main routes – the main potential pedestrian flows in the study area. According to this, the results are presented as a comparative analysis of attitudes towards specific routes. Concrete recommendations/comments are presented in relation to each individual street covered by this research. These results showed that 70% of respondents are satisfied with the size of sidewalks and pedestrian flows along main routes. However, best-characterized main route, Vasina Street, has the following disadvantages: narrow sidewalks that are not consistent with a large capacity of pedesrtians. Dunavska Street, characterised as the worst main route, has the following disadvantages: narrow sidewalks, too exposed to the heavy traffic and unsafe



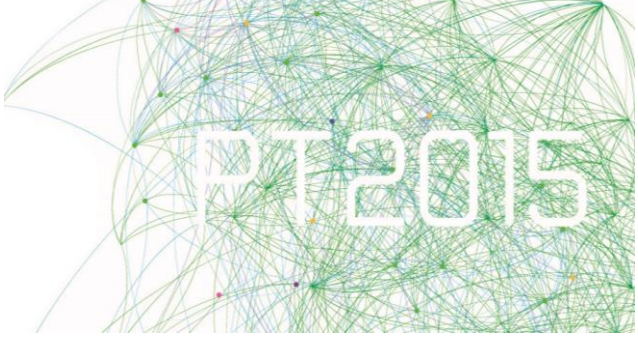

In relation to the secondary routes, the respondents (75%) expressed satisfaction with sidewalks/pedestrian flows, while 25% of them declared negative. However, it must be pointed out that secondary flows are also of great importance in terms of pedestrian movement, because through them one can reach the main routes. In terms of quality of these routes, respondents indicated the following deficiencies: parked cars on the sidewalks, some parts of the sidewalk is narrow which prevent pedestrian bypassing, as consequence - pedestrians are moving along the middle of the street – roadway, not maintained sidewalks, etc. Based on this, it can be concluded that these comments are mainly related to the criteria of safe movement, which is the primary quality that pedestrian environment should have.

## Sidewalks/pedestrian routes/paths

In relation to the specified set of questions, tendency was to determine the citizens' attitudes regarding the quality of pedestrian flows in the research territory (Table 3).

**Table 3: Sidewalks/pedestrian routes/paths.**

| Questions group | Question | Answers | % | Positive/ negative trend | Safety | Comfort | Attractiveness |
|---|---|---|---|---|---|---|---|
| *Sidewalks/pedestrian routes/paths* | Sidewalk width compared to the number of pedestrians | Corresponds | 24 | ⊕ | ⊕ | ⊕ | |
| | | Partly corresponds | 59 | | | | |
| | | Do not correspond | 17 | | | | |
| | Walking anywhere in the study area | Yes | 51 | ⊕ | ⊕ | ⊕ | ⊕ |
| | | Mostly | 45 | | | | |
| | | No | 4 | | | | |
| | Sufficient distance between the sidewalk and roadway | Yes | 30 | ⊕ | ⊕ | ⊕ | |
| | | Mostly | 50 | | | | |
| | | No | 20 | | | | |
| | Vulnerability of pedestrians in relation to motor vehicles | Yes | 31 | ⊗ | ⊗ | ⊗ | |
| | | Mostly | 18 | | | | |
| | | No | 51 | | | | |
| | The amount of pedestrian crossings in the study area | Yes | 50 | ⊕ | ⊕ | | |
| | | Mostly | 42 | | | | |
| | | No | 8 | | | | |
| | Condition of pedestrian crossings | Good | 11 | ○ | ○ | ○ | ○ |
| | | Satisfactory | 69 | | | | |
| | | Poor | 20 | | | | |
| | Visibility of the sidewalks in the study area | Good | 33 | ⊕ | ⊕ | | |
| | | Satisfactory | 52 | | | | |
| | | Poor | 15 | | | | |
| | The existence of barriers during pedestrian movement | Yes | 42 | ⊕ | ⊕ | | |
| | | No | 58 | | | | |
| | The surface / sidewalk paving | Yes | 25 | ⊕ | | ⊕ | ⊕ |
| | | Mostly | 52 | | | | |
| | | No | 13 | | | | |
| | | Yes | 20 | | | | |




| | | | | | |
|---|---|---|---|---|---|
| Equipment with street furniture | Mostly | 46 | ⊗ | ⊗ | ⊗ |
| | No | 34 | | | |
| The attractiveness of pedestrian flows | Not attractive | 27 | ⊕ | | ⊕ |
| | Attractive | 69 | | | |
| | Very attractive | 4 | | | |
| Duration of staying outdoor | Up to 1h | 30 | ⊕ | ⊕ | ⊕ |
| | 1-3h | 45 | | | |
| | More than 3h | 25 | | | |
| Quality of stay outdoor | Good | 12 | ⊕ | ⊕ | ⊕ |
| | Satisfactory | 74 | | | |
| | Poor | 14 | | | |

These results lead to several concluding remarks. In terms of sidewalk width and its relation to the number of pedestrians in the study area, respondents considered that the width of sidewalks should be adjusted to the intensity of pedestrian movements along certain routes both on the main and secondary routes.

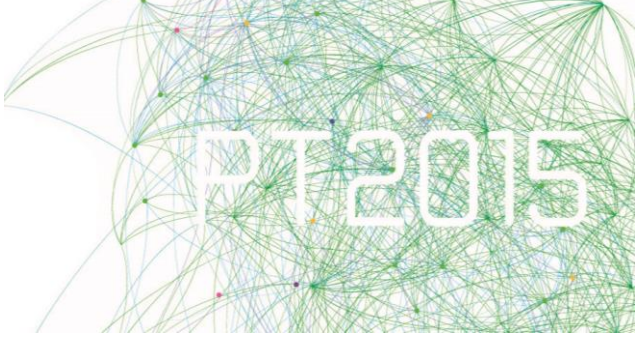
One of the positive results was citizens' attitude towards walking distances. Having in mind that 51% of them answered that the study areas is pedestrian manageable, this can be used as an additional argument for promotion and stimulation of pedestrian movement as sustainable mode of transport on this specific location.

The question about distances between sidewalks and roadways aimed at psychological sense of citizens. Results showed that the critical condition is mostly on secondary flows: respondents have noticed certain barriers on sidewalks that reduced the distance between cars and pedestrians. These barriers are parked cars on a sidewalk, narrow sidewalk, etc. Besides their psychological sense, this means that the actual safety is undermined. However, it can be used as a framework for future interventions, for example laws and plans to regulate parking in different way, sidewalk extension, etc.

As for the pedestrian crossings, the majority of respondents consider there is efficient number of them. Nevertheless, they are not well maintained, especially for people with disabilities. It can be a trigger for local government to start a project about maintaining and implementing principles of Access for All and Design for All in the study area.

The majority of answers about sidewalks (in)visibility and existence of barriers during pedestrian movement are related to parked cars, outdoor cafes, construction sites, signs, fencing posts, misfits' ramp for baby carriage, staircases, all on the sidewalk surface. This means that walking in the study is rather difficult, although it has all physical preconditions to be pedestrian-friendly environment.

In terms of sidewalk paving and street furniture equipment, respondents are generally unsatisfied in the following: not accessible, parked cars, missing green, poor maintenance, damaged sidewalks, missing urban furniture, etc. Thus, in their point of view, it should be improved in terms of placing benches, trashcans, lighting, attractive design and more attractive contents along some routes.




The question about duration and quality of staying outdoors brings on the conclusion that the citizens are mostly satisfied as they consider it pleasant. However, negative trend goes on towards inadequate maintenance, missing and insufficient greenery, unconformity for pedestrians, and so on.

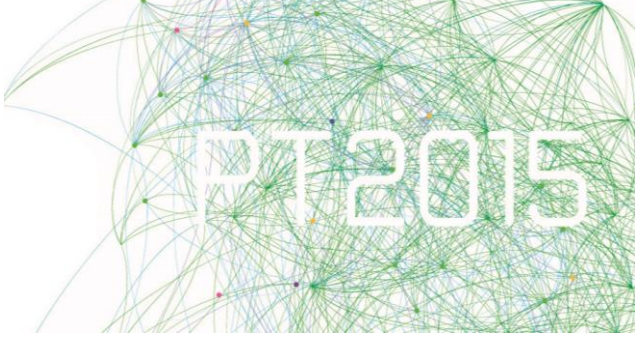
### Traffic flows

This group of questions was aimed to determine the citizens' attitude towards other modes of transport, other road users and possibilities of establishing mutual relations. In relation to the traffic flows and based on these results (see Table 4), it can be concluded that the speed of the cars endanger pedestrians even traffic calming measures were applied in reconstructed streets. The study areas, as it belong to the central part of the city, is well connected by public transport to other parts of the city and its citizens are satisfied with the timetable. However, there is a need to introduce signalization on public transport stops, which would indicate the arrivals and other information about possible traffic jams, changes or temporary abolition of certain lines.

**Table 4: Traffic flows.**

| Questions group | Question | Answers | % | Positive/ negative/ neutral trend | Safety | Comfort | Attractiveness |
|---|---|---|---|---|---|---|---|
| Traffic flows | Attitude towards car's speed | Fast | 34 | ⊗ | ⊗ | ⊗ | |
| | | Moderate | 30 | | | | |
| | | Slow | 36 | | | | |
| | The existence of measures for traffic calming | Yes | 48 | ⊕ | ⊕ | | |
| | | No | 35 | | | | |
| | | Don't know | 17 | | | | |
| | Connections with public transport to other parts of the city | Yes | 58 | ⊕ | | ⊕ | ⊕ |
| | | Mostly | 35 | | | | |
| | | No | 7 | | | | |
| | The existence of an appropriate timetable | Yes | 44 | ⊕ | | ⊕ | |
| | | Mostly | 41 | | | | |
| | | No | 15 | | | | |
| | The existence of adequate pedestrian signalization | Yes | 43 | ⊕ | ⊕ | ⊕ | |
| | | Mostly | 43 | | | | |
| | | No | 14 | | | | |
| | Need for introduction of pedestrian operated signals | Yes | 35 | ⊗ | ⊗ | ⊗ | |
| | | No | 65 | | | | |

Respondents are generally satisfied with existing pedestrian signalization and find that it should not be promoted in pedestrian-operated. However, those who believe that it should be improved in this way, state that it would contribute to increased flow, increased safety especially for children, reduced length of waiting at pedestrian crossings, especially at night, but some of them have stated that it could also contribute to the continually traffic flows when pedestrians are not on the crossings.




### The quality and climate of walking

This group of questions was aimed at highlighting the current position, i.e. climate of walking in the research territory. Furthermore, it should point out possible improvements that would happen by increasing the intensity of pedestrian traffic. In order to increase the intensity and quality of pedestrian movement, citizens believe (see Table 5) that it is necessary to adopt a pedestrian development strategy (although most of them think this territory is pedestrian-friendly). The strategy would encompass all previously mentioned problems and contributed to improving the quality of life in this part of the city. It would result in renovation of pedestrian spaces, their staying outdoors, equipping dominant routes, giving preference to pedestrians, awareness, increased safety and comfort of citizens, speed reduction, availability, more elderly in the street, attractiveness, flow regulation, reducing the number of motor vehicles together with pollution and noise reduction, pedestrians and drivers would be better educated in traffic, the organisational quality of pedestrians in traffic would be improved and that would result in new hierarchy of the of road users, etc.

**Table 5: The quality and climate of walking.**

| Questions group | Question | Answers | % | Positive/ negative/ neutral trend | Safety | Comfort | Attractiveness |
|---|---|---|---|---|---|---|---|
| **The quality and climate of walking** | Existence of pedestrian movement strategy | Yes | 31 | ⊕ | | | |
| | | No | 69 | | | | |
| | The need for pedestrian movement strategy | Yes | 70 | ⊕ | | | |
| | | No | 30 | | | | |
| | Study area in friendship with pedestrians | Yes | 23 | ⊕ | | ⊕ | ⊕ |
| | | Mostly | 64 | | | | |
| | | No | 13 | | | | |
| | The level of noise in the streets | Low | 6 | ⊗ | | ⊗ | |
| | | Middle | 35 | | | | |
| | | High | 41 | | | | |
| | | Very high | 18 | | | | |
| | The level of pollution in the streets | Low | 5 | ⊗ | | ⊗ | |
| | | Middle | 26 | | | | |
| | | High | 40 | | | | |
| | | Very high | 29 | | | | |

## SUMMARY OF OVERALL RESULTS AND CONCLUSION

The obtained overall results are categorized and evaluated as positive, negative or neutral, in terms of general impression as well as in individual criteria on which specific issues were referred. An overview of these results is shown in Table 6.

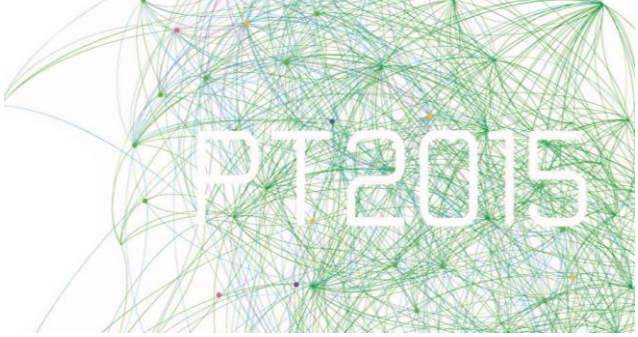


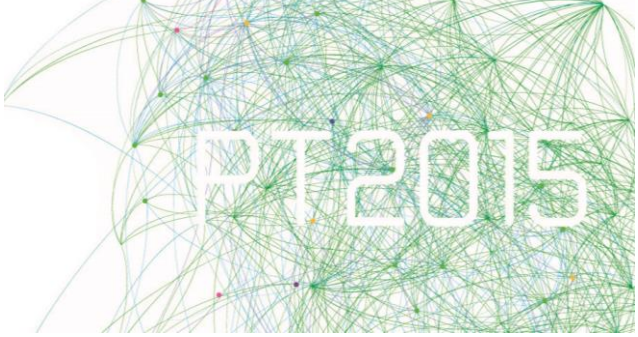

**Table 6: Summary of overall results.**

| Negative, positive or neutral stand | **General impression** | Individual criteria | | |
|---|---|---|---|---|
| | | Safety | Comfort | Attractiveness |
| ⊗ | **9** | 3 | 6 | 1 |
| ⊕ | **22** | 11 | 11 | 9 |
| ○ | **2** | 1 | 1 | 1 |

Based on the results of the survey, citizens have **positively** characterized the current situation of pedestrian movement in the study area that belong to the central part of the city. This has shown that citizens have a **high level of awareness related to the pedestrian movement as a sustainable form of transport**, but so far have not the opportunity to consider individual aspects of this type. In addition, by separating comments and their analysis related to specific problems may lead to **a number of concrete guidelines and recommendations** that would have resulted in improving the pedestrian environment. These guidelines should address the secondary flows of movement, which are necessary for establishing a complete pedestrian network and that could contribute in the formation of the direct pedestrian connection between the core of the city with Danube's waterfront.

By analysing the quality of the pedestrian environment, a specific stakeholders and users of information have been recognized: (a) organizations involved in the maintenance of facilities and open public spaces, (b) the police who is responsible for enforcement and monitoring of appropriate behaviour of traffic participants, (c) city planners and traffic engineers who influence the initiation of decisions (as elements of the wider planning process) related to improving pedestrian environment, (d) tourist organizations which defines the requirements for the existence of a pedestrian flows network (this applies particularly to the criteria of comfort and attractiveness of direct pedestrian environment), (e) association of persons with disabilities who are carriers and initiators of the decisions implementation related to the creation of pedestrian environment according to the principles Design for All, (f) schools that appeal to the existence of a secure movement flows, (g) organizations that are involved in business of providing adequate public transport and installation of stations.

In collaboration with these stakeholders, there should be a comprehensive approach in a form of Strategy of walking in the central part of the City as well on the whole City of Belgrade territory. However, individual criteria should be addressed as well. A special emphasis should be placed on the negative attitudes towards certain aspects (safety, comfort, attractiveness) and recommendations which citizens gave regarding some questions. The improvement and enlargement of the pedestrian network (which is planned to be implemented on the part of the study area) would then contribute to the increase of the pedestrian movement in the city and which would result in and influence on the improvement of public health of the citizens of this area as well all over Belgrade.




## ACKNOWLEDGEMENT

The paper was realized, as a part of the research project "Modernization of Western Balkans" (No. 177009) and the project "Spatial, Environmental, Energy and Social Aspects of Developing Settlements and Climate Change – Mutual Impacts" (No TP36035), PP1: "Climate change as a factor of spatial development of settlements, natural areas and landscapes", both financed by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

## REFERENCES

C3 Collaborating for Health. 2012. C3 *Collaborating for Health*. [Online], Available from: http://www.c3health.org/wp-content/uploads/2009/09/C3-report-on-walking-v-1-20120911.pdf. Accessed 27 June 2014.

Centers for Desease Control and Prevention. 2003. "Prevalence of physical activity, including lifestyle activities among adults - United States, 2000-2001" *Morbidity and Moratlity Weekley Report*, 764-769.

*COST Action 358: Pedestrian Quality Needs*. 2010. [Online] Available at: www.walkeurope.org. Accessed 29 February 2012.

Gehl, J. 2010. *Cities for People* Washington: Island Press.

Gerlach, J. 2010 "Pedestrian Quality Audits and Inspections – more than a part of the new EU-Directive on Road Safety Infrastructure Management". In Methorst R, Monterde i Bort H, Risser R, Sauter D, Tight M, Walker J, editors. *Pedestrian' Quality Needs. Final Report of the COST project 358*. Cheltenham: Walk21,83-133.

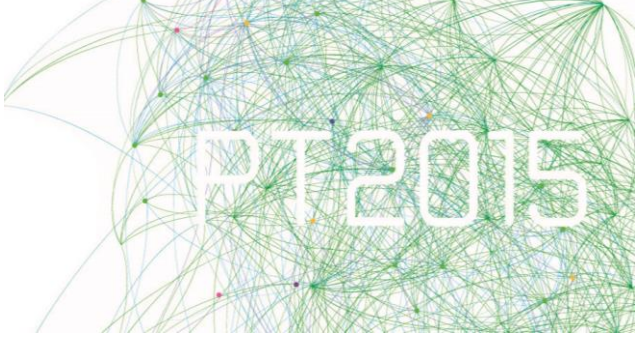
Kahlmeier, S., Cavill, N., Dinsdale, H., Rutter, H., Gtschi, T., Foster, C., et al. 2011. *Health economic assessment tools (HEAT) for walking and for cycling: methodology and user guide: economic assessment of transport infrastructure and policies* Copenhagen: WHO Regional Office for Europe.

Lee, I.M., Buchner, D.M. 2008. "The importance of walking to public health" *Medicine and science in sports and exercise* 40(7 Suppl.): S512-S518.

Litman, T. 2010. *Evaluating public transportation health benefits* Victoria: Victoria Transport Policy Institute.

Neithart, V. 1997. *Čovjek u prostoru: Antroposocijalna teorija projektiranja*, Zagreb: Školska knjiga.

Pikora, T., Giles-Corti, B., Bull, F., Jamrozik, K., Donovan, R. 2003. "Developing a framework for assessment of the environmental determinants of walking and cycling", *Social Science & Medicine*. (56): 1693-1703.

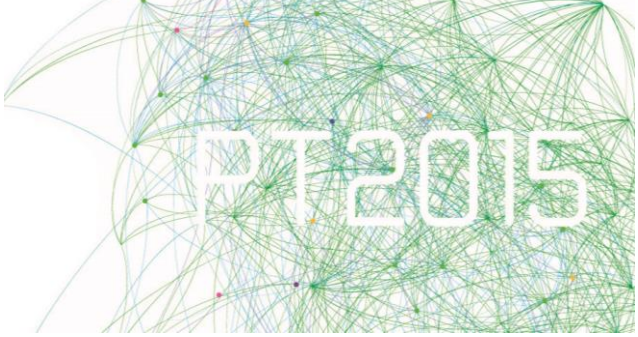



Sallis, J.F., Johnson, M.F., Calfas, K.J., Caparosa, S., Nichols, J.F. 1997 "Assessing perceived physical environmental variables that may influence physical activity". Research Quarterly for Exercise and Sport. December 01; 4(68), 345-351.

Vukmirović, M. 2010. *Projekat Napravi korak – Unapredi okruženje: Rezultati anketiranja građana*, Beograd. [Online] Available at: http://www.dub.org.rs/napravikorak/ankete.html. Accessed 29 February 2012.

Vukmirović M., Vukmirović J. 2014. "Pešačko kretanje u funkciji unapređenja javnog gradskog prostora i javnog zdravlja u Beogradu" Samardžić N. (ed.) *Special Issue Acta historiae medicinae, stomatologiae, pharmaciae, medicinae veterinariae: Javni gradskih prostor i zdravstvena kultura u Beogradu*, br. 1, str. 46-73.

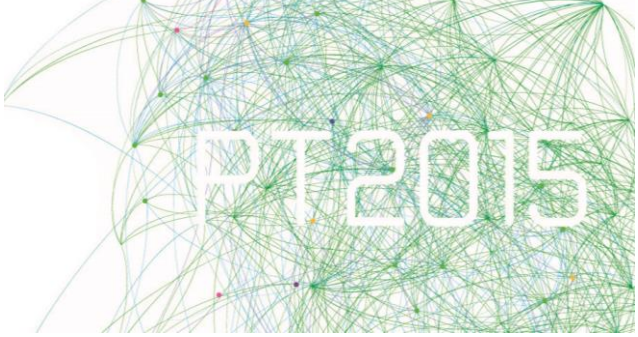
WHO - World Health Organization. 2009. *WHO - World Health Organization*. [Online], Available from: http://www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_full.pdf. Accessed 27 June 2014.




# TOPIC XI:

# Health Promotion, Protection and Prevention

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# OUTDOOR GYMS: "NO MORE EXCUSES FOR PEOPLE WHO CANNOT AFFORD MEMBERSHIPS. GET OUT AND GET IN SHAPE!"

**Anne-Kathrin Will**
Dr. phil., InterVal GmbH, Habersaathstr. 58, 10117 Berlin, Germany,
ankawill@hotmail.com

## ABSTRACT

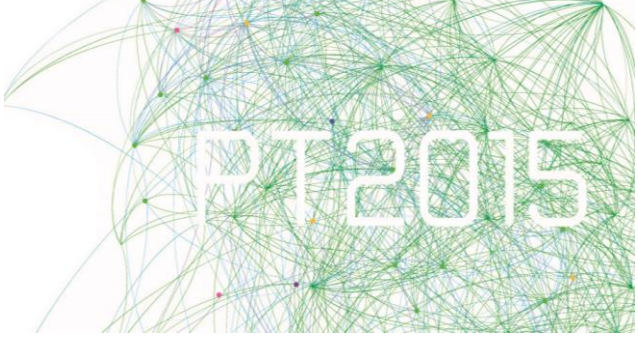
*In public space is outdoor fitness equipment is installed to offer training possibilities to a broad public. The new trend has its predecessors in the United States. Muscle Beach in California was by accident the first outdoor body building area, getting well known through its proximity to Hollywood. But it is probably the germ cell of outdoor fitness with workout devices. These "playgrounds for grown-ups" are seen as public investments in health prevention.*

*The article tracks firstly the societal changes that led to the setting up of fitness facilities in public space. It asks secondly for the demand of recreational motion as a part of technologies of self in the sense of Michel Foucault. Thirdly it tries to illustrate the targeted and reached groups of public investmens.*

***Keywords**: outdoor gyms, workout in public space, technologies of self.*

## INTRODUCTION

Tracing the term "sport" gives already a hint about the social changes which accompanied its appearance. The word has an old French root (desport) and was used in English as "sport" since the 19th century (Harper, 2001-2014). From England it entered with little variation all European languages. Only the Greeks stuck to their αθλητισμός. The term distinguishes physical exercises from labour. From the beginning sport is connected to leisure time. Somebody can do sports actively or only watch it for amusement. The latter was the normal throughout centuries since there is no European tradition of bodily exercises for prayer or meditation as in the East. But at the end of the 19th century it changed its meaning towards physical activities of the wide population. Actively performed sport was soon associated with team games and with gymnastics or exercises, which came from a military tradition. These exercises were employed in the philanthropic projects all over Europe to educate children, youth and later also the working classes.

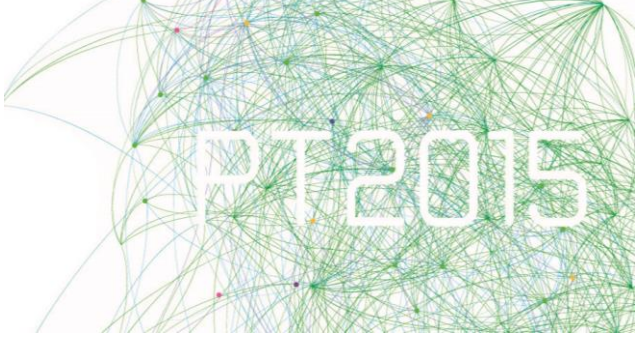



## PUBLIC SPORTS IN POSTMODERN TIMES – BOURGEOIS ROOTS WITH IMPACT ON POPULAR CULTURE

One has to move his or her body to exercise, to keep in shape, to prevent from illnesses. These imperatives raised parallel with the change of work circumstances from hard physical work to office work with only little physical activities and more leisure time. In Germany for example in 1825 the weekly working hours were 82 and reduced to 35 in certain industrial sectors in 1995 (Strawe, 1994). Additionally to work circumstances social contexts as family patterns changed also. Today people live in smaller families and increasingly in cities. The ties of kin and family became less important. States took over a lot of duties of welfare for whom families, lordships or the church were responsible in ealier times. But also the individual is called on to take care for itself. And a healthy and good life goes with a healthy body which is gained through healthy diet and exercises. These philanthropic theories came from Europe, but their further translation into an individualistic way of life took place in the United States.

At the beginning of the 20$^{th}$ century a new picture of (nude) trained muscular bodies occurred and was shown in visual arts (Toepfer 1997). The beauty of human nature was celebrated with young, nude bodies often at the seaside. The raising and growing middle classes had time and money to go to the sea. Tourism and with swimming fashion a new fashion sector were born. And the portion of cloth decreased constantly culminating in the 1960ies with the Bikini covering little but exhibiting a lot of a body. At that time the seaside was no longer an exclusive site for the middle class. Holidays became also weeks for vacation for the working class, which did not only overtake the bourgeoisie life-style, it took over also their bodily ideals. This was supported by movies and pictures in magazines.

There is a narrow connection of European philanthropy and bodily culture to American popular culture which influenced the European popular culture subsequently. In the turn of the century many European intellectuals and artists went to the U. S. The movie industry promised money and fame to musicians, composers, dancers, athletics, writers and actors. Together with them a new perception of nudity and exposed bodies came to the United States, the country of liberty by definition. Given these developments it is no surprise that the first open air training facility is at a beach near Hollywood and a scene for bodybuilders and artists to exercise and to be watched at the same time: Muscle Beach in Venice/Los Angeles (Wikipedia, 2015). Trained bodies are displayed in public sport events or outdoor training sites where devices for the training were installed. Here sport is again a figure of amusement. But it is not only for bystanders, it is an invitation to exercise by oneself and to get also a beautiful trained body. The performances are also advertisements for and invitation to the fitness club which Muscle Beach was as well.




