7th European Conference

on Social Networks

Abstracts & Program

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Abstracts and Program

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Some information

Faculty of Social Sciences
University of Ljubljana
Kardeljeva ploščad 5
1000 Ljubljana

Website: www.eusn2023.org
Twitter: @EUSNconference

WIFI

Network: `fdvconf`
Password: `unifdv2008`
... or use Eduroam.

City transport

Ljubljana's public transportation system, managed by Ljubljanski potniški promet (LPP), is efficient and user-friendly. City buses will be free for all conference participants (**having a conference tag**), providing easy access to various parts of the city.
For more information see:
https://eusn2023.org/practical-information/

Hospitality suite

Tuesday, Wednesday and Thursday at Aula Caffee, starting at 20:00.

Keynotes

Opening keynote: 5 Sep, 12:30
Prof. Dr. Károly Takács

Keynote: 7 Sep, 15:20
Prof. Dr. Betina Hollstein

Special events

Early and Middle Career Researchers Social Gathering

Early and Middle Career Researchers (EMCRs) on Social Networks group aims at bringing together researchers and postgraduate students to boost connectivity and share what it means to be in this stage of their careers while working with networks. This group provides the space to discuss themes and share ideas for taking individual actions and identifying potential collective problem-solving solutions for the whole community.

EUSN 2023 is proud to host the Early and Middle Career Researchers Social Gathering on Tuesday, September 5th at 18:00 in a place to confirm. The EMCRs event at EUSN 2023 aims to create the space to get to know other early and middle-career researchers working with networks and discuss current/future research collaborations. Everyone is more than welcome to join. If you have any questions, please email the organisers Francisca Ortiz Ruiz (Millennium Institute for Care Research MICARE, Santiago, Chile) and Zoran Kovacevic (Social Networks Lab, ETH Zürich).

Round table: The Future of Teaching SNA

A panel discussion on "The Future of Teaching SNA". Each panellist will talk for around 5 minutes on emerging issues in the field (such as the rise of AI technologies and the challenges it poses to teaching SNA). This will be followed by a Q&A discussion of the issues and challenges associated with teaching SNA, and the implications for the future. We will then conclude the panel by a 'call-to-action', where we will discuss, with any interested parties, whether they would like to co-author a collective article on teaching SNA or be part of a special issue. Panel discussants: Christina Prell, Isabella Gollini, Juergen Lerner and Riccardo De Vita.

Restaurant recommendations

Ljubljana boasts an array of excellent restaurants. Given the close proximity of the conference venue to the city center, you are encouraged to explore and dine at these establishments. You can find a comprehensive list of recommended restaurants on this website: https://gourmet-lj.si/en/gourmet-experiences/restaurants-and-bars.

Bellow is the list of restaurants that are located very close to the conference venue.

Vivo
Website | Map | **Distance:** 6 min walk
As one of our catering partners Vivo Catering will host the EUSN 2023 gala dinner on Wednesday, 6 September but you are welcome to visit them for lunch every day from 10 am to 2 pm.

Aula Cafe
Map | **Distance:** in-house
Our catering partner will make coffee for you during conference breaks but you can also visit their modern café on the ground floor of the conference venue. They also offer tasty sandwiches and a variety of snacks.

Slovely
Website | Map | **Distance:** in-house
The cantine conveniently located on the ground floor of the conference venue will provide you with affordable meals.

Barbado
Website | Map | **Distance:** 3 min
Barbado restaurant is open from 7 am for morning coffee and 9 pm. During lunch hours they offer a daily variety of food, including pizza, wiener schnitzel, fried cheese, and pancakes.

Kapital
Map | **Distance:** 2 min
Convenient for coffee or a fast-food meal.

Enka
Website | Map | **Distance:** 3 min
Enka is convenient for a quick cup of coffee or hotdog.

Hotspot
Map | **Distance:** 5 min
Convenient for coffee or a fast-food meal.

Contents

About

The 7th European Conference on Social Networks (EUSN 2023) was hosted by the Centre for Methodology and Statistics of Faculty of Social Sciences at the University of Ljubljana, 4 – 8 September 2023.

Continuing the traditions of previous conferences in Barcelona (2014), Paris (2016), Mainz (2017), Zurich (2019), Naples (2021) and Greenwich (2022), as well as the legacies of predecessors Applications of Social Network Analysis (ASNA) and UK Social Network Analysis (UKSNA), the conference brings together researchers and practitioners from the social sciences in the broad sense as well as statistics, computer science, data science, physics, economics, humanities, and other areas dealing with social networks.

Organizing committee

- **Luka Kronegger**, Conference Coordinator
- **Marjan Cugmas**, Program Coordinator
- **Marina Trkman**, Coordinator of Special Events
- **Katja Koren Ošljak**, Organizer of Social Activities
- **Špela Orehek**, Poster Session Organizer

Program committee

The Program Committee for the European Network Conference consists of renowned experts and scholars in the field who play a pivotal role in the selection and evaluation process of submissions. With their wealth of knowledge and experience, the committee conducts a rigorous review process to ensure that the conference program reflects the latest advancements and cutting-edge research in the field of network science.

- **Alexandra Gerbasi**, Exeter Business School
- **Anna Piazza**, University of Greenwich
- **Bernie Hogan**, University of Oxford
- **Bruce Cronin**, University of Greenwich
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- **Sophie Mützel**, University of Lucerne
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- **Stefano Ghinoi**, University of Greenwich
- **Srinidhi Vasudevan**, University of Greenwich
- **Susanna Zaccarin**, University of Trieste
- **Termeh Shafie**, University of Manchester
- **Tom Snijders**, University of Groningen and University of Oxford
- **Ulrik Brandes**, ETH Zürich
- **Viviana Amati**, University of Milano-Bicocca
- **Yasaman Sarabi**, Edinburgh Business School Heriot-Watt University
- **Zsófia Boda**, University of Essex

Program overview

The reception desk will open on Monday at 11:00 and will remain open throughout the conference from 9:00 to 18:00.								
Monday, September 4								
Room	**FDV-6**	**FDV-7**	**FDV-12**	**FDV-13**	**FDV-14**	**FDV-20**	**FDV-21**	
13:00-16:00 (Workshops)	REM beyond dyads: relational hyperevent modeling with eventnet (beginners)	Introduction to UCINET	Cancelled: manynet: an R package for multimodal network analysis and more	Egocentric network analysis with R	Social Network Analysis Workshop: How do I develop and answer my research question?	Advanced RSiena workshop	The Analysis of Longitudinal Social Network Data using RSIENA	

Tuesday, September 5								
Room	**FDV-6**	**FDV-7**	**FDV-12**	**FDV-13**	**FDV-14**	**FDV-20**	**FDV-21**	
8:30-11:30 (Workshops)	REM beyond dyads: relational hyperevent modeling with eventnet (advanced)		Cancelled: Social network analysis in STATA	Egocentric network analysis with R	Social Network Analysis Workshop: How do I develop and answer my research question?	Advanced RSiena workshop	The Analysis of Longitudinal Social Network Data using RSIENA	
12:10-12:30	**Welcome & Conference opening (auditorium)**							
12:30-13:50	**Keynote: Prof. Dr. Károly Takács (auditorium)**							
Room	**FDV-6**	**FDV-7**	**FDV-12**	**FDV-13**	**FDV-14**	**FDV-20**	**FDV-21**	**FDV-23**
14:00-15:30	Negative Ties and Signed Graphs (1/2)	Modeling Social Influence (1/2)	Interpersonal networks and the COVID-19 pandemic (1/2)	Networks, Culture, Interaction (1/2)	Egocentric networks (1/2)	Gender and social networks	Agent-based models of social networks	Networks and knowledge production (1/6)
15:30-15:50	**Coffee**							
15:50-17:20	Negative Ties and Signed Graphs (2/2)	Modeling Social Influence (2/2)	Interpersonal networks and the COVID-19 pandemic (2/2)	Networks, Culture, Interaction (2/2)	Egocentric networks (2/2)	The Future of Teaching SNA		Networks and knowledge production (2/6)
20:00 -	**Hospitality Suite (Aula Caffee)**							

Wednesday, September 6								
Room	**FDV-6**	**FDV-7**	**FDV-12**	**FDV-13**	**FDV-14**	**FDV-20**	**FDV-21**	**FDV-23**
9:00-10:30	Networks and crime (1/2)	Modeling Network Dynamics (1/4)	Political networks (1/2)	Family networks and personal networks through the life-course (1/3)	Hypergraphs for complex systems: methods and applications	Spatial networks	Social media, online networks (1/2)	Networks and knowledge production (3/6)
10:30-10:50	**Coffee**							
10:50-12:20	Networks and crime (2/2)	Modeling Network Dynamics (2/4)	Political networks (2/2)	Family networks and personal networks through the life-course (2/3)	Multilayer and feature-rich networks	Organizational networks (1/4)	Social media, online networks (2/2)	Networks and knowledge production (4/6)
12:20-13:30	**Lounch time** **Business Meeting (FDV-6)**							
13:30-15:00			Social networks and health (1/3)	Family networks and personal networks through the life-course (3/3)	Networks in history and archaeology (1/3)	Organizational networks (2/4)	Networks, practices, and beliefs: relational and neo-structural approaches to institutional processes	Networks and knowledge production (5/6)
15:00-17:00	**Poster & coffee session**							
19:00-21:00	**Conference dinner (Vivo)**							
20:00 -	**Hospitality Suite (Aula Caffee)**							

Thursday, September 7								
Room	**FDV-6**	**FDV-7**	**FDV-12**	**FDV-13**	**FDV-14**	**FDV-20**	**FDV-21**	**FDV-23**
9:00-10:30		Modeling Network Dynamics (3/4)	Social networks and health (2/3)	REDES panel: promoting collaboration and new studies in the community (1/2)		Organizational networks (3/4)	Blockmodeling, community detection and network partitioning (1/2)	Networks and knowledge production (6/6)
10:30-10:50	**Coffee**							
10:50-12:20		Modeling Network Dynamics (4/4)	Social networks and health (3/3)	REDES panel: promoting collaboration and new studies in the community (2/2)	Networks in history and archaeology (2/3)	Organizational networks (4/4)	Blockmodeling, community detection and network partitioning (2/2)	Multilevel networks
12:20-13:30	**Lunch time**							
13:30-15:00	Networks of inter-ethnic relations and integration	Networks, employment and the labour market	Sustainability and Social Network Analysis	Multimethod approach / mixed method approach	Networks in history and archaeology (3/3)			
15:00-15:20	**Coffee**							
15:20-16:45	**Keynote: Prof. Dr. Betina Hollstein (auditorium)**							
16:45-17:00	**Closing (auditorium)**							
20:00 -	**Hospitality Suite (Aula Caffee)**							

