

THE WORLDS OF ART AND SCIENCE

**Reality and Experience
in Architecture and Art**

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- 1 Gaston Bachelard, *The Poetics of Space* (1958) (Boston: Beacon Press, 1969).

- 2 Gaston Bachelard, *The Philosophy of No: A Philosophy of the New Scientific Mind* (New York: The Orion Press, 1968).

Gaston Bachelard was a philosopher of science until his mid-life, when he came to the conclusion that science does not - and cannot - say anything meaningful about the reality of lived life, the human life world and its existential meanings. This is the realm of sensory encounters, lived experiences and emotions, and it can be articulated and mediated only through artistic and poetic imagery. After this dramatic shift in his interest from science to poetics, Bachelard wrote significant books on the poetic imageries of air, water, earth and fire, as well as on dreams and reveries, and the imagination of matter. His book *The Poetics of Space* (1958)¹ became one of the most influential books in the architectural discourse of the past half a century. The continued interest in Bachelard's philosophy of poetic imagery reflects a yearning for the mental dimensions of building, which the dominance of professionalist rationality in the practice of architecture tends to eliminate. The threatened dimension is the existential meaning, its mental content and the mediation between ourselves and the world.

Altogether, the quasi-rationality of our culture tends to wipe away mental meanings, not to speak of the spiritual dimensions. Human culture has devised three parallel approaches for the aspiration of meaning in the world and our existence in it: religion (and myth), science and art. The first seeks meaning through faith and primordial experience, the second through rational knowledge, and the third through sensory and emotional encounter. These three realms are independent paths of search, which cannot be fused into each other, and I intend to focus on the boundary and interactions of the worlds of science and art in.

TWO DOMAINS AND OPPOSITE DIRECTIONS

In his intriguing book *The Philosophy of No: A Philosophy of the New Scientific Mind*², written in 1949 at the time when his interests were beginning to shift from science to art, Bachelard explains the development of scientific thought as a gradual transition from animism through realism, positivism,

- 3 Ibid., 15.
- 4 Ibid., 16.
- 5 Lecture of William Gass in the series of philosophical conversations of the Washinton University in St Louis at the Pulitzer Foundation Library in 2002. The author's personal note.
- 6 Colin St John Wilson, "Public Good and Private Necessity", *RIBA Journal*, March 1979.
- 7 Jean-Paul Sartre, "What is literature?", *Jean-Paul Sartre: Basic Writings*, ed. Stephen Priest (London and New York: Routledge, 2001), 272.

rationalism and complex rationalism to dialectical rationalism.³ This is the closed orbit of scientific thought in Bachelard's view. "The philosophical evolution of a special piece of scientific knowledge is a movement through all these doctrines in the order indicated", the philosopher argues.⁴

William H Gass, the American logician-philosopher-writer (1924-2017) once suggested interestingly that the arts develop along the same route as science, but in the opposite direction away from rational, analytic and conceptual knowledge back towards an animistic encounter, existential knowledge and an embodied identification with the world.⁵ This image of science and art moving along the same path of human consciousness to opposite directions is thought-provoking and worth remembering when discussing the interchanges between neuroscience and architecture, for instance, a widening interest today. In our current culture, which is undeniably developing away from the natural, ecological and lived sense of reality towards an increasingly fabricated and manipulated experience, art desires to turn back towards life and the lived reality, its forces and processes, away from the world of excessive rationalisation and conceptualisation. Artistic imagery works its way from the cerebral and analytic understanding back towards a mythical, existential and animistic grasp of the world and an individual mental identification with it.

Science evolves and communicates through ideational concepts and rational argumentation, whereas art addresses our bodily and mental being directly with lived images without concepts, definitions and proofs. Colin St John Wilson, the architect of the British Library in London, describes this non-ideational and embodied language vividly: "It is as if I am being manipulated by some subliminal code, not to be translated into words, which acts directly on the nervous system and imagination, at the same time stirring intimations of meaning with spatial experiences as though they were one thing. It is my belief that the code acts so directly and vividly upon us because it is strangely familiar; it is in fact the first language we ever learned, long before words, and which is now recalled to us through art, which alone holds the key to revive it"⁶