## CARE FOR ONESELF – THE NEW IMPERATIVE

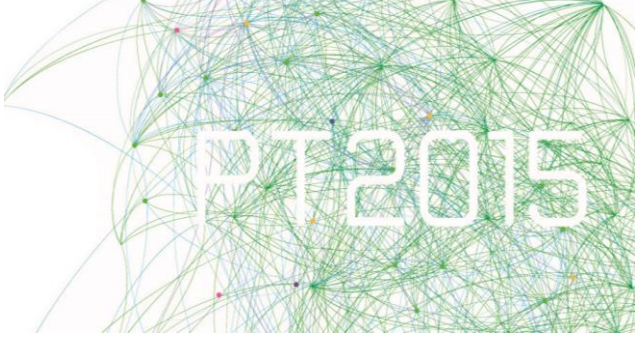
To take care for oneself including one's body became a new imperative. Persons in public life, for example bodybuilders in Muscle Beach, were and are ideals to whom somebody can orient. The most famous and successful one is Arnold Schwarzenegger who as émigré from Austria started his career as bodybuilder, wrote bodybuilding books, was successful as actor in Hollywood and is now the governor of California. These ideals are in the centre of the imperative and evidence for its possible success: everybody has the responsibility for its own life and to succeed in this by himself. One has to work every day to be a better person, with more money, constant health, good condition, perfect look. This constant struggle is the logic of protestant ethics but the very fundament of neoliberal capitalism and consumerism.

Foucault describes the reaction to these imperatives as "technologies of self" (Dreyfus/Rabinow, 1982) and Nikolas Rose exemplifies four mayor trends: responsabilisation, healthism, normalisation and self-esteem (Rose, 1999), which shape these technologies. Within these four discourse formations the subject constitutes itself. They define a large field of possibilities. And there is no escape from them, even innovations and protest relate to these discourse formations at least as contrapoint.

The care for the own body is in the very centre of "technologies of self". Exercises are visible, muscles and a trained good-looking body also. Mental works of postmodern individuals like positive thinking, therapies, reflection, planning etc. are invisible. And we live after the visual turn. Appearance is more important than ever. Think of internet-dating platforms where an uploaded picture is the basis for the decision about a potential partner. Where the first sight is important people are willing to spend money and time because it promises to pay-off later. The investment in active sport is not only one in beauty it is also one in health. Through practicing sport these two very important postmodern goals can be addressed at the same time.

## GYMS VS. PARKS – A QUESTION OF INCOME?

As mentioned above work circumstances changed over the last century drastically. The service sector grew and production increasingly mechanised. Recreational sport became a new domain in health prevention. Additionally the variety of food changed and became less expensive due to mechanisation in agriculture. This led to health problems like obesity: "The majority of the population, and one in five children, are overweight or obese in the OECD area." And it is a matter of class: "Social disparities in obesity persist, and have increased in some countries" (OECD, 2014). The poorest are the biggest in Western countries.




Probably it is not due to other ideals of beauty that have people with low-income in comparison to the middle class. There are no extra popular magazines with oversized models. Here Arnold Schwarzenegger can serve as a role model for all social classes in respect to his body and also his success in sport, movie and politics. There is also a cult of the body in populations with low-income. If they perceive gyms as part of popular culture as smart phones, other consumer items or body modifications as tattoos, brandings, piercings etc., they will probably still get those even if they need to go into debt. But these individuals and groups in poor populations who are very much oriented to their bodily appearance do not weight out the over-weighted in obesity-statistics. The latter might have a lack of knowledge of healthy food, but even if they know that processed food and drinks, loaded with sugar, salt and simple carbs are linked to obesity, it is cheaper or faster to buy them. And also a membership in a gym costs, but more important: it is discipline necessary to go there regularly.

Nevertheless the fitness industry expands progressively. In Germany the sales volume in 2014 was 4,7 milliards Euro (Statista, 2015a). Per capita it is only 55 Euros per year, but given that only a tenth of all Germans are member of fitness club (Center of Genetic Analysis and Diagnosis, 2015) it is quite a sum for these who actively exercise. US Americans similarly spend about 70 dollars per year (Statista, 2015b).

But beside the offers of the fitness sector itself governments on national and local level campaign also for prevention through awareness-raising (responsabilisation and healthism) and fight against pounds with public sports events (normalisation) and training sites. Especially city councils invest in recreation equipment in parks. When areas are newly planned fitness devices are installed as well. There is a growing market. Thus public recreation areas are also sites for biopower (Foucault 1990) targeting the average BMI of a nation or city through technologies of self. The good old sport clubs were matches were played and training was an activity of a group seems to be out-dated. Fitness centres allow for an individual training at times which fit into the working week. They are flexible, where the old sport clubs give a structure to time through their weekly routines and fixed training and matching dates, in short: obligations. But obligations contradict the postmodern life-style. Everything and everybody has to be flexible.

## NEWLY DESIGNED PARKS – JUSTIFICATION AND FACTS

A German congress of the communal head organisation was directed to outdoor fitness equipment in 2013. The focus was on the elderly who, following the explanation, need also possibilities to exercise in public space. For them however and not further explained existing facilities seem to be not suitable (Deutscher Städte- und Gemeindebund, 2013: 8). Where in the 1960ies and 70ies exercise circles were installed outside cities in local recreations areas it is argued that today

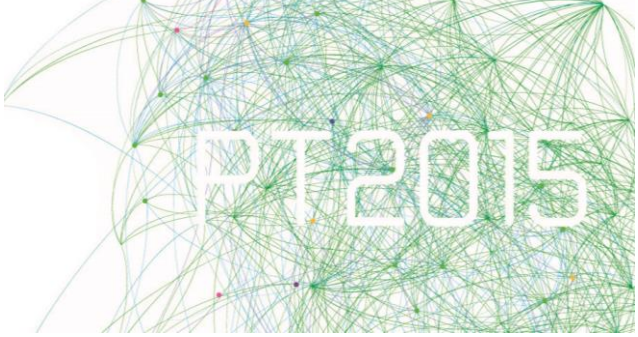
there is a need for nearby devices which allow an individual training without long ways to recreation sites.

One example of such a place with devices is a small park in Berlin (Fuggerstrasse/Eisenacher Strasse), where four devices were installed in 2008 as the place was redesigned. But these devices are nearly never in use. They are far away from a jogging area and in the middle of a city quarter. The area is also known for prostitution, but it is rather a problem at evening and night, when fitness devices normally will not be used. The intended upgrading of the park did not succeed with these devices. But a neighbouring playground is regularly used for basketball and soccer. So in this case the innovation failed. Successful examples from the US (Calisthenics At Its Finest 2011), from Serbia (Novi Sad at the riverside of the Danube) (Fig. 1) or Cologne (Eickler, 2014) (Fig. 2) imply that fitness devices are only in use when they are in the green, when joggers might use it after their rounds or when people walk there to be at the fresh air as well as in a green surrounding.

**Figure 1: Fitness parc in Novi Sad at the Danube 2011.**

**Figure 2: Fitness parc in Cologne from Eickler 2014.**

This also implies that users have to be agile in a certain way to reach theses training sites. The elderly are therefore not the primary users of such devices. A newspaper




article about newly installed devices suggests the same. Two persons were interviewed at the training site: a dietician and a jogger who did several chin-ups after his jogging round (Eickler, 2014). The target audience of old, poor and over-weighted who justify public investments are not present. Arguments for usage are fresh air and the proximity to a jogging area. So a study in the U.S. did not find a significant relation in park usage between parks with and without fitness equipment. Users of parks with equipment and without equipment had similar BMIs, they were 61 % female and the medium age was 40 years (Cohen et al., 2012).

But also in the United States the explanation is the same as in Europe. A TV-production about a newly opened training site with outdoor equipment summarizes: "Outdoor gyms are built as playgrounds for grown-ups. No more excuses for people who cannot afford memberships. Get up! Get out and get in shape!" (Calisthenics At Its Finest., 2011). These "playgrounds" are seen as investment in public health and target people who are less active and have less monetary resources even if there is evidence that these goals are not reached.

## CONCLUSIONS

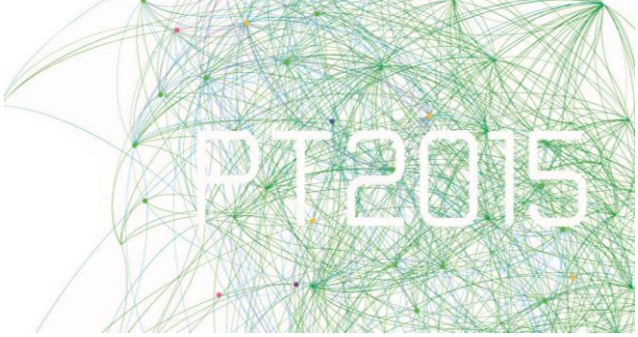
There is a new trend of outdoor fitness in public space. Parks in cities are equipped with several devices. These public investments are justified with public health and demographic change. But the elderly do hardly use these devices. Users are middle-aged, not more over-weighted as users of other parks and mostly very aware of their health and bodies. This implies that the devices are in use, not by the target groups, but by people who care for themselves and use the provided devices thankfully. Outdoor fitness devices in public space work out not as intended but successfully.

## REFERENCES

Calisthenics At Its Finest. 2011. "Outdoor Gyms To Open In Miami, Miami Beach Video WPLG Miami." Accessed April 12th, 2015. https://www.youtube.com/watch?v=F5zSoTF3i_E.

Center of Genetic Analysis and Diagnosis. 2015. "Eckdaten der deutschen Fitness-Wirtschaft." Accessed April 12th, 2015. http://www.cogap.de/deutsche-fitness-wirtschaft.html.

Cohen, D., Marsh, T., Williamson, S., Golinelli, D., McKenzie, T. L. 2012. "Impact and Cost-Effectiveness of Family Fitness Zones: A Natural Experiment in Urban Public Parks." *Health Place* 18. No. 1 (Jan): 39–45.




Deutscher Städte- und Gemeindebund. 2013. *Städte und Gemeinden bringen Bürger in Bewegung. Bewegungsparcours im öffentlichen Raum*. *DStGB Dokumentation No 127*. Berlin: DStGB Dokumentationen.

Dreyfus, H. L. and Rabinow, P. 1982. *Michel Foucault: Beyond Structuralism and Hermeneutics.* Chicago. University of Chicago Press.

Eickler, M. 2014. Fitnessparcours läuft bestens. Decksteiner Weiher. Angebot der GrünStiftung für Kondition und Ausdauer. *Kölner Stadtanzeiger*, April 22nd: 35.

Foucault, M. 1990 (originally 1978). *The History of Sexuality. Volume I: An Introduction.* New York: Vintage Books.

Harper, D. 2001-2014. *"Online Etymology Dictionary. Sport."* Accessed April 12th, 2015. http://www.etymonline.com/index.php?allowed_in_frame=0&search=sport&searchmode=none.

OECD. 2014. "Obesity Update June 2014." Accessed April 12th, 2015. http://www.oecd.org/els/health-systems/Obesity-Update-2014.pdf.

Rose, N. 1999. *Powers of Freedom. Reframing Political Thought.* Cambridge: Cambridge University Press.

Statista. 2015b. "U.S. fitness center / health club industry revenue from 2000 to 2013 (in billion U.S. dollars)." Accessed April 12th, 2015. http://www.statista.com/statistics/236120/us-fitness-center-revenue/.

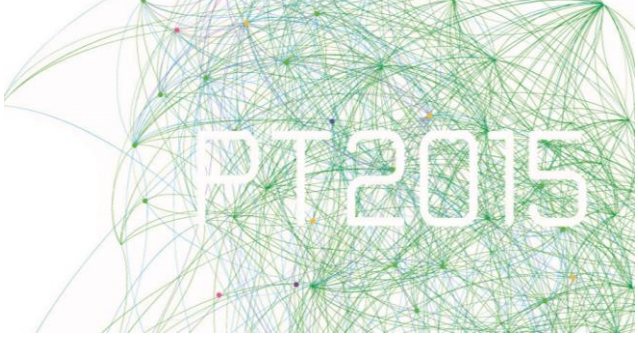
Statista. 2015a. "Umsatz der Fitnessbranche in Deutschland in den Jahren 2000 bis 2014 (in Milliarden Euro)." Accessed April 12th, 2015. http://de.statista.com/statistik/daten/studie/6228/umfrage/umsatz-der-fitness-branche-in-deutschland-seit-2000/.

Strawe, C. 1994. "Arbeitszeit – Sozialzeit - Freizeit. Ein Beitrag zur Überwindung der Arbeitslosigkeit." Accessed April 12th, 2015. http://www.dreigliederung.de/download/1994-12-001.pdf.

Toepfer, K. 1997. *Empire of Ecstasy. Nudity and Movement in German Body Culture. 1910-1935.* Berkeley et al.. University of California Press.

Wikipedia. 2015. *"Muscle Beach."* Last modified March 7th. Accessed April 12th, http://en.wikipedia.org/wiki/Muscle_Beach.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# STUDENT PHYSICAL EDUCATION FOR HEALTHY LIFESTYLE

**Aleš Golja**
MSc, Senior Lecturer, University of Ljubljana, Faculty of Civil and Geodetic Engineering, Jamova 2, Ljubljana, ales.golja@fgg.uni-lj.si

## ABSTRACT

*Today, physical education is not just a transmission of sport knowledge and the development of motor abilities and physical characteristics, but also the process of motivation for healthy living and socialization. If we started with physical educational programs in kindergarten, it would be wise and correct to continue to the end of educational process at university.*

*University physical education program has additional aspects beside educational, recreational and competitive. Its basic mission is to educate students about sport. With quality university physical education programs students gain conceptual and practical understanding of health-related fitness, develop physical competence, self-esteem, and experience overall enjoyment in physical activity.*

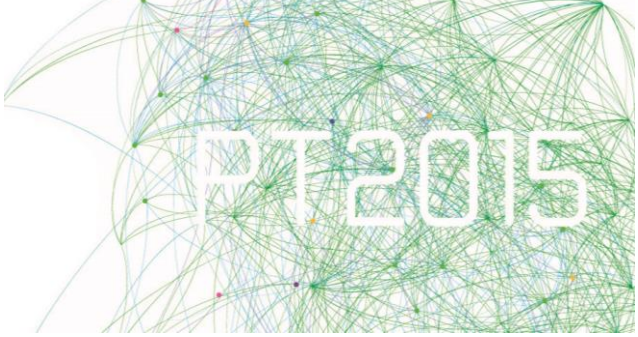
*Course Physical education should be, because of its specific benefits, the essence and unique content of the university curriculum and should be integrated as obligatory course at each faculty and each study program. It is the only program that provides students during their study with opportunities to learn motor skills, develop fitness and understanding about physical activity, which influence disease prevention, safety and injury avoidance, decreased morbidity and premature mortality, and increased mental health. The faculty physical education course syllabus should provide contents about all of the benefits gained from being physically active as well as the skills, knowledge to incorporate safe and satisfying physical activity into their lives.*

*Today students are becoming increasingly independent as their daily lives become more complex and diversified. They are faced with situations that require decisions and choices and taking increased responsibility for themselves.*

*The benefits of student physical education can affect both academic learning and physical activity patterns of students. Physical education plays a vital part in helping students maintain and refine their skills and knowledge needed during their studies and for the future throughout their lives.*

*These experiences enable students to make informed decisions and choices about how to lead a healthy and active lifestyle, also after finished university studies.*

***Keywords**: physical education, health promotion, Active Lifestyle, university sport.*




## INTRODUCTION

Two years ago the course of Physical Education celebrated the 50th anniversary of its existence at the University of Ljubljana[2]. In the last ten years, particularly marked by the acceptance of the Bologna reforms, the developmental trend in the area of the entire university sport and the course of Physical Education especially have decreased significantly. With the change of study programs at the faculties the course of Physical Education has effectively been eliminated. A decision was passed by the management of the University of Ljubljana that the course of Physical Education will no longer be a compulsory educational component of the curriculum. It was definitely a step backwards and this act was difficult to understand from the point of view of students and national sports culture.

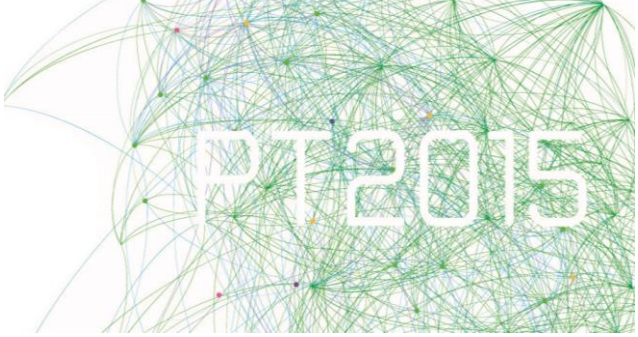
The university Physical Education has its real forming and experiential sense if it is a regular (mandatory) activity as opposed to an optional or occasional one. As lecturers of Physical Education we have more than 20 years of experience with student physical education program, and are the only ones dealing with the professional, pedagogical and organizational capacity in the field of university sport since its introduction in the University of Ljubljana (we as experts from each faculty are united in the Department of Sport at the University). We feel obligated to draw attention to the harmful effects of such a proposal and provide our expertise. Several times in the past we have sent documents with analysis of the situation, with the opinion of the medical profession as well as the opinion of students, the current issues and the organization of the course of the University sports, to be discussed at the University Senate. But our expertise has not been taken into consideration.

Because the course of physical education was dropped from the compulsory curriculum, the faculties responded differently and adapted to the situation. Some have maintained the course of physical education in the regular program without credit quantified ETCS points, some introduced it as an elective course with credit quantified ETCS points and some faculties removed the course from their curricula. Thus, we have come to the point where the reform of study programs caused the diminishing of physical activities of students and the level of their healthy lifestyle is poorer than it was before the change.

## THE IMPORTANCE OF REGULAR EXERCISE

The movement is a basic human need. Regular and sufficient movement brings a number of positive benefits to individuals of all ages, among other things, protects and enhances physical and mental human health.[1]

[2] Berčič 2014.
[1] Drev 2010.




Lack of movement is a common cause of death, disease and other handicaps. Approximately two million deaths per year worldwide are attributed to said cause. Research by the World Health Organization on risk factors suggests that sedentary lifestyle is one of the ten major causes of death and disability in the world[2]. Research in Slovenia has shown that a significant proportion of adults and young people do not move sufficiently or play any sports[3].

## Why is movement and physical education so important for health?

With the proper physical education and sports training the students get accustomed to the conscious control in implementing proper pose and movement of the body and learn to form the correct posture[4], develop movement coordination, endurance, strength, speed and mobility[5], effectively regulate body weight and the amount of subcutaneous fat[6] as well as contribute to general health[7].

Implementation of diverse sporting and physical activities enables the acquisition of movement competencies, which represent one of the most important development tasks[8] and brings many benefits[3]:
• reduces the risk of premature death;
• reduces the risk of death by heart disease or stroke, which causes one third of all deaths;
• reduces the risk of developing heart disease, or cancer of the colon up to 50%;
• reduces the risk of developing type II diabetes by 50%;
• helps to prevent/decrease high blood pressure which is troubling a third of the adult world population;
• helps prevent osteoporosis and reduce the risk of hip fractures by 50% in women;
• promotes mental well-being, reduces stress, feelings of anxiety, depression and loneliness;
• helps to prevent or control risky behaviour such as tobacco, alcohol and other substance abuse, unhealthy diet or violence in children and adolescents;
• helps to control body weight and reduces the risk of obesity by 50% compared to people with sedentary lifestyles;
• helps build and maintain healthy bones, muscles, joints and increases the energy of people with chronic diseases.

Patterns of movement and sports activities acquired during childhood and adolescence are more likely to maintain their lives and build a basis for an active

[2] WHO 2004.
[3] Strel, Sila 2010.
[4] Fairclough, Stratton, 2005.
[5] Armstrong, 2007.
[6] Jurak et al., 2013.
[7] Ortega et al., 2008.
[8] Hardman, 2008.

and healthy life. Lack of exercise and physical education can cause health problems throughout life[9].

## REPORT ON STUDENT HEALTH BY THE HEALTH CENTER OF THE UNIVERSITY OF LJUBLJANA

For all students who study at the University of Ljubljana, the Health Centre for Students performed a systematic review in the 1st and 4th year of study. Systematic review also presents a condition for their enrolment in the next year.

In the academic year 1992/1993, in the first and fourth year, 8,866 students enrolled to the University of Ljubljana, of 4054 invited systematically reviewed were 62% (Table1) [10].

**Table 1: Student health problems in the past.**

- 29,4% of students in had failure of refractive anomalies
- 24,3% had failure of the locomotor system
- 17% of students had failure of the skin disease
- The recommendation of the public health services was to control and prevent this with more regular and professionally guided hours of physical exercises.

In the academic year 2012/2013, in the first and fourth year, 15,700 students enrolled to the University of Ljubljana, of whom 12,520 were systematically reviewed (Table 2, table 3) [11].

**Table 23: Systematic review of students of the University of Ljubljana, October 2013.**

- 1/3 of students have vision problems,
- Increase in endocrine diseases,
- Locomotors defects,
- 9% students have allergies and respiratory problems,
- 13% students have skin diseases
- With 44% students at least one risk factor for the development of cardiovascular diseases was detected (smoking, weight increase, physical inactivity),
- 1/5 of students are smokers (10 cigarettes per day),
- A large proportion of students indulge in risky drinking,
- 12% of students confirmed experience with drugs (this information may not be completely credible),
- 12.5% of students never drank alcohol.

[9] WHO, 2004.
[10] Maren, 1994.
[11] Miholič, 2013.

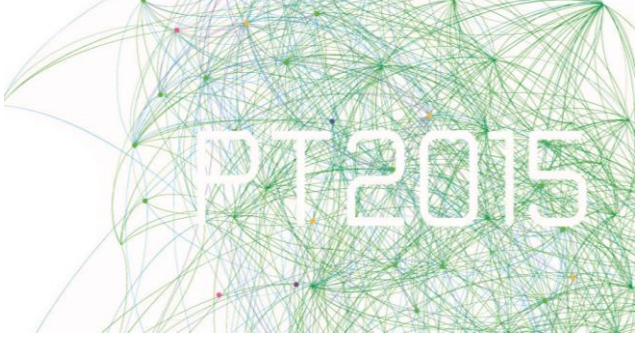



**Table 3: Students' attitude towards physical activity.**

- They express a positive attitude towards physical activity but without real motivation to start regular, healthy exercise,
- They complain about the lack of free time - 56% of students work from time to time, 16% more than 10 hours a week,
- Only 1/4 of students are physically active several times a week.

If students had in the nineties especially medical problems with the refractive anomalies and locomotors system, we can say that the upward trend in health problems among students today has increased. Today lecturers of Physical Education observe differences in the psychophysical condition from one student generation to another. In particular, it is evident in lack of physical activity (strength, endurance, flexibility, balance and coordination), lack of motivation and enthusiasm as desire and interest that pushes you to take action and pursue goals.

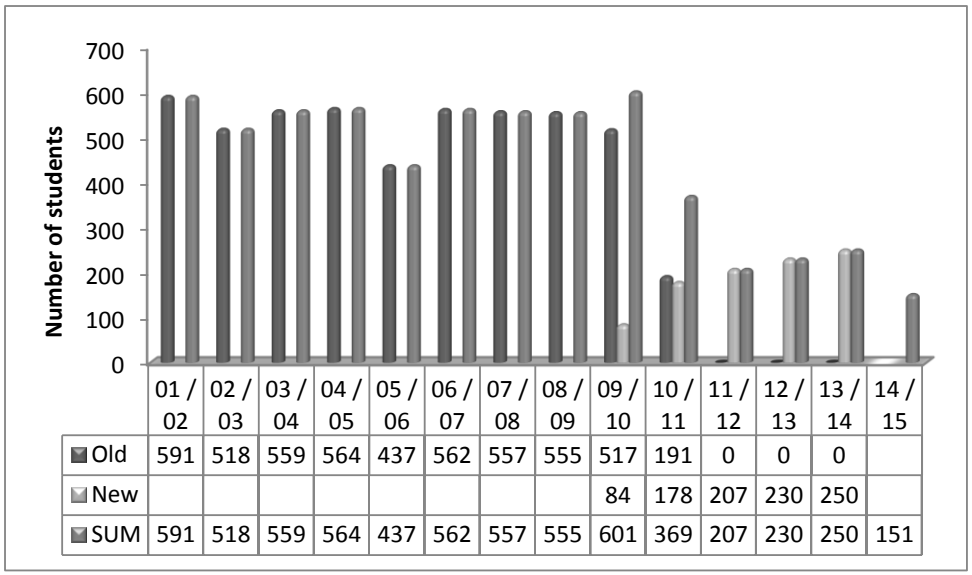
## CASE STUDY -STUDENT PHYSICAL EDUCATION AT THE FACULTY OF CIVIL AND GEODETIC ENGINEERING OF THE UNIVERSITY OF LJUBLJANA (UL FGG)

Until the introduction of the Bologna system, students had the subject of Physical Education in the 2nd and 3rd year of studies. In those days the program was attended by more than 500 students per year.

Since the Bologna system did not allow the implementation of the subject Physical Education under the old system, the faculty management decided that the subject of physical education would be offered to students as an elective subject in the first and second cycle of the Bologna study (assessed by 3 ECTS). Students can choose the subject once during their study.

With the implementation of the Bologna reform (new) we saw decrease by more than 50% in the total number of student attendance each year. Although there was an increase in numbers in the new program, their drop at the old program was more significant (Fig. 1[12]). This indicates that the students who already are physically active choose the course of Physical Education, while those who would need it most do not.

[12] Students Affairs Office UL FGG, 2015.




| | 01 / 02 | 02 / 03 | 03 / 04 | 04 / 05 | 05 / 06 | 06 / 07 | 07 / 08 | 08 / 09 | 09 / 10 | 10 / 11 | 11 / 12 | 12 / 13 | 13 / 14 | 14 / 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Old | 591 | 518 | 559 | 564 | 437 | 562 | 557 | 555 | 517 | 191 | 0 | 0 | 0 | |
| New | | | | | | | | | 84 | 178 | 207 | 230 | 250 | |
| SUM | 591 | 518 | 559 | 564 | 437 | 562 | 557 | 555 | 601 | 369 | 207 | 230 | 250 | 151 |

**Figure 1: The number of students at the UL FGG Physical Education (2001 – 2015).**

## Student opinion about the course of physical education

In the academic year 2012/2013 a survey regarding the elective course of Physical Education was made among the students. From among 230 students 138 responded to the survey (Figure2, Figure3)[13].

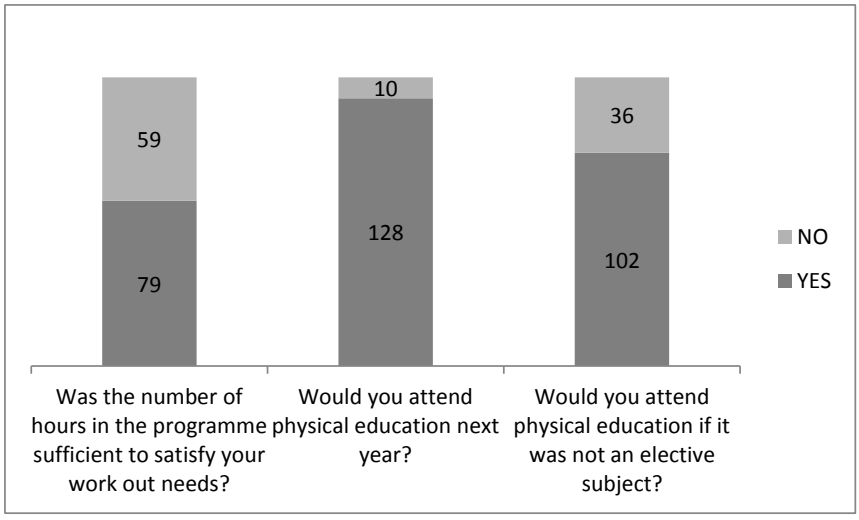



**Figure 2: Survey about elective course Physical Education.**

[13] Golja, 2013.