Friday, September 8								
Room	**FDV-6**	**FDV-7**	**FDV-12**	**FDV-13**	**FDV-14**			
9:00-12:00 (Workshops)	Tidy Networks: the tidyverse and tidygraph for social network analysis in R	Analyzing negative and signed networks	Mixed Methods Research into Social Networks	The goldfish package in R	Empirically calibrated network simulations			

Keynotes

Social Network Analysis and Analytical Sociology

Károly Takács

Linköping University, Sweden and
Centre for Social Sciences, Hungary

Analytical sociology seeks to explain macro societal phenomena and collective dynamics as outcomes of micro-mechanisms comprised of individual decisions and interactions. Social network analysis explores the structural patterns of these interactions and interpersonal normative constraints. This presentation aims to demonstrate how integrating these disciplinary traditions can aid in understanding and explaining core problems in the social sciences: inequality, cooperation, conflict, and social order. These problems encompass enduring and contemporary societal challenges that are intended or unintended consequences of individual decisions, beliefs, and opportunities that are interrelated and interdependent; and constrained by relationships and interactions. Social network analysis identifies two main types of structural constraints: influence through existing ties and the endogenous selection of relations. Several structural micro-mechanisms falling under these two main types have been explored and identified in diverse empirical settings. Yet the crucial link to core macro societal problems—an essential element of analytical sociology—has rarely been established. To encourage the audience to create this link more frequently, I present a taxonomy of links of structural mechanisms to macro societal problems. The taxonomy includes how selection by in-degree popularity and transitivity, as well as forbidden cycles, could lead to inequality; how cooperation could be generated through mechanisms of reciprocity, indirect reciprocity via cyclical closure, two-path effects, reputation, and competitive altruism; how social identity and conflict could arise from structural balance mechanisms and parochial altruism; and how homophily, behavioral assimilation, gossip, and tension management could contribute to monitoring, punishment, and social order.

Personal network dynamics. A relationship-related structural approach

Betina Hollstein

University of Bremen, Germany

The mechanisms of network dynamics are still not fully understood. In this presentation, I propose a concept of social relationships that provides a novel perspective on the dynamics of personal relationships and networks, especially the ways in which relationships are formed, maintained, or lost. Building on Georg Simmel's concept of "form", this relationship-related structural approach specifically accounts for opportunities and constraints resulting from the fact that relationships are solidified patterns of interaction that, once established, can develop a power of their own (inertia, momentum) that cannot easily be influenced by the involved actors. As I will illustrate this approach allows a nuanced analysis of the impact of life events on the functional capacity and the structure of personal relationships and networks. Implications for empirical network studies are discussed.

List of abstracts – talks

Agent-based models of social networks

An agent-based modeling approach to social cohesion

Nigel van Herwijnen

Universitat Autònoma de Barcelona, Spain

Social cohesion, the “social glue” that bridges categorical cleavages, is a profoundly relational concept. Theories generally focus on either its ideational component (e.g., trust, solidarity, etc.) or its structural component (e.g., clustering in social networks). But by mostly studying these components separately, researchers miss the role of the structure of everyday interactions and relationships in the formation of trust and solidarity. This paper uses an agent-based model (ABM) to connect the micro, meso, and macro dynamics to explore how societal cohesion forms differently under different social network structures.

In a simulated network representing a small scale society, ideational cohesion is implemented as a continuous variable representing an individual’s trust towards a group of individuals. Interactions with individuals of that group influence a person’s trust toward this group, as proposed by intergroup contact theory. The underlying mechanism here differs from most opinion polarization models, as it is not the alter’s trust that influences an ego’s trust, but the alter’s characteristics. Originally, intergroup contact theory describes only positive effects through dyadic interactions. If this were the case, cohesion would increase indefinitely, regardless of network structure. This changes however when indirect contact effects and negative interactions are added to the model. In this case, we no longer always find society-wide trust. Simultaneously, my preliminary analyses show that the results appear highly dependent on the social network structure. Negative interactions dampen the spreading of trust, but indirect contact appears to have different effects in different cases. Especially in networks that show stronger clustering, exposure to intergroup contacts becomes increasingly influential to the spread of trust. Ultimately, this paper shows an initial exploration of the influence of the social network structure on the causal mechanisms driving ideational cohesion.

Mechanisms underlying personal network homophily – difference between the similarity in preferences & behaviors and the similarity in sociodemographic characteristics

Beata Łopaciuk-Gonczaryk[1], ***Katarzyna Growiec***[2], ***Bogumił Kamiński***[3]

[1]University of Warsaw, Poland
[2]SWPS University of Social Sciences and Humanities, Poland
[3]SGH Warsaw School of Economics, Poland

We investigate the mechanisms underlying the homophily in personal social network, especially evident in the closest network circles. We pay a special attention to the relationship between psychological characteristics of individuals and composition of their social networks. In particular, we focus on the role of the need for cognitive closure (NFC), which is a tendency to prefer simplified representations of the world and potentially leads to avoidance of heterogeneity within social networks. We also investigate the significance of social trust as factor which facilitates creating and maintaining ties with dissimilar others, by lowering stress and uncertainty. Our hypothesis is that social trust is a moderator of the positive correlation between NFC and homophily. We expect higher trust to lead to greater tolerance for heterogeneity in case of high-NFC individuals, as the trust lowers the sense of unpredictability. Our methodological approach is three-track. First, we take a theoretical and general approach. We utilize an original agent-based simulation model for analyzing mutual relationships between evolution of social networks and psychological characteristics of actors. We show that in high-social-trust societies, high NFC individuals have a lower tendency to homophily in social relations than in low-social-trust societies. Secondly, we apply structural equation modelling to analyze specific data for Poland, an example of low-trust society. We utilize data collected in the survey of a representative sample for Polish population (N=1035), including original measures capturing egocentric networks and their composition, paired with information on different psychological traits. We confirm that differences in social trust between individuals matter for differences in the relationship between NFC and personal network (up to 15 alters) homogeneity regarding common hobbies and beliefs (similarity in interests, as well as political and religious views). However, we find no significant relationship between NFC and similarity in sociodemographic characteristics (gender, age, education, and economic status). Interestingly, similarity in the preferences and behaviors can be an effect of both selection and influence, while similarity in sociodemographic characteristics of adults can be expected to be an effect of selection only. Lastly, we use panel data regarding ties between students (based on original study on students' groups from three Polish universities), in order to verify our conceptualization regarding mechanisms underlying different types of homophily in an alternative dataset and within a longitudinal framework.

Organising network generators: a taxonomy of algorithm mechanisms and the properties of the generated networks

Cristina Chueca Del Cerro*, *Jennifer Badham

Durham University, United Kingdom

Social networks are known to have certain structural properties that distinguish them from other types of networks (Newman and Park 2003), notably their relatively high assortativity and clustering coefficient. While they share the skewed degree distributions of other networks, there is an upper limit to the number of meaningful connections a person can maintain so skewness may be less extreme. Examples of social networks include high school friendship networks, epidemic networks, research collaboration networks, and social media interactions, among others.

Classic network generators developed by Erdos-Renyi (1960), Barabasi-Albert (1999), and Watts-Strogatz (1998) create artificial networks that differ with respect to these properties, however these networks are not realistic in terms of all three properties. Properties measure different aspects of the network and are therefore interdependent. Yet, we do not know the constraints that certain values of network properties indicate about each other. To the best of our knowledge there are no network generator algorithms available that target multiple structural properties at once, independently of each other.

We are developing a taxonomy that examines existing network generators, classifies their mechanisms in a meaningful manner, and assesses the extent to which structural properties can be targeted. Our publicly available database will have searchable network generator papers, our taxonomy, and a step-by-step explanation of how these algorithms work. This database of network generators and the taxonomy are essential to understand how these network generators are implemented, to ultimately target these properties on a single algorithm capable of generating more realistic artificial social networks (RASN). We intend to present this work in progress and preliminary findings.

Our future plans include using RASN alongside real social network data in simulations applied to a range of topics from diffusion processes like epidemics to collective outcomes such as health behaviours. Overall, we propose a systematic organisation of existing network generators with their corresponding structural properties in the form of a database to inform the development of a new algorithm capable of targeting multiple network properties to generate realistic artificial social networks.

Predicting a SPiral of mutually reINforcing negative OUTgroup attitudes (SPIN-OUT) in multiethnic classrooms

Alla Loseva[1], ***Andreas Flache***[2], ***Christian EG Steglich***[1], ***Michael Mäs***[3], ***Sabine Otten***[1]

[1]University of Groningen, Netherlands
[2]Groningen University, Netherlands
[3]Karlsruhe Institute of Technology, Germany

The growing ethnic and cultural diversity in Western European societies has raised concerns about threats to societal cohesion. One particularly worrying possibility is what we term the SPiral of mutually reINforcing negative OUTgroup attitudes (SPIN-OUT), where interaction dynamics in multigroup environments exacerbates negative attitudes towards outgroups. We theorize that different combinations of conditions and micro-level processes could form this vicious cycle. For example, a spin-out could arise if negatively perceived interpersonal outgroup interactions lead to worsening outgroup attitudes which in turn increase ethnic friendship homophily, fostering the further reinforcement of negative outgroup attitudes in interactions between ingroup members while reducing positive outgroup interactions. To assess the potential of it taking place in different contexts, we develop in this project simulation models of possible spin-outs in multiethnic classrooms, using stochastic actor-oriented models (SAOM).