Whereas scientific thought progresses and differentiates, artistic thought seeks to return back to an undifferentiated and experientially unified, oceanic understanding of the world. Artistic imagination seeks expressions that mediate the complexities of human experiential encounters with the world through lived poetic images. They mediate complete existential experiences. "If the painter presents us with a field or a vase of flowers, his paintings are windows, which are open on the whole world", Jean-Paul Sartre writes.⁷ The paradoxical task of fusing singularities and universalities is achieved through embodied images that are experienced and lived rather than reasoned and understood. It is painful to look at Tizian's painting *Flaying of Marsyas*

- 8 Paul Valéry, *Dialogues*, (New York: Pantheon Books, 1956), 94.
- 9 Jorge Luis Borges, *This Craft of Verse* (Cambridge, Massachusetts: Harvard University Press, 2000), 115.
- 10 Vida Katarina Vidovic, "The Abstract World Urn for Giorgio Morandi", *Juhani Pallasmaa, One week workshop*, Ljubljana, May 2015, Workshop Report (Ljubljana: University of Ljubljana, 2015), 55.
- 11 J.G. Ballard, *Crash Kolari* (Helsinki: Loki-Kirjat, 1996), 8.

(1570), in which Marsyas the Satyr is skinned alive in Apollo's revenge. The viewer feels his own skin being peeled off; this is a forceful bodily identification characteristic to artistic experience. We do not just watch or listen to a piece of art, it becomes part of our very being. The fact that we are moved by the cave paintings nearly thirty thousand years after their conception, is a proof of the magic power, the perpetual nowness and persistence of art. "An artist is worth a thousand centuries", Paul Valéry, the poet, declares⁸, and the oldest rock art in Africa and Australia is already approaching the half age of the poet's prediction. Jorge Luis Borges suggests an even longer time perspective for artistic quality: "Beauty connects us with the eternal"⁹.

Our quasi-rational materialist and disenchanting culture prioritizes cerebral understanding and knowledge over intuition and feeling, and regards science as a mediator of unquestionable and verified facts and truths, whereas art is commonly understood to convey mere subjectivities, emotions and sensory pleasures. Consumer culture even tends to regard art as mere cultural entertainment and spectacle. This dichotomy disappears, however, when we realize and accept that science and art are engaged in different dimensions of reality. The first investigation takes place in the world outside of ourselves (even in the case of the sciences of the human mind and the neural realm, the phenomena are studied outside and separate from ourselves as unique, living individuals), the latter directly in our experiential, embodied and mental reality, as well as the realms of memory, imagination and empathy.

Reality is another complex and arguable notion. Giorgio Morandi, the painter of metaphysical still-lives, suggests provokingly: "Nothing is more abstract than reality"¹⁰. Here the painter points at the complexity and fundamentally mysterious nature of the concept and experience of reality. The same can be said about the notion of time. The forceful development of consumerist culture is making the concept of reality ambiguous. J.G. Ballard, the writer of the best-selling novel *Crash*, makes an interesting comment on the altered reality of our time. He argues that the relation of fiction and reality is in the process of being up-ended. As we live increasingly in technologized, economic, social, and aesthetic fictions, the task of the writer is not any longer to invent fiction. Fictions are already here, Ballard suggests, and the writer's task is now to re-invent reality.¹¹ Even the physical settings of our technologized consumer culture are losing their sense of the real as they turn increasingly fictitious, aestheticized, unreal and dreamlike; just think of the ghostlike structures in our cities wrapped in opaque coloured glass, and totally without any existential meaning. We are living in deliberately fabricated stage sets for consumerist life, devoid of meaning. The dimension of architecture, which is especially endangered today is its existential meaning, the mental content in its experience. The task of architecture has never before in history been reduced to utility

- 12 Rudolf Wittkower, *Architectural Principles in the Age of Humanism* (New York: Random House, 1965), 117.
- 13 Alberto Pérez-Gómez, *Architecture and the Crisis of Modern Science* (Cambridge, Massachusetts and London, England: The MIT Press (1983), 1990), 298.
- 14 Hannes Meyer, "Building" (1928), in Claude Schnaidt, *Hannes Meyer Buildings, Projects and Writings* (Teufen AR / Schweiz: A Niggli, 1965), 94.

and economy, as its primary task has always been to mediate the human relationship with the world, between the gods and the mortals. As a consequence of this development towards the unreal, the task of the architect in strengthening our sense of the real, is as crucial as that of the writer. Our duty is to invent – or re-invent - a humane, existentially meaningful and dignifying reality, that is capable of continuing the human saga.