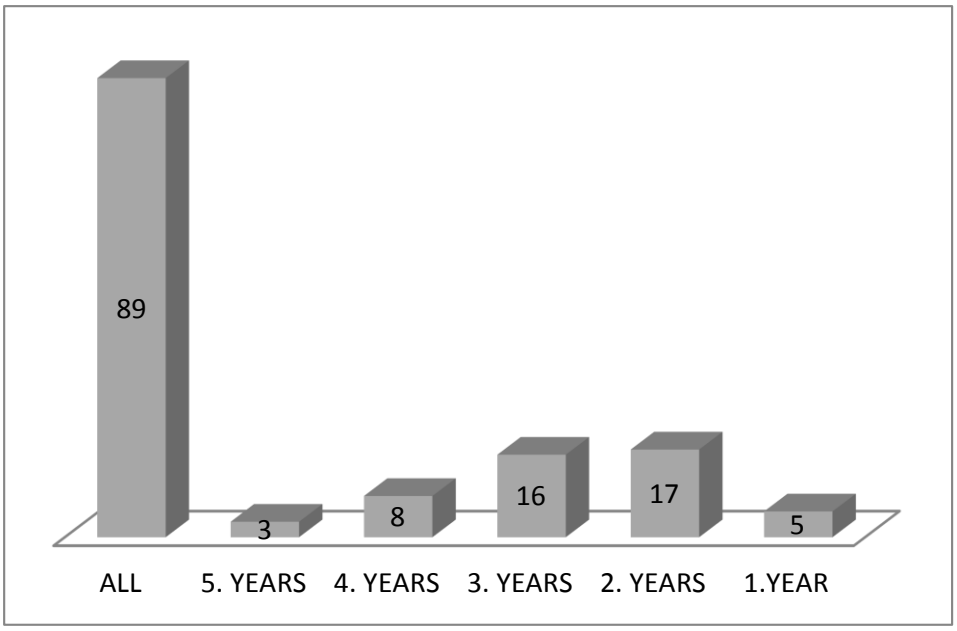


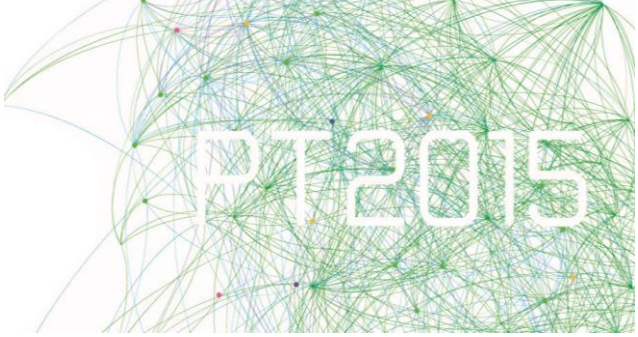

**Figure 3: How many years of study would you like to attend the physical education?**

Based on the questionnaire that was done we can recognize that the elective course does not satisfy students' wish or demand to have a continuous and frequent workout and also that this physical education should be incorporated better into the faculty programmes throughout all study years.

## Discussion

In our study, we attempted to present the data acquired even if this student data spans only two years and a sample appears relatively small, due to the increase in number of students by more than 200% in the course of Physical Education, we can still show a serious problem forming in the development of social capital of future intellectuals. Changing the concept of the program we simply lost most students who could use information about health benefits of exercise and thus would improve their health status.

We can imagine the reasons why these students do not exercise which is also hindered by being elective and for the experts who work on this field in the future it will be a big challenge to provide them with the right incentive. The incentive however should primarily be in sync with inner values of the students and not be based too much on the popularity of a professor. On the other hand the challenge may be simply to make this course obligatory again which would continue the praxis of physical education throughout the study years from kindergarten to university. That way more students would simply continue in the active lifestyle they adopted at the young age into adulthood.




## CONCLUSIONS

The lifestyle of young people is becoming more diverse and competitive. Therefore, during their study they need, more than ever before, time to relax, get some rest and recreation, as well as some social and personal fulfilment**Error! Reference source not found.**.[14] Because of that Physical Education plays an important role and is a large component of faculty education programs. The lack of education in the field of Physical Education programs reduces the quality of personal life. From the socio-economic point of view the demand for long-term health care increases. Therefore, Physical Education is intended to students, future intellectuals to embrace sport as a cultural value to achieve and maintain a healthy and active lifestyle. Students who recognize and develop their relations with the values of a healthy lifestyle are able to respect views and values of others and adopt more responsible personal and social decisions.

Most contemporary expert opinions support its positive influence on bio-psycho-social development and health of a young person[15]. Because of that regular physical activity should be the cornerstone of university sport for a student's healthy life style in the long run.

## REFERENCES

Armstrong, N. 2007. *Physical fitness and physical activity patterns of European youth, Chapter 2.* V: W. D. Brettschneider in R. Naul (ur.), Obesity in Europe: young people's physical activity and sedentary lifestyles. Sport sciences international, vol. 4. Frankfurt am Main [etc.]: Peter Lang, str. 27–56.

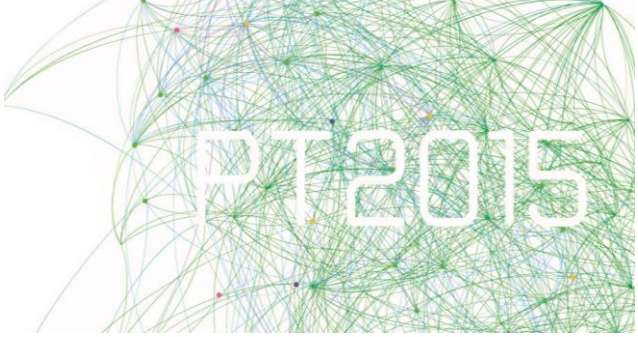
Bureau of the Committee for the Development of Sport 2002. *Conclusions on improving physical education and sport for children and young people in all European countries.* 16th Informal Meeting of European Sports Ministers. Warsaw, Poland, 12–13 September 2002. Council of Europe.

Drev, A. 2010. *Pomen rednega gibanja za otroke in mladostnike.* Last modified September 17,2010. Accessed April 30, 2015. http://zdravjevsoli.si/index.php?option=com_content&view=article&id=169:pomen-rednega-gibanja-za-otroke-in-mladostnike&catid=36:uvod&Itemid=80.

Berčič, H. 2014. "50 let športne vzgoje na Univerzi v Ljubljani: 1963-2013. *Kje smo in kam gremo na področju univerzitetnega športa"*. 13 – 16. Slovensko akademsko športno društvo.

Fairclough, S. J., Stratton, G. 2005. *Physical education makes you fit and healthy: physical education's contribution to young people's activity levels.* Health Education Research, 20(1), 14–23.

[14] Kuhar, 2007.
[15] Trudeau.




Golja, Aleš. 2013. "*Študentska športna vzgoja na UL FGG* - Fakulteti za gradbeništvo in geodezijo". *Most*. year. 10, no. 4 (December): 13.

Hardman, K..2008. *Physical education in Schools and PETE programmes in the European context: Quality issues.* V: G. Starc, M. Kovač in K. Bizjak (ur.), 4th International Symposium Youth Sport 2008 – The Heart of Europe. Book of Abstracts. Ljubljana: Fakulteta za šport, str. 9–26.

Jurak, G., Kovač, M. in Starc, G. 2013. *The ACDSi 2013 - the analysis of chidren`s development in Slovenia 2013* : study protocol. Anthropological notebooks, 19(3), 123–143.

Kuhar, Metka. 2007. "*Prosti čas mladih v 21. stoletju = Leisure time of the young in the 21st century"*. Socialna pedagogika. Year. 11, No. 4. (November). 453-471.

Ortega, F. B., Ruiz, J. R., Castillo, M. J., Sjostrom, M. 2008. *Physical fitness in childhood and adolescence: a powerful marker of health.* International Journal of Obesity (Lond), 32(1), 1–11.

Maren, J. 1994. *O preventivnih pregledih študentov UL v šolskem letu 1992/93*. Univerza v Ljubljani. Vestnik, letnik 25, številka 5/94, 6-8.

Miholič, Mojca. 2013. *Zdravje študentov*. Interview. Accessed April 10, 2015, http://www.zdstudenti.si/strokovni-prispevki/56-strokovni-prispevki/197-zdravje-studentov.

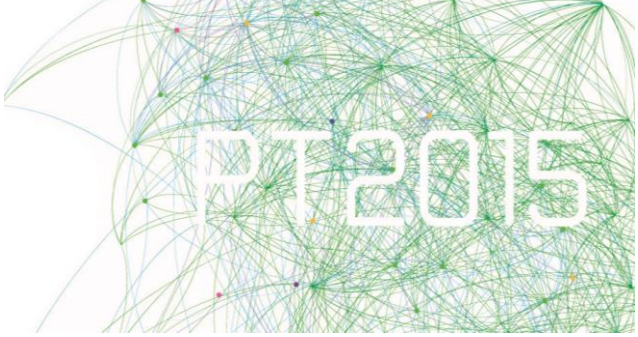
Resolucija Evropskega parlamenta o vlogi športa v izobraževanju z dne 13. novembra 2007 (2007/2086(INI)). Accessed April 21, 2015**.** http://www.europarl.europa.eu/sides/getDoc.do?type=TA&reference=P6-TA-2007-0503&format=XML&language=SL.

Trudeau, F. in Shephard, R. J. 2005. *Contribution of school programmes to physical activity levels and attitudes in children and adults.* Sports Medicine, 35, 89–105.

Strel, J., Sila, B. 2010. Sport Activities of Slovenian Adolescents Aged Between 15 and 18. Fakulteta za šport. Revija Šport, št.1 -2, 124-129. Accessed April 21, 2015**.** http://www.fsp.uni-lj.si/cvus/zaloznistvo/revija_sport/arhiv_stevilk/2010111612080093/.

WHO 2004. *Global Strategy on Diet, Physical Activity and Health.* Accessed April 28, 2015 http://www.who.int/dietphysicalactivity/strategy/eb11344/strategy_english_web.pdf.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# KEY POINTS OF HUMAN AWARENESS AND EMERGENCY PLANNING. SCHOOLS AS A CASE STUDY

**Maddalena Coccagna**
PhD, Researcher, TekneHub, University of Ferrara, Dept of Architecture, via Quartieri 8, 44121 Ferrara, Italy, cnm@unife.it

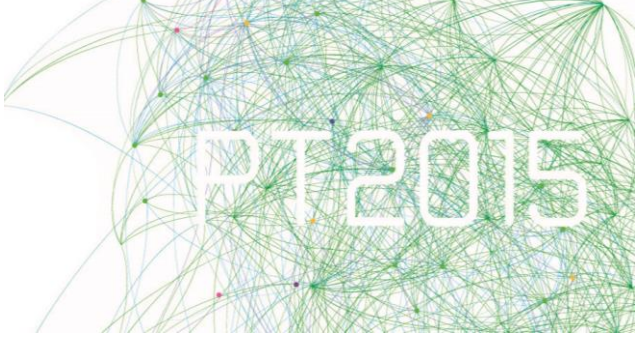
## ABSTRACT

*Environmental, architectural and organizational issues may support or hinder planned emergency measures. Existing laws define a set of parameters that have to be implemented within the framework for disaster, in order to ensure the health and safety both for workers and guests. A recent study has been developed to test the response of individuals and the efficiency of emergency plans, analysing the response of people just after an earthquake. Educational institutions have been chosen as field of application, because these buildings represent a mix of staff, employees, students and families, anyone with different knowledge, behaviours and roles of emergency procedures as planned. The study of the emergency and post-emergency stages, as perceived by the 1,300 individuals who took part in the survey, have highlighted a preferred list of key points used later by educational teams, municipality offices and civil protection to strengthen the existing procedures. The scope is to organize a feasible defence in case of danger, based on a better building and urban evaluation, training people within a broader "civil based" emergency instruction.*

***Keywords**: emergency, earthquake, job safety, health, schools.*

## INTRODUCTION

On May 2012, a large area of the Northeast side of Italy was shaken by an earthquake that destroyed heritage buildings as well as homes, factories and schools. This event had a considerable affect on the resident's perception of the surrounding environment, commonly considered as little prone to quake. A group made of firefighters, researchers, school and safety managers decided to analyse the actions done during and after the emergency, in particular the 29 May when a severe quake occurred at daytime (9 a.m.). The main goal was to suggest possible improvements, both at the organizational, building and urban scale. The survey has been focused on schools because they represent a job activity (therefore supposed to have an existing emergency plan), with a large number of different users/employees and with strong relationship with families/citizens. Eighteen pilot educational activities were grouped into six categories (from nurseries to university




departments), selecting them according to building type and educational organization, this to have a wide list of parameters (i.e. construction method, age of the school, number of floors or of classes, school location, etc). Between March and June 2013, 1,324 questionnaires have been collected, later entered into a database in order to compare similar situations in different contexts. Each set of queries (totalling 56, including multiple and short answer questions) was used in all schools but adapted to the organization, role and age of the participants (with the help of the Educational Office). The results have been discussed with the staff of the pilot schools (to assess the element of crisis as well as best practices), with the office for Public Works (for building improvements) and with members of the Civil Protection system (to plan communication and training activities). Further training activities have been later arranged for teachers, operators and professional safety managers.

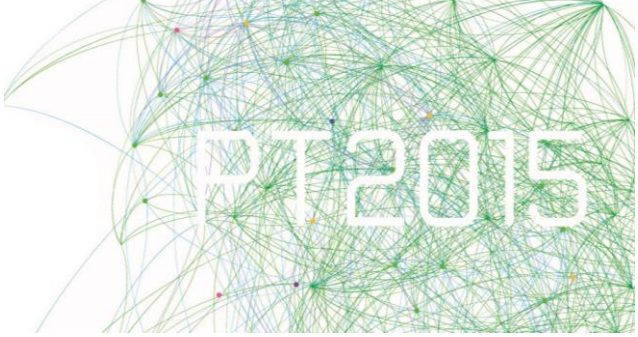
## AWARENESS OF RISK AND EMERGENCY PLANNING PROCEDURES

Before of the emergency, just two schools of eighteen considered the quake as a real possible risk, therefore some procedures have been proposed (and not always tested) just between the first and second quake (9 days: 20-29 May). The emergency measures (usually just the fire safety ones) were known to around the 95% of people on primary and middle schools, decreasing to 85/90% in kindergartens and high schools and falling to the 73% in nurseries. Within the university departments, just the 30% of employees declared to know the emergency plan (sometime unavailable) and the 63% of students acted according to their existing knowledge (from previous education). Around the 80% of employees and the 30% of students tried to help or to calm their colleagues after the earthquake and the 20% of them used this job also to keep busy. The 40% of students declared to have no idea of what they could do to be helpful and this is a great training gap, a priority for the future. Students must have a core function in the Plan, since their improvement of managing the unknown has a direct relation with the knowledge they may brings to their family, future employment, recreational activities and to society in general. This can foster a natural spread of information from students to people normally less informed (friends, elderly, foreign families, etc.). The Italian Ministry for Education, analysing the rules for school safety (MIUR n. 119/1999), underlined how "*job safety regulations are, even more than a legal obligation, an opportunity to promote a culture security, to enhance its content with the involvement and earnest participation of all school members, in a process of collective growth*". The level of information, training and management of responsibilities (now generally poor) should be shaped to the age and competence of students. The simple representation of the three stages for earthquake protection (drop, cover, hold on) has the sole purpose to represent the action required to save people during an earthquake (US FEMA, 2013). This was either ignored or not tested before the quake or was not easily applied if the facility did not have school desks. Staff members and students must learn to be quick in choosing and enabling protective measures, also being able to adapt them according to their purpose

(Blaich, 2008). The survey highlighted many doubts, mainly for teachers, about the implementation of measures not included into the Plan or not foreseen during the school drills. Primary schools largely applied protective measures (the 85% of students and 100% of teachers); this value decreases at the 83% of students and 78% of teachers at middle school and it falls down to the 59% and 35% at the high school. Within university students and employees, the most part of people was motionless (63%) and the 20% run to the exit. The position of students in large classrooms with fixed seats or in laboratories was a strong barrier to the fast identification and put into practice of protective measures. In nursery and kindergarten, the evacuation stage generally started without a protection stage, because of the fear for babies, not self-sufficient. Afterwards, schools promoted specific training activities in order to improve this phase, playing with children to train them about to protective reaction (i.e. reaching the stars or little hands painted on the bearing wall or going under the coloured table). A further improvement has been done to the buildings, adding walkways from the exit toward safe places, because the wheels of cots, used to move babies, had problems to roll on grass or gravel (Figure 1).


**Figure 1: Booklet about emergency procedures in kindergartens (designed with the Municipality and Fire-fighters, 2014) and picture of a baby cot used for emergency drills.**

The stress management highlighted many gaps, both for teachers and students (especially the elder ones). It was reported that some teachers had walked out without accompanying their class, many people were in shock or not able to provide information; students were on the run, weeping or ignoring school instructions. In some cases (more than a dozen), teachers attempted or continued to work after the earthquake, mainly in high school and university depts. Therefore, the assistance of a professional is suggested during the training stages (psychologist, expert in emergencies, etc.) to explain the possible reactions of individuals under stress and how to react to it. Some preferred exercises have been




suggested: testing the class without a teacher (to assess if students would be able to follow the procedures when alone), checking how to supervise more than a class (i.e. a colleague appointee of other activities or panicking or outside his class for any reason) and managing the defence in place instead of the evacuation.

The ambiguity of how to trigger alarms was one of the main fields of misunderstanding or concern amongst employees. In many schools, the alarm was given "during" the quake (following the fire procedure), sometimes immediately after in other cases repeatedly, until the complete evacuation; several schools used more than a tool (bell, siren, horns). Statistics showed that, after a year, very few people kept in mind the alarm (remembering similar percentage for school bell, emergency siren, indications given by the staff, any warning, etc). In the case of fire, the meaning of the siren is clear, for earthquakes or other environmental risks the alarm must be linked with scheduled actions, for example: verify the soundness of corridors and staircases, start the evacuation of classes, etc. Many Countries (including Italy) need an alarm system with voice speakers in large public buildings (as school, healthcare facilities, shopping centres, etc.), providing specific information about the event in progress and the actions to be played (Zuliani, 2013). Out of the eighteen pilot schools, twelve required such an alarm; however, it was installed in only two of them, sadly with one functioning. In the case of the school with a voice system working (used by trained personnel), the evacuation procedures caused lower levels of stress in both staff and students, when compared to other schools. The warning system has to describe when to verify the building safety (with or without evacuation), how to communicate the end of the emergency to people and how to change the procedures (because evacuating without a suitable reason could be not exactly efficient). Starting from these results, it is planned a wider study to develop planning guidelines to properly locate and use vocal alarm inside public buildings (schools, museums and shopping centres).

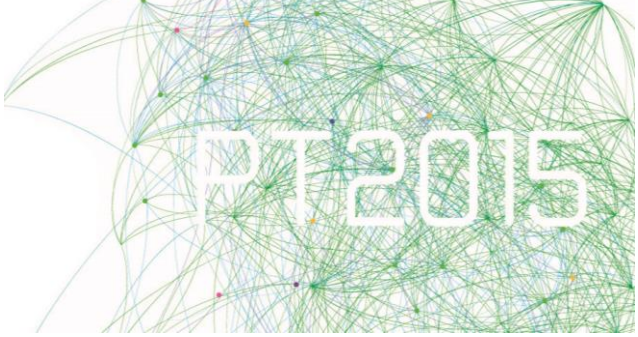
## EMERGENCY PLANNING TAKING CARE OF THE CONTEXT

There are many possible emergencies and the building location affects unavoidably on the margin of intervention; this creates a large set of scenarios, with crossed risks and duties. To work on a wide list of instructions for all possible circumstances (Philippot, 2010) it may be difficult to learn, in particular if taking care of the variables due to the context. Post-earthquake, several schools showed little evidence of structural failure but they faced with falling roof tiles or gutters, even the risk of collapsing of neighbouring buildings. Evacuation may be dangerous if addressed towards derelict structures, buildings or historical artefacts (statues, decorations, etc.), temporary structures or fittings (downspouts, gutters, tiles, cables, pipes, etc.). A "seismic-resistant" school can be an important facility to accommodate citizen during an emergency and its Plan should not only focus on building evacuation. On the other hand, many people came back inside evacuated schools just after the quake: to collect objects, to use the toilet (because not available outside), to prepare meals (in nurseries and kindergartens), to make phone

calls (to parents, to the school administration, etc.). In the aftermath of an evacuation, it is inappropriate to allow staff or users to come back. Many risks have to be faced through "defence in place" and not with the mere evacuation, because the danger should be outside the building (such as a flood) or because the panic reactions may be dangerous. Many other environmental features have a great impact on emergency management, for example the arrival of rescue vehicles, the chance of people assembly or rapid departure (mainly for the historical city centres). In the case of assembly areas, shared by public or other activities, the spaces must be delimited and shaped, in order to accommodate and control people, possible without overcrowding. With difficulties accessing the building, quarrels between parents or tensions with the school staff have been reported. These risks are typical of emergency planning when focused only on the danger of fire (localized) and not on a wider set of hazards (involving larger groups). The Emergency Plan generally analyses job activities as closed and independent cells, with poor o no evidence of outdoor spaces or access routes; the procedures are usually taken out of context. The environmental framework should be part of the Inter-Municipal Plan of Emergency; any danger that is beyond an individual understanding may be organized by the local Civil Protection System, appointed to support the safe assistance of citizens and their properties (Figure 2).


**Figure 2: Booklet about emergency procedures and evacuation areas and example of the sign now marking the Evacuation Areas (designed together with the Civil Protection, 2014-15).**

The Emergency Plans of schools, as well as of other activities, should not miss their link with the Civil Protection Plan, explaining how to do in the event of a




environmental hazard. The Municipality of Ferrara made this Plan before the earthquake, but this field test revealed that many aspects were little known by citizens, asking for more simple and reliable information (before, during and after the emergency). The website www.cronacacomune.it, together with its related Facebook and Twitter addresses, were already used by the Municipality to spread operative information to citizens (i.e. road works, meetings, etc). During the earthquake, they have been used to inform people about how and where receiving help, then later institutionalized for this purpose. The Civic Protection Plan is focused on the organization of rescuers; a booklet for citizens summarise its content, including a set of maps with pictures (downloadable from the city website and printed for schools). These tools explained how to manage a possible evacuation and the role of Evacuation Areas, selected because safe and accessible for rescuers and now marked with special urban signs.

## CONCLUSIONS

Each organization has to evaluate and reduce any possible risk, coordinating citizens quickly during an alarm and providing them with support, throughout the duration of the emergency. The risk is related with people, building and context, therefore all these fields have to be analysed by the Safety assessment, organizing training activities, planning installations and emergency measures not just for single activities (i.e. schools) but also as a community. The role of the Civil Protection System is pivotal, safety managers have to take into account the environmental risk as well as the need to face not just an evacuation but also a defence in place or a post-emergency stage. The development of the Emergency Plan should be pragmatic, assessing the possible and predictable events but relying on the "in-house" capabilities and the sharing of responsibility with all those involved, giving to younger a growing role, from acting to designing the emergency procedures.

## REFERENCES

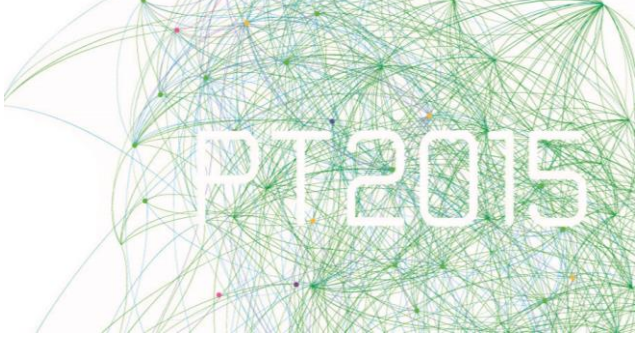
Blaich, P. W. 2008. *The benefits of behavioural research to the fire service. Human behaviour in fire and emergencies*. iUniverse, Lincoln (USA).

Philpott, D., Serluco, P. 2010. *Public School Emergency Preparedness & Crisis Management Plan*. The Scarecrow Press, Lanham (USA).

US Federal Emergency Management Agency. 2013. "Plan, Prepare & Mitigate". Last modified April 2014. Accessed June, 2014. http://www.ready.gov/be-informed.

Zuliani, A. 2013. *I comportamenti umani nelle situazioni critiche di emergenza*, Hirelia, Milano (Italy).

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# ANOTHER SIDE OF THE COMFORT OF LIVING – ELECTROMAGNETIC POLLUTION

**Nebojša Arsić**[1]
PhD, Full Professor, Faculty of Technical Sciences, Kosovska Mitrovica, nebojsa.arsic@pr.ac.rs

**Jordan Radosavljević**
PhD, Associated Professor, Faculty of Technical Sciences, Kosovska Mitrovica, jordan.radosavljevic@pr.ac.rs

**Nataša Fikfak**
Prim. MD, General hospital »dr. Franca Derganca« Nova Gorica, Ulica padlih borcev 13A, 5290 Šempeter pri Gorici, fikfak.natasa@gmail.com

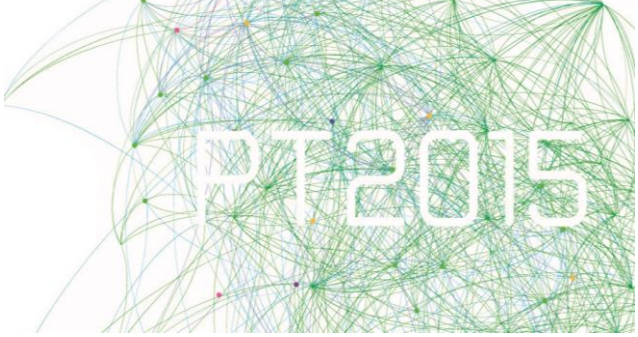
**Saša Štatkić**
PhD, Assistant Professor, Faculty of Technical Sciences, Kosovska Mitrovica, sasa.statkic@pr.ac.rs

## ABSTRACT

*Electricity is often taken for granted, as a commodity which is inseparable from an everyday life, offering to all of us unprecedented comfort of living. But such a comfort has its price we have to pay. Not only in relation with an exploitation of natural resources, devastation of land, risk of nuclear radiation, but also in relation with an invisible pollution – so-called electromagnetic pollution, or electromagnetic smog.*
*Smart or green buildings heavily rely on electrical devices and installations. It increases exposure of inhabitants to unwanted electromagnetic pollution. What are acceptable levels of such an exposure? How it influences human health? What are (if they exist) protective measures? There are strong disputes among manufacturers, ecologists and health practitioners about the harm this radiation can cause.*
*This paper describes actual situation and presents different views and facts in relation with this topic.*

***Keywords**: electromagnetic pollution, electromagnetic compatibility, health hazard*

[1] Corresponding author




## INTRODUCTION

Electromagnetic pollution is defined as an electromagnetic radiation which has a negative effect on the health of living organisms. This radiation is among other sources produced by housing appliances and electrical wiring which are constitutive parts of all residential, industrial and office buildings. Such kind of radiation could also cause malfunction or irregular operations of other appliances. Thus, it is important to understand the origin of this phenomenon and the effects on their potential "victims" in order to optimize the essential reduction or protection devices necessary to conform to the standards of Electromagnetic Compatibility (EMC). EMC is related to the unintentional generation, propagation and reception of electromagnetic energy with reference to the unwanted effects that such energy may induce.