In this paper, we empirically assess micro-processes in the co-evolution of networks and interethnic attitudes that could contribute to the spin-out dynamics. We test the effects of influence coming from friends and normative pressures from the ingroup, accounting for the effects of positive and negative contact with the outgroup. We also investigate whether peer influence effects are more pronounced at higher levels of ethnic identification. The model controls for attitude- and homophily-driven network changes that affect the very interpersonal relations through which contact and social influence occur. We test the model on longitudinal data from the "Friendship and Identity in School" project, which includes six waves of data on ethnically diverse grade-level networks comprising more than 2,000 secondary school students in Germany.

We then aim to use the empirically calibrated models to explore the scenarios of joint network and behavioral evolution in simulated classrooms. By doing so, we will identify which processes and conditions (e.g., initial network structures or attitude distributions) contribute to unfavorable outgroup attitudes over time. The resulting empirically validated models can be employed to conduct counterfactual simulation studies that explore how different policies could affect these dynamics.

Overall, this study offers insights into the complex mechanisms behind interethnic attitude dynamics and how spin-outs can be simulated and assessed. The results can inform policymakers and educators on how to create more positive intergroup relations in diverse societies.

Blockmodeling, community detection and network partitioning (1/2)

Some considerations when approaching blockmodeling of dynamic networks

Aleš Žiberna

University of Ljubljana, Slovenia

Blockmodeling of dynamic networks might look like a well-defined and quite specific problem. However there is a wide array of problems that fall under this name, which stem from the vast number of different versions of dynamic (or temporal) networks, and also the vast number of different approaches to blockmodeling or more generally partitioning nodes in them. For example, when looking at the networks themselves, dynamic networks could have fixed nodes or the nodes in the networks could come and go thru time. In addition, the dynamic network could be a network where we know for each tie the time of creation, occurrence or duration, or we could have time a collection of snapshot of a network at different points in time, or aggregation of a number of "ties" that occurred (or whether at least one occurred) in a given time period. These different types of networks of course demand different blockmodeling approaches, as they must take into account the nature of the data. In addition, the types of research question and the nature of the data may influence the requirement of the blockmodeling approaches. For example, one might one to find a partition of units that is the same for the whole time in question, or for each time point, or perhaps even find a partition of time-periods where the same partition is appropriate. Similarly could be said for the blockmodel or community structure as it is sometimes called, that is for the pattern of ties among the so obtained clusters. That is, we might one blockmodel for the whole time or we would like to allow that it changes over time.

In the talk, I will go over some of this considerations and some blockmodeling approaches that I am aware of that might be appropriate in such cases, where a bit more focus will be placed on a case where we want to blockmodel co-authorship (or similar) networks, which have several characteristics that make them especially interesting.

Comparison of blockmodeling approaches for dynamic networks with newcomers and departure nodes by Monte Carlo simulation

Marjan Cugmas*, *Aleš Žiberna

University of Ljubljana, Slovenia

While the "ordinary" one-mode blockmodeling is commonly used to identify groups and ties among them in a single one-mode network (measured at one point in time), the blockmodeling approaches that can be used to study the networks observed at several points in time (i.e., dynamic networks) were proposed recently. The aim of these blockmodeling approaches is to identify groups and ties among them for each point in time by considering the possible dependencies among the networks from different time points. Considering this dependency can increase the validity of the results.

Because most of these approaches were proposed recently, there is a need for their comprehensive evaluation. Cugmas and Žiberna (2023) used Monte Carlo simulations to compare and evaluate several approaches for dynamic networks. They generated networks with different properties, such as size, blockmodel type, local network mechanisms (to make the networks more similar to the real-world networks), and stability of partitions. However, all simulations were done on asymmetric networks with a fixed set of nodes at all time points.

In this presentation, we will present the continuation of the above-mentioned study, in which symmetric networks with newcomers and departure nodes are considered. Various blockmodeling approaches (e.g., Matias and Miele 2017, Bar-Hen 2020, Peixoto 2020, Žiberna 2020, Škulj and Žiberna 2021, Chabert-Liddell 2022) for dynamic networks that allow considering newcomers and departure nodes and can be applied to the undirected networks are considered in the study.

Dynamic blockmodel of Slovene co-authorship networks (1991-2020)

Fabio Ashtar Telarico*, *Aleš Žiberna

University of Ljubljana, Slovenia

Recently, the research on blockmodeling has witnessed the emergence of a growing literature on so-called dynamic (or temporal) networks representing relations between units in two or more time periods. Notably, the literature offers several techniques to blockmodel such networks that are distinguished by the definition of the network, the modeling of temporal dependencies, and other important aspects. This presentation will present a dynamic blockmodeling analysis of a Slovenian co-authorship network based on data from the COBISS database. After providing a brief summary of the data-selection and preparation processes, the focus shifts on the presentation and comparison of blockmodels obtained using different methods. Amongst the several the stochastic blockmodeling (SBM) approaches offered in the literature, the most empirically sounds as well as the most noteworthy from a methodological standpoint are: the Bayesian nested SBM, the SBM for generalised multipartite networks (also known as MBM), the SBM for linked networks and that for multilevel networks, as well the dynamic SBM. Based on empirical needs and the results of previous simulation studies, the specific properties of the co-authorship networks under scrutiny and preliminary results, this presentation will focus on the best-performing approach and detail the characteristics of the produced partition.

Cores in multiway networks

Vladimir Batagelj

University of Ljubljana, Slovenia

The notion of a core is generalized to multiway networks. To determine the multiway cores, we adapted already-known algorithms for determining the generalized cores in one-mode and two-mode networks. A new node property, node diversity has been introduced. The newly introduced notions are illustrated with application on the multiway networks of European airports and airlines and Summer Olympic medals till 2016. For the interactive inspection of the results, their 3D layout in X3D is supported. To support the analysis of multiway networks we are developing in R a package MWnets available at Github/Bavla https://github.com/bavla/ibm3m .

Blockmodeling, community detection and network partitioning (2/2)

Anomaly detection and community detection in networks

Hadiseh Safdari*, *Caterina De Bacco

Max Planck Institute for Intelligent Systems, Germany

Anomaly detection in networked systems is a crucial problem in the field of data analysis. The detection of unusual patterns of interactions in networks is important for a variety of applications, including intrusion detection, fraud detection, and medical condition monitoring. In many networked systems, in particular social networks, the interaction pattern is driven by community membership: individuals belong to groups and this determines how they interact. To properly detect anomalies, one should incorporate this insight to build a suitable null model that distinguishes between regular interactions and those instead relatable to malicious activities. Various models have been proposed for applying community detection approaches in anomaly detection. In general, most of the approaches focus on attributed graphs to predict anomalous behavior. However, we assume that the only data we observe is the set of edges, coded by the adjacency matrix of entries. In this work, we consider the problem of observing a network that can have two possible, mechanisms for edge formation; one involves the majority of the edges, whereas the other is an anomaly that we aim to detect. In other words, we have a regular pattern of interactions, and an anomaly. The latter belongs to a subset of interactions that deviates from the regular pattern. We propose a probabilistic generative approach that incorporates community membership as a fundamental model for regular behavior. Our algorithm uses an expectation-maximization routine to infer latent variables for community membership and anomaly parameters, and outputs labels identifying anomalies on network edges. In particular, we exploit the information learned about anomalous edges to enhance performance in community detection, i.e., we can act on the dataset by removing those edges that have higher probability of being anomalous, thus reducing noise in favor of better community detection. Our results show that this approach improves community detection while also effectively identifying anomalies in synthetic and real-world datasets. Additionally, we discuss potential extensions of the model, such as incorporating node attributes and reciprocity effects, and the importance of considering the qualitative interpretation of anomalies in the context of the specific application. Overall, our proposed method offers a promising tool for addressing anomaly detection in networked systems. The manuscript is available at https://doi.org/10.1186/s40537-022-00669-1.

Eigenvector type centrality on disconnected graphs

Martin G Everett

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Eigenvector centrality (Bonacich 1972) is one of the most used centrality measures in social network analysis. When applied to disconnected graphs in most cases it results in the nodes in the component with the largest eigenvalue (when taken as a stand alone connected graph) having non-zero values and every other node in the network having the value of zero. In the case where there is more than one component with the same largest eigenvalue then most software packages arbitrarily assign non-zero values to one of the components and all other nodes are assigned values of zero. The usual solution to this issue is to calculate the dominant eigenvector for each component separately. This solution is fine if the goal is to rank the nodes within each component, however if the researcher needs to compare centrality scores across components then there are clear difficulties. In this paper we suggest some aklternative approaches that try to address this issue.

Evaluation of concept mapping in the framework of social network analysis

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Concept mapping (CM) is a widely known methodological framework applied in exploratory research and it has been proven to be an invaluable tool for program planning and evaluation. Decades after the seminal paper of William M. K. Trochim (1989b) the method is used predominantly in social science in the academic context. As a structured conceptualization tool, it combines qualitative and quantitative methods to prioritize and interrelate the components, dimensions, and particularities of the objects. The purpose of the method is, by providing a visual representation of relationships among ideas and concepts, to serve as a comprehensive theoretical basis.

In this study, the traditional approach of CM is exhibited, in addition, the data are defined as a relational object, and exploited through its network- related characteristics. For this methodological comparison, blockmodeling for valued networks serves the analogical basis for the theoretical context (Batagelj et al 2004; Žiberna, 2006b, 2008).

The CM technique involves four main consecutive steps (1) the participants are selected for the conceptualization phase with the heterogeneous participation of the relevant people; (2) mainly via focus group sessions, participants generate statements related to the research and as the units of the analysis. Therefore, participants are asked to structure statements (3) which includes rating of each statement (3a) on a scale in terms of importance and organizing the statements into groups (3b), which are meaningful to participants (4) in the subsequent analytical phase, the statements are clustered by computing coordinates in the two (or more) dimensional space using non-metric multidimensional scaling on the co-occurrence matrix, which are then clustered using hierarchical clustering. (Kane & Trochim, 2007).

The utilized data of outlined technique were primarily aimed to contribute to a European-wide understanding of the Dual Career (DC) of student-athletes mainly focusing on the (DC) parents' opinions and perceptions in the framework of the EMPATIA project (Gjaka et al., 2021; Varga et al, 2021). The data were gathered in five European countries involving over 400 DC parents. The aim of the project was to construct an empirical ground for an extensive European level policy framework.