RATIONALISING ARCHITECTURE

Ever since the Renaissance time, there have been repeated efforts to turn architecture from an artistic and cultural craft into a scientific practice and a fully rationalized operation, based on a theoretical ground, measurable facts, and rational methods. Renaissance theories believed that through giving architecture a mathematical ground by means of associating it with the Pythagorean theory of musical harmony, this goal could be achieved. Indeed, in the Renaissance era, architecture became recognized in the *quadrivium* of the “mathematical arts” along with arithmetic (the study of numbers), geometry (the study of spatial relationships), astronomy (the study of the motions of celestial bodies), and music (the study of the motions apprehended by the ear).¹²

At the time of the Enlightenment systematic attempts to turn architecture into pure and predictable rationality emerged through the vocabulary and syntax of a pre-determined language of building types. This is exemplified by Jacques-Nicolas-Louis Durand’s *System of Architectural Elements*. Alberto Pérez-Gómez describes Durand’s intention in *Précis des Leçons d’Architecture* (1819): “Because architecture was the most expensive of all the arts, it should not be whimsical or guided by prejudice or routine. In order to avoid wasteful expense, architectural design had to follow closely totally rational and immutable rules”.¹³

Today there is a persistent line of thinking that wants to reduce architecture into performance, economy and aestheticized image. This approach necessarily implies the loss of poetic and existential meaning, and the reduction of architectural practice into a mere service profession satisfying only the desires of clients and investors.

The early Functionalist theories of the 1920s and 30s also presented efforts of turning architecture into a rationalized practice. Hannes Meyer’s ultra-materialist equation ARCHITECTURE = FUNCTION x ECONOMICS demonstrates the extreme reductivist view, which is increasingly seen as a target again today.¹⁴ Yet, Meyer’s own creative talent gave rise to such passionately charged architectural projects as the Peterschule of 1926 in Basel, suggesting that in his design work Meyer was himself guided by artistic desires and intuitions rather than his rationalist theories. The same has to be

15 Aino and Alvar Aalto, "Mairea", project description, *Arkkitehti*, No. 9, 1939.

16 Aalto held two lectures in 1930 with the title "Non-Synthetic Aspirations in Architecture"; the lectures do not exist.

17 Alvar Aalto, "Interview", *Nidaros*, Trondheim, Norway, 28 June, 1930 in *Alvar Aalto The Decisive Years*, Göran Schildt (New York: Rizzoli, 1986), 195-6.

said of the touchingly humane and optimistic buildings of early Functionalism, in general. Modern architecture was altogether inspired and guided by ideas of modern art just as much as by any operational theories or scientific views. “It all began in painting”, Alvar Aalto confessed, and revealed that his legendary Villa Mairea (1938-39) was inspired by spatial and formal ideas in modern painting.¹⁵ The separation of architecture from its connections with the realm of the arts and human mental parameters is exemplified by today’s fascination with algorithmic, digitalized and evidence based design. At the same time that the analytic interest is welcome, it projects a distrust in man’s intuitive, imaginative and empathic capacities, the ground of the arts...

As understood in phenomenological philosophy, the outer and the inner, the material and the mental, constitute a continuum, and architecture is unavoidably part of our mental reality. Built structures express our very humanity and its historicity. They should not be dealt with as external and neutral objects or utilitarian and instrumental issues outside of ourselves and the realities of life. Like life itself, architecture is a complex and “impure” mixture of incompatible worlds, such as technological rationality and artistic expression, knowledge and belief, conscious intentionality and unconscious projection, and consequently, its very essence cannot be inclusively theorized or predicted. Architecture is not a result of a fully rational operation, as it is always also an expression of intentions and desires, beliefs and dreams. It facilitates concrete requirements, but it is always also a confession. It is a confession, wish and vision, as much as it is a result of reasoning and deduction. It fuses reality and dream, knowledge and desire. It is not just a vehicle for specific utilitarian purposes, as it also unavoidably shapes ourselves, our self-understanding. In the Jonas Salk Institute by Louis Kahn, for instance, it is not the architect’s performative skill that moves and dignifies us, it is the unexplainable authority of the building and the metaphysical void of the courtyard, a space opening to the horizon of the Pacific ocean, that connects us with cosmic dimensions and sends shivers through our nervous system.