Usually, when we discuss the health risks we think of polluted food, unsafe environment, ionizing radiation etc. Raising awareness about new kind of pollution has as a consequence increase of deeper independent researches in relations with an influence of different types of electromagnetic radiation on human health. It is very complex issue involving the broad spectrum of experts, including scientists, doctors, engineers, technicians, and other experts conducting researches for reasons and effects of the electro smog over the people, animals, nature and environment, and the ways of protection from the same.

## SOURCES OF ELECTROMAGNETIC POLLUTION

Each electricity-powered device or electricity conductor produces its own electro-magnetic field (EMF) – a wave of energy radiating outwards, getting weaker with increasing distance. It is invisible but can easily penetrate the human body, depending on the wave length, and thus affect each cell of our bodies. Most of these sources generate radio-frequency EMF, but some (such as house-wiring and power lines) produce low-frequency EMF. Both kinds could be potentially dangerous to one's health.

Electromagnetic pollution, or electromagnetic smog, is maybe too pretentiously, called by some authors as 21st Century plague. But the pure fact that it was compared with one of the most terrible scourges in human past shows potential danger it can cause to human health. Inevitably there is a price, whatever the real cost is, we have to pay for enjoying in everyday luxury provided by the electrical appliances.

Some of the major contributors to EMF pollution are cell or mobile phones, digital phones and base stations, computers and related equipment, wireless gaming consoles and base stations, wireless base stations, electrical appliances, electronic equipment, cell phone masts, radio and TV transmitters, microwave ovens, house-

wiring, high and low-voltage power lines, information networks, cars, motorcycles, buses, trains and planes, smart meters etc. (Figure 1).

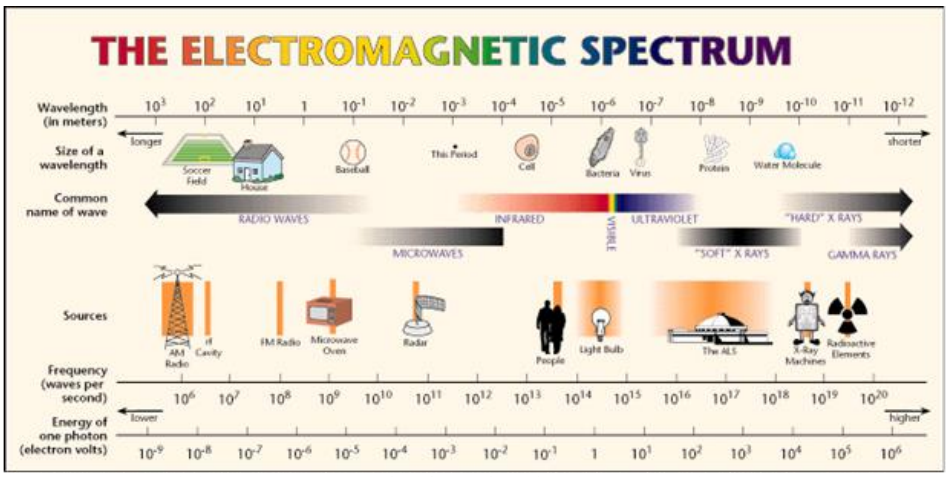



**Figure 1: Sources of non-ionizing radiation.**

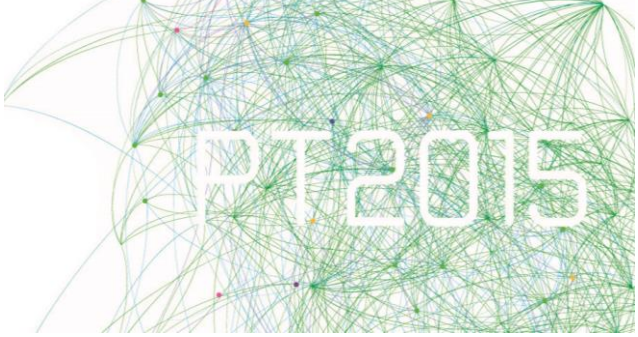
Let's take as an example two of appliances mostly used in everyday life: microwave and cellular phone.

Microwave oven can increase temperature of one cup of water from $30^0$C to $100^0$C in approx. 70 seconds with 500 W of microwave power. With 1W power, what is equivalent to output power of cell phones, temperature will increase by $1^0$C in 500 seconds. However, the level of radiation outside the microwave is far below energy levels that can cause heating of human cells.

Temperature of ear lobes increases by approximately $1^0$ when cell phone is used for approximately 20 minutes. In USA, limit of Specific Absorption Rate (rate at which radiation is absorbed by human body) for cell phones is 1.6 W/kg, or 6 minutes. It has a safety margin of 3 to 4, so a person should not use cell phone for more than 18 to 24 minutes per day.

## IMPACT ON HUMAN HEALTH

We are all aware of risks associated with the ionizing radiation. Exposures to ionizing radiation can come from natural and from human-made sources. We are continuously exposed to naturally occurring radioisotopes contained in soil, rocks and plants and, as a result, in building materials. One of the greatest sources of naturally occurring radiation is radon. In addition, we are exposed to cosmic rays. The amount of exposure is related to where we live. At higher altitudes the amount of exposure from cosmic rays is higher than at sea level. It is often not appreciated that the most significant human-made source of radiation exposure comes from



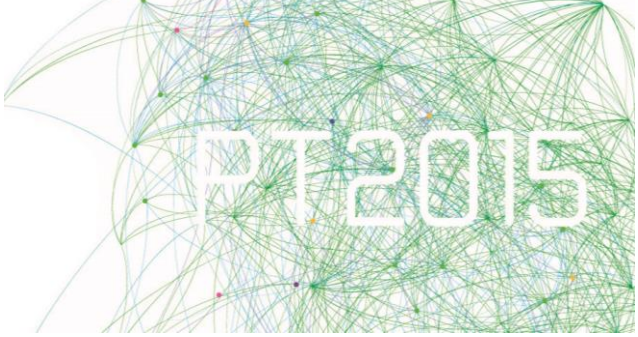

medical procedures, including diagnostic imaging, nuclear medicine, and therapeutic procedures. On average, the dose to the general population from medical procedures is similar to that received from background radiation. However, the medical contribution to radiation exposure is rapidly incrising.This is a result of the wider application of more powerful imaging tools, such as helical computed tomography (CT) scans and the movement to the use of digital images rather than film, and the application of techniques such as intensity –modulated radiation therapy (IMRT).

Gamma rays, X – rays and UV light are all part of the electromagnetic spectrum.Their interractions with biologic material depend on the frequency of wavelength of the radiation. UV lights and EM forms of ionizing radiation have the highest frequencies and energies that can couse removal of the electrons from atoms = ionization and that is the mechanism of biological damage: direct or indirect by formation of free radicals and that way damage of cell wall and genetic material (DNA). The cell and microinvironment have its own reparing mechanisms that is the reason that small damages, even if frequent, can be repaired and removed. Higher exposition and longterm expositions can accumulate and the repairing mechanisms exhausted that result in cell damage: direct cell killing, damage to the DNA genetic material, which causes changes in chromosomal material and it results in induction of mutations of genetic material and cancer induction. This may happen by direct ionization on target molecules such as DNA or indirectly through interactions with water molecules that result in the formation of free radicals. These free radicals then produce the damage to the DNA.We use these characteristics of radiation in diagnostic and especially in therapy: radiation therapy of cancer → cell damage and death of localized tumours (reduction of tumour size), analgesic effect by tumour shrinkage.

Unlike ionizing radiation, non-ionizing radiation cannot ionize absorbing material (human body, for instance). However, it has the ability to increase the temperature of a target material, depending on exposure time and energy concentration.

One generally cannot feel or touch Electromagnetic Field (EMF) in his or her environment, but it's becoming increasingly clear that one's cells are indeed impacted. Diseases, that can be potentially associated also with high levels of electromagnetic radiation exposure, in addition to many other causes, include allergies, Alzheimer's disease, autism, blood pressure abnormalities, brain cancer, breast cancer, depression, electro-hyper-sensitivity (EHS), fertility impairment, headaches, heart disease, hormonal disruption, immune system damage, leukemia, miscarriage, nervous system damage, sleeping disorders, sperm abnormalities, stress disorders.

Most of the EMFs affecting our bodies right now are too weak to worry about. But there may be a few stronger ones. The strongest EMF is probably coming from something quite close to us – computer, cellular phone or household appliance. The



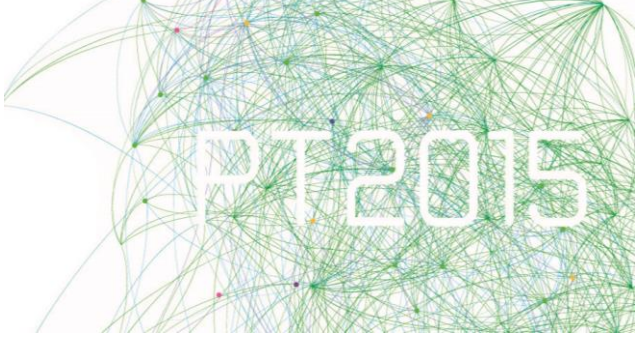

average level of EMF we experience every day is estimated at 50 times greater than our parents experienced at the same age.

Since 1992, numerous studies have been conducted in relation with the influence of effects of non-ionizing radiation on human health and vast majority of them have not demonstrated any adverse effects on human health. There was no consistent indication from *in vitro* researches that radio frequency affect cells at the non-thermal exposure level. There was no firm evidence on significant change in tumour incidence, significant alterations of psychological and behavioural parameters, changes in endocrine and cardiovascular systems as well as in sleep patterns. Studies using functional imaging of the brain and deep thermography have shown that there is no significant heating which is caused directly by EMF radiation either in the bone or in the brain.

Although there are strong disputes in relation with the hazard caused by non-ionizing radiation, it is beyond any doubt that such radiation can interfere with the proper work of other appliances, for instance peacemakers, since it can cause wrong responses toward cardiac signals.

## CONCLUSIONS

Modern way of life is inseparable from the electricity. Vast diversity of electrical apparatus, we are surrounded with, inevitably has as a consequence exposure to another type of radiation, which is not result of natural radiation (Sun, Earth etc.). Is it another type of pollutant or not? Since it is invisible, unlike other type of pollutions which we can see, smell or hear, we do not think too much about this issue. It becomes more and more actual with the rapid growth of number of electrical appliances which radiate EMF. Smart houses heavily rely on the state of the art equipment. Adequate insulation is one side of the story, but the other one include mechanical and electrical appliances as well as an intensive wiring, what raises the anxiety about exposure to the intensive electromagnetic fields and their impacts on human health. Numerous studies conducted during the couple of last decades did not find any convincing evidence of harmful effects on human health. It could be the case that the detrimental effects could become visible after years or even decades of exposure. It is beyond any reasonable doubt that this issue will in days ahead be more and more in the focus of experts and general public. So, until the time when we will have trustful evidences on any possible detrimental effects, we have to be cautious when it is about the exposure to the EMF and avoid as much as possible any excessive exposure to such type of non-ionizing radiation.




## REFERENCES

Barnes, F., Greenebaum, B. 2006. *Biological and Medical Aspects of Electromagnetic Fields*. CRC Press.

Effects of Electromagnetism Exposure on Human Environment. http://www.slideshare.net/Kenko95/effects-of-electromagnetism-exposure-on-human-environment?related=2.

Effects of Non-Ionizing Electromagnetic Radiofrequency Fields on Human Health. http://www.slideshare.net/rsabbatini/effects-of-nonionizing-electromagnetic-radiofrequency-fields-on-human-healt?related=4.

Electromagnetic pollution and its health effects on the organism. http://www.slideshare.net/ivanfigueroaotero/electromagnetic-pollution-and-its-health-effects-on-the-13565533?qid=82bd6c66-f3ad-4137-8b74-ca0544cd8c08&v=qf1&b=&from_search=1.

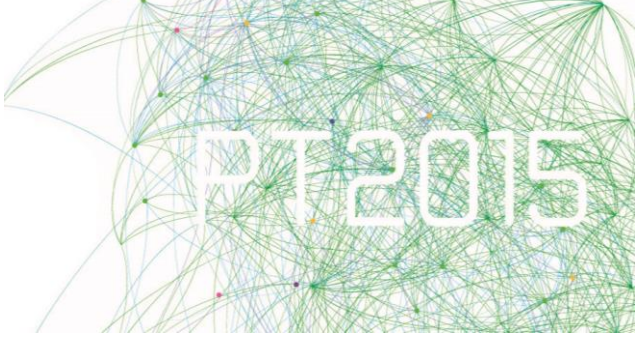
Electromagnetic Radiation & its effect on human health. http://www.slideshare.net/shuvosaharoy/1003008-2?related=3.

Electromagnetic Radiation Health and Safety. www.emwatch.com.

Electromagnetic radiation problems. http://www.slideshare.net/tatjanastankovic1/electromagnetic-radiation-problems?related=1.

Furse, C., Christensen, D., Durney, C. 2009. *Basic introduction to bio-electromagnetics*. CRC Press.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# RECOMMENDATIONS FOR UNIVERSAL DESIGN OF OUTDOOR LEISURE AND RECREATIONAL AREAS

**Lara Slivnik**
PhD, Assistant Professor, University of Ljubljana, Faculty of Architecture, Zoisova 12
1000 Ljubljana, lara.slivnik@fa.uni-lj.si

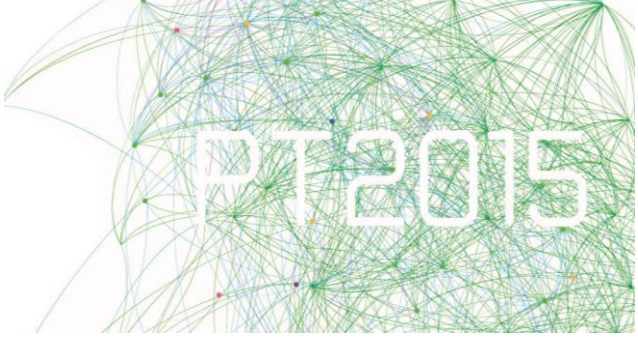
## ABSTRACT

*This paper summarizes the recommendations for the universal design of outdoor leisure and recreational areas. These recommendations are the result of the author's personal everyday experience both as a person with motoric impairment as well as an architect. Universal design applies not only to buildings but includes the exterior of building sites, accesses to buildings, paths of travel, and outdoor leisure and recreational areas as well. Hence, barrier-free outdoor areas are very important for seniors, for people with impairments, for exceptionally short, tall or fat people, for children, and for persons with babies in prams or pushchairs. Besides designing parking areas and toilettes for people with disabilities, pedestrian crossings, curb ramps, pathways, and various kinds of street furniture in particular are important for barrier-free outdoor leisure and recreational areas. This paper provides some general recommendations for universal design of outdoor pedestrian routes and open spaces that include leisure areas. A special attention is paid to various solutions of the principal problems in the design of outdoor recreational areas. There are many variations and degrees of disabilities: motoric impairments, mental impairments, sensorial impairments, and cognitive impairments. Each of these may present different difficulties and should be addressed with different strategies. Hence, the problem of a single universal design for barrier-free outdoor leisure and recreational areas suitable for all kinds of different impairments is still not satisfactory resolved.*

***Keywords**: barrier-free design, outdoor leisure areas, outdoor recreational areas, people with disabilities, universal design*

## INTRODUCTION

As an architect with a motoric impairment and more importantly as a president of a local chapter of a society of patients with cardiovascular disease (CVD) I'm regularly getting in touch with people who have got many variations and degrees of disabilities. Among them there are people with motoric impairments (restricted movement, strength, dexterity and coordination abilities), sensorial impairments (visual, hearing, lack of sense of smell or taste), cognitive impairments (speech, learning or mental functions), and mental impairments (Heiss, Degenhart and Ebe




2010: 35). Furthermore, seniors, exceptionally short, tall or fat people, children, persons with babies in prams or pushchairs, and persons with luggage also need special care. All these categories of impairments (and other movement issues) require additional attention during the design of their living environment.

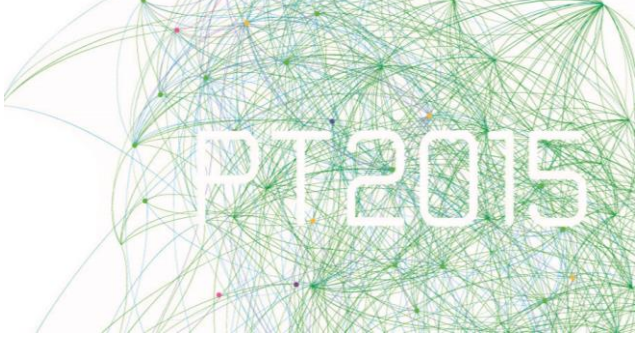
## RELATED WORK AND RECENT RESEARCH

During the last 15 years many authors focused on the problem of accessibility and usage the disabled persons face in (residential) buildings (Goldsmith 2000; Drivers 2003; Inclusive design 2003, Fischer and Meuser 2009). In Slovenia the research of this problem goes back to 1982 (Moškon 1982). Later, Marija Vovk of the Urban planning Institute of the Republic of Slovenia (UIRS) carried out a number of research projects about how to design buildings for seniors and disabled people (Vovk 2010). Her extensive work was continued by her younger colleagues (Vodeb 2006; Sendi and Kobal 2010). Their research focused mainly on public buildings, public transport, and lately on cultural heritage accessibility.

Even though it is important for people with impairments to engage in outdoor activities the design of barrier-free outdoor recreational areas has been more or less neglected in Slovenia so far. One could follow the examples set by Finland as it is one of the pioneers in the field of outdoor leisure and recreational areas for people with disabilities (Heiss, Degenhart and Ebe 2010: 46), or Canada where many urban authorities significantly improved accessibility of open spaces for seniors and people with different kinds of impairment (Vancouver 2012).

## UNIVERSAL DESIGN

Architect Ronald L. Mace described universal design as “the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design” (UD 2008). There are seven principles of the universal design (NDA 2014): equitable use (the design is useful and marketable to people with diverse abilities); flexibility in use (the design accommodates a wide range of individual preferences and abilities); simple and intuitive use (use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level); perceptible information (the design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities); tolerance for error (the design minimizes hazards and the adverse consequences of accidental or unintended actions); low physical effort (the design can be used efficiently and comfortably and with a minimum of fatigue); size and space for approach and use (appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility).




## OUTDOOR LEISURE AREAS AND OUTDOOR RECREATIONAL AREAS

Different organizations of disabled people and some disabled individuals compiled a report on the accessibility of Slovenian open spaces (Sendi and Kobal 2010: 83) stating that a number of architectural elements still represent significant barriers for people with impairments. The list includes, for example, steps and staircases, curbs, sloppy sidewalks, unsuitable parking places and narrow doors.

### Public transport / road crossings / parking spaces

Appropriate public transport stops should be positioned as close to the outdoor areas as possible. These stops should be clearly marked with textured ground surface, colour signs and tactile cues. Furthermore, enough suitable seating places should be planned for all people waiting at these stops.

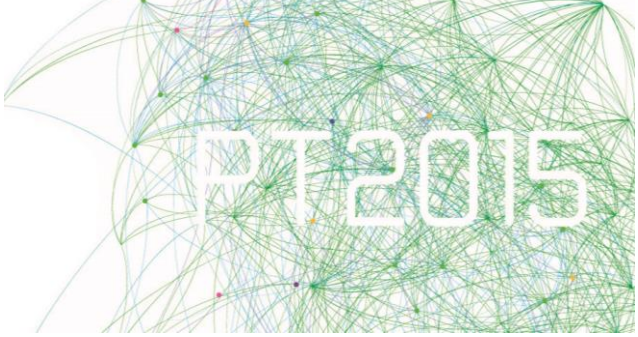
For people with different categories of impairments it is often a problem to move from the pavement level to the road level when crossing a street. The difference between these two levels might be an unsurmountable barrier to disabled people and people with mobility impairments (Vancouver 2012). For wheelchair users and persons with mobility impairments non-slippery and completely flat surfaces without any curbs are required. Visually impaired people need unambiguous information in order to move around safely (Fischer and Meuser 2009). Curb ramps should be installed at all corners. Double design with a maximum grade of 8% (ranges between 5% and 7% are best) is required, but any grade less than 5% may be undetectable to a visually impaired people.

The measures and equipment for parking spaces and toilets are well described in various architectural handbooks (Albreht 2010, Grdiša 2010, Vovk 2010, Za boljše življenje in brez ovir 2010). Parking places clearly marked with the disabled parking sign are required as close to the entrance as possible. They must provide easy access to the curb ramp in order to get from the road to the pavement easily. Wider parking places are also desired for seniors and persons with babies in prams or pushchairs.

### Barrier–free footpaths

All footpaths should be designed free of barriers. Curb ramps should provide access for people who use wheelchairs or other mobility aids. Visually impaired people need special signs and information tables in colour contrast and braille sign to assist way-finding and provide guidance throughout the footpaths.

Recommended width for the footpaths is 180 cm, but should be not less than 150 cm (Vancouver 2012). Footpaths should have a slope of at most 8% to limit the effort of manual wheelchairs users. Minimal cross fall for drainage of 2% is required in footpaths, but should not exceed 6%. For visually impaired people the




height above the footpaths should be at least 240 cm. This also applies for branches of trees along footpaths.

Surface material used for footpaths should be firm. Broom-finished concrete is considered as the best surface for footpaths used by pedestrians and wheelchair users (Vancouver 2012). Concrete pavement plates must be laid in a smooth, uniformed manner. Surface should not have any opening that would permit the passage of a sphere more than 1.3 cm in diameter and should not have any elongated openings oriented approximately perpendicular to the moving direction. Furthermore, it should be stable, firm and slip-resistant, and provided with sloped floors or ramps (Barrier-free design guide 2008).

Walking and standing is difficult and painful for some people with impairments. Thus it is important to provide plenty of resting areas with seats along footpaths for people to rest. Different distances between resting areas are recommended for different disabilities (Vancouver 2012). For impaired people using walking stick the minimum distance for walking without a rest is 30 to 50 m, but for wheelchair users and visually impaired people the distance should be not more than 150 m. It is also worth to consider whether the handrails or cross railings are needed for visually impaired people or for people who are not able to walk a long distance.

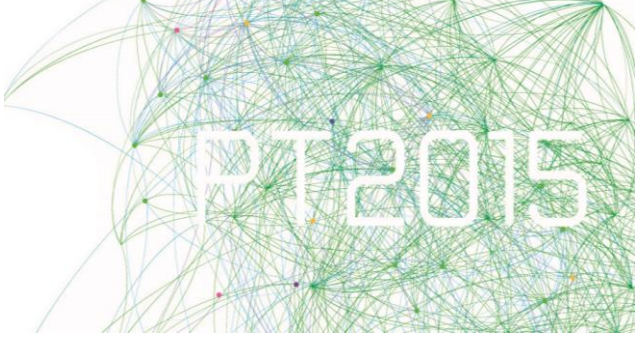
**Street furniture universal design**

The street furniture may be an obstacle to pedestrians that use walking aids and to visually impaired pedestrians.

Seats should be appropriately placed at resting areas. Wheelchairs users and persons without wheelchairs should be able to sit next to one another on park benches to facilitate everyday communication. All the furniture should be planned as universal design. Lighting is essential in footpaths for overall safety.

Some of the resting areas should have tables for having a picnic, playing cards or table chess. Activities as outdoor chess, playing bocce or boules, croquet, or outdoor bowling are also desired and should be planned as barrier-free. Some other activities like mini golf could be played near footpaths and siting areas. A group of people can practice Tai Chi or Qi Gong near seating areas or on green areas. Footpaths can be used for Nordic walking which is becoming more and more popular. Trim trails are especially recommended as they often include exercises for improving balance, strength and coordination. Outdoor areas should provide leisure activities for all people with impairments.

Green areas around footpaths are very important. Trees create a natural barrier and provide a natural environment for animals, keep microclimate colder in the hot weather, provide shelter from rain, and absorb $CO_2$. Birds produce pleasant sound, something that is especially important for visually impaired people. But tree roots




could damage footpaths and pose a problem for the disabled people. To avoid this root barriers should be installed.

## CONCLUSION

Outdoor leisure and recreational areas are not often designed to be easily accessible to everyone. Ensuring that all individuals, especially those with visual and mobility impairments, can access these areas is of vital importance and must be considered during the universal design.

People with mobility impairments, including those using wheelchair, need completely flat and non-slippery surfaces without borders or changes in level. A change in level between different areas is generally manageable for visual impaired people. But visual impaired people need unambiguous and readily distinguishable signs in order to move around safely.

Things to consider when designing outdoor leisure and recreational areas are the natural surroundings, i.e., the terrain, weather, and users with and without impairments. Materials, sustainability, maintenance, new technologies, and budgets should also be considered.

Outdoor leisure and recreational areas should be designed so that they can be used by as many members of the society as possible, irrespective of their age or physical ability.

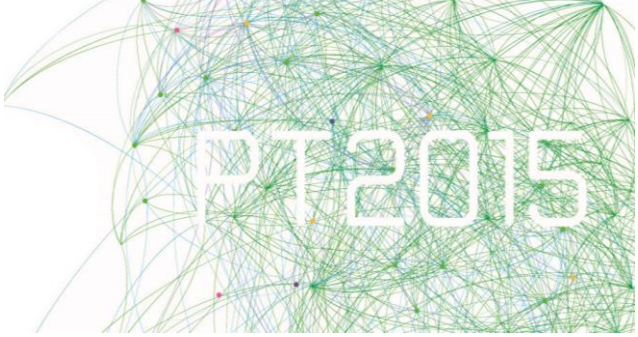
During the last decade, many very appropriate solutions for people with impairments were successfully introduced in the interior design. However, the outdoor design is lagging behind even though people with impairments are longing to spend more quality time outside. And although the universal design of outdoor leisure and recreational areas is highly encouraged in a few countries, it is nowhere systematically enforced. Written by an architect with CVD in the name of all people with impairments living in Slovenia, this paper is aimed at raising the awareness about how to design the outdoor living space that would be appropriate for them as well.

## REFERENCES

Albreht, A, et al. 2010. *Prostor za vse: priročnik za načrtovanje brez ovir v zunanjem javnem prostoru.*. Maribor: Mestna občina.

*Barrier-free design guide: Design for independence and dignity for everyone. Vision, hearing, communication, mobility, cognition.* Alberta: Safety codes council, 2008.

Drivers, J. 2003. *Planning and access for disabled people: a good practice guide*. London : Office of the Deputy Prime Minister.




Fischer, J., and Meuser, P. 2009. *Accessible architecture: age and disability-friendly planning and building in the 21st century*. Berlin: DOM.

Grdiša, R. 2010. *Priročnik za načrtovanje sodobnih oblik bivanja starih ljudi.* Ljubljana: Univerza v Ljubljani, Fakulteta za arhitekturo, Katedra za urbanizem.

Goldsmith, S. 2000. *Universal design: a manual of practical guidance for architects*. Oxford: Butterworth-Heinemann.

Heiss, O, Degenhart, C., Ebe, J. 2010. *Barrier-free design: principles, planning, examples.* Basel: Birkhäuser and München: Edition Detail.

*Inclusive design: design for the whole population*. ed. Clarkson, John et al.. London: Springer, 2003.

Moškon, D. 1982. *Vključevanje funkcionalno oviranih ljudi v življenjsko okolje.* Ljubljana: Fakulteta za arhitekturo, gradbeništvo in geodezijo.

NDA. 2014 "Seven principles of the universal design" National Disability Authority. Last modified 2014. Accessed March 10, 2015. http://universaldesign.ie/What-is-Universal-Design/The-7-Principles/.

Sendi, R., Kobal, B. 2010. *(Ne)dostopna Slovenija?: grajene in komunikacijske ovire, s katerimi se srečujejo invalidi:* Ljubljana: Urbanistični inštitut Republike Slovenije.