In our analysis, the final phase of the CM process will include the SNA based clustering method, valued blockmodeling (Žiberna, 2006b). Despite the structural and methodological analogy that might be obtained between these approaches, CM and SNA are conceptually different. From the SNA viewpoint, co-occurrence matrix can be considered as a network of aggregated ideas and therefore can provide more nuanced understanding of the data. Blockmodeling includes supplementary descriptive and explanatory features. Therefore, the evaluation of the results focuses on the comparison of these two approaches by utilizing the different interpretations of the object of the research.

Community detection analysis with robin on hashtag network

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In Social Network science, and especially in the Social Media field, the research of

communities is still an open and challenging task, mostly for what concerns the reliability of the results obtained. When dealing with hashtag networks, the research of communities is related to the identification of topics, which is a challenging achievement. Moreover, when dealing with political debates, which is our study's aim, it is even more complex. In this work, we aim to look for reliable communities on a co-occurrence hashtag network related to the Italian Political campaign (2022). To achieve this goal, we applied two different procedures to compare and validate different community detection algorithms.

Egocentric networks (1/2)

Language skills, social networks and outcomes for international MBA students

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International students studying in a foreign country often encounter difficulties adapting to their new academic surroundings and different approaches to teaching, learning and assessments. Universities acknowledge this problem through provision of professional services to support them and yet students make little use of these services and report that they rely on personal networks for advice while studying abroad. This paper examines the role of language proficiency, social networks and academic outcomes for international students. It aims to find what impact academic preparedness plays on international student performance and what network coping strategies students deploy to overcome academic challenges.

This study draws on a survey and interviews with international students on an MBA programme in the United Kingdom to identify and assess student motivations to pursue a graduate degree, the influence of networks in identifying university search trajectories and the role of social connections in helping them address challenges of overseas study. The students are predominantly from South Asia, studying for their second or third degree, may already have a professional background and generally possess a good level of English language proficiency. We find that even from prior to arrival in the UK, students rely on personal social networks to inform their decisions regarding their studies and that during their studies, students with weaker English literacy skills make greater use of personal social networks for academic advice. This is particularly problematic because the advice given is not always aligned with that provided by professional services.

Voices Unheard: Exploring the Absence of Discussants in Network Studies

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Understanding the size and distribution of networks has been a key focus in social network analysis. One widely used tool in surveys for collecting information on the size and distribution of networks is the "name generator". Previous research has shown that respondents report a low number of alters or, in some cases, an absence of them altogether. These findings have led to several interpretations, including the possibility that the lack of discussants is due to interviewer or wording effects. Additionally, it has been suggested that these results imply that individuals may be socially isolated. From a comparative perspective, this study examines the sociodemographic and social factors associated with the likelihood of individuals not reporting discussants. Our research uses data from the Comparative National Elections Project (CNEP), which includes information from 41 surveys conducted across 22 countries. This study focuses on two specific name generators: whom they talk to about important issues, and whether they discuss political matters with them. On the one hand, our preliminary results show that certain sociodemographic and social interaction factors can reduce the likelihood of individuals not reporting discussants, such as being male, having a high education level, being member of an organization or group, being married, and having a job. On the other hand, that interviewers still help to reduce the likelihood of not reporting discussants. However, these factors vary across countries and change over time. To shed further light on this issue, we provide an example using some CNEP surveys conducted in Italy and Chile over different periods (Italy: 1996, 2013; Chile: 1993, 2017, 2021). The composition of the conversation networks in these countries is described in detail, followed by a discussion of the strengths and weaknesses of the name generator. By understanding the potential limitations of this approach, researchers can develop strategies to improve data collection and analysis. Additionally, by acknowledging the possibility of social isolation, scholars can better understand the challenges some individuals face in several contexts.

The role of place and personal networks in the unequal availability of social support

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Social support is a crucial factor for young people's health and well-being and plays a central role in their life-course aims. However, not all individuals have access to the same level of social connections and support. Research on social support widely recognises the importance of space and place. It is well known from neighbourhood studies that youth living in disadvantaged and remote areas are more likely to experience social isolation. Nevertheless, most studies have examined the role of spatial contexts (neighbourhoods, schools) and largely ignored the personal network context, possibly leading to misattribution errors. Social network research is, in turn, often limited to the analysis of physical distance and has generally failed to consider that both networks and spatial environments affect opportunities for social support. The objective of this project is to link both sides and examine how support from personal ties varies with both networks and residential areas. We use personal network data from a large survey sample of young adults aged 18-20 living in Switzerland (n=10,000), including the full national cohort of young men of this age, to examine which ties from significant others (alters) to the young adults (egos) are supportive. Social support can take many forms such as motivational words, career advice, and assistance with challenging tasks. The central premise is that support not only hinges on individual or tie characteristics, but also on the properties of personal networks (e.g. density) and areas (e.g. deprivation) where egos and alters live. Using variance component models, we examine the relative importance of personal networks and the places where young adults and their alters live. We use descriptive statistics on several characteristics at these levels to investigate what the provision of different types of social support is associated with and how the influencing factors interact, e.g. whether positive effects of close-knit networks are diminished by geographical barriers to their mobilisation, or whether the lack of local resources for alters translates into a lack of support for egos. Finally, we outline how cross-classified multilevel models can serve as an appropriate method to address the complex interdependencies of individuals' embeddedness in residential areas and personal networks. By simultaneously analysing the role of social networks and their spatial embeddedness in the provision of social support, we contribute to the understanding of the interdependencies of social relationships and place. In this way, we aim to better identify risk profiles of young adults regarding social isolation and the lack of social support to better target social policies.

Personal network inequalities between migrant generations: in search of explanations

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The personal networks in which migrants and their descendants are embedded exert a profound influence on various outcomes of migration and incorporation trajectories, from occupational attainment to health to civic participation. Research on social networks in specific migrant communities has grown in number in recent years, while literature in the social capital tradition has produced a few studies of inequalities in network-related resources between certain ethnic minorities and majorities. However, most existing studies are confined to analyses of core networks, social resources as measured via position generators, and cross-sectional snapshots of social ties. Systematic and comprehensive comparisons of personal networks in different migrant generations, taking account of various aspects of network composition and structure and their dynamic nature, are still rare. These more in-depth comparisons could be key to understanding disadvantages, resources, and inequalities linked to migration.

We propose a multifaceted comparison of personal networks between three migration-status groups in the San Francisco Bay area of California (USA): first-generation migrants, migrant descendants (second generations), and people with no migration background. We use uniquely rich, longitudinal data collected in 2015-2018 with a population-representative panel survey. Analyses involve a wide range of network characteristics, including (1) social relationships in different domains (e.g., family, social companions, practical support providers, etc.); (2) different features of personal ties, such as emotional closeness, spatial dispersion, and difficult or demanding nature; (3) the structure of alter-alter ties; and (4) the dynamics of personal networks over time. We first describe differences between migration groups (overall and net of confounding sociodemographic factors), then explore alternative explanations for these differences drawn from existing theories.

We find that first-generation migrants have, on average, significantly smaller personal networks, more limited access to social support in all domains, and more geographically dispersed ties. There is no evidence, however, that migrants' networks are characterized by higher prevalence of strong ties (operationalized as emotionally closer or multiplex relationships) or difficult relationships. There is also no evidence, across a wide battery of measures, that migrants are involved in different patterns of participation in organizations, social groups, and foci of interaction. We conclude that observed inequalities in personal networks between migration groups cannot be explained by different levels or types of participation in foci of sociability. In the next step of the project, we ask whether observed personal network differences may then be due to systematic variation between migrants and non-migrants in terms of life events and disruptions, such as residential moves or changes in employment.

Egocentric networks (2/2)

Describing the relationship of the structural properties of personal networks with the psychological sense of community in the neighborhood

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The sense of belonging to the neighborhood depends on the interaction with neighbors, the satisfaction of needs, place attachment and shared emotional connection. However, studies on the psychological sense of community have delved into the subjective perception of residents, paying less attention to interaction networks. In this study we explore the association between the structural properties of personal networks and the psychological sense of community. To do this, we conducted a survey with 225 residents in four neighborhoods in the city of Seville (Spain). For each interviewee, we generated nine summary measures of personal networks with which to assess structural cohesion, fragmentation, and the existence of cohesive subgroups. The density showed a positive association with the psychological sense of community, while the number of components and fragmentation showed a negative association. The potential and limitations of a structural approach in community studies is discussed.

Reciprocal Valuation of Social Milieus: Lines of Conflict and Alliances

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The presentation offers results from the research project "Segmentation and reciprocal Valuation of Social Milieus" which focuses on the degree of mingling or segmentation between social milieus and the question of how social networks or contact barriers structure (non-)knowledge and beliefs about other social milieus.

The project is based on a mixed methods research design consisting of a combination of standardised survey items and open narrative interview parts. Other features include an egocentric network survey of the respondents and the presentation and evaluation of eleven ideal-typical milieus. The survey was conducted as computer-assisted face-to-face interviews and online interviews (n=614) in two lager cities in the western and eastern part of Germany as well as the neighbouring rural region surrounding both cities.

In the standardised part of the survey, respondents are confronted with ideal-typical milieu members and evaluate them along various dimensions and assign themselves to a milieu. We conceptualise the rejection of other social milieus as a directed social network. In addition, the ego-centred networks of the respondents are recorded, in which the alteri are also assigned to the social milieus, making statements about the concentration of milieu affiliations within the network and ego's contacts to other milieus possible. The non-standardised aspect of the survey, consist of open narrative parts, whereas interviewees openly talk about their thoughts and experiences in regard to specific topics, such as their own similarity or dissimilarity to the ideal-typical social milieus. This enables observations about reasons for rejection and provides insights about perceptions of other social milieus.

In the presentation we take a look at reciprocal valuation of social milieus and focus on rejection and coalition tendencies of social milieus and their possible polarising meanings. We want to give insights on how members of social milieus perceive each other and which images and attributions are virulent. Furthermore, we shed light on how social milieus draw symbolic boundaries towards others. The theoretical framework is provided by the concepts of social distance (Bogardus) and the social production function (Lindenberg) as well as on the concept of symbolic boundaries (Lamont).