ARCHITECTURE AS A SYNTHESIS

As a young man, Alvar Aalto believed in the possibility of a purely rational architecture, and in the early 1930s he was even working on a book on “non-synthetic architecture”.¹⁶ “I do not believe that it is sensible to concentrate on synthesis in tackling an architectural assignment [...] the Functionalist architect is an entirely different professional type from the old-style architect. In fact he is not an architect at all; he is a social administrator”, Aalto said in an interview.¹⁷ Yet, ten years later he made an exactly opposite statement with equal assurance: “Architecture is a synthetic phenomenon covering practically all fields of human activity. An object in the architectural field

- 19 Alvar Aalto, "Rationalism and Man", *Alvar Aalto in His Own Words*, op.cit., 91.
- 18 Alvar Aalto, "The Humanizing of Architecture", *Alvar Aalto in His Own Words*, ed. Göran Schildt (Helsinki: Otava Publishing Company Ltd., 1997), 102-3.
- 20 Alvar Aalto, "The Trout and the Stream", *Alvar Aalto in His Own Words*, op.cit., 108.
- 21 Richard Neutra, *Survival Through Design* (Oxford: Oxford University Press, 1954), 7.
- 22 Alvar Aalto, "Art and Technology", *Alvar Aalto in His Own Words*, op.cit., 174.

may be functional from one point of view and unfunctional from another [...] If there were a way to develop architecture step by step, beginning with the economic and technical aspects and later covering the other more complicated human functions, the purely technical functionalism would be acceptable; but no such possibility exists [...] Technical functionalism is correct only if enlarged to cover even the psychophysical field. That is the only way to humanize architecture.¹⁸ As a result of his newly reversed ideology, Aalto began to speak of architecture as a synthetic aspiration and to theorize ideas of “extended rationalism” and “flexible standardization”.¹⁹ Aalto also saw the biological and neurological dimensions of architecture: “I would like to add as my personal, emotional view that architecture and its details are in some way all part of biology”.²⁰ Four years later Richard Neutra extended the biological view to the human “nervous make-up”. “Today design may exert a far-reaching influence on the nervous make-up of generations”, Neutra professed.²¹ Today, sixty years later, neuroscientists are studying these influences and interactions with today’s extraordinary laboratory instruments and focused scientific thinking. Due to the enticing power of new technologies in research, the philosophical understanding of the nature of architecture as a fundamentally mental endeavour, is crucial as a guide to research and, especially, for the interpretation of the scientific findings in neuro-science.

ART, ARCHITECTURE AND SCIENCE

In his inaugural lecture entitled “Art and Technology”, as the newly appointed member of the Academy of Finland in 1955, Aalto made his confidence in the artistic approach in architecture clear: “Almost every formal assignment involves dozens, often hundreds, sometimes thousands of conflicting elements that can be forced into functional harmony only by an act of will. This harmony cannot be achieved by any other means than art. The final value of individual technical and mechanical elements can only be assessed afterwards. A harmonious result cannot be achieved with mathematics, statistics, or probability calculus”.²² Aalto made this statement on the primacy of art over science in the context of architecture knowing that some of the most authoritative representatives of scientific thinking in Finland were present at his lecture. I am not speaking here of a primacy of art over science, or vice versa, I am pointing out their constitutive difference.

The relationships and interactions of science and art are still an ongoing discussion today. In our utilitarian culture science is usually judged to have a higher truth value, but there are also voices that see the meaning of art being closer to the realities of life. Vittorio Gallese, one of the discoverers of the mirror neurons, which have opened promising views into our

- 23 Vittorio Gallese and C Di Dio, "Neuroesthetics: The Body in Esthetic Experience", *The Encyclopedia of Human Behaviour*, Vol. 2, ed. V.S. Ramachandran (Amsterdam: Elsevier, 2012), 693.
- 24 Semir Zeki, *Inner Vision: An Exploration of Art and the Brain* (Oxford: Oxford University Press, 1999), 2-3.