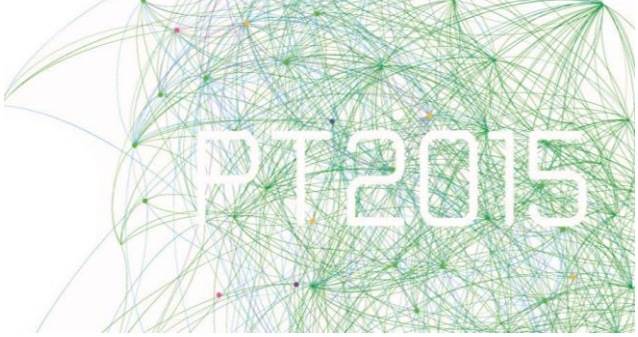
UD. 2008. "Principles of Universal Design" Center for Universal Design. Last modified 2008. Accessed March 10, 2015. http://www.ncsu.edu/ncsu/design/cud/about_ud/about_ud.htm

Vancouver. 2012. "Accessible Street Design" City of Vancouver. Last modified April 21, 2012. Accessed April 2, 2015. http://vancouver.ca/people-programs/building-for-accessibility.aspx

Vodeb, V. 2006. *Dostopnost urbanega okolja: San Francisco – London – Ljubljana.* Ljubljana: Urbanistični inštitut Republike Slovenije.

Vovk, M. 2010: *Načrtovanje in prilagajanje grajenega okolja v korist funkcionalno oviranim ljudem: priročnik.* Ljubljana: Urbanistični inštitut Republike Slovenije.

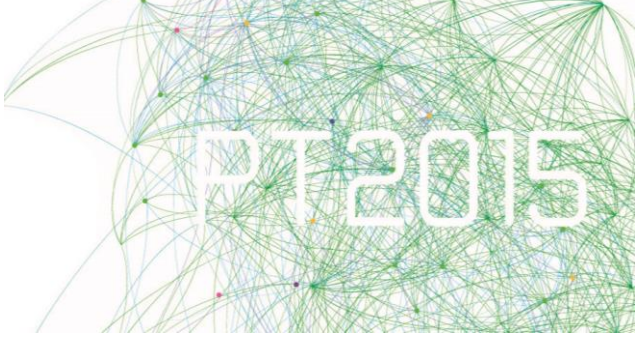
*Za boljše življenje in brez ovir: zbornik predavanj, virov in literature za pomoč pri razumevanju, načrtovanju in prilagajanju grajenega okolja v korist funkcionalno oviranim ljudem. Strokovni posvet.* Krško: Savaprojekt, 2010.




# TOPIC XII:

# Social Networks and Human Basic Needs

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# VISUAL REPRESENTATION AND EXPERIENCE OF PLACE: CASE STUDY ALHAMBRA IN GRANADA

**Isidora Karan**[1]
University of Granada, Slobodana Dubocanina 1., 78 000 Banjaluka, isidora_karan@yahoo.com

**Vedrana Ikalović**
Graduate School of Science and Technology, Keio University, 3-14-1 Hiyoshi, Kohoku-ku, Yokohama-shi, Kanagawa 223-8522, Japan

## ABSTRACT

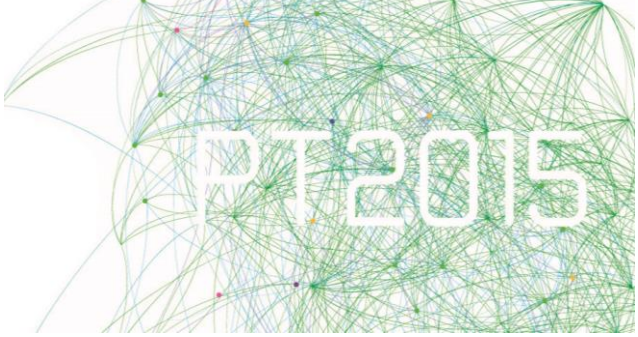
*Individuals recognize place, observed on the scale of an urban environment, not only through the direct experience of its "tangible" and "intangible" elements, but also from the preconceptions related to it. Those preconceptions, beside the cognition about place in general, derive from the different representational forms of the place. With the development of technology, information systems and networks, representational forms of place have become accessible and present more than ever. Hence, its higher level of accessibility doesn't necessarily provoke its higher diversity. With the purpose of creating a recognizable brand of a place, its visual representation or images are even being reduced.*

*This research is questioning in what way and to what extent do visual presentations of a place, as the most suggestive and the dominant ones, influence immediate experience of a place. Case study is the complex of fortress and palace of Alhambra in Granada, one of the most visited and known cultural and historical sites in Spain and Europe. Perception of Alhambra in its urban environment, its visual representations available on internet and various types of promotion material, were analysed and compared with the impressions and experiences of the short-term residents, before and after moving to Granada.*

*The aim of this paper is to show whether the prior visual representations of the place enhance or reduce its real experience created in situ, in this particular case, and to what extent the images about the place and the place differ and overlap.*

***Keywords**: place, experience, visual representations.*

[1] Corresponding author




## INTRODUCTION

Urban environments are being recognized, depicted, and planned as a series of different visual and mental models. These models construct a new reading of the city as a system of representations, which are often scenic and theatrical, made from fixed images that for a moment reflect significant fiction about the city. That is why, Boyer (2001) claims, contemporary city appears to be fragmented and decomposed. According to the authors Maki (2008) and Augé (1995), "fragments" of the city, by insinuating themselves through various forms into empty areas of the consciousness, suggest the deflection from the spectacle to the spectator, from the place to the movement itself, and to the "reader", which altogether reduces the experience of a place. But, while experience of a place is not a fixed scene and it should entail a continuity of urban topography, it also certainly cannot be separated from its representational images. These images, as visual representations of a place, are not just neutral containers of references intended to be transmitted. Through them people "get closer to things", and they are a socially constructed way of people looking at a set of different scenes, or landscapes, or townscapes (Haynen, 1999) with an ability to represent a place in particular ways. They can be disassociated from the original intention "to represent", and reinterpreted by people who "read" the image (Biddulph, 2014).

In this research we are questioning in what way and to what extent do visual presentations of a place, as the most suggestive and the dominant ones, influence immediate experience of a place.

## METHODOLOGY

Research is applied on the case study of Alhambra in the city of Granada, located at the foot of the Sierra Nevada mountains. The city has 237.540 inhabitants, about 65.000 students, and more than 2.5 million tourists. Alhambra, the palace and the fortress complex, is the best known monument in Granada, and one of the most visited cultural sites in Spain and Europe. It was constructed in the mid-11th century, and rediscovered in the 19th century, as a place with specific history and architecture in Mudéjar style.[2]

Three different aspects of visual representations of Alhambra have been analyzed and compered: (1) the one evolved from its urban environment and defined by its morphology, showing Alhambra at urban scale (2) the one that exists in popular culture, available on the internet, in tourist material, etc., (3) and the one created from the direct experience of the persons, showing Alhambra at architectural scale.

[2] The Mudéjar style, a symbiosis of techniques and ways of understanding architecture resulting from Muslim and Christian cultures living side by side, emerged as an architectural style in the 12th century on the Iberian peninsula

Personal "images" of Alhambra were analysed through the questionnaire oriented towards the temporary residents of Granada (a total of 55 respondents). In the first part we questioned the preconceptions and images of the place before the visit, while in the second part we focused on the immediate experience and impressions after "discovering" the place.

## RESULTS AND DISCUSSION

Alhambra is located on the hill next to the city center, and it is surrounded by the most emblematic neighbourhoods in Granada, such as Albayzin, Sacromonte and Realejo. Although Rossi (1999) described Alhambra as a "pathological monument", or monument that is not intimately related to the city, it could be said, that beside being the "touristic gaze" (Urry, 1990), complex and its immediate soundings are still the place where local people often go. Because of its elevated and centric position in the morphology of urban structure, with the Sierra Nevada in the background, Alhambra is visible from the different parts of the city, and it belongs to the view that many inhabitants of the city have from their homes. In that way, it forms important part of the scenery where everyday life is taking place. The most spectacular views of Alhambra are from Sacromonte and Albayzin, the old urban nucleon of Muslim Granada. Alhambra's incorporation in the city fabric, access to the complex, and the views towards it, are elaborated in the Figure 1.

From the analyses of the photographs available on internet (official and promotional/ touristic websites, personal blogs, etc.), three dominant images that represent Alhambra were noticed: (1) the image of Alhambra complex from Mirador de San Nicolas at Albayzin, (2) the image of Patio de los Arrayones, and of (3) Patio de los Leones (Figure 2 and Figure 3). First one shows the complex from "outside", while second and third discover it from "inside".

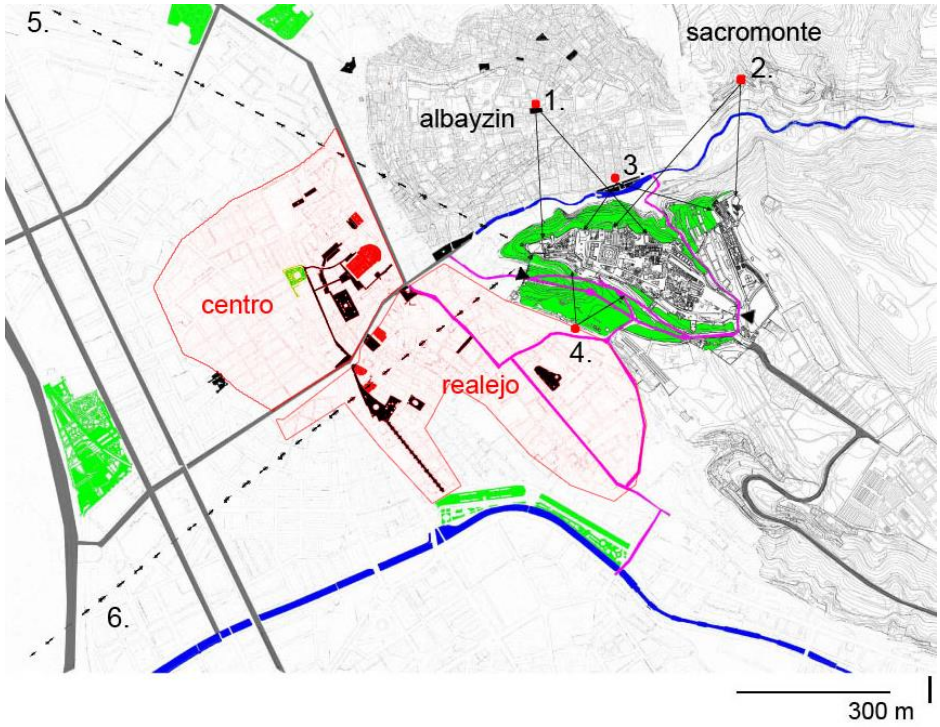




**Figure 1: Alhambra in its urban context (situation, accesses, morphology) and the typical views from different part of the city (view no. 1. is shown on Figure 2.). Source: elaborated by authors.**


**Figure 2: Representational images of Granada. Source: elaborated by authors.**

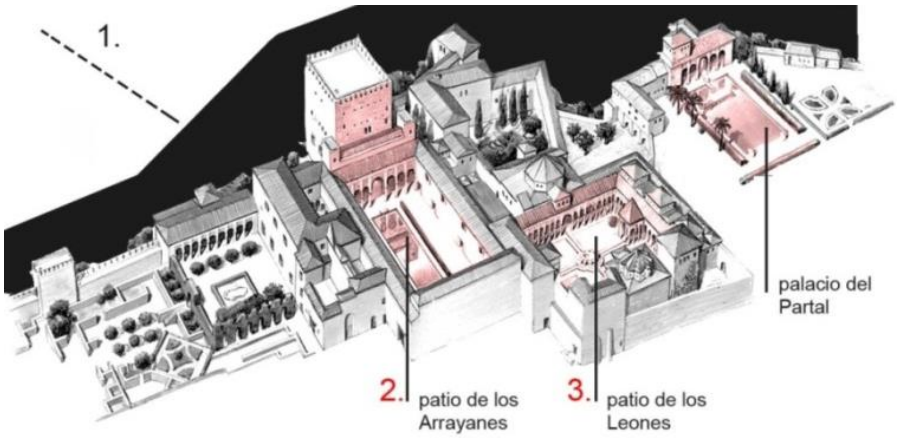


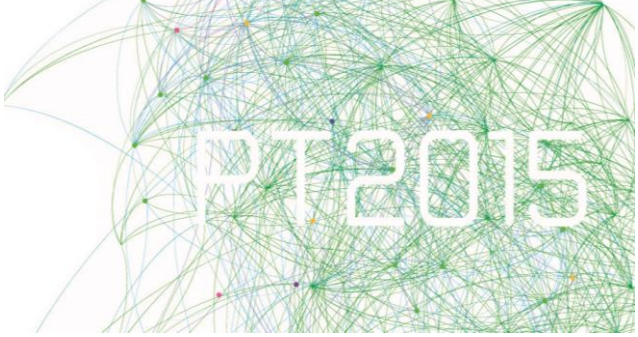

**Figure 3: The most representative imagines of Alhambra (also shown in the Figure 2). (Source: elaborated by authors).**

From the questionnaire, the best-known (popular), and the most familiar (personal) view of Alhambra is the view no 1 in the Figure 2 and Figure 3. 36 out of 55 respondents selected it as the image of Alhambra they were familiar with before the visit. Same image, view no 1, was the closest representation after the visit but with the significant shift of images. After the visit 19 respondents selected the same visual representation, while 36 changed it. The most common shift was from image no 1 to image no 3 (36 %), which suggests a change in the scale (from the "outside" view, to the "inside" view). Compared with the feelings and experiences of the visit, this change shows positive lively feelings (HUMAINE, 2006) of excitement, surprise and pleasure and quiet positive feelings (relieved). Negative feelings (disappointment) and unfulfilled expectations were expressed in only two cases. For the description of their experiences and impressions, respondents used the terms related to the invisible (such as "full of life", "feeling the vibe", "takes us back in time", "I could feel the beauty", etc.).

Before the visit 56 % of respondents related the image of Alhambra to Granada (in 62% the source was internet). Even 93% of them think of Alhambra as the main symbol of Granada and mostly it is the case because of the architectural value of the place (44%), and then historical meaning (22%) or ambience (16%).

## CONCLUSION

The results showed that the position of the fortress, its specific architecture, and its presence in the city landscape, created strong images experienced both directly (while walking in the streets, working it the office, staying at home, etc.) and indirectly (via internet, guide-books, television, etc.). It has been demonstrated that the prior images of Alhambra reduced its visual perception in the city landscape to the limited number of "views". But, it is also confirmed that feelings and impressions related to the shifts of the "views" and the change in scale were




experienced as surprising, pleasant and positive. This implies that although the "character" of the place was suggested by the prior "decomposed" and "fragmented" images, these images did not reduce the following, personal experience of Alhambra. Moreover it could be concluded that to a certain extent, they contributed to the impression of "discovering" Alhambra (respondents stressed the positive experience of the place, surprised by its interior).

On the other hand, the best- known image of Alhambra, is precisely the one that captures it in its urban context, within the morphology of the city and as a place of the everyday life. Therefore, in this particular case, despite the decontextualization, representational forms of Alhambra did not reduce its experience, and experience of the city.

## REFERENCES

Augé, M. 1995. Non-Places. Introduction to an Anthropology of Supermodernity. London, New York: Verso.

Boyer, M. C. 2001 *The City of Collective Memory: Its Historical Imagery and Architectural Entertainment*. Cambridge: MIT Press.

Biddulph, M. 2014. "Drawing and Thinking: Representing Place in the Practice of Place-making". *Journal of Urban Design* 19, no 3: 278-297.

"HUMAINE Emotion Annotation and Representation Language". Emotion-research.net. Retrieved June 30, 2006. Accessed April 11. 2015. http://emotion-research.net/projects/humaine/earl/proposal#Inventories.

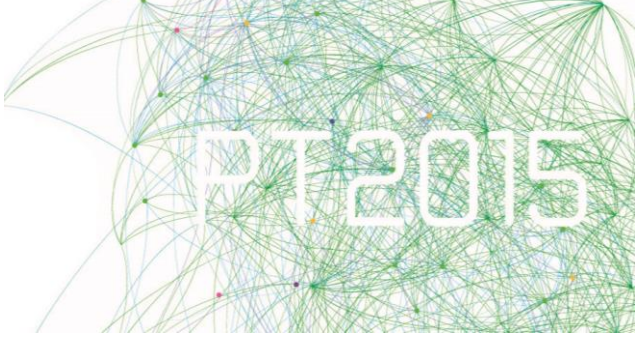
Heynen, H. 1999. "Petrifying memories: architecture and the construction of Identity". *The Journal of Architecture* 4, no 4: 369-390.

Maki, F. 2008. *Nurturing Dreams*. COLLECTED ESSAYS ON ARCHITECTURE AND THE CITY. Cambridge: MIT Press.

Rossi, A. 1999. *La arquitectura de la ciudad*. Barcelona: Gustavo Gili.

Urry, J. 1990. *The Tourist Gaze*. London: Sage.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# BEYOND THE QUANTIFIED SELF: A LOOK AT THE SOCIAL DIMENSION OF HEALTH

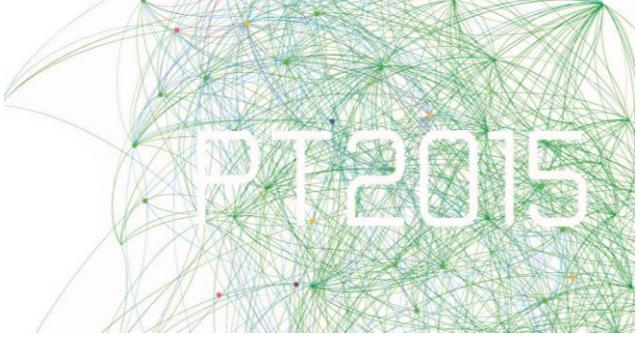
**Svea Heinemann**
Dipl-Ing. M.Sc., Berlin Institute of Technology, Straße des 17. Juni 152, 10623 Berlin, Germany, svea.heinemann@tu-berlin.de

## ABSTRACT

*The rise of the smart phone, apps and networked add-on devices has led to a major trend in the health and technology sector: the data-driven approach used by individuals to accurately read their body's inner workings such as heart rate or blood glucose levels or monitor behavior such as steps walked during the day to analyze, draw conclusions and suggest behavioral changes. Personal devices record information and send it to the data cloud for algorithms to analyze and propose lifestyle changes. Studies on telemedicine suggest that a data-driven approach if supervised by healthcare professionals might be useful to treat chronic conditions such as diabetes or recovering from substance abuse conditions such as alcoholism. However, self-tracking alone seems not to improve people's health in general. People don't loose weight because they accurately count calories with weight loss apps but because they connect with other people online who share similar goals.*

*Recent research into pockets of extreme longevity around the world – classified as Blue Zones – suggests that certain lifestyle characteristics such as not smoking, staying physically active, being socially engaged, cherishing family and friends, as well as eating a predominantly plant-based diet can contribute to a long and healthy life. Healthy lifestyles therefore do not solely rely on individual behavior but are also influenced by social and environmental determinants of health. Can places be designed to contribute to healthy lifestyles? How can social relationships help people to achieve their goals and how can they be fostered by public places? Can community-based technologies help to improve overall health and mitigate some of the drawbacks of contemporary life – a sedentary lifestyle, heightened stress and anxiety levels, consumption of highly processed food, environmental pollution, and challenges to build and sustain long-term positive human relationships across generations and diverse groups?*

***Keywords****: quantified self, computing, mobile apps, online communities, wearables.*




## INTRODUCTION

With the ubiquity of personal mobile devices, the discussion about the role of mobile technologies for personal health and medical care is dominated by a data-driven approach which is based on individual attempts to rigorously track, record and analyze the activities of the own body – a movement known as the Quantified Self (QS). The now almost universal availability of mobile devices and the sheer amount of data that these devices produce suggests great potential to gain new knowledge that can be leveraged to improve individual health and preventing disease.

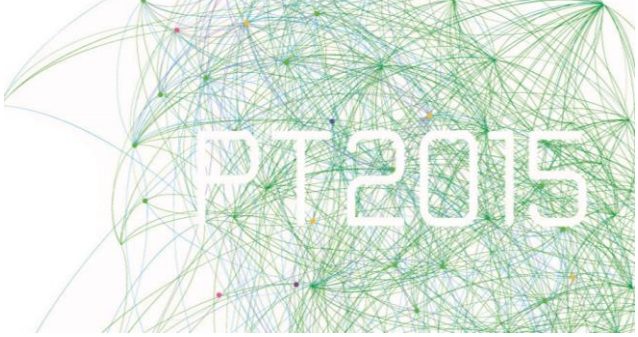
The first part of this article looks at the self-tracking apps market and opportunities and pitfalls of the Quantified Self approach. The second part aims to look beyond the individual level taking into account the role of social and physical determinants of health. This can happen by aggregating individual data sets and combining it with other kinds of data. The third part looks at insights to be gained from self-tracking and how this knowledge can instigate positive behavior changes and inform the design of environments so as to encourage more healthy lifestyles.

## TAKING MEASURES: THE SELF-TRACKING APPS MARKET

Smart phones, smart watches and other wearable devices are increasingly equipped with sensors and apps that allow to track health-related biometrics of the person who wears them. Fitness trackers monitor heart rate, blood glucose levels, number of steps walked and calories used thus producing a wealth of data, that companies producing these devices hope to analyze and use for various purposes.

People not only make conscious choices to use these apps and services, despite the many unresolved issue data privacy issues. In the wake of these technological changes, users of these apps and services hope to understand themselves better through numbers thus becoming data analysts of their own data. The Quantified Self is a movement that claims the data for their own personal use, for insight generated through data journaling. The term Quantified Self was coined Wired Magazine editors Gary Wolf and Kevin Kelly in 2007 and described as "a collaboration of users and tool makers who share an interest in self knowledge through self-tracking." These kinds of collaboration seem to become widely accepted in the industry. Apple just launched ResearchKit, a platform for apps that collect health-related data as an open-source platform.

This development can be seen as a democratization of healthcare data use and preventive medicine. Everybody who has access to a smart phone can become a mobile health app user, generate information for personal use and deploy analytic tools that were previously limited to healthcare professionals. On the other hand, many health claims made by app producers share the reductionist view that all health behavior can be reduced to measurable metrics when in fact some behaviors




such as physical activity are more easy to validate than others such as diet (Barett et al. 2013). However, studies into the effectiveness of fitness tracking apps suggest that the use of these applications alone does not improve health (Laing et al. 2014). To contribute to long-term behavior change, the recorded information needs to have social relevance. Users have better success when they network with other users who share a common goal (Poncela-Casasnovas et al. 2015). Another commonly held belief of protagonists of the Quantified Self movement is that tracking apps can be epistemological tools once large enough quantities of personal data are generated. But how exactly can this new knowledge be generated?

## TOWARDS QUANTIFIED COMMUNITIES: THE SOCIAL AND PHYSICAL DIMENSION OF HEALTH

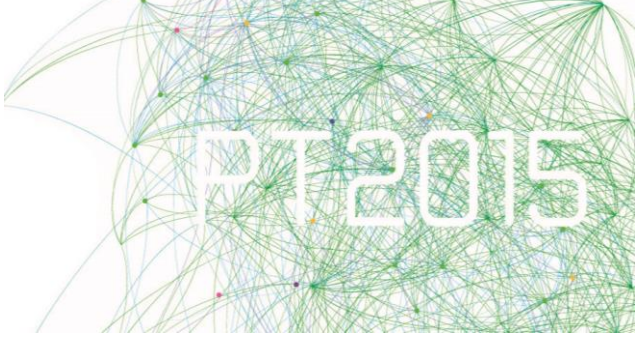
Studies of pockets of extreme longevity around the world – the so-called Blue Zones (Buettner, 2004)– suggests that lifestyle characteristics such as not smoking, staying physically active, keeping socially engaged, cherishing family and friends, and eating a plant-based diet contribute to a long and healthy life. These lifestyles do not rely on individual behavior but address the environment at large. Preventable chronic diseases that are related to behavioral factors such as drug use, diet and physical activity are now the most common cause of premature death in the United States (Mokdad et al. 2000). For digital information from wearable devices to become an effective tool for preventing diseases, the application of these data-capturing technologies needs to be expanded from the individual level (Quantified Self) to the group level (Quantified Communities) to increase knowledge on the "behavioral, social and environmental determinants of health in populations" (Barrett et al. 2013). This can be done on the one hand by aggregating large numbers of individual data sets to achieve sufficient study sample sizes and, on the other hand, linking this data to other sources of information such as geographic location information or environmental characteristics of neighborhoods such as air pollution. Once health risk factors are better understood, groups or individuals can be addressed in a personalized and supportive manner that more effectively helps to reach personal and public health goals and encourage long-term behavior change.

## GEOGRAPHY AND SOCIAL NETWORKS

Technology can help to improve overall health and mitigate the drawbacks of contemporary life – a sedentary lifestyle, heightened stress and anxiety levels, consumption of highly processed food, environmental pollution, and challenges to build and sustain long-term positive human relationships across generations and diverse groups by supporting individual decision making. Apps can suggest healthier food options in the area or remind of exercising after a day in the office. It can also help planning the next running routes and even help planners to design places that encourage healthier lifestyles.


**Figure 1: Where people run in major cities – Boston. (Source: http://flowingdata.com).**

Geography provides a useful tool to unify disparate data sources (Barrett et al. 2013). Nathan Yau used data from fitness app RunKeeper to map running routes in major US cities (Where People Run in Major Cities, Yau 2014). These maps are




interesting because they plot the running trails from all publically available user data onto open-source city maps. The maps thus highlight collective preferences by showing that most people in most cities run along water bodies and in parks and try to avoid roads with heavy traffic, which can be useful information for runners and city planners alike.

Another useful framework are social networks. A second case study for application of data technologies in the health care field is Panoply, a crowdsourced website for improving mental health. It trains a community of volunteers skills that help to reframe and reassess negative thoughts. It is based on established technique called reappraisal and was developed by a psychologist. Only after having been successfully tested, it is now being turned into a consumer app. (Vanhemert, 2015)

## CONCLUSIONS

To tackle individual aspects that influence health, more and better studies of risk prevention are needed. New consumer devices can help to produce a better basis of data for the understanding of issues of public health, an area of research that has traditionally been data-poor by largely relying on questionnaires. The new methods of acquiring, more quickly processing and studying larger amounts of individual data, if practiced to proper ethic standards, will further our understanding of healthy lifestyles and help improve health on an individual and collective level.

## REFERENCES

Barrett, M. A., Humblet, O., Hiatt, R. A., and Adler, N. E. 2013. "Big Data and Disease Prevention: From Quantified Self to Quantified Communities". *Big Data*. September 2013 pp. 168-175.

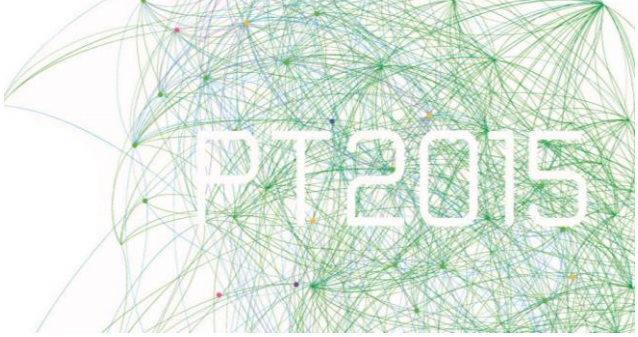
Buettner, D. 2005. "Who's best at living longest?" National Geographic. Accessed on http://www.bluezones.com.