Initial quantitative-empirical findings show that certain social milieus experience rejection disproportionately often (Precarious Milieu and Milieu of Performers). Contacts within and between milieus differ in their structuring effect for the rejection of social milieus. The homogeneous composition of the networks in terms of milieu affiliation also influences a negative attitude towards selected social milieus. The qualitative-empirical findings clarify collective patterns of interpretation and ideas that are used in the evaluation of other social milieus.

Mapping young migrants' support networks in the context of Life-Long-Learning interventions

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Young people build their own identity and support networks interacting with the agencies of socialization such as family and schools. Particularly for those of a migrant background, the development of systems of personal support stems from a complex process that is neither linear nor uniform, and whereby individual, relational and identitarian factors intermingle. Previous research has shown the key role of informal social networks in providing migrants with: material aid; help in legal and administrative issues; opportunities for social participation; symbolic support, companionship and affection; employment opportunities; and access to social, education and health services. In other words, the construction of social networks is the necessary – though not sufficient – condition to obtain social capital, which in turn enables access to those material and emotional resources which are required to cope with everyday needs and to pursue personal goals and ambitions. Thus, for social researchers, 'mapping' social networks of support can be of the utmost importance in understanding young migrants' processes of social inclusion.

In this paper we present findings from a study which is part of a wider research project – "Key Inclusive Development Strategies for Life-Long-Learning" (KIDS4ALLL) – involving academic institutions, civil society organizations and policymakers from 12 EU and non-EU countries. The project aims to promote young migrants' social inclusion trough the provision of relation-based learning contexts in formal and informal environments. Children engaged in the KIDS4ALLL project worked on learning contents related to 8 Life-Long-Learning (LLL) competences through theoretical understanding, online and offline applied contents and interactive co-creational and collaborative activities. These interventions aimed to develop authorship (guided by educators) and agency on the 8 LLL competences and to enhance their intercultural, linguistic and socio-emotional skills. Throughout the project, participants were asked to complete a 'name generator' questionnaire about the nature, size and composition of their own networks of support, including intensity and content of ties, as well as the background characteristics of alters. On this basis, we explored the social support networks of young migrants attending intervention activities in informal learning context, from two KIDS4ALLL Consortium countries, Italy and Greece. In this paper we share some emerging findings and discuss the strengths and weaknesses of our name generator methodology, reflecting on the insights it can provide in understanding the complex and diverse spheres of relational support experienced and perceived by young people of a migrant background. Thus, we contribute to an understanding of different patterns and levels of social inclusion within the informal contexts in which they are embedded, with a focus on the changes occurred as a result of the 8LLL learning intervention.

Family networks and personal networks through the life-course (1/3)

Transition to Widowhood and Subjective Wellbeing: The Buffering Effects of Social Networks

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The loss of a spouse is a major and stressful life event with a lasting impact on physical, emotional, and psychological wellbeing. Widowhood can lead to feelings of isolation, depression, and loneliness, and many widows/widowers continue to experience lower levels of subjective wellbeing even years later. Widowhood involves significant changes in social roles and support networks, which can exacerbate the negative effects on mental and physical health.

Social networks (including family members, friends, and community) can provide emotional support, practical assistance, and opportunities for social interaction. Given the loss of an important relationship, the presence of supportive social networks could be especially important for deal with the stress of the event. Although close relationships can be beneficial in various ways, the main concern is how they serve as a buffer against stress.

This paper aims to explore the transition to widowhood and its effects on subjective wellbeing. Additionally, it will examine the role of social networks in buffering these effects. We concentrate on the size of social network, the perceived quality of relationships, the frequency of contact with social network members, and presence of friends in the network circle. We use a longitudinal design with data from SHARE surveys (waves 4-8) to examine the change in subjective wellbeing during the transition to widowhood ant the extent to which social support buffers the effects of widowhood.

We selected a sample of individuals who were already married in the first wave they enter the survey and became widowed at some point during the data collection. We used fixed-effect regression models with life satisfaction as the dependent variable and the level of social network and time to event (measured as waves before and after the event) as independent variables. To examine the protective potential of social resources, we constructed them as time-invariant variables per event, measured before the event occurred (in wave 4) to avoid endogeneity. Each resource was measured as a dichotomous variable with two groups. Our analysis focused on changes in life satisfaction over time, rather than comparing different groups of individuals. To assess buffering effects, we compared life satisfaction levels after the event (at t=0, t=1, and t>=2) to those at least two years before the event (our reference category). The interaction coefficient between a given resource and the years after the event indicates its buffering effect.

Preliminary results indicate no buffering effect in the case of social network size, satisfaction, and frequency of contact, but some effects in the case of presence of friends in the social network circle. Further research is needed to better understand the mechanisms underlying these effects and to develop effective interventions to support widows and widowers.

You as well? Separation of Couples and the Prevalence of Union Dissolution in Their Social Network

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Earlier union dissolution research shows that couples are more likely to separate when their parents or siblings have separated before. While it is likely that social norms regarding union dissolution are not only shaped by family members, it remains unclear whether earlier separations among other types of connections can be linked to higher risks of union dissolution as well. This study investigates if, and to what extent, couples are more likely to separate when union dissolution is more prevalent in their broader social network. We examine this question in the Dutch context, taking into account the type of connection to other households, as well as how long ago union dissolution in these households occurred. To do this, we use two sources of data.

Dutch register data is used to identify married and cohabiting couples, their characteristics, and their union dissolutions. To limit the impact of missing information, we focus on heterosexual couples with two Dutch-born partners, between 25 and 50 years old, who cohabited for at least three years (N=961,255). For each couple, we use residential histories to determine which couples dissolved their union between 1 October 2018 and 1 March 2020. We consider couples to have dissolved their union when they have not lived together for over 365 days.

The Dutch Population Network 2018 is used to define the social context of each couple. Derived from Dutch integral register data, the network contains more than 17 million nodes (the entire Dutch population) and over 1.4 billion links. Using this network we can connect couples to their family members, neighbors, coworkers of the couple, and the parents of a couple's children's classmates. While it is not clear whether each connection represents real life contact between people, we believe that the prevalence of union dissolution in this combination of connections together is a good indicator of union dissolution in a couple's broader social network.

In this study we use logistic regressions to test our hypotheses on the link between a couple's union dissolution risk and union dissolution in a couple's social context. As every social context examined in this paper is unique to each couple, every social context is a couple-level characteristic. In the analyses we correct for known correlates of union dissolution such as income, education, length of cohabitation, marital status, and presence of children.

Same-sex family networks in Switzerland: inclusive or exclusive?

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The existing literature stresses the inclusive nature of same-sex families, assuming that such families reject the nuclear family model focused on married partners and their biological children. However, quantitative empirical evidence about the composition and relational features of family networks of individuals with gay or lesbian sexual orientation remains scarce. This study addresses several issues, about the compositions and relational features of family networks of gays and lesbians. What is the balance between kin and non-kin members in such same-sex family networks? Do same-sex family networks reproduce the trend towards heteronormativity with the nuclear couple at the center of kinship or, on the contrary, do they differ from the heteronormative model by the prevalence of elective ties?

We hypothesized that same-sex families networks include a wide set of relationships beyond nuclear family members. In particular, we expect it to include a wide range of family terms associated with elective kin and to some extent under-stress links with blood ties from the former generation, because of problems of stigma and stereotyping. This may be particularly true in a national context such as Switzerland where family rights of same-sex partners have only recently been recognized.

The data comes from the survey on same-sex families in French and German-speaking Switzerland, conducted in June-September 2021. The questionnaire was adapted to the particularities of same-sex families in collaboration with Association of Rainbow families in Switzerland (https://www.regenbogenfamilien.ch). 157 participants provided a list of all alters they considered as important members of their family at the time of the interview. The term “family” was not defined, as respondents were asked to use their own definition. A series of questions on networks of emotional support, material support and conflict among listed family members were asked using the Family Network Method. A typological approach is used to estimate the diversity of family network composition. The retained types of family network composition are associated with a variety of social capital indices.

Parenthood status of horizontal kin and entry into parenthood. A horizontal kinship network approach

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Horizontal kinship ties last a lifetime and life-course transitions of horizontal kin are known to be interlinked. Previous research focusing on siblings has for example shown that siblings influence each other's home leaving (Her, Vergauwen, & Mortelmans, 2022), marriage and divorce behavior (Buyukkececi & Leopold, 2021), and fertility (Buyukkececi & Leopold, 2021; Lyngstad & Prskawetz, 2010). Siblings however, are only one example of individuals' horizontal kin and half-siblings and cousins may also influence their and each-other's life-course transitions. Moreover, the influence of horizontal kin may differ depending on the degree of relatedness, i.e., whether they are full siblings, half-siblings, or cousins, kin's gender, i.e., whether they are (half-)brothers, (half-)sisters, male or female cousins, and by lineage, i.e., kin from the paternal or maternal side of the family. This study will analyze the full horizontal kinship network to understand how individuals' entry into parenthood is associated with the parenthood status of their horizontal kin. It will be tested whether 1) close compared to more distant kin, 2) female compared to male kin, and 3) maternal compared paternal kin have a stronger influence on individual's entry into parenthood. Recently published kinship networks derived from the Dutch (van der Laan, de Jonge, Das, Te Riele, & Emery, 2022) and Finnish registers will be analyzed. First results of a multi-level model considering the nested structure and dependence of relationships (Snijders & Bosker, 2012; van Duijn, 2013) will be presented as well as a comparison of the Dutch and Finnish context.

Family networks and personal networks through the life-course (2/3)

Changes in personal networks when becoming the transnational family

Vida Česnuitytė

Mykolas Romeris University, Lithuania

In nowadays, families with members – emigrants, i.e. family members who live abroad spread too widely. It is consequence of mass global migration. Today, people migrate so easily that it is almost impossible to predict when such a phenomenon will appear on the family life course. At the same, there is no doubt that geographical distance changes interpersonal relationships, and structure of personal network. Therefore, it is important to acknowledge the phenomenon.

In this research, families in which at least one member lives beyond the state border when the other family members live in home country are called transnational families. The aim of the presentation is to discuss the impact of mass migration on changes in the personal network of the transnational family. The main research question is: How does the personal network change when the family becomes transnational?