unconscious pre-reflective and affective interactions with the world, expresses an unexpected view of the relationship between science and art. “From a certain point of view, art is more powerful than science. With much less expensive tools and with greater power of synthesis, artistic intuitions show us who we are, probably in a more exhaustive way with respect to the objectifying approach of the natural sciences. Being human squares with the ability to ask ourselves who we are. Since the beginning of mankind, artistic creativity has expressed such ability in its purest and highest form.”²³ This statement by a humanist scientist is surprisingly parallel with Alvar Aalto’s intuitive view 60 years earlier. Semir Zeki, the British neurobiologist, extends the realm of the intuitive artistic grasp to human neural phenomena: “Most painters are also neurologists [...] they are those who have experimented upon and, without even realizing it, understood something about the organization of the visual brain, though with the techniques that are unique to them.”²⁴ I see no reason to limit this argument of the artist’s intuitive grasp of neural realities to visual brain alone. The artist cannot, of course, be a neuroscientist in the disciplinary sense of the science, but she can intuit aspects of the functioning of her neural networks. As we know now, the senses interact and collaborate and cross-modal interactions are not limited to the special phenomenon of synesthesia. An artist may not know anything about neuroscience, yet she may be able to live and intuit neurological correlations through her sensitized sense of existential causalities. This sensitivity to its own functioning must be considered a unique quality of our neural constitution.

It is evident that there are numerous areas and sub-questions in architectural design—that can and should—be approached through scientific knowledge and methodologies. Architecture has a double essence, functional and technical rationality, on one hand, and the existential mediation between the mind and the world, on the other. Even functional design does not only respond to the brief, as it actively choreographs and initiates action, and even the technical aspects can mediate poetic intentions. I do not underestimate the cognitive and rational ground of building design, but I wish that the human capacities of feeling, atmosphere, intuition, memory, empathy, compassion and imagination are not underestimated. Questioning the significance of computers in the various phases of project development today would be thoughtless. My argument is that as a deeply grounded cultural, mental and artistic complexity, an architectural proposition cannot be fully theoretically formulated and mechanically or digitally conceived. Thus, architecture must be grounded on “impure” and partial theories, and “hybrid” methods combining knowledge and precision with imagination and intuition. As a consequence of its complexity, architecture is bound to arise from an iterative and fused embodied action rather than mere rationality. There can well be theories and science-based rational aspects in the design process, but in its entirety the process is

- 25 José Ortega y Gasset, *The Dehumanization of Art and Other Essays on Art, Culture, and Literature* (Princeton University Press, Princeton, NJ, 2013).
- 26 I learned the quote of Alberto Giacometti from a student in my workshop in Ljubljana in 2015, see note 9. Original source unknown.

iteratively synthetic, which was Alvar Aalto's view above. The architectural design process is guided by a subjective "self-piloting" action and an immersive embodied identification with the concrete task, that fuses rationality and emotion, knowledge and intuition, reality and imagination, instead of being an application of cerebral, methodical and predictable procedures. The design is not a logical path, as it contains repeated deviations, dead-ends, new beginnings, hesitations, temporary certainties and a gradual emergence of an acceptable goal as the result of the process itself.

All artistic works are essentially forms of questioning. In fact, questions and answers arise simultaneously in the poetic realm. Metaphorically, creative work is closer to hunting or fishing than a scientific project; you never know what you are going to catch, if anything. Due to the essential existential content of architecture, its design cannot be a smooth logical problem-solving process. This call for a hybrid approach, that is intuitively balanced, is also the demanding task of architectural education, but rarely understood in its full essence. In fact, the architect needs to understand all the three realms of existential meaning – faith, knowledge and emotion - mentioned in the beginning of this essay.

ART AS REPRESENTATION AND REALITY

One of the central developments in the art of the past one hundred years has been its distancing from its mediating representational function to become an increasingly autonomous and independent reality of its own. In his book *The Dehumanization of Art* of 1925, José Ortega y Gasset presented a thoughtprovoking idea concerning the shifting subject matter of art. In his view, the subject matter was first "things" or events (as in the art of Caravaggio and Velasquez), then "sensations" (as in the works of Cézanne and Picasso), and finally, "ideas" (as in modern and contemporary art).²⁵ Ortega's view actually suggests that art has approached science in its new ideational quality. However, "The object of art is not to reproduce reality, but to create a reality of the same intensity", Alberto Giacometti reminds us.²⁶ The historical development of art encompasses the emergence of abstraction and autonomy, the pluralisation of conceptions of reality as well as the increasing prominence of multisensory practices moving away from pure retinality towards full embodiment. These orientations also include the questioning of the artist's unique creativity (Marcel Duchamp, automatism, conceptual art), disengagement of the work of art from its frame and base and its transformation into an environment or part thereof (landscape and land art) and, lastly, atmospheric works whose essence lies in their multisensory, physical and emotive presence, rather than in representation (Olafur Eliasson). At the same time, art has accepted the multi-sensory