Hardesty, L. 2015. "Crowdsourced tool for depression." Accessed March 30, 2015. http://newsoffice.mit.edu/2015/crowdsourced-depression-tool-0330.

Laing, B. Y., Mangione, C., Tseng, C-H., Leng, M., Vaisberg, E., Mahida, M., Bholat, M., Glazier, E., Morisky, D. E., Bell, D. S. 2014. "Effectiveness of a Smartphone Application for Weight Loss Compared With Usual Care in Overweight Primary Care Patients: A Randomized, Controlled Trial" *Annals of Internal Medicine Supplement*.

Majcher, K. 2015. "What Can Smartphone Apps Do to Improve Health?" Technology Review. Accessed February 15, 2015.

Mokdad A, Marks J, Stroup D, et al. 2000, "Actual causes of death in the United States", 2000. *JAMA* 2004; 291:1238–1245.




Picon, A. 2010. *Digital Culture in Architecture*. Basel: Birkhäuser.

Poncela-Casasnovas, J., Spring, B., McClary, D., Moller, A. C., Mukogo, R., Pellegrini, Christine A., Coons, M. J., Davidson, M., Mukherjee, S., Nunes Amaral, L. A. 2015. "Social embeddedness in an online weight management programme is linked to greater weight loss." *The Royal Society Interface*.

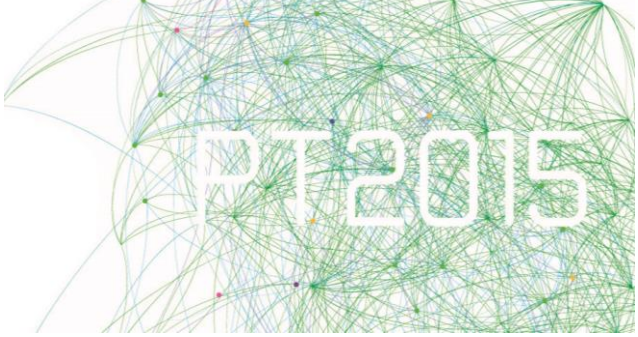
Porter, T. M.. 1995. *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*. Princeton: Princeton University Press.

Simons, D. 2015. "IBM and Apple want to share how you are with others." Accessed April 14, 2015. http://www.bbc.com/news/technology-32301118.

Vanhemert, K. 2015. "A social network designed to combat depression." Accessed April 2, 2015. http://www.wired.com/2015/04/social-network-designed-combat-depression/.

Yau, N. 2014. "Where people run in major cities". Accessed April 2, 2015. http://flowingdata.com/2014/02/05/where-people-run/.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA



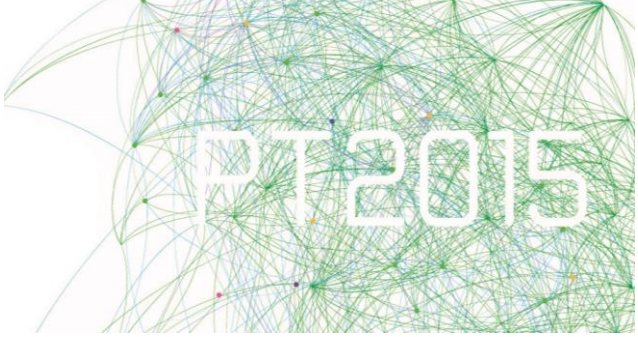

# SKYSCRAPER'S PUBLIC AREAS: THE IMPACT ON SPACE AND SOCIAL LIFE

**Alicja Stefańska**
PhD student, Gdańsk University of Technology, ul. Narutowicza 11/12, 80-233 Gdańsk, Poland, stefanska.alicja@gmail.com

## ABSTRACT

*In recent years, more careful consideration is taken into social issues of designing skyscrapers by humanizing adherent internal and external public areas. Case studies of The Shard (London: 2012), 122 Leadenhall Street (London: 2014), 20 Fenchurch Street (London: 2014), Heron Tower (London: 2011), Tower 25 (Nicosia: 2013), Zoofenster (Berlin: 2012), DNB House (Oslo: 2012), Centrum Biurowe Neptun (Gdansk, 2014), Skytower (Wroclaw: 2012), Plac Unii (Warszawa: 2013) and JM Tower (Warszawa: 2011) investigate the emerging comprehension of social needs by examining how the skyscrapers public areas are designed and used. The result of the analysis establishes the connection of the skyscraper to the network of public spaces in the city and its designed continuation as interior public areas. The study aims to examine their influence on the level of comfort of the skyscraper's occupier, his perceptive scale of the building's structure and the newly created microclimate. Further subjects to consideration were: the impact of shared spaces on establishing social ties of skyscraper's community, the reason why are they used, the accessibility of recreational areas within the building, the supervision of them, its influence on the occupant, the level of safety of the building with pursued policies of openness or easy access to the interior spaces and utopia of recreational areas of the skyscraper. Greater fluidity of spatial perception is observed despite the property boundaries. While the most easily accessible places are still located around the ground floor, there is a tendency to localize significant recreational areas, such as gardens, inner squares and sport zones, not only on the top level of the skyscraper, but also interspersing this function towards the storeys. Public areas act as friendly environment for the conglomerate of occupants. Shared spaces influence personalized perceptive zonal division, which as a repercussion decreases homogeneous nature of the skyscraper.*

***Keywords**: architecture, skyscraper, public area, public space.*




## INTRODUCTION

One of the indirect methods of implementation of Leipzig Charter on Sustainable European Cities from the year 2007 is boosting skyscrapers, what limits urban sprawl and leads to saving land management. Concentration on the social aspects of using such tall buildings may drive questions about the quality of fulfilling needs of their occupants. Existence of public areas relieves some of societal tensions and adds human aspect to the building as a machine. Establishing social ties helps to maintain psychological balance, however, the result of public areas that are safe and inclusive at the same time requires complex solutions. Designing the skyscraper with intention regarding the function of its public areas leads to more coherent results visible also on a larger scale. Easily readable places through analogous experiences of the occupier do not require additional physical barriers which also prevents occurring mental barriers. User friendly building should comply users needs. The aim is to explore the subject to elaborate the best solutions for designing skyscrapers of the future.

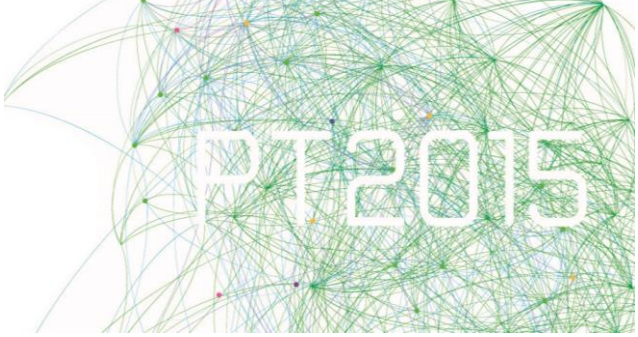
## CHARACTER OF PUBLIC AREAS

If the building is thoughtfully inserted into urban fabric, it may be its integral part and positively affect the surrounding. Public spaces within the city vary significantly. Due to their diversity, it is more difficult to precisely define their character. Some of them change depending on the time and circumstances. The boundaries are not always permanent. City life affects places, as long as they act as human environment (Majer 2009). To examine the environment of skyscraper's interior areas the method of Morrill and Snow was used.

**Table 1: Characteristic of public areas.**

| Object name | Location | Completed | Framing of place | | Regulation of place | |
|---|---|---|---|---|---|---|
| | | | open | closed | permissive | restrictive |
| **The Shard** | London | 2012 | **X** | | **X** | **X** |
| **122 Leadenhall St.** | London | 2014 | **X** | | **X** | |
| **20 Fenchurch St.** | London | 2014 | **X** | | **X** | |
| **Heron Tower** | London | 2011 | **X** | | | **X** |
| **Tower 25** | Nicosia | 2013 | | **X** | **X** | **X** |
| **Zoofenster** | Berlin | 2012 | **X** | | | **X** |
| **DNB House** | Oslo | 2012 | **X** | | **X** | |
| **Centrum Biurowe Neptun** | Gdansk | 2014 | | **X** | | **X** |
| **Skytower** | Wroclaw | 2012 | **X** | | | **X** |
| **Plac Unii** | Warszawa | 2013 | **X** | | | **X** |
| **JM Tower** | Warszawa | 2011 | | **X** | | **X** |

**Framing of place is how a space is both officially and interactionally defined to its uses, access and visibility. Regulation of place are taken-for-granted codes, ground rules that undergird face-to-face communication and interaction orders (Morrill, Snow 2005).**



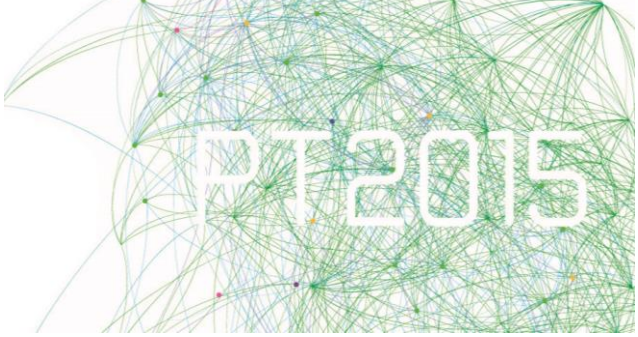

The method takes into account *Framing of place* and *Regulation of place*. As a research group, number of contemporary skyscrapers was set. They are examples of European commercial buildings completed after the year 2010. The enquiry assumes interpretive understanding of person-to-place and person-to-person interactions. It shows that character of similarly functioning objects may differ. Actions such as interpositioning to entrance halls trade and recreational elements change the place's regulation to less restrictive. It allows users to act more alike in external public spaces. The clue is to design shared spaces in a way that allows its user to identify himself in these places and understand theirs principles of operation. Arranging these places, according to intended effects, can prevent from being used by intruders or other people that are not connected to the activity of the skyscraper's proprietors. The more interior public areas, the more roles they can fulfill. As a result, there is always a possibility to link interior public areas with the network of public spaces in the city. It seems that designers are increasingly willing to plan the urban fabric in a consistent way. However, contemporary skyscrapers have much in common with utopias from the past (Koolhaas 1994).

## COMFORT AT PUBLIC AREAS

Although our perfect vision is just an illusion and can be easily manipulated (Tsotsos, Rothenstein 2011), we expect recurrent results when corresponding conditions are fulfilled. The level of comfort depends on several aspects, such as: lighting, air movement, thermal mass motions, moisture, vegetation (Sayigh 1998) and more. The physical properties are significant, however, psychological aspects largely contribute to the success or defeat of the place to a large degree (Shaftoe 2008). There are needs connected with spending time cosily regarding relax, dining and conversation. The way people feel in a common space is a result of its design (Gehl, 2011). Apart from the factors that let us prosper in the comfort zone, we encounter other people. Establishing social ties is one of two main conditions to maintain healthy and in welfare. The second one, according to Shaftoe, is an access to some greenery. Taking into account that knowledge, we can come to a conclusion that public areas may be contributory to the skyscraper itself. Thinking about the building not only as a sum of political and economical decisions, but also as an environment full of people with social needs, changes the priorities. Creating places that let occupants experience less restrictive regulations, leads to more fluid spatial perception.

## SECURITY OF PUBLIC AREAS

Places where strangers meet are potentially exposed to conflicts of interest. If the skyscraper is the research subject, due to accumulation of people and personal goods, the risk of security breach is multiplied (Craighead 2003). The answer to the question of providing inclusive or exclusive public areas depends on the specificity of the building, the investor's notion and the designer's idea. The




approach to people not connected to the activity of the skyscraper's proprietors vary. The building is equipped with number of alarm systems and the access to crucial technical rooms is additionally hindered. There are also difficulties in moving freely caused by limiting and constantly verification of the access to subsequent spaces. Interior public areas are additionally monitored. The main aim of the system is to exclude intruders with the minimum inconvenience to the rightful occupant (Craighhead 2003). The research on the impact of security systems on human behavior proved mixed results (Shaftoe 2008). Due to the scale of the building, the safety should be assured the more with great caution. However, it should not limit the relationship with the building's exterior.

## CONCLUSIONS

As a result of analysing examples from the group of European commercial buildings completed after the year 2010, the increasing importance of interior public areas is being noticed. It affects not only the precisely created image of the investment, but also the daily usage of the skyscraper. According to the particular function of the building, it is more often equipped in recreational areas such as gardens, inner squares and sport zones. Most of these places are located on the ground and top floors, however they occur also on other levels. The more public areas, the more their purpose may vary. The character of shared spaces may be designed. Apart from factors such as access and visibility, the regulation of place plays significant role. The occupant is more willing to use public areas when he understand them on the basis of his experiences. The existence of such places may arrange the building as a whole. Creating landmarks in an organized maze helps maintain the intuitive understanding of place and makes the space user friendly. It provides also increased comfort and opportunity to establish social ties, which is psychologically relevant. The skyscraper is always monitored from the security purposes. The influence of supervising on the average user may vary. That could be examined in further studies regarding social aspects of occupying skyscrapers.

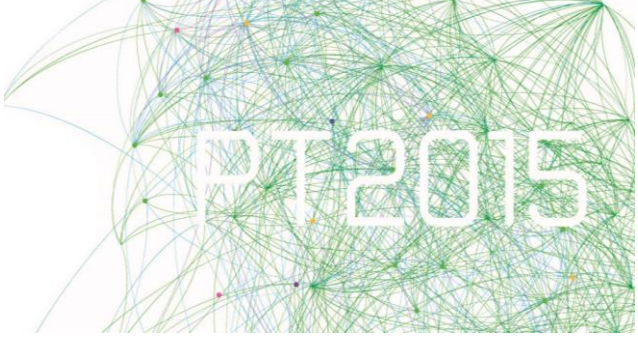
## REFERENCES

Craighead, G. 2003. *High-Rise Security and Fire Life Safety*. Butterworth-Heinemann.

Gehl, J. 2011. *Life between buildings: Using public space*. Washington: Island Press.

Koolhaas, R. 1994. *Delirious New York: A Retroactive Manifesto for Manhattan*. New York: The Monacelli Press.

Majer, A. 2009. “Miasto z perspektywy środowiska” In *Współczesne miasta*, edited by Małgorzata Dymnicka, Andrzej Majer, Łodź: Wydawnictwo Uniwersytetu Łódźkiego.



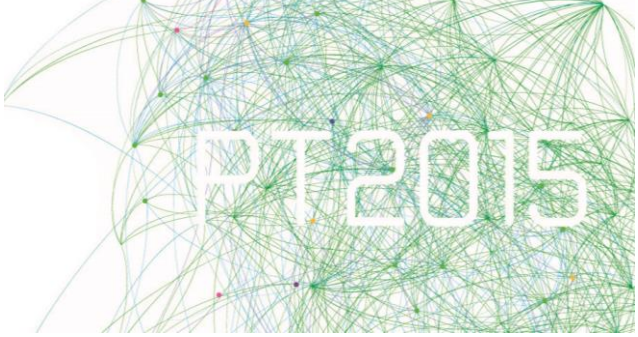

Morrill, C., Snow, D. A.. 2005. "Taking stock: Functions, places and personal relationships" In *Together alone: personal relationships in public places*, edited by Calvin Morrill, David A. Snow, Cindy H. White, 225–46. Berkely: University of California Press.

Sayigh, A. 1988. "Introduction" In *Architecture: Comfort and Energy*, edited by Cettina Gallo, Marco Sala, Ali Sayigh, Amsterdam: Pergamon.

Shaftoe, H. 2008. *Convival urban spaces: creating effective public spaces*. London: Routledge.

Tsotos, J. K., Rothenstein, A. L.. 2011. "The Role of Attention in Shaping Visual Perceptual Processes" In *Perception-Action Cycle*, edited by Vassilis Cutsuridis, Amir Hussain, John G. Taylor, 5–22. New York: Springer.

2ND INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2015
KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES
18 & 19 JUNE 2015 | NOVA GORICA | SLOVENIA




# THE IMPACT OF SOCIAL NETWORKS USE ON REDUCTION OF DEPRESSION IN CANCER PATIENTS

**Leila Habibi**[1]
PhD student, Management department, University of Tehran, Tehran, Iran, Leila.habibi@ut.ac.ir

**Hamid Reza Farpour**
MD, Physical Medicine and Rehabilitation clinic, Amir Al Momenin hospital, Gerash, Fars, Iran, farporh@gmail.com

## ABSTRACT

*As depression can has profound negative effects on the functional status, quality of life, duration of hospitalization and even medical outcome of cancer patients, so evaluation and treatment of this disorder is important.*

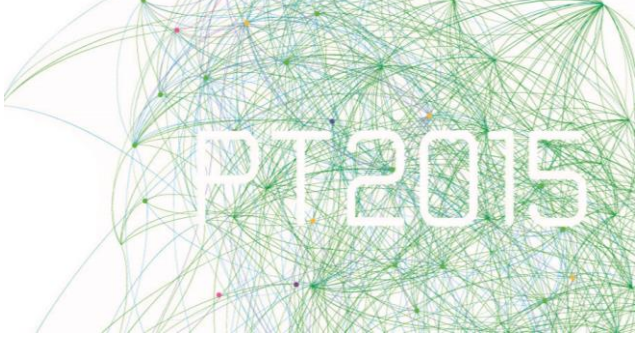
*Previous studies show that communication and social activities have a direct effect on the reduction of depression symptoms of the heart disease patients. This was a descriptive study aimed at assessing the prevalence of depression in cancer patients who used social network and those who did not. A total number of 316 patients participated in this study.*

*The Beck Depression Inventory (BDI) was applied to measure depression. Data were analysed using chi-square test running SPSS soft-ware.*

*The Result shows that using social network led to reduction in psychological symptoms in dimensions of Beck Depression Inventory (BDI) variables among patients.*

*Keywords: social network, cancer, anxiety, depression.*

[1] Corresponding author




## INTRODUCTION

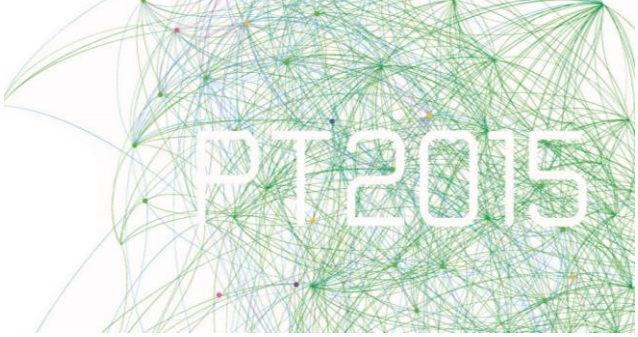
Depression is one of the most common psychiatric diseases. It is characterized by lack of pleasure, staying away from family and friends, lack of motivation and inability to tolerate failure, vegetative symptoms including decreased sex drive, appetite disturbance and weight loss, decreased energy and early fatigue, sleep disturbance, menstrual disorder, constipation, dry mouth, and headache. Different types of cancer are among the chronic diseases that increase the risk of depression in people. Various studies have found that different types of cancer are important risk factors for depression. Metastasis-induced bone pain, reduced social activities, and disability are among the main causes of depression. Depression is a risk factor for reduced survival among cancer patients, and it is an important factor in the refusal of treatment among such patients (Rajabizadeh & co, 2005).

Cancer is a term used to describe a bodily process during which cells in the body grow in an uncontrolled and unregulated manner to the extent that a mass of cells develop to form a tumour. Cancers are harmful to the body because they tend to metastasize throughout the body. Cancers from different cell types, grow at different rates, cause different symptoms in different individuals, and respond differently to medical treatments. Treatment selection is dependent on type and stage of tumour growth, and it is not uncommon for individuals to require more than one type of treatment. Individuals are prone to experiencing aversive side effects, including fatigue, nausea, concentration deficits, hair loss, and irritability.

The prevalence rates for anxiety and affective disorders in cancer patients depends on many factors including sites of cancer, cancer status and prognosis, associated medical complications (including pain, limited physical functioning, and hospitalization status), social support, and marked variability in assessment methods and diagnostic instruments (Kangas & co, 2002).

As mention, Depression is most prevalent symptoms afflicting cancer patients. The idea that there is a causal link between psychological factors such as depression and the subsequent development of cancer has had a relatively long history. The belief that psychological factors such as excess stress or depression can lead to a person developing cancer appears to be relatively common in the general community (McGee & co, 1994). Also Cancer patients, may experience severe symptom distress, which may influence social and physical function, and lead to emotional responses of anger, frustration or depression (Kurtz & co, 1995)

Before the widespread acceptance of the Internet as a source for health information, people received health information from information sources such as doctors, family members, and the mass media. Since 2000, people have become dependent on Internet search engines because these engines have enabled access to web pages all over the world. Using search engines is still a popular method to find health information. In addition to static websites with merely informative function




through which interactive communication is not impossible, interactive websites, which are somehow called social media, have attracted attention as a source for health information. The emergence and development of social media have turned the Internet from a static source of health information into a more dynamic source of health communication.

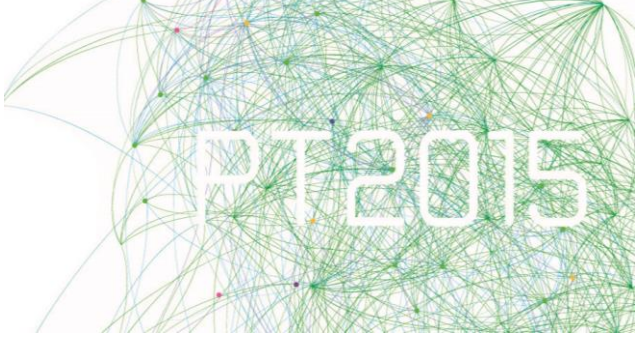
The term social media is a broad one that encompasses a vast array of online resources. The main categories are: social networking, blogging, microblogging, social news, social bookmarking, and media sharing. Each of these categories has unique features that appeal to different people in the social media sphere (Perdue, 2010).

More content production, sharing, and publishing of health messages and information will be possible by users through social network. These media also make it possible to access the part of society that is no longer accessible through traditional methods (such as young people in society). Moreover, social network can provide the general public with social and emotional support to accept or change health behaviour. Social network will also make it possible to discuss sensitive medical and health issues that are impossible to publically talk about due to cultural limitations .Given their capabilities, social network can help develop effective health communications. Since they allow health messages and information to be transmitted immediately, social network also have unique potential for hazard communication. Health data and information accumulated from social network can aid health and health communication policy-making.

Today, those who, for whatever reason such as elderliness or disease, have to stay away from society will be forgotten as if they have never existed. Cancer patients are among this group of people who are isolated and deprived of their natural right to live in society. Fear of premature death and the idea that their life is different from others are among the causes of isolation and depression in such patients.

As previously mentioned, social networks make it possible to share users' health experiences. Therefore, the balance in health information is likely to increase. Sharing experiences in open-source social networks can lead to giving and receiving social support and better patient understanding by other users (Ahadzadeh, 2014).

Diaz & co. in 2002 by studying 512 patients who returned the survey, 53.5% (274) stated that they used the Internet for medical information. Respondents used the Internet for information on a broad range of medical topics. Sixty percent felt that the information on the Internet was the "same as" or "better than" information from their doctors (Diaz & co, 2002) The author estimates that in the developed world, about 39% of persons with cancer are using the Internet, and approximately 2.3 million persons living with cancer worldwide are online. In addition, 15% to 20% of persons with cancer use the Internet "indirectly" through family and friends




(Eysenbach & co, 2003) Researchers believe that those who have pessimistic interpretations of life are at risk of health problems because their immune system does not function properly (Gholami & co, 2009).

As mentioned above, this study aims to investigate the use of social media to help cancer patients overcome their stress and depression caused by incurable diseases, which cause deep emotional and mental problems in individuals and families. It is expected that the results of this study would improve such patients' individual and social performance and their quality of life, and finally accelerate treatment.

## METHOD

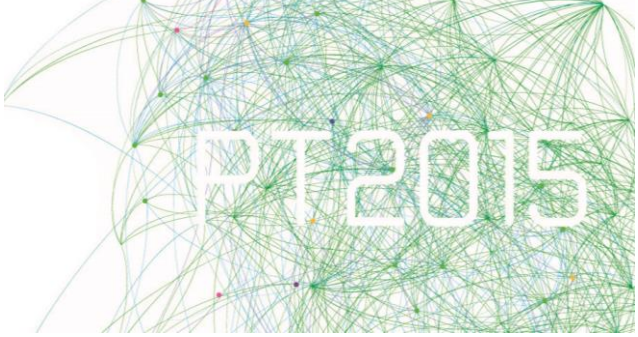
The participants of this descriptive study included 316 cancer patients who were selected using convenience sampling. Finally, using social networks and treatment centres, those who agreed to have an interview and had no problem to participate were included in the study. The instrument used for measuring depression was the Beck Depression Inventory (BDI). This inventory has been designed and standardized by Aeron Beck in 1960 at the University of Pennsylvania. The inventory includes 21 multiple choice questions (self-report), and each option describes four situations. Each question is scored from 0 to 3, and total score ranges from 0 to 63. Beck adjusted this inventory according to the following five factors composed of the signs and symptoms of depression:

1) Pessimism, sense of failure, self-hate, suicidal thoughts, indecisiveness, and slowness,
2) Feeling guilty and expecting punishment and blame,
3) Crying, self-image change, unhappiness, and sadness,
4) Weight loss, physical complaints, and fatigue,
5) Irritability, insomnia, and anorexia.

Many studies have been conducted on the validity and reliability of this test, all indicative of the high reliability and validity of the test and its non-acculturation around the world so that it is applicable to different social classes. In this study, those whose cut-off score was equal to or above 16 were considered depressed. Patients' individual information, including sex, age, disease duration, education level, and use of social networks were recorded and then analysed using SPSS in terms of the prevalence of depression. Chi-square test was used to compare the groups and to test the hypothesis.

## RESULT

In this study, 316 cancer patients aged 20-53 were investigated, among whom 184 were female and 132 were male. The mean patients' age was 28.8±9.17 years. Of the participants, about 181 were social network users, among whom 65 were




female and 116 were male. Table 1 shows the participants' demographic characteristics.

**Table 14: participants' demographic characteristics.**

| Variable | N | percent |
|---|---|---|
| **Gender** | | |
| **Male** | 132 | 41.77 |
| **female** | 184 | 58.22 |
| **Age** | | |
| **Under 30 years** | 191 | 60.44 |
| **Above 30 years** | 125 | 39.55 |
| **Education** | | |
| **Under diploma** | 93 | 29.43 |
| **Above diploma** | 223 | 70.56 |
| **Duration of illness** | | |
| **Under 2 years** | 134 | 42.40 |
| **Above 2 years** | 182 | 57.59 |
| **Use of social network** | 181 | 57.27 |
| **Male** | 65 | 35.91 |
| **Female** | 116 | 64.08 |

The prevalence of depression was 61% (N=192) that 86 (44.79%) and 106 (55.20 %) of the males and females were depressed, respectively. The difference observed between the two sexes was statistically significant ($p<0.036$). In terms of using social networks, the patients were divided into two groups, namely users of social networks and non-users of social networks. A significant difference was observed between depression and cancer patients in terms of using and not using of social networks ($p<0.001$) so that 33.85% and 66.14% of the users and non-users of social networks were depressed, respectively. No significant relationship was observed between the subjects' age and depression. The participants were divided into two groups (2 years, 2 years and over) in terms of disease duration, and a significant difference was observed between the two groups in terms of depression and disease duration ($p<0.003$). In terms of educational level, the participants were also divided into two groups of under diploma and above diploma, and a significant difference was observed between the two groups in terms of depression and educational level ($p<0.004$). Table 2 shows the frequency of depressive symptoms in patients with cancer.