The empirical analysis is based on the data of the representative quantitative survey of adult Lithuanian population (18+), collected in 2018, during implementation of the project "Global migration and the Lithuanian family: family practices, circulation of care and return strategies" (principle investigator prof. Irena Juozeliūnienė). The project was funded by the Science Council of Lithuania. In total, 1005 habitants were asked by using a standardized questionnaire.

Personal networks of transnational families are analyzed here through the family practices. The analysis focuses on four groups of family-building practices: daily routine (includes emotional support, help with daily household chores, financial management), traditions (meals together at least once a week, holidays together at least once a year), religious holidays (Christmas, Christmas, Easter, All Saints' Day) and secular holidays (Mother's Day, Father's Day, Birthday, New Year Eve). Based of empirical data, it is analyzed how the structure of personal networks involved in these practices changed when the respondents emigrated abroad to live there for a certain period of time.

The research results show that the members of the procreative family withdraw from many shared activities when a family member emigrates. It is especially evident from such family practices as daily routines, which are crucial for the stability of the family and personal network. At the same time, new members join the personal network of a transnational family's member in emigration, and mostly they aren't members of the family of procreation or the family of orientation. Usually, they are persons that have no blood or marriage relationships. These persons begin to participate in shared practices and eventually replace family members in the personal network. In conclusion, change of personal networks of transnational families' members is especially evident in such practices like financial management, mutual emotional support, and the celebration of religious holidays.

Do conflict structures of family networks matter for loneliness in later life? The case of a cohort of Swiss older adults

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Little is currently known about the consequences of negative family interactions for loneliness in old age. The aim of this study is therefore to investigate how conflict in family networks of older adults is related to loneliness feelings in old age. It hypothesizes that dense conflict family networks are related with increasing feelings of loneliness in old age. The paper draws on the Vivre/Leben/Vivere survey which studied family life and health conditions of persons aged 65+ residing in Switzerland. Analyses focused on 1050 participants who were surveyed in the first wave in 2011–2012 and responded also in the second wave in 2017–2018. The information was gathered by means of face-to-face interviews. Data on family networks was collected in both waves, and feelings of loneliness were measured in the second wave using the loneliness scale developed by De Jong Gierveld and Van Tilburg (1999). Findings revealed that conflict in family networks has a lasting and detrimental effect on loneliness feelings in old age because of its association with increased stress experienced by individuals within their family. The consequences of such a result for family interactions and well-being in old age are discussed.

Social network configurations and life satisfaction in old age: A comparison of Italian migrants and natives in Switzerland

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While we know that social networks are important for older persons' well-being, few studies compare older persons with and without a migration background. This presentation draws on an original survey conducted in 2020 in Switzerland and Italy in the framework of the project "Transnational Ageing among Older Migrants and Natives: A Strategy to Overcome Vulnerability". In this presentation, we aim to study the social networks of two populations aged 65 and over: international migrants from southern Italy ageing in place in Switzerland and nationals in Switzerland (N=1 318). Respondents were asked to list up to five significant persons in their life during the last year and the characteristics of these persons such as relation to the respondent (partner, children, other family member, friend or somebody else), among others.

In this presentation, we first examine the social network's characteristics of the two populations, like their size and composition. Through our analyses we identified three types of social networks: nuclear family, child-oriented and friendship. Secondly, we explore the extent to which the type of network impacts life satisfaction.

The role of grandparents in support networks

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This intergenerational study aims at depicting and understanding the role of grandparents in caregiving networks of families revolving around children affected by rare metabolism diseases. For this purpose, we outline and quantify the partaking of grandparents regarding care activities and commitment in their family. Although grandparents are often considered as important components in care relations and support networks of families and do provide corresponding support services, the composition and extent of their involvement is not often clearly defined. We seek to understand the interrelationships beyond the scope of primary caregivers.

Through statistical descriptions, enriched and supported by qualitative interview data and insights from the multi-informant support network data, we intend to examine the role of grandparents in family contexts and explore the different dimensions of their participation. We anticipate that the combination of multiple data types and the multi-informant perspective will enable us to generate a comprehensive overview with regard to the specific context of children with rare diseases. The relevant data derive from the Inherited Diseases, Caregiving, and Social Networks Study at the National Human Genome Research Institute. To meet the research interest, the empirical basis of the study will refer to a data set of 91 families with a child affected by an inborn error of metabolism.

We aim to operationally outline the grandparental involvement in childcare processes in order to facilitate future research in this field. This study contributes to the care research by adding empirical insights to the intergenerational dimensions of caregiving and support of families.

Family networks and personal networks through the life-course (3/3)

Analyzing multi-informant network data with interpretative methods

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Most research on the role of social networks in caregiving relies on the collection of egocentric network data of one principal caregiver. However, in many families, there are multiple caregivers involved, so focusing on a single caregiver's experience ignores the experiences of other caregivers who play important an important role. Use of a multi-informant approach to caregiving networks addresses this problem by adding information from multiple informants. As well, the multi-informant design, expands the field of view for these caregiving networks, because the boundaries of the network are not solely defined by the first informant, expanding as additional informants are brought into the study. In this presentation, we propose a procedure to analyze multi-informant network data using qualitative, interpretative methods.

We illustrate this approach using data from the project "Inherited Diseases, Caregiving, and Social Networks" which focuses on the networks whose members are involved in caring for children affected by inherited metabolic diseases, collected between 2017 and 2020. In this study, multi-informant network data with several caregivers of affected children were collected. Participants listed their personal network as well as the care network of the affected child. In that way we get insight on the personal network of the informants and different perspectives of the caregiving network. Data represent 91 caregiving networks and the interviews and networks reported by 191 caregivers.

In the presentation, we will discuss the possibilities and advantages but also the challenges of analyzing multi-informant network data using qualitative methods, with a focus on case selection and qualitative, interpretative research strategies to analyze these multi-perspective-network data.

Family Solidarity in the Kinship Network: Examining Differences Between Immigrants and Non-Immigrants

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In difficult situations people rely on their family for support. Such support might be especially relevant for immigrants who tend to have less economic resources and hold stronger normative expectations towards the family than those without a migration background.

Current research on family solidarity focuses strongly on the relationship between parents and their children and the differences between immigrants and non-immigrants regarding this specific relationship. However, less is known about family solidarity within the wider kinship network. This is unfortunate since knowing more about the availability and accessibility of solidarity within immigrants' kinship networks could inform on what kind of support can be provided by the network and which social policies might help disadvantaged immigrants cope with future crises.

Our expectations regarding the differences between those with and without a migration background depend on the specific type of solidarity considered. Generally, we expect immigrants to receive more (non-material) solidarity from their families, and particularly from the wider kinship network. This is because many immigrants were socialized in countries in which individuals depend more strongly on the family network for social security.

For the analysis we are using data from the ERC-KINMATRIX project, collected across nine European countries and the US during the winter of 2022/2023. The data set offers a sample of roughly 10,000 respondents aged 25-35, who provided detailed information on their family composition and relationships. Our analysis includes descriptive as well as multivariate statistics tailored to the measurement levels of the individual solidarity measures.

Results from the US subsample indicate that overall, compared to non-immigrants, immigrants' had somewhat stronger relationships with their siblings and mothers, but weaker ties with their grandparents. Those with an immigration background where more likely to indicate that their mothers played an important role in their life and also reported having more regular contact and a closer relationship with both their mothers and their siblings.In contrast the relationships with their fathers did not differ greatly between those with and without an immigration background. The relationships with their grandparents however did. Those with an immigration background were less likely to report having received financial assistance, advice, and comfort from their grandparents. They were also less likely to indicate that their grandparents played an important role in their life.

Overall, immigrants did not seem to have a family network that provides more solidarity across the board, rather the differences in the solidarity highly depended on the solidarity type and the specific relationship inspected. We plan to expand our analyses to also include other family members, such as aunts and uncles, while also including other countries.

Patterns of resources and strains in family networks: Some evidence of cumulative inequality in life course health

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This research examines the patterns of resources and strains in family networks in relation with health and mental health, cross-sectionally in a general population sample. We explored the whole patterns support and conflict interdependencies within family networks using a typological approach of structural interdependencies, considering jointly both structural features of support and conflict interdependencies within family networks. We identified five patterns of family interdependencies, with some of them reflecting bonding and/or bridging type of family-based social capital, featuring certainly the availability of relational resources. However, other patterns, mixing-up supportive and conflict relationships, mirror more strains than resources. Results shows that the whole patterns of family-based social capital and straining relationships matter for health and mental health. We also assessed the extent to which such patterns of support and conflict interdependencies related to the social structure and to specific life stages. Straining patterns in family networks were found in a large proportion and were significantly associated with lower level of economic and cultural capital, contributing to cumulative inequality in life course health. These results have policy implications in the current context where increasing complexity of society, economic downturn, and decreasing welfare state, have created new area of vulnerability where frailty of social support networks and welfare state might cross.

Positive, negative and ambivalent dyads and triads with family and friends: A personal network study on how they affect young adults' well-being

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Whereas it sounds rational to terminate social relationships in which the negative valences outweigh the positive valences, the reasons to maintain them may be more complex. Relationships often exist in non-voluntary associations which makes it difficult to terminate them if conflict arises. Although families are the example par excellence of such 'inescapable relationships', relationships with schoolmates, colleagues, or ties in tightly knit friendships groups – especially in young adulthood – may also have a comparable inescapable character. This study investigates (1) whether ambivalence with and between family members is more prevalent than ambivalence with and between non-family members and (2) whether ambivalence with and between non-family members affects well-being more strongly than ambivalence with and between family members. The 2020 sample of the Swiss CH-X study is analyzed in which 10,000 young adults report about the relationships in their personal networks. In addition to positive, negative and ambivalent dyads, the ambivalent triad census is operationalized, which counts the frequencies of 18 non-isomorphic triads in which ties can be positive, negative, or ambivalent, and proposes linear combinations of three theoretical mechanisms (ambivalent balance, diffusion of stress, divide and conquer) predicting how embeddedness in an ambivalent triad affects individual well-being. The results show that ambivalence is indeed more prevalent with and between family members. Ambivalent dyads including focal actors (ego-alter dyads) are associated with higher well-being, especially for dyads with family members, whereas ambivalent dyads between network members (alter-alter dyads) are associated with lower well-being.