- 27 Albert Einstein, quoted in Richard Dawkins, *op.cit.*.
- 28 Erich Fromm, source unidentified, most likely *Escape from Freedom* (1941).
- 29 The notion "dirty proof" was used by several lecturers at the conference "Simplicity - Ideals in Practice in Mathematics & the Arts", City University of New York, Graduate Center, 3-5 April, 2013.
- 30 Paul Dirac, "The Evolution of the Physicist's Picture of Nature", *Scientific American*, 208, nro 5 (May 1963), 45-53.

nature of human perception. In his works Richard Serra has activated our sense of weight, gravity and muscular experience, James Turrell has articulated experiences of light and enabled us to see “tactile light” and “old light”, cosmic light that has travelled thousands of light years through outer space before hitting our retina; this experience even permits us to touch time and sense infinity and eternity. We may well be looking at the light of a planet that does not exist any more. A number of artists have also approached their field by means of scientific theories and methods, such as the members of the Light and Space Movement (most notably Robert Irwin and James Turrell), that emerged in the 1960s, and more recently the Islandic-Danish artist Olafur Eliasson, a later member of this movement.

THE MAGIC OF BEAUTY

The basic structure of Olafur Eliasson’s works recurs from one piece to the next: a technical construction based on rational knowledge and deduction—an “experimental setup”, in his own words—elicits a personal experience in the spectator. The artistic or poetic experiential reality is suspended between the work and the viewer’s self. Often the experience reveals an unexpected dimension in the perception of physical reality, awakening a sense of ultimately inexplicable, mystical or poetic nature of the lived reality. The very clarity of the effort calls forth the hidden mysteriousness of our experiences. Even Albert Einstein made the surprising confession: “The most beautiful thing we can experience is the mystical. It is the source of all true art and science.”²⁷ Here lies also the power of Louis Kahn’s cosmic void at the Salk Institute. It is the sense of the mystical that is in the danger of being annihilated in our culture of consumption and quasi-rationality, the superstitions of our time, masked as rationality and reason.

It is evident that beauty is an ideal and aim in science and mathematics as much as in the arts. It also seems that in both science and art beauty is connected with ethical judgement. “Beauty is not the opposite of the ugly, but of the false”, the social psychiatrist Erich Fromm claims.²⁸ Today mathematicians use the notion of “dirty proof” for a mathematical proof that has been achieved by immense computing power, but which cannot be judged and grasped by human senses and intelligence.²⁹ A dirty proof does not conform with the ideal of mathematical beauty.

Like Einstein, many other great scientists have seen an aesthetic criterion in their work and choices. Paul Dirac, the British theoretical physicist, who discovered the laws governing the quantum behaviour of the electron, believed that theories of physics that are beautiful are probably also true.³⁰ Herman Weyl, who developed the quantum and relativity theories, made an even more frank confession: “My work always tried to unite truth with

- 32 Semir Zeki, *op.cit.*, 1.
- 31 "In meiner Arbeit habe ich immer versucht, das Wahre mit den Schönen zu vereinen; wenn ich mich über das Eine oder das Andere entscheiden musste, habe ich stets das Schöne gewählt". The quotation appears above the bust of Weyl located in the Hermann Weyl Zimmer at the ETH Zurich.
- 33 For a thoughtprovoking discussion on beauty and autonomous aesthetic choice among animals, especially birds, see: Richard O. Prum, *The Evolution of Beauty: How Darwin's Forgotten Theory of Mate Choice Shapes the Animal World – and Us* (New York: Anchor Books, 2018).
- 34 Paul Valéry, "Eupalinos or the Architect", *Dialogues* (New York: Pantheon Books, 1956), 107.
- 35 Gaston Bachelard, *The Poetics of Space*, *op.cit.*, 6.