**Table 2: The frequency of depressive symptoms in 316 patients with cancer.**

| Variable | Depression (n=192) | Non-depressed (n=124) | result |
|---|---|---|---|
| **Gender** | | | |
| **Male** | 86(44.79%) | 46(37.09%) | P < 0.036 |
| **Female** | 106(55.20%) | 78(62.90%) | $X^2$ = 4.38 |
| **Age** | | | |
| **Under 30 years** | 107(55.72%) | 84(67.74%) | NS* |
| **Above 30 years** | 85(44.27%) | 40(32.25%) | NS |
| **Education** | | | |
| **Under diploma** | 72(37.50%) | 21(16.93%) | P < 0.004 |
| **Above diploma** | 120(62.50%) | 103(83.06%) | $X^2$ = 8.19 |
| **disease duration** | | | |
| **Under 2 years** | 71(36.97%) | 63(50.80%) | P < 0.003 |
| **Above 2 years** | 121(63.02%) | 61(49.19%) | $X^2$ = 8.08 |
| **Use of social network** | | | |
| **user** | 65(33.85%) | 116(93.79%) | P < 0.001 |
| **non-user** | 127(66.14%) | 9(7.25%) | $X^2$ = 10.96 |

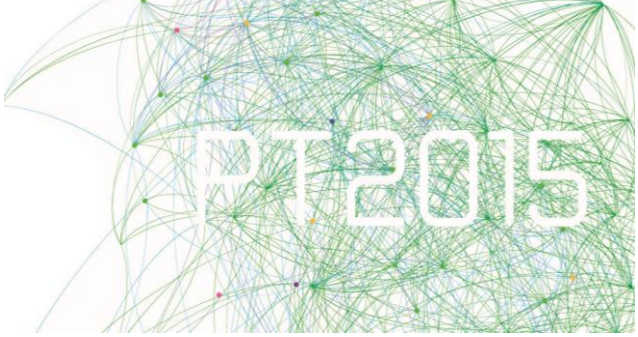
The results show that the users of social network are less depression symptom, moreover, the women with cancer are at greater risk for depression, which might be due to the limited social relationships in female patients and women's special condition in terms of stressful situations in the family. Therefore, using social networks can be an opportunity for women to improve their psychosocial condition. In our study, the educated participants were less depressed than the non-educated ones. Therefore, given the high prevalence of depression among cancer patients, access to social networks and provision of facilities to increase interaction in such patients through cyberspace can be important and useful in the prevention and treatment of their depression. Moreover, special attention is recommended to be paid to patients' sex and educational level in counselling and psychological skill training programs.

## REFERENCES

Ahadzadeh, A. 2014. "Health communication and social media". *Education and Research Center of hamshari Institute*. Accessed March 16, 2014. http://www.hamshahritraining.ir/news-3709.aspx.

Diaz, J.A., Griffith, R.A., James, J., Reinert, S.E., Friedmann, P.D. and Moulton, A.W. 2002. "Patients' use of the internet for medical information", *Journal of General Internal Medicine*, Vol. 17 No. 3, pp. 180-5.

Eysenbach, G. (2003), "The impact of the internet on cancer outcomes", *Cancer Journal for Clinicians*, Vol. 53, pp. 356-71.




Gholami, M, Pasha, Gh. and Sudan, M. 2009. "The effect of Group therapeutic on life expectancy and general health of female patients with thalassemia". *Science and Research Psychology, Islamic Azad University, Branch of Khorasan*, No. 42, pp. 45-25.

Kangas M, Henry JL, Bryant RA.2002. "Posttraumatic stress disorder following cancer. A conceptual and empirical review". *Clin Psychol Rev*, no. 22(4): 499-524.

Kurtz Margot, EKurtz, J.C., Given,Charles W& Given Barbara. 1994. "Relationship of caregiver reactions and depression to cancer patients' symptoms, functional states and depression—a longitudinal view". *Social Science & Medicine*, vol. 40, no. 6, pp. 837-846.

McGee,Rob, Williams, Sheila & Elwood, Mark .1994. "Depression and the development of cancer: A meta-analysis". *Hereditas (Beijing)*, vol. 38, no. 1, pp. 187-192.

Perdue David Joshua. 201). "Social Media Marketing: Gaining a Competitive Advantage by Reaching the Masses", *Senior Thesis, Liberty University.*

Rajabizadeh Gh. Mansoori S.M., Shakibi M.R and Ramazani M.R. 2005 ."Determination of Factors Related to Depression in Cancer Patients of the Oncology Ward in Kerman", *Journal of Kerman University of Medical Sciences*, no.12 (2), pp. 142-147.

## PROGRAMME OF THE CONFERENCE

## THURSDAY, 18 JUNE 2015_PINTA CONFERENCE HALL

**8:30–9:00 a.m.** Registration

**9:00–10:00 a.m.** Welcome speeches and Introduction
**Matej ARČON,** Mayor, *City municipality of Nova Gorica, Slovenia*
**Prof. Dr Ivan SVETLIK**, Rector, *University of Ljubljana, Ljubljana, Slovenia*
**Prof. MSc Peter GABRIJELČIČ,** Dean, *University of Ljubljana, Faculty of Architecture, Ljubljana, Slovenia*
**Prof. Dr Eva VANIŠTA LAZAREVIĆ,** Conference Director, *University of Belgrade, Faculty of Architecture, Belgrade, Serbia*

**10:00–12:00 a.m.** **Session 1_ ARCHITECTURE AND MEDICINE FOR TOMORROW**
*Session chair: **MSc Tadej GLAŽAR***
*keynote speaker_***Roger RIEWE:** "DESIGNING THE FUTURE" – MEDICAL R & D LABS IN AUSTRIA AND GERMANY
*keynote speaker_***Dr Ilka ČERPES:** MEDICINE AND ARCHITECTURE IN THE CONTEMPORARY SOCIETY
**Stephan MAEDER:** NO TECH - DON'T EXPECT FROM TECHNOLOGY WHAT YOU CAN HAVE FOR FREE
**Dr Jadranka BUTUROVIĆ-PONIKVAR:** HUMANIZATION OF DIALYSIS: GREEN AND COZY
**Dr Matjaž KLEMENC:** FRACTAL ARCHITECTURE OF THE CORONARY ARTERY TREE

**12:00 a.m.–1:30 p.m.** Lunch break

**1:30 –3:30 p.m.** **Session 2_HEALTHY PLACES – FROM VISIONS TO PRACTICES**
*Session chair: **Dr Alenka FIKFAK, Prim Nataša FIKFAK***
*keynote speaker_***Dr Cor WAGENAAR:** THE URBANIZATION OF PUBLIC HEALTH
*keynote speaker_***Dr Ružica BOŽOVIĆ STAMENOVIĆ:** HEALTHY CITY - TECHNOLOGY AND URBAN RESILIENCE
**MSc Peter GABRIJELČIČ:** A HEALTHY AND WELL DESIGNED ENVIRONMENT AS PART OF HUMAN RIGHTS AND ECONOMIC VALUE
**MSc Albert KOROŠEC:** CO-CREATING HEALTHY PUBLIC PLACES WITH RESIDENTS
**Dr Marko VUDRAG:** CONTEMPORARY CHALLENGES OF PUBLIC HEALTH AND AN ACTIVE APPROACH TO OVERCOME THEM

**3:30–4:00 p.m.** Coffee break

**4:00–4:45 p.m.** **Session 3_THE WAY TO A HEALTHY FUTURE**
*Session chair: **Dr Eva VANIŠTA LAZAREVIĆ***
*keynote speaker_***Dr Pedro RESSANO GARCIA:** INNOVATING AT LISBON'S WATERFRONT PLACE, THE "TAGUS PLATFORM" PROJECT
**Robert GOLOB, Prim Nataša FIKFAK**: REFLECTIONS ON THE PROGRAMME OF EZTS

**4:45–6:00 p.m.** **ISOCARP event**
**Dr Eva VANIŠTA LAZAREVIĆ, Dr Piotr LORENS, Manfred SCHRENK:** SHORT DISCUSSION ON KEY ISSUES

**8:00 p.m.** **Gala Dinner**

## PROGRAMME OF THE CONFERENCE

## FRIDAY, 19 JUNE 2015_PINTA 1, PINTA 2 AND PINTA 3 CONFERENCE ROOMS

**8:30–9:00 a.m.** Registration

**9:00–10:30 a.m.** PARALLEL **Sessions 5, 6 and 7**

5. Architecture and Health I.
   _*Session chair*: _ **Dr Saja KOSANOVIĆ**_*Special guest lecturer:* **Dunja SAVNIK WINKLER**
6. Physical Planning and Quality of Place I.
   _*Session chair:* _**Dimitrij KLANČIČ**_*Special guest lecturer:* **Prim Dr Vlasta VODOPIVEC**
7. Health Promotion, Protection and Prevention; Health Intensive Care; Active Living and Health
   _*Session chair*:_**Dr Milena VUKMIROVIĆ**_*Special guest lecturer:* **Simon BITEŽNIK**
   _*Special presentation_book: Planning Capital Cities: Belgrade, Bucharest, Sofia*

**10:30–11:00 a.m.** Coffee break

**11:00–12:30 p.m.** PARALLEL **Sessions 8, 9 and 10**

8. Architecture and Health II.
   _*Session chair:* _**Dr Alenka FIKFAK**_*Special guest lecturer:* **Prim Dr Krunoslav MARGIČ**
9. Physical Planning and Quality of Place II.
   _*Session chair:* _**Sanja PAUNOVIĆ ŽARIĆ and MSc Irena RAJKOVIĆ**_*Special guest lecturer:* **Prim Franci KOGLOT**
10. Inclusive and Accessible Environment; Lifetime Communities and Participation
    _*Session chair:* _ **Ilaria GAROFOLO**_*Special guest lecturer:* **Dr Alberto ARENGHI**

**12:30 a.m.–2:00 p.m.** Lunch break

**2:00–3:30 p.m.** PARALLEL **Sessions 11, 12 and 13**

11. Adaptive Reuse and Urban Renewal
    _*Session chair:* _**Dr Anja JUTRAŽ and Sanja ŠTIMAC**_*Special guest lecturer:* **Mojca HUMAR**
12. Cultural Patterns and Sensitivity; Social Networks and Human Basic Needs
    _*Session chair:* _**Miha KONJAR**_*Special guest lecturer:* **Dr Matevž GORENŠEK**
13. Environmentally Friendly Transport; Building Technologies
    _*Session chair:*_**Janez P. GROM**_*Special guest lecturer:* **Dr Igor KRANJEC**

**3:30–4:00 p.m.** Coffee break

**4:00–5:30 p.m.** FINAL DISCUSSION and CLOSURE OF THE CONERFENCE

**Dr Milena VUKMIROVIĆ:** NEW NETWORKING IN EU PROGRAMMES

## PROGRAMME OF THE CONFERENCE

## FRIDAY, 19 JUNE 2015_FRANCE BEVK PUBLIC LIBRARY NOVA GORICA

### Regional and guest deans' workshop

**10:00–10:30 a.m.** **Welcome speeches and Introduction**
**Matej ARČON**, *Mayor of City municipality of Nova Gorica*
**MSc Peter GABRIJELČIČ,** *Dean, University of Ljubljana, Faculty of Architecture, Ljubljana, Slovenia*
**Irena ŠKVARČ**, *Director, France Bevk Public Library*

**10.30-11.00 a.m.** **Tour of France Bevk Public Library**

**11:00 a.m.–1:30 p.m.** **Regional and guest deans workshop**
*Session chair:* ***MSc Tadej GLAŽAR and Prim. Nataša FIKFAK***
Visions for the future. Presentations and Discusions.

**1:30 –3:00 p.m.** Lunch

**4:30 p.m.** **Visiting locations**
Regional excursion - Goriška Brda for a guests of Regional deans workshop.

FRANCE BEVK PUBLIC LIBRARY
Trg Edvarda Kardelja 4
5000 Nova Gorica, Slovenia

http://www.ng.sik.si/en/

## PROGRAMME OF THE CONFERENCE

## SATURDAY, 20 JUNE 2015_EXTRAS - REGIONAL EXCURSION

### Regional excursion

**10:00 a.m.–5:00 p.m.** **URBAN WALK TOUR Nova Gorica_Gorizia**
**Janez P. GROM,** *University of Ljubljana, Faculty of Architecture*

***Sqaure Europa, Museum of the border, Gorizia castle, monastery Kostanjevica, Trgovski dom - Fabiani exhibition***
Lecture about M. Fabiani: **Nataša KOLENC**
Lecture and guide: **Igor DEVETAK**
**Aljoša SOSOL,** EGTC

*The Urban walking tour will be 20 eur/person (including lunch).*

---

*Other options, individual excursion in the near surrounding (connected with a free public transport)*
*The organiser will offer a guide if the group will be more then 10 persons. Registration on 1st day of the conference.*
*The tour with a guide will be 5 eur/person (without lunch).*

**11:00 a.m.–5:00 p.m.** **Castle KROMBERK Nova Gorica_Vrtojba**
***Castle Kromberk, Ajševica, Šempeter, Nova Gorica center: libraby, cultural home, municipality building, Eda center, monument of Edvard Rusjan, new architecture,...***

**11:00 a.m.–5:00 p.m.** **ADRENALIN TOUR Solkan**
***Adrenalin park - Soča Fun park*** *(entrance fee*), Solkan, bridge Solkan*
**www.socafunpark.si/en/price-list*

## 5_8_SESSIONS_TOPIC_ARCHITECTURE AND HEALTH

*Session chair 5:* ***Dr Saja KOSANOVIĆ***
*Special guest lecture:* ***Dunja SAVNIK WINKLER: DISABILITY OF HEARING***
**9:00–10:30 a.m.**

*Session chair 8:* ***Dr Alenka FIKFAK***
*Special guest lecture:* ***Prim Dr Krunoslav MARGIČ: ARCHITECTURE OF THE HAND***
**11:00–12:30 p.m.**

**Session 5**

**Lucia MARTINCIGH, Francesco BIANCHI, Dr Cecilia DE MARINIS, Marina DI GUIDA, Giovanni PERRUCCI:** UNIVERSITY AND DWELLERS' ASSOCIATIONS TOGETHER FOR CREATING SUSTAINABLE AND HEALTHY URBAN ENVIRONMENTS

**Dr Eva VANIŠTA LAZAREVIĆ, Jelena MARIĆ, Dr Milena VUKMIROVIĆ, Dr Goran RADOVIĆ:** HEALTH CARE DESIGN REVISITED – NEW APPROACHES TO USER – CENTRIC, EFFICIENT AN EFFECTIVE DESIGN: EXPERIENCES OF MILITA RY MEDICAL ACAD EMY (MMA) IN BELGRADE – 3 DECAD ES AFTER ITS FAMOUS DESIGN

**Dr Saja KOSANOVIĆ, Dr Alenka FIKFAK, Dr Mirko GRBIĆ:** BUILDING MATERIALS AND HUMAN HEALTH: DESIGNERS' PERSPECTIVE

**Dr Saja KOSANOVIĆ, Dr Eva VANIŠTA LAZAREVIĆ, Dr Slađan TIMOTIJEVIĆ:** TOWARDS A NEW UNDERSTANDING OF HEALTHY PLACE

**Session 8**

**Dr Dženana BIJEDIĆ, Dr Rada ČAHTAREVIĆ, Senaida HALILOVIĆ:** HEALTHY ARCHITECTURE AS A RESULT OF THE BALANCED INTEGRATION OF ARTIFICIAL AND NATURAL RULES

**Dr Julija ALEKSIĆ:** HEALTHY ARCHITECTURE FOR CHILDREN

**MSc Magnus NICK, MSc Verena STECHER:** MARGINALISATION OF LOCAL COMMUNITIES ALONG THE STRAIT OF SINGAPORE

**Marko MATEJIĆ**: THE SCALE OF ACUTE CARE HOSPITALS IN SERBIA – THE NEED FOR RETHINKING

**Dr Goran RADOVIĆ:** ARCHITECTURE AND HEALTHY LIVING SPACE

**ISTVÁN KISTELEGDI, BÁLINT BARANYAI, BÁLINT BACHMANN:** POTENTIAL ANALYSIS OF DYNAMIC, THERMAL BUILDING SIMULATIONS AND DEVELOPMENT OF MEASUREMENT AIDED SIMULATION TECHNIQUE

## 6_9_SESSIONS_TOPIC_ PHYSICAL PLANNING AND QUALITY OF PLACE

*Session chair 6:* ***Dimitrij KLANČIČ***
*Special guest lecture:* ***Prim Dr Vlasta VODOPIVEC: THE CHALLENGE OF CARDIOVASCULAR DISEASE PREVENTION: IS HEALTHY LIFESTYLE THE ANSWER?***
**9:00–10:30 a.m.**

*Session chair 9:* ***Sanja PAUNOVIĆ ŽARIĆ and MSc Irena RAJKOVIĆ***
*Special guest lecture:* ***Prim Franci KOGLOT: SPORT INJURIES-TEHNOLOGIES-HEALTHY PLACES***
**11:00–12:30 p.m.**

**Session 6**

**Dr Velimir STOJANOVIĆ:** DEVELOPMENT DIRECTIONS OF URBAN STRUCTURE THROUGH REGISTRATION OF CHANGES OF SEGMENTS OF URBAN COMPLEX

**MSc Ivana SENTIĆ, Dr Ksenija HIEL:** THE TRANSFORMATION OF THE SQUARE CARICA MILICA IN NOVI SAD (SERBIA)

**Giovani SERGI, Carlo BERIO, Giulia CANTON, Giacomo CROVO:** "VARESE LIGURE: AN ITALIAN RURAL MUNICIPALITY WHICH HAS IMPLEMENTED AN EXEMPLARY MODEL OF SUSTAINABLE DEVELOPMENT"

**MSc Ina ŠUKLJE ERJAVEC, Dr Carlos SMANIOTTO COSTA:** CYBERPARKS CHALLENGES - NEW DIGITAL MEDIA FOR ATTRACTIVE URBAN OPEN SPACES

**Dr Jasna ČIKIĆ TOVAROVIĆ, Dr Jelena IVANOVIĆ ŠEKULARAC, Dr Nenad ŠEKULARAC:** MEDIA ARCHITECTURE AND SUSTAINABLE ENVIRONMENTS

**Dr Alenka TEMELJOTOV SALAJ, Svein BJØRBERG, Simon VRHUNEC, Dr Andrej BARIČIČ:** IMPLEMENTATION OF NORWEGIAN EXPERIENCE TO SLOVENIAN HOSPITAL SECTOR

**Dr Dijana SIMONOVIĆ:** INTERWEAVING OF BANJALUKA'S URBAN AND RURAL LANDSCAPES

**Dr Bob GIDDING, Dr James CHARLTON:** DEVELOPMENT OF PUBLIC SQUARES IN NORTH WESTERN EUROPEAN CITIES CENTRES

Session 9

**Lucia MARTINCIGH, Dr Cecilia DE MARINIS, Janet HETMAN:** AN APPLICATION OF THE "ENVIRONMENTAL ISLAND": A PRESCRIPTIVE TOOL TO CREATE HEALTHIER URBAN ENVIRONMENTS

**Anja KOSTANJŠAK, Morana PAP, Tena LAZAREVIĆ:** MUSIC AND SOUND AS A TOOL INTO DESIGNING HEALTHIER ENVIRONMENT

**Dr Enrico ANGUILLARI:** FOUR PARADIGMS FOR VENETO REGION'S CENTRAL AREA

**Dejan VASOVIĆ, Nataša ĆUKOVIC-IGNJATOVIĆ, Dušan IGNJATOVIĆ:** MUNICIPALITY POLICY AS A KEY FACTOR FOR THE ROLE OF ARCHITECTURE AND TECHNOLOGY IN PUBLIC HEALTH

**Dr Florian NEPRAVISHTA:** INDUSTRIAL HERITAGE IN ALBANIA AND THE OPPORTUNITIES FOR REGENERATION AND ADAPTIVE RE-USE

**Branislav ANTONIĆ, Biserka MITROVIĆ:** THE POSSIBILITIES OF THE APPLICATION OF THE CONCEPT OF HEALTHY CITY IN ILLEGAL SETTLEMENTS IN SERBIA

**Filip PETROVIĆ:** URBAN REGENERATION AS A TOOL FOR POPULATION HEALTH IMPROVEMENT

**Hanna OBRACHT-PRONDZYNSKA:** URBANIZATION OF METROPOLITAN AREAS – THE IMPORTANCE OF NEW SPATIAL DATA ANALYSIS TOOLS

**Piotr Marek SMOLNICKI:** AQUAPONICS BASED ARTIFICIAL BIOSPHERE INCLUDED IN ARCHITECTURE: FROM MITIGATION OF NEGATI VE IMPACTS TO POSITIVE ADDED VALUES OF URBAN SPATIAL STRUCTURES ON LOCAL , REGIONAL AND GLOBAL SCALE

## 7_SESSION_TOPIC_HEALTH PROMOTION, PROTECTION AND PREVENTION

*Session chair 7:* ***Dr Milena VUKMIROVIĆ***

*Special guest lecture:* ***Simon BITEŽNIK: REUMATIC DISEASES - DISABILITIES AND FUTURE PERSPECTIVE WITH NEW BIOLOGIC DRUGS***

**8:30–9:00 a.m.**

***Special presentation_book:*** ***Planning Capital Cities: Belgrade, Bucharest, Sofia***

Editors: Doytchinov, Grigor/Djukic, Aleksandra/Ionita, Catalina

Publisher: Verlag der Technischen Universität Graz

Authors (alphabetic): Alexandru, M., Djukic, A., Doytchinov, G., Duda, M., Ganchev, H., Heppner, H., Ionita, C., Lazarevic, E.V., Roter-Blagojevic, M., Samardzic, N., Sebestyen, M., Stan, A., Stroe, M., Swoboda, H., Udrea, A., Valkanov, Y., Vukmirovic, M.

**Dr Anne-Kathrin WILL:** OUTDOOR GYMS: "NO MORE EXCUSES FOR PEOPLE WHO CANNOT AFFORD MEMBERSHIPS. GET OUT AND GET IN SHAPE!"

**Dr Maddalena COCCAGNA:** KEY POINTS OF HUMAN AWARENESS AND EMERGENCY PLANNING. SCHOOLS AS A CASE STUDY

**Dr Nebojša ARSIĆ, Dr Jordan RADOSAVLJEVIĆ, Prim Nataša FIKFAK, Dr Saša ŠTATKIĆ:** ANOTHER SIDE OF THE COMFORT OF LIVING – ELECTROMAGNETIC POLLUTION

**Dr Lara SLIVNIK:** RECOMMENDATIONS FOR UNIVERSAL DESIGN OF OUTDOOR LEISURE AND RECREATIONAL AREAS

## 7_SESSION_TOPIC_HEALTH INTENSIVE CARE

**Nevena DUTINA, Aleksandra DUTINA;** ANALYSIS AND CONTEMPORARY APPROACH OF SPACE DESIGN OF INTESIVE PSYCHIATRIC CARE UNIT

## 7_SESSION_TOPIC_ACTIVE LIVING AND HEALTH

**Dr Aleksandra ĐUKIĆ, Dr Aleksandra STUPAR:** OPEN PUBLIC SPACES FOR HEALTHIER CITIES

**Nikola Z. FURUNDŽIĆ, Dijana P. FURUNDŽIĆ, Dr Aleksandra KRSTIĆ FURUNDŽIĆ:** RESPONSIBILITY TO THE EMPLOYEES' HEALTH UNAVOIDABLE IN THE CREATIVE AND INNOVATIVE DESIGN OF OFFICE SPACES

**Katarina Ana LESTAN, Dr Ivan Eržen, Dr Mojca GOLOBIĆ:** HEALTHY PLACES, ACTIVE PEOPLE

**Dr Milena VUKMIROVIĆ, Dr Eva VANIŠTA LAZAREVIĆ:** THE IMPACT OF QUALITY OF PEDESTRIAN SPACES ON WALKING AS A MODERATE PHYSICAL ACTIVITY

## 10_SESSION_TOPIC_INCLUSIVE AND ACCESSIBLE ENVIRONMENT

*Session chair 10:* ***Ilaria GAROFOLO***

*Special guest lecture:* ***Alberto ARENGHI, MD Daniele MALGRATI, MD Michele SCARAZZATO: HEALTHY BUILDINGS: THE ICF CLASSIFICATION AS A DESIGNING TOOL***

**11:00–12:30 p.m.**

**Ilaria GAROFOLO, Barbara CHIARELLI:** INCLUSIVE AND THERAPEUTIC URBAN ENVIRONMENT: INVOLVING USERS IN THE DESIGN PROCESS
**Silvia GRION, Paola COLONI:** DEVELOPING INNOVATIVE SOCIAL HOUSING TO FOSTER INCLUSIVE COMMUNITIES
**Lucia MARTINCIGH, Dr Cecilia DE MARINIS:** URBAN PUBLIC SPACES ACCESSIBLE FOR ALL: A CASE STUDY IN A HISTORICAL DISTRICT OF ROME
**Dr Christian SUAU, Dr Carmelo ZAPPULLA:** ECOLOGICAL LANDSCAPE, PHYTODEPURATION AND MANMADE WETLANDS IN MAGOK LAKE PARK, SEOUL
**Urša KALČIČ, Janez P. GROM:** ADVANCED SYSTEMS FOR IMPROVING COMMON HEALTH
**Dr Christine CHALOUPKA- RISSER, Daniel BELL:** FACTS4Stops – USER NEEDS REGARDING PUBLIC TRANSPORT STATIONS AND ENVIRONMENT

## 10_SESSION_TOPIC_LIFETIME COMMUNITIES AND PARTICIPATION

**Adolfo BARATTA, Fabrizio FINUCCI, Annalisa METTA, Luca MONTUORI:** COHOUSING FOR BUILDING REUSE
**Dr Anja JUTRAZ, Sanja STIMAC:** HOW TO DESIGN HEALTHY BUILDING FOR HEALTHY LIVING? COMPLEX NETWORK OF HEALTH
**Dr Višnja KUKOČ:** PARTICIPATORY URBAN PLANNING AND PUBLIC POLICY

## 11_SESSION_TOPIC_ADAPTIVE REUSE AND URBAN RENEWAL

*Session chair 11:* ***Dr Anja JUTRAŽ and Sanja ŠTIMAC***
*Special guest lecture:* ***Mojca HUMAR: ONCOLOGY DAY HOSPITAL: OUR EXPERIENCE***
**2:00–3:30 p.m.**

**Francesca GUIDOLIN:** SYSTEMS FOR THE REQUALIFICATION OF NON-LISTED ARCHITECTURE: THE "ADAPTIVE EXOSKELETON"
**Dr Jelena IVANOVIĆ ŠEKULARAC, Dr Jasna ČIKIĆ TOVAROVIĆ, Dr Nenad ŠEKULARAC:** RECONSTRUCTION AND REVITALIZATION OF THE COMPLEX SENARA, WITHIN THE MONASTERY HILANDAR, IN ORDER TO ADAPT TO MODERN TRENDS AND SOCIAL CHANGES
**Anita STOILKOV-KONESKI, Zoran KONESKI:** BROWNFIELDS AS PLACES AND RENEWABLE ENERGY SYSTEMS AS TECHNOLOGIES : POTENTIALS AND RISKS IN CASE OF SERBIA
**Dr Lea PETROVIĆ-KRAJNIK, Dr Damir KRAJNIK, Dr Ivan MLINAR**: LANDFILL JAKUŠEVEC IN ZAGREB – POTENTIAL FOR NEW SPACE IDENTITY AND ENHANCEMENT OF QUALITY OF LIFE