Gender and social networks

Gender dynamics of social support for adolescents and young adults in highly resource-constrained communities in rural South Africa

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Background: Social networks play key roles in the manner and success of transitions from adolescence to adulthood, partly by providing social support. Such support is particularly important in resource-constrained settings where alternative sources of assistance are scarce. Rural KwaZulu-Natal (KZN), South Africa, is one such setting with pervasive youth unemployment and poverty where high rates of labour mobility and HIV-related parental deaths limit support sources typically available to youth elsewhere. Youth social networks also differ by gender, due both to gender homophily and differential support patterns. Qualitative evidence in KZN suggests that gender differences here may be amplified by context-specific gender norms and coping strategies, e.g., young women relying on older sexual partners for financial and practical support. We therefore explore the gendered nature of social support of late adolescents and young adults (ages 16-29) in a rural KZN setting.

Research Design: We use cross-sectional egocentric social network data from three communities collected in 2022-23. In each community, we originally aimed to interview 200 16-24 year olds, as well as their named contacts of any ages. As well as collecting participants' social and health characteristics, we used exchange-based name generators and name interpreters (alters' gender, residency, age, relation to ego) to capture their personal networks, including information on the frequency of provision of five forms of positive support (emotional, informational, financial, physical and social) and conflict.

Data Analysis: After describing participants' network composition, size, tie multiplexity and frequency of social support, we performed ordinal logistic multilevel regressions separately for males and females to evaluate how each of the six support types (including conflict) are predicted by alter characteristics.

Results and Discussion: Preliminary analysis of the first site (N=344) show significant differences between young men and women's support networks. (Results will be updated with further sites' data by September 2023; site 2 data collection completed in April.) First, young women receive most kinds of support more frequently than men. Second, while co-resident parents provide high levels of support, the role of non-parental family members and sexual partners differs markedly by ego gender. While co-resident parents are the major source of support for men, young women additionally draw on other family members for social companionship, emotional and financial support. Sexual partners play differing roles for men and women: compared to friends, young men receive more emotional support from their partners and less financial support; in contrast, young women receive more financial help from their partners. In summary, social support dynamics of rural South African youth display both similarities to those seen elsewhere, and particularities

reflecting local gender norms.

Networking behavior and Career Success- How do women use their social capital in formal networks?

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Social capital is a crucial factor for career success. According to Lin (1999), social capital lies in the structure of networks and can be accessed through social connections. The usage of social connections, construction, and maintenance is described as network behavior. There are gender specific differences in network behavior and network structures. Research shows men tend to build stronger connections to individuals with high power and a high social status, while women tend to take a different position in the network, as brokers or gatekeepers. Men have different access to social capital. Women are systemically banned from formal male networks like 'old-boys'-networks which restricts their social capital. The observed lack of social capital hinders women from gaining powerful positions and sustains the glass ceiling effect. Female only networks were formed to balance out the exclusion of male networks and receive psychosocial support. Previous research focused on gender mixed networks and there is little to no research about social capital within all female formal networks and its effects on career success.

To gain a deeper insight into the structure and support from women's networks, a mixed-methods design was used. With the combination of an online survey N = 140 and an online ego centric social network analysis N = 50, the relation between network parameters and career success was examined. The women worked in arts and culture in Germany. First, the participants filled out an online survey composed of demographic variables and psychological scales assessing career success, satisfaction, and care work. Secondly, the participants filled out a social network map by drawing their developmental network and the perceived support of each alteri.

Social network maps were analyzed with qualitative structural analysis (QSA). Correlations and ordinal logistic regressions were used for analyzing the relationship between network parameters and objective and subjective career success. Care work and perceived support were examined as influential factors for career success and networking behavior.

Results showed no positive correlation between network parameters, satisfaction, networking behavior, and career success. Care work and extraversion did not have a significant effect on networking behavior. There were positive relations between different network ties and perceived support. Descriptive results showed similar network characteristics as reported in previous studies. On average the ego-centered networks consisted of 7.47 alteri, which can be considered big.

In all female networks, social capital seems to be capitalized, but mobilization of accumulated social capital cannot be found. Workshops for networking behavior and career coaching might help women use their accumulated social capital for career enhancement. Further research regarding the circumstances under which the mobilization of women's social capital is successful is needed.

Social Network Dynamics in the Context of Age and Gender: An Empirical Investigation

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This paper explores patterns and motivations for social tie formation and dissolution in the context of age and gender. It provides empirical tests of the social convoy model, socioemotional selectivity theory, and the differential investment of resources (DIRe) model. Data comes from a survey administered face-to-face to a large, representative sample of the population of Poland (n=1000). Controlling for between-tie and between-ego differences, it is found that the intensity of forming new ties drops systematically with age, but this process becomes slower for people aged 40 and older. The relationship between the intensity of tie dissolution and age is U shaped with fewest ties being dissolved among people of around 50 years old. The number of social ties people maintain (degree) declines with age except for people in their middle age (particularly between the ages 35-50) when, on average, the degree goes up. Young women tend to form fewer ties if they are married. Both expressive and instrumental motivations for social tie formation are relatively most active in middle adulthood.

Social influence on Moroccan and Pakistani migrant women's access to health information for cervical cancer prevention in Spain: a qualitative social network analysis

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Background: Participation in cervical cancer (cc) screening programs is lower among migrants compared to native women in Spain. Increasing awareness through access to accurate health information is crucial to decrease this disparity. Social influence is one pathway through which health information can be influenced; however, there is little evidence on the role of social support and social networks in migrants' health information and their attitudes to self-care and prevention, including adherence to cc screening.

Study design: We conducted 22 interviews with Moroccan (12) and Pakistani (10) migrant women living in three urban areas of Barcelona (Spain) between September and December 2022. Each interview combined structured and open-ended questions. We used a two-step method to elicit the personal networks of each participant using a context-focused name generator, based on a series of questions on the different contexts that migrant women inhabit (e.g. family and friendship circles, neighbourhood, social activities, mosque, workplace), and an exchange-name generator to capture migrant women's core networks for receiving health information and advice. Additionally, participants (egos) ranked their contacts (alters) by emotional closeness using a visual sociogram. Alters' attributes and ties between alters were also captured. We examined respondents' attitudes to self-care, prevention and cc screening qualitatively.

Analysis plan: We will combine thematic content analysis using a framework approach with summary statistics to 1) explore contexts of socialization and social support exchange dynamics among Moroccan and Pakistani migrant women living in Spain, 2) examine their health information seeking behaviour and 3) identify key agents who may influence women's attitudes, particularly to cc screening behaviour. We will examine the composition of each migrant women's personal network calculating networks' size and percentages based on alters' sex, country of origin, place of residence, type of relationship and frequency of contact. This will give us a broader picture of the participants' personal network and its characteristics, e.g. whether or not they are female dominant, co-ethnic or kin-based networks and with which contacts women speak most often and whether these are from or living in their country or origin. We will also calculate the density of each participant's egocentric network and finally, we will visualize each network to better identify network patterns and health information flows.

Expected findings/discussion: Our study is expected to reveal the main patterns of health information and advice transmission within Moroccan and Pakistani migrant women's networks, and key influential agents on their attitudes to self-care and cervical cancer prevention. Our findings will help inform future interventions aiming to enhance access to health information and increase awareness about cc screening uptake among migrant populations in Spain.

Hypergraphs for complex systems: methods and applications

Flexible and efficient probabilistic generative models for Hypergraphs with community structure

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Complex interacting systems are often described by higher-order interactions, where groups of more than two nodes interact simultaneously.

These systems are better described by mathematical frameworks that generalize standard pairwise networks, such as hypergraphs, where hyperedges encode interactions among an arbitrary number of system units.

In several contexts, interactions can be explained by an underlying community structure, where node belong to groups and their membership helps explaining the observed set of hyperedges. This can be rigorously formulated using probabilistic generative models, where interpretable latent variables, e.g. communities, determine the probability of an interaction. While there exists many such approaches in standard networks, despite few contributions, how to formulate them in hypergraphs is still an open question. One of the main challenges hindering this exploration is computational, as the number of possible hyperedges is large, thus posing a major obstacle in the development of any probabilistic model.

Here we describe recent work where we propose flexible and efficient probabilistic generative models for hypergraphs using a latent community structure. We will show how our proposed approach can be used to learn flexibly mixed-membership community structures of various types, to generate synthetic data with desired properties and to make predictions of missing observations.

Remarkably, our approach can be implemented efficiently and all the implementations have been released open source to facilitate downstream analysis of practitioners interested in investigating complex interacting systems.

Through a variety of experiments, we show how our model can be utilized in a variety of practical scenarios. In particular, we show the main advantage of detecting communities with our approach for hypergraphs compared to others that first process the data into a pairwise network structure and then rely on standard approaches for networks.

The works are available online at https://arxiv.org/abs/2212.08593, https://arxiv.org/abs/2301.11226 and https://doi.org/10.1038/s41467-022-34714-7.

Measuring the assortativity in two-mode networks

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Social networks often show the tendency to assortative behavior if actor attributes, such as age, gender, level of education, ethnicity, etc. Assortativity implies that similar people are more likely linked to each other and tend to be more connected. It can be explained through homophily behavior.

Assortativity measures have been widely studied in one-mode networks, but little attention has been paid to the same concept in two-mode networks.

In the present paper, we discuss the idea of assortative mixing when two, or more than two, sets of nodes are linked and different sets of attributes are defined on such sets. We introduce three measures of assortativity. The first is based on the probability that two nodes have the same attribute; the second is based on the Gini heterogeneity index; while the third is based on the entropy of the attribute.

We propose also a testing strategy based on the reshuffling of the attributes.

As an illustrative example, we consider an interlocking directorate network. Surnames of the director and NACE codes for the economic sectors of the firms are considered. The tendency to form family firms is measured through the assortativity by surname, while the tendency to create sectorial cartels through homophily by NACE codes.