the beautiful, but when I had to choose one or the other, I usually chose the beautiful".³¹ Today Frank Wilczek, the Nobel Laureate theoretical physicist and mathematician, is working on theories of symmetry as the fundamental source of order and beauty in the physical and natural worlds. On the other hand, Semir Zeki has suggested "a theory of aesthetics that is biologically based".³² Research on the evolutionary ground of aesthetic choice among animals can be expected to valorize our own environmental preferences.³³ As mentioned earlier, the connection of architecture and biology was already intuited by Alvar Aalto. Today, we are entering an age of biology on all fronts.

THE SHARED MISSION OF ART AND SCIENCE

Profound architecture strengthens our sense of the real, the reality of our experience, instead of leading us to a world of fantasy. However, this strengthened sense of reality also enables us to dream. The courtyard space of the Salk Institute sets us in the reality of the landscape, the view of the ocean and the changing weather and illumination, as if we were on a stage, but the clarity of Kahn's vision leads us to metaphysical contemplation. Indeed, Paul Valéry asks: "Is there anything more mysterious than clarity?"³⁴

As Bachelard noted, the task of architecture is to allow us to dream: "If I were asked to name the chief benefit of the house, I should say; the house allows one to dream in peace [...] the house is one of the greatest powers of integration for the thoughts, memories and dreams of mankind".³⁵ Through their scientific or alchemical nature, Eliasson's works remind us of the common mythical and historical origins of art and science in wonder, and the fact that earlier in history artists practiced both endeavours simultaneously. In fact, as long as science studied the reality observable by the human senses, the great artists were among the most significant scientists of their times, whereas closer to our time, especially many biologists were remarkable draftsmen and watercolorists.

Eliasson's work reminds us of the explorers in history of the mysteries common to science and art. Both practices were inspired and guided by a sense of curiosity and wonder. We can think of Filippo Brunelleschi verifying his theory of perspective in front of the Baptisterio in Florence; Leonardo da Vinci performing his nocturnal anatomy studies in a secret Florentine cellar room; Albrecht Dürer constructing a perspective image of a woman lying on the table in front of him, with his framed drawing device; Johannes Vermeer examining his model through a *camera lucida* in front of the window, so familiar to us in his paintings, and; Paul Cézanne contemplating the discontinuous transitions of horizontal lines resulting from his incessant staring at the still life on the table. We might also think of David Hockney today stooped over optical devices in his attempt to prove that scientific

36 Quoted in Richard Dawkins, "Bar Codes in the Stars", *op.cit.*, 13. This quote has also been attributed to another poet, William Buttler Yates.

37 Maurice Merleau-Ponty, *Signs* (Evanston, Ill.: Northwestern University Press, 1982), 56.

instruments were used as technical aids by artists hundred years earlier than so far assumed. In order to prove his assumption, he has returned back to the use of the historical technical devices to practice his own art as his predecessors did more than four centuries before him. With the help of his numerous specially skilled assistants, Olafur Eliasson is also studying the mysteries of physics, as well as human perception and understanding, in order to create experiences that express truth, beauty and magic, all at the same time.

Science and art can be seen as opposite, perhaps even mutually exclusive approaches to reality, as Bachelard did. Science has occasionally even been accused of robbing the world of its sense of magic and poetic wonder through offering explanations that only appeal to reason. In 1817 the poet John Keats blamed scientists like Isaac Newton for destroying the poetry of the rainbow.³⁶ However, we need not to be supporters of either science or art, as we can have confidence in both realms, each one with its own specific intentions and tasks. I do not believe that neuroscience could destroy the poetry of architecture. Do not science and art ultimately both approach the mysteries of the world, human consciousness and understanding, and the enigma of our existence in the world? “How would the painter or the poet express anything other than his encounter with the world”, Maurice Merleau- Ponty argues, and this argument surely applies to the scientist and architect as well.³⁷

An earlier, more brief, version of this essay was published in the first issue of the *Intertwining Journal*, Venice, 2018. A version of the essay was also given as a lecture in August 2018 entitled “Between Art and Science: reality and experience in architecture and art” at the New School of Architecture and Design in San Diego, California in the summer course on Architecture and Neuroscience.