## 12_SESSION_TOPIC_CULTURAL PATTERNS AND SENSITIVITY

*Session chair 12:* ***Miha KONJAR***
*Special guest lecture:* ***Dr Matevž GORENŠEK: ARCHITECTS AND ORTHOPEDICS***
**2:00–3:30 p.m.**

**Dr Egle NAVICKIENE:** SENSE OF PLACE IN ARCHITECTURAL DESIGN: TOWARDS HEALTHY PLACES P&T 2015
**Dr Gabriella MEDVEGY, Dr Gabor VERES:** ARCHITECTURE AND ITS AFTERLIFE; GREEN URBANITY
**Ana ŠPIRIĆ, Sanja TRIVIĆ:** INVESTIGATION OF RELATIONSHIP BETWEEN CULTURE OF THE INHABITANTS AND QUALITY OF HOUSING
**Vladimir KOVAČ:** UTOPIAN PROJECTS DRAWINGS AS INDICATORS OF MODERN SOCIETY NEEDS
**Svetlana STANAREVIĆ, Stevan TATALOVIĆ:** YOUTH AND THE FEELING OF SAFETY IN PUBLIC SPACES

## 12_SESSION_TOPIC_SOCIAL NETWORKS AND HUMAN BASIC NEEDS

**Svea HEINEMANN:** BEYOND THE QUANTIFIED SELF: A LOOK AT THE SOCIAL DIMENSION OF HEALTH
**Alicja STEFANSKA:** SKYSCRAPER'S PUBLIC AREAS: THE IMPACT ON SPACE AND SOCIAL LIFE
**Dr Leila HABIBI, Hamid Reza FARPOUR:** THE IMPACT OF SOCIAL NETWORKS USE ON REDUCTION OF DEPRESSION IN CANCER PATIENTS

## 13_SESSION_TOPIC_ENVIRONMENTAL FRIENDLY TRANSPORT

*Session chair 13:* ***Janez P. GROM***
*Special guest lecture:* ***Dr Igor KRANJEC: OPTICAL COHERENCE TOMOGRAPHY - GUIDED PRIMARY PERCUTANEOUS CORONARY INTERVENTION IN ACUTE MYOCARDIAL INFARCTION***
**2:00–3:30 p.m.**

A**leksandra ĐORĐEVIĆ, Ivana ČAVKA, Dr Olja ČOKORILO:** SHIFTING TO MORE ENVIRONMENTALLY FRIENDLY MODES IN LONG-DISTANCE TRANSPORT

**Evgenia NIKOLAEVA YOSIFOVA:** ASSESSING PUBLIC TRANSPORT EFFICIENCY IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

**Dr Dino ŠOJAT, Dr Davor BRČIĆ, Dr Marko SLAVULJ:** THE ROLE OF PUBLIC TRANSPORT PRIORITY IN SUSTAINABLE URBAN MOBILITY

**Budimir SUDIMAC, Andjela DUBLJEVIĆ:** APPLICATION OF PV MODULES ON NOISE BARRIERS

**Ana TIVADAR, Stanko MANOJLOVIĆ, Simon PODKORITNIK:** PLANNING OF ELECTRIC TRANSPORTATION IN THE KRŠKO REGION

**Bia MANDŽUKA, Dr Ljupko ŠIMUNOVIĆ, Mario ČOSIĆ:** INTELLIGENT TRANSPORT SYSTEMS FOR SMART CITIES

## 13_SESSION_TOPIC_BUILDING TECHNOLOGIES

**Dr Aleksandra KRSTIĆ-FURUNDŽIĆ, Dr Aleksandra ĐUKIĆ:** RETROFITTING OF MULTI-FAMILY BUILDINGS TOWARDS HEALTHIER SETTLEMENTS

**Dr Aleksandra NENADOVIĆ:** FERROCEMENT ARCHITECTURAL STRUCTURES FROM THE ASPECT OF SOCIAL WELL-BEING

**Sanja PAUNOVIĆ ŽARIĆ, MSc Irena RAJKOVIĆ, Marija BOJOVIĆ:** DAYLIGHT ANALYSES OF “READY-MADE” FAÇADES WITH MODULAR OPENINGS - CASE STUDY LOCATION IN PODGORICA

**MSc Irena RAJKOVIĆ, Sanja PAUNOVIĆ ŽARIĆ, Marija BOJOVIĆ:** ACTIVE SOLAR SYSTEMS – STUDY OF POTENTIAL FOR APPLICATION IN THE MATERIALIZATION OF TOURIST FACILITES IN MONTENEGRO

**Dr Ljubomir MIŠČEVIĆ, Dr Ivana BANJAD PEČUR, Dr Bojan MILOVANOVIĆ:** PREFABRICATED PASSIVE HOUSE VENTILATED FAÇADE PANEL SYSTEM WITH RECYCLED CONCRETE

PLACES & TECHNOLOGIES 2015

# KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES

2nd International Academic Conference

Organizers:
University of Belgrade, Faculty of Architecture, Serbia
University of Ljubljana, Faculty of Architecture, Slovenia
Professional Association, Urban Laboratory, Serbia
General Hospital, »Dr Franca Derganca« Nova Gorica, Slovenia

***Dr Vladan Đokić***
*University of Belgrade, Faculty of Architecture, Belgrade, Serbia*

***MSc Peter Gabrijelčič***
*University of Ljubljana, Faculty of Architecture, Ljubljana, Slovenia*

Organizing Committee:
***Dr Eva Vaništa Lazarević***, *Conference Director, University of Belgrade, Faculty of Architecture, Belgrade, Serbia*
***Dr Alenka Fikfak***, *Regional Conference Director, University of Ljubljana, Faculty of Architecture, Ljubljana, Slovenia*
***Dr Milena Vukmirović***, *Conference Executive Coordinator, University of Belgrade, Faculty of Architecture, Belgrade, Serbia*
***Prim. Nataša Fikfak,*** *General hospital "Dr Franca Derganca", Nova Gorica, Slovenia*
***Dr Aleksandra Krstić - Furundžić,*** *University of Belgrade, Faculty of Architecture, Belgrade, Serbia*

## ABOUT

The conference examines the formation and presentation of knowledge on technologies and the environment, as well as ethical considerations and potential risks, developing solutions, expertise and discussions with respect to one of the most important strategic issues – ***public health***. The stated objective point to the necessity of a multidisciplinary approach to this matter, identification and establishment of relationships between issues of technological development, environmental protection and social change. Consequently the conference program and research are based on the knowledge of several academic disciplines: engineering and technical sciences, medical sciences, humanities and social sciences.
The main tasks of the conference are defined in order to discuss the issues related to:
(1) the future of society and places,
(2) design of healthy places, facilities and infrastructure in line with needs of inhabitants,
(3) development of institutions and regulations with an aim of creating healthy-supportive environment, and
(4) creation of favourable conditions for the advancement of innovation and business to achieve a good quality of life.
Having in mind the conference goals and objectives, we wish to research and understand from the critical aspect the importance and role of technology in design and creation of healthy places through:
(1) built environment perspective,
(2) medical perspective,
(3) technological perspective,
(4) government perspective,
(5) social perspective.

## TOPICS

1. Architecture and Health
2. Physical Planning and Quality of Place
3. Lifetime Communities and Participation
4. Cultural Patterns and Sensitivity
5. Health Intensive Care
6. Inclusive and accessible environment
7. Environmental Friendly Transport
8. Building Technologies
9. Adaptive Reuse and Urban Renewal
10. Active Living and Health
11. Health Promotion, Protection and Prevention
12. Social Networks and Human Basic Needs2

*Info:* **http://placesandtechnologies2015.org/**

OFFICIAL LANGUAGE OF THE CONFERENCE - English

## KEYNOTE SPEAKERS

**Dr Ružica Božović Stamenović,** *University of Belgrade, Faculty of Architecture, Belgrade, Serbia and National University of Singapore, Singapore*

Associate Professor, specialized in Danish housing at the Royal Danish Academy of Fine Arts, Copenhagen. Dr Božovič-Stamenović has joined the University of Belgrade in 1989 and the National University of Singapore NUS from 2000-2011. Since 2011, she works as a full time Associate Professor in Belgrade and visiting academic lecturing in semester 2 in NUS, Singapore. Faculty Fellow at TAMU Center for Health Systems and Design, Texas A&M University, USA and Member of Executive Board of the UIA Public Health Group and GUPHA-Global University Programs in Healthcare Architecture. Her research interest is in Human Ecology-space and health, healthful architecture for mega-mature societies and health restoring design processes. Author of two books, a number of book chapters, peer reviewed journal articles and conference papers and a frequent speaker and invited lecturer at scientific conferences worldwide (USA, Australia, France, Germany, Denmark, Greece, Singapore, Malaysia, Korea, etc.). Dr Božović Stamenović is awarded with the 2014 Berkeley Prize Teaching Fellowship, endorsed by the University of California, Berkeley, Department of Architecture, College of Environment Design, for the academic course curricula titled: "Teaching Healthful Architecture". For her design work Dr Božovič-Stamenović won major national architectural awards: October Salon (1998), Salon of Architecture (1998, 1991, 1991), Borba (1992), and a number of national and international competition prizes including the prestigious Aldo Rossi's Selection for the 2nd Biennale of Architecture Venice, Italy in 1985 and the national selection for the 8th Biennale of Venice Exhibition NEXT- Destruction & Construction in 2002.

**Dr Cor Wagenaar,** *Delft University of Technology, Delft, The Nederlands*

Associate Professor. He studied History at the University of Groningen and he was awarded a PhD in 1993 for a thesis entitled "Welvaartsstad in wording". De wederopbouw van Rotterdam 1940-1952 (about the rebuilding programme in the city of Rotterdam after Second World War). In his role as academic advisor, Wagenaar was closely involved in writing a book and organizing a conference entitled 'Architecture of Hospitals', which was held at the UMCG in 2005. He has been working as an associate professor in the chair History of Architecture and Urban Planning of the Faculty of Architecture and the Built Environment of Delft University of Technology. From 1st January 2014, Dr Cor Wagenaar has been appointed professor by special appointment in Architecture, Urbanism and Health at the Faculty of Arts of the University of Groningen. The Chair has been established by the Thomassen à Thuessink Foundation. Which fits into the Healthy Ageing strategic focus area of the University of Groningen and the UMCG. Dr Cor Wagenaar teaching and research mandate thus includes a study of the built environment, as well as research into architectural and urban planning designed to benefit the health of the urban population. In this way, he links the history of architecture and urban planning with current social-societal, policy-based and spatial developments in healthcare.

**Prof. Roger Riewe,** *Graz University of Technology, Institute of Architecture Technology, Austria*

Roger Riewe was trained at the RWTH Aachen. He then founded Riegler Riewe Architekten in Graz in 1987. Further offices were founded in Cologne in 2008 and in Katowice in 2010. The office has become an internationally renowned, with projects in Austria, Germany, Poland, Croatia, Korea, Switzerland and USA. The focus is on public buildings, infrastructure projects and urban design. The realized projects have received numerous international awards and distinctions. Roger Riewe has been guest professor in Prague, Houston, Barcelona, Aachen, Calgary and Graz. He has lectured worldwide with a specific focus on structure, space and technology. In 2001 he was appointed professor at the Graz University of Technology, where he is since then head of the Institute of Architecture Technology.

**Dr Pedro Ressano Garcia,** *Universidade Lusófona, Lisbon, Portugal*

Professor and Senior Architect in charge at Ressano Garcia Arquitectos. For the last years he has been researching the transformation of port cities and waterfront regeneration under the frame of ecology and healthy city. In his office in Lisbon, theory and practice are combined in projects of architecture, urban design and participation in international competitions. He started teaching at U.C. Berkeley, since 1997 to the present teaches in Lisbon at Universidade Lusófona and is a visiting teacher at International Workshops. Since 2010 is the coordinator of the European Workshop on Waterfront Urban Design. Awarded with Calouste Gulbenkian and Fundação Ciência e Tecnologia grants. He has published widely in books, magazines and international conferences. In 2010 received the Pancho Guedes Architecture Award.

**Dr Ilka Čerpes,** *University of Ljubljana, Faculty of Architecture, Ljubljana, Slovenia*

Architect, Doctor of Science and Assistant Professor in Urban Planning. She is the author of the monograph Urbanistično načrtovanje ('Urban Planning'), of the collection of papers O urbanizmu ('On Urban Planning') and co-author of several professional monographs. As part of teaching staff exchange, she was a visiting professor at five renowned European schools of architecture in France, Germany, Great Britain and Switzerland. She is Area Editor for Urban Planning at the international scientific journal Igra ustvarjalnosti/The Creativity Game and member of the Scientific Committee of the scientific conference Pametni urbanizem. At the Faculty of Architecture she carries out the tasks of Deputy Head of the Chair of Urbanism and works as tutor coordinator. She is the author of many architecture and urban design studies and projects, which have been recognised by the national and international professional community. She is a co-author of two retrospective exhibitions of architecture in the Kresija Gallery in Ljubljana and associated with renowned associations of architects. She was president of the Association of Architects of Ljubljana (DAL) for two terms of office, member of the commission for awarding the prestigious architecture award conferred by the Jože Plečnik Fund, member of several domestic and European competition panels and member of the Slovenian committee of the European association Europan.

## REGIONAL AND GUEST DEANS WORKSHOP COMMITTEE

**Prof. Dr Vladan Đokić**, *University of Belgrade Faculty of Architecture, Belgrade, Serbia*

**Prof. MSc Peter Gabrijelčič**, *University of Ljubljana, Faculty of Architecture, Ljubljana, Slovenia*

### Hosting Rector

**Prof. Dr Ivan Svetlik**, *University of Ljubljana, Ljubljana, Slovenia*

**Prof. Dr Danilo Zavrtanik**, *University of Nova Gorica, Nova Gorica, Slovenia*

### In Alphabetical order

**Prof. Dr Nebojša Arsič**, *Faculty of Technical Sciences, Department of Archi¬tecture, Kosovska Mitrovica, Kosovo*
**Prof. Dr Bálint Bachmann,** *University of Pécs Pollack Mihály Faculty of Engineering and Information Technology, Pécs, Hungary*
**Prof. Dr Dženana Bijedić** *(Vice-dean), University of Sarajevo - Faculty for Architecture, Sarajevo, Bosnia and Herzegovina*
**Prof. Giovanni Fraziano**, *Universita degli studii di Trieste, Facolta di architettura, Gorizia*
**Prof. Dr Davorin Gazvoda**, *University of Ljubljana, Biotechnical Faculty, Ljubljana, Slovenia*
**Prof. MSc Boris Koružnjak,** *University of Zagreb, Faculty of Architecture, Zagreb, Croatia*
**Prof. Ante Kuzmanić** *(Vice-dean), University of Split, Faculty of Civil Engineering, Architecture and Geodesy, Department of Architecture, Split, Croatia*
**Prof. Dr Urška Lavrenčič Štangar**, *University of Nova Gorica, School of Environmental Sciences, Nova Gorica, Slovenia*
**Prof. Dr Matjaž Mikoš**, *University of Ljubljana, Faculty of Civil and Geodetic Engineering, Ljubljana, Slovenia*
**Assoc. Prof. Dr Florian Nepravishta** *(Direktor departement), Department of Architecture at Polytechnic University of Tirana,*
*Tirana, Albania*
**Assist. Prof. Dr Nevena Novaković** *(Vice-dean)***,** *Faculty of Architecture and Civil Engineering, Banja Luka, Republic of Srpska, Bosnia and Herzegovina*
**Assist. Prof. Dr Svetislav Popović,** *Montenegro University, Faculty of Architecture Podgorica, Podgorica, Montenegro*
**Prof. Dr Miroslav Premrov**, *University of Maribor, Faculty of Civil Engineering, Maribor, Slovenia*
**Prof. Dr Dušan Šuput**, *University of Ljubljana, Faculty of Medicine, Ljubljana, Slovenia*

### Guest deans

**Prof. Dr Uģis Bratuškins,** *Riga Technical University, Faculty of Architecture & Urban Planning, RTU, Latvija*

**Prof. Stephan Mader,** *Zürich University of Applied Sciences and Arts, School of Architecture, Design, and Civil Engineering, Winterthur, Switzerland*

## SCIENTIFIC COMMITTEE

**Dr Eva Vaništa Lazarević** *(Conference Director), University of Belgrade Faculty of Architecture, Belgrade, Serbia*

**Dr Alenka Fikfak** *(Regional Conference Director), University of Ljubljana, Faculty of Architecture, Ljubljana, Slovenia*

**Dr Milena Vukmirovic** *(Executive coordinator), University of Belgrade Faculty of Architecture and Urban Laboratory, Belgrade, Serbia*

**Prim. Nataša Fikfak,** *General hospital "Dr Franca Derganca", Nova Gorica, Slovenia*

### In Alphabetical order

**Enrico Anguillari**, *Indipendent Researcher, Venice, Italy;* **MSc Petar Arsić**, *University of Belgrade Faculty of Architecture, Belgrade,* Serbia; **Dr Milica Bajić Brković,** *ISOCARP - The International Society of City and Regional Planners, The Hague, Netherlands;* **Dr Bojana Beović**, *University of Ljubljana, Faculty of medicine, Ljubljana, Slovenia;* **Dr Boštjan Bugarič,** *Indipendent Researcher, KUD C3, Ljubljana, Slovenia;* **Dr Jadranka Buturović-Ponikvar,** *University Medical Center Ljubljana (UMCL), Department of Nephrology;* **Boštjan Cotič,** *Urban Planning Institute of the Republic of Slovenia;* **Dr Ilka Čerpes,** *University of Ljubljana, Faculty of Architecture, Slovenia;* **Dr Olja Čokorilo,** *University of Belgrade, Faculty of Transport and Traffic Engineering, Belgrade, Serbia;* **Dr Grygor Doytchinov,** *Institute for Urban Design, Technical University of Graz, Austria;* **Dr Aleksandra Đukić,** *University of Belgrade Faculty of Architecture, Belgrade, Serbia;* **Ilaria Garofolo,** *University of Trieste, Deaprtment of Engineering and Architecture, Italy;* **Dr Bob Giddings,** *Northumbria University Faculty of Engineering and Environment, Newcastle, United Kingdom;* **MSc Tadej Glažar**, *University of Ljubljana, Faculty of Architecture, Ljubljana, Slovenia;* **Dr Mojca Golobič,** *University of Ljubljana, Biotechnical Faculty, Ljubljana, Slovenia;* **Dr Matevž Gorenšek,** *University Medical Center, Department of Orthopedic Surgery, Spine Surgery Unit, Ljubljana, Slovenia;* **Dr Liljana Jankovič Grobelšek**, *DUPPS, Municipality of Ljubljana, Departmant for spatial planning, Ljubljana, Slovenia;* **Dr Vojko Kilar,** *University of Ljubljana, Faculty of Architecture, Slovenia;* **Dr Ioannis Kiousopoulos,** *Technological Educational Institute of Athens, Athens, Hellas;* **Dimitrij Klančič,** *General hospital "Dr Franca Derganca", Nova Gorica, Slovenia;* **Dr Matjaž Klemenc,** *General hospital "Dr Franca Derganca" and University of Ljubljana, Faculty of Medicine, Slovenia;* **Dr Vlatko Korobar,** *St. Cyril and Methodius University, Faculty of Architecture, Skopje, FYR Macedonia;* **Dr Saja Kosanović**, *University of Priština settled in Kosovska Mitrovica, Faculty of Technical Sciences, Department of Architecture, Serbia;*
**Prof. Janez Koželj,** *University of Ljubljana, Faculty of Architecture, Ljubljana, Slovenia;* **Dr Aleksandra Krstić – Furundžić,** *University of*

*Belgrade Faculty of Architecture, Belgrade, Serbia;* **Dr Višnja Kukoč,** *University of Split, Faculty of Civil Engineering, Architecture and Geodesy, Split, Croatia;* **Prof. Vladimir Lojanica,** *University of Belgrade, Faculty of Architecture, Belgrade, Serbia;* **Dr Piotr Lorens,** *Faculty of Architecture, Gdansk University of Technology, Gdansk, Poland;* **Prof. Lucia Martincigh,** *Faculty of Architecture, University of Roma Tre, Rome, Italy;* **Dr Marja Maruna,** *University of Belgrade, Faculty of Architecture, Begrade, Serbia;* **Dr Vladimir Milenković,** *University of Belgrade, Faculty of Architecture, Begrade, Serbia;* **Prof. Ljubomir Miščević,** *University of Zagreb Faculty of Architecture, Zagreb, Croatia;* **Dr Eglė Navickienė,** *Vilnius Gedimino Technical University Faculty of Architecture, Vilnius, Lithuania;* **Dr Nevena Novaković,** *University of Banja Luka, Faculty of Architecture, Civil Engineering and Geodesy, Banja Luka, Bosnia and Herzegovina;* **Dr Lea Petrović Krajnik,** *University of Zagreb, Faculty of Architecture, Department of Urban Planning, Spatial planning and Landscape Architecture, Zagreb, Croatia;* **Dr Marija Pfeifer,** *University of Ljubljana, Medical Faculty, Ljubljana, Slovenia;* **Dr Gabriel Pascariu,** *"Ion Mincu" University of Architecture and Urban Planning, Bucharest, Romania;* **Tomaž Pipan,** *London Metropolitan University, The CASS, London, United Kingdom*; **Dr Goran Radović,** *Faculty of Architecture Podgorica, Montenegro University, Podgorica, Montenegro;* **Dr Ralf Risser,** *Research Institute FACTUM, Vienna, Austria;* **Manfred Schrenk,** *CEIT - Central European Institute of Technology Research Network, Vienna, Austria;* **Dr Jasmina Siljanoska,** *St. Cyril and Methodius University, Faculty of Architecture, Skopje, FYR Macedonia;* **Dr Metka Sitar,** *University of Maribor Faculty of Civil Engineering, Department of Architecture;* **Dr Ljupko Šimunovic,** *University of Zagreb Faculty of Transport and Traffic Sciences, Zagreb, Croatia;* **Dr Stefan van der Spek,** *TU Delft, Delft, The Nederlands*; **Dr Aleksandra Stupar,** *University of Belgrade, Faculty of Architecture, Begrade, Serbia;* **Dr Cristian Suau,** *University of Strathclyde, Department of Architecture, Glasgow, Scotland, United Kingdom;* **Dr Sandra Treja,** *Riga Technical University, Faculty of Architecture & Urban Planning, RTU, Latvija;* **Prim. Dr Vlasta Vodopivec Jamšek,** *Health Centre Nova Gorica, Slovenia;* **Dr Carmelo Zappulla,** *Institute for Advanced Architecture of Catalonia, Barcelona, Spain*; **Dr Alma Zavodnik Lamovšek,** *University of Ljubljana, Faculty of Civil and Geodetic Engineering, Ljubljana, Slovenia;* **Dr Martina Zbašnik Senegačnik,** *University of Ljubljana, Faculty of Architecture, Ljubljana, Slovenia.*

## TECHNICAL COMMITTEE:

**Dr Milena Vukmirović**, *University of Belgrade, Facult_y of Architecture and Urban Laboratory, Belgrade, Serbia*
**MSc Mitja Blaganje**, *University of Ljubljana, Faculty of Architecture, Ljubljana, Slovenia*
**Mojca Potočnik Kogovšek**, *University of Ljubljana, Faculty of Architecture, Ljubljana, Slovenia*
**Assist. Janez P. Grom**, *University of Ljubljana, Faculty of Architecture, Ljubljana, Slovenia*
**Urša Kalčič**, *University of Ljubljana, Faculty of Architecture, Ljubljana, Slovenia*
**Lea Obreza**, *University of Ljubljana, Faculty of Architecture, Ljubljana, Slovenia*
**Nejc Koradin**, *Društvo primorskih Arhitektov, Nova Gorica, Slovenia*
**Mija Rijavec**, *Konference center Perla, Nova Gorica, Slovenia*
**Aleksandra Torbica,** *City municipality of Nova Gorica, Nova Gorica, Slovenia*

## REVIEWERS

**Dr Enrico Anguillari**, IUAV Venezia, Italy
**Dr Boštjan Bugarič**, Indipendent Researcher, KUD C3, Ljubljana, Slovenia
**Boštjan Cotič**, Urban Planning Institute of the Republic of Slovenia
**Dr Olja Čokorilo**, University of Belgrade, Faculty of Transport and Traffic Engineering, Belgrade, Serbia
**Dr Aleksandra Đukić**, University of Belgrade Faculty of Architecture, Belgrade, Serbia
**Dr Grygor Doytchinov**, Institute for Urban Design, Technical University of Graz, Austria
**Dr Alenka Fikfak**, Univerza v Ljubljani, Fakulteta za arhitekturo, Ljubljana, Slovenia
**Prim. Nataša Fikfak**, MD, General Hospital Dr Franca Derganca, Šempeter Nova Gorici, Slovenia
**Prof. Ilaria Garofolo**, Universita degli studii di Trieste
**Dimitrij Klančič**, MD, General Hospital Dr Franca Derganca, Šempeter, Nova Gorica, Slovenia
**Dr Matjaž Klemenc**, MD, General Hospital Dr Franca Derganca, Šempeter Nova Gorici, Slovenia
**Dr Vlatko Korobar**, St. Cyril and Methodius University, Faculty of Architecture, Skopje, FYR Macedonia
**Dr Saja Kosanović**, Dr Faculty of Technical Sciences, Department of Archi¬tecture, Kosovska Mitrovica, Kosovo
**Dr Lea Petrović Krajnik**, University of Zagreb, Faculty of Architecture, Zagreb, Croatia
**Dr Aleksandra Krstić-Furundžić**, University of Belgrade Faculty of Architecture, Belgrade, Serbia
**Dr Višnja Kukoč**, University of Split, Faculty of of Civil Engineering, Architecture & Geodesy, Split, Croatia
**Dr Piotr Lorens**, Faculty of Architecture, Gdansk University of Technology, Gdansk, Poland
**Prof. Lucia Martincigh,** Roma Tre University, Rome, Italy
**Dr Marija Maruna**, University of Belgrade Faculty of Architecture, Belgrade, Serbia
**Dr Vladimir Milenković**, University of Belgrade Faculty of Architecture, Belgrade, Serbia
**Dr Eglė Navickienė**, Vilnius Gedimino Technical University Faculty of Architecture, Vilnius, Lithuania
**Tomaž Pipan**, TU Berlin, IfA -Institut fur Architektur, ADIP, Berlin, Germany
**Dr Ralf Risser**, Research Institute FACTUM, Vienna, Austria
**Dr Stefan van der Spek**, TU Delft, Delft, The Nederlands
**Dr Eva Vaništa Lazarević**, University of Belgrade Faculty of Architecture, Belgrade, Serbia
**Dr Milena Vukmirović**, University of Belgrade Faculty of Architecture and Urban Laboratory, Belgrade, Serbia
**Dr Dušan Vuksanović**, Faculty of Architecture Podgorica, Montenegro University, Podgorica, Montenegro
**Dr Martina Zbašnik-Senegačnik**, University of Ljubljana, Faculty of Architecture, Ljubljana, Slovenia

# Places and Technologies 2015
# KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES

**BOOK OF CONFERENCE PROCEEDINGS**
**Scientific conference, Nova Gorica, Slovenia, 18.–19.6.2015**

**Organizers:**
University of Belgrade, Faculty of Architecture, Serbia
University of Ljubljana, Faculty of Architecture, Slovenia
Professional Association, Urban Laboratory, Serbia
General Hospital, 'Dr Franca Derganca' Nova Gorica, Slovenia

**Editors:**
Alenka Fikfak, Eva Vaništa Lazarević, Nataša Fikfak, Milena Vukmirović, Peter Gabrijelčič

**Publisher:**
University of Ljubljana, Faculty of Architecture, Zoisova 2, Ljubljana, Slovenia

**Design and layout:**
Gašper Mrak

Ljubljana, June 2015