Spatio-temporal changes in the Twitter Brexit debate: a functional graphical model approach

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In recent years, there has been a growing body of literature on multivariate functional graph models. These models present a graphical depiction of the conditional dependence among a finite set of functional random variables and have found applications in various fields, including studies on brain connectivity. Our objective is to explore a new extension of this methodology that incorporates spatial and temporal correlations among random functions. To illustrate this, we focus on analyzing the semantic network formed by Twitter users, specifically examining the evolution of the Brexit debate across the United Kingdom during a specified period.

In our approach, we consider the temporal changes in word usage as functional realizations, thereby defining the semantic network as a grap representation of the conditional dependencies among these functional variables. Since each tweet is not only timestamped but also geolocated, we must incorporate these spatial and temporal aspects to accurately define the functional semantic networks. By leveraging the richness of information provided by these estimated networks, we employ various descriptive statistics on graphs to capture the evolving nature of the public discourse surrounding Brexit in both time and space.

The primary outcome of our research is a novel representation of the connections between words within a social network, which is based on their monthly trends. This offers an alternative perspective on public debates, surpassing the conventional semantic networks that rely on word co-occurrences within sentences or tweets. Through our methodology, we provide a deeper understanding of the Brexit discussion on Twitter, highlighting the changing patterns of interaction and association between words over time and across different regions in the UK.

In summary, our study contributes to the emerging field of multivariate functional graph models by introducing an innovative approach that incorporates spatial and temporal correlations. By applying this methodology to the analysis of the semantic network formed by Twitter users discussing Brexit, we enhance our understanding of the public debate dynamics and present a fresh perspective on the relationships between words within the context of a social network.

From Multimode Networks to Hypergraphs. A procedure for network projection, simplification and filtering

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Complex network data structures are considered to capture the richness of social phenomena and real-life data settings. Multipartite networks are an example where various scenarios are represented with different types of relations, actors or modes. Within this context, the present contribution aims at discussing an analytic strategy to simplify multipartite networks in which different sets of nodes are linked. By considering the connection of multimode networks and hypergraphs theoretical concepts, a three-step procedure is introduced to simplify, normalize, and filter network data structures. Hence, a model-based approach is introduced for derived bipartite weighted networks in order to extract statistically significant links. The usefulness of strategy is demonstrated in dealing with two application fields, that is intra-national student mobility in higher education and research collaboration in European framework programmes. Finally, both examples are explored by using community detection algorithms to detect the presence of groups mixing up different modes.

Interpersonal networks and the COVID-19 pandemic (1/2)

Assortative mixing of opinions about COVID-19 vaccination in personal networks

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Many countries worldwide had difficulties reaching a sufficiently high vaccination uptake during the COVID-9 pandemic. To understand this hesitancy better, we performed cross-sectional research on a panel of 30,000 individuals which were representative of the population of Romania – a country in Eastern Europe with a low 42.6% vaccination rate – to determine whether people are more likely to be connected to peers displaying similar opinions about COVID-19 vaccination. We have extracted 443 personal networks amounting to 4430 alters, and we have used opinions of peers, quantitative network measures, and socio-demographic features to predict individual opinions about COVID-19 vaccination. Our evidence indicates that the likelihood of having a positive opinion increases when peers have, on average, a more positive attitude than the rest of the nodes in the network. Also, we find that individuals with higher education and age are more likely to hold a positive opinion and that positive opinions about COVID-19 vaccination are clustered. With the given empirical data, our study cannot reveal whether this assortative mixing of opinions is due to social influence or social selection. Still, it may have implications for public health interventions, especially in countries striving to reach higher uptake rates.

Vaccination Homophily in Social Networks During the Covid-19 Pandemic

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Homophily, a well-observed attribute of social networks refers to the tendency of social contacts to be similar to one another. This similarity applies not only to social-demographic characteristics such as gender, educational attainment, or race and ethnicity but also to values, personality traits, and behavioral aspects, including health behavior. Vaccination status is not an exception: research on vaccine hesitancy – the primary barrier to the adaptation of vaccines among high-income countries – suggests that the predictors of vaccine refusal widely correlate with factors shaping interaction patterns in society, while they also cluster geographically. As attitudes and behaviors tend to spread within social networks, the vaccination decision of an individual is also strongly influenced by their social contacts, eventually leading to vaccination homophily and vaccination clustering. The consequences can be significant, particularly in terms of vaccine hesitancy, which contributes to outbreaks of diseases.

This paper aims to survey and understand vaccination homophily in egocentric networks during the Covid-19 pandemic. We use a merged dataset of two nationally representative surveys conducted in Hungary in November 2021 and June 2022 (N=2,000). Using a network diary approach, we measured the egocentric network by asking respondents to list all their personal interactions in the last 24 hours. The diary log contained information about the Covid-19 vaccination status of each alter. This allowed us to calculate vaccination rates in the network of each individual.

The results suggest strong clustering by vaccination status. The mean vaccination rate in vaccinated individuals' networks is 91% compared to 49% in unvaccinated individuals' networks (MED = 100% vs. 50%). When focusing on household members, these differences are even more polarized, with 92% for vaccinated individuals and 31% for not vaccinated ones (MED=100% vs. 0%). The level of homophily decreases when considering more exterior circles of the ego network, like other family members, friends, or colleagues.

The vaccination rate of the respondents' social network is indeed the strongest predictor of vaccination status (AME=0.33, SE=0.02) and we found high inbreeding homophily scores both among vaccinated and unvaccinated individuals (vacc.: 0.43; unvacc.: 0.39).

Lastly, the model predicting inbreeding vaccination homophily suggests that individuals who are older (b=0.01, SE=0.00) or have higher levels of education (b=0.15, 0.04) are more likely to be surrounded by others who share their vaccination status, regardless of whether they themselves are vaccinated or not.

Our findings corroborate previous reports by showing that vaccination homophily is prevailing and close contacts in egocentric networks may have played a crucial role in vaccination decisions during the Covid-19 pandemic.

Social Networks of First Generation Students in Times of a Global Crisis: Social Support and Mental Health

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Not all students who venture into tertiary education start with the same prerequisites: First Generation Students (FGS) are the first in their family to pursue an academic degree, while Continuing Generation Students (CGS) have at least one academically educated parent. FGS differ from CGS: they often have a lower socio-economic status (SES), they encounter more barriers in their studies and, compared to CGS, they change their subject or drop out of their studies more often. Possible explanations are fewer resources and social support: FGS have less access to academic networks, although well-informed peers support study success. Due to the lack of appropriate contacts, access to social support is lower for FGS. Networks and resources, as contextual factors and environmental influences, also affect students' career planning, actions and goal achievement, as well as their health: a lack of resources triggers stress. Thus, in addition to direct disadvantages, negative effects on the mental health of FGS are increased and put additional strain on them.

In this study we examine the relationships between the assumptions of SCCT and the experience of stress due to lack of resources using Conservation of Resources (COR) Theory, with emphasis on social support during a crisis (lockdown in this case).

For this purpose, preservice teachers (N = 899), whose education and professional future was directly affected by the lockdown, named their five most important contact persons during a crisis situation (lockdown in this case) and the form of social support they received as well as the overall quality of support in an online survey and filled out a stress questionnaire, the Perceived Stress Scale in a German translation. Social network analysis is used to compare the most important contacts of FGS and CGS during lockdown and the receipt of instrumental support, informational support and appraisal by the named contacts. On the basis of previous research findings we assume that FGS report less instrumental support, informational support and appraisal than CGS. Social support is a resource and according to COR theory, a lack of resources leads to stress. Therefore, FGS are expected to have higher stress levels than CGS.

The hypothesized discrepancies reinforce the assumptions of SCCT that individuals from different academic backgrounds receive different levels of social support, as well as the assumptions of COR Theory that a deficit of resources leads to more stressful experiences. Further, they underline the reciprocal links between the two theories and social networks as a gateway to social support. Additionally, they replicate findings from non-crisis times in a special and threatening situation (lockdown in a pandemic in this case) which could not have been transferred before replication. We discuss options to prepare for future nationwide or worldwide crisis situations.

Interpersonal networks and the COVID-19 pandemic (2/2)

Detecting Active Networks with Contact Diaries during the Covid-19 Pandemic: Findings, Advantages, and Limitations

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As an alternative to conventional methods of network data collection, contact diaries help generate comprehensive information that facilitates researchers in reconstructing dynamic patterns and deep structures in active personal networks. Not only does contact data allow one to draw network visualization beyond nodes and edges, but more-sophisticated multilevel analysis also enhances the understanding of a wide range of substantive research issues. On the micro level, for example, diary-based analysis has distinguished how weak-tie effects vary by who initiates a specific contact, how the benefits of reaching upward in the social hierarchy manifest contact by contact, and how daily contact between Buddhist masters from different ranks brings about instrumental and affective outcomes. On the macro level, cross-national diary studies identify and compare the patterns of contact networks between new democracies in Europe and Asia that share a similar authoritarian past.

Given its advantages in building active and comprehensive personal networks, contact diaries appear to be an appealing or desirable tool for detecting active networks during a pandemic, even though they may be more difficult to implement. As most conventional methods of network data collection became impractical or infeasible during the Covid-19, could this diary approach prove to be more unobtrusive and productive, or would the overly tense situations of social interaction amplify the limitations of the diary approach because it requires strong commitment from all parties involved in data collection?

Drawing from three diary studies and five pilot tests conducted in Taiwan from 2020 to 2022, this paper first compares the basics of the diary data during the pandemic against those from earlier diary studies. It then evaluates the advantages and limitations of implementing contact diaries at this difficult time. The three diary studies yielded nested data containing a total of 404 diary keepers (egos), 13,652 contact persons (alters), and 118,165 contacts, with each ego keeping the diary for at least thirty days. Preliminary analysis of these diary datasets confirmed a few obvious patterns of personal contact networks during Covid-19: fewer numbers of contact and active network members overall, a lower proportion of in-person contact, and a higher proportion of contact with kin members and close friends. Multilevel analysis further enables us to identify the extent to which the outcomes of interpersonal contact during the pandemic vary by both contact and tie features. After addressing some of these key findings, the paper discusses the limitations of using contact diary data to infer the patterns of active networks during the pandemic.

Simulating Covid-19-vaccination discussion network of Hungary based on egocentric survey data

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BACKGROUND:Given the potential for future zoonotic outbreaks, it is crucial to gain a deeper understanding of the social processes that contribute to Covid-19-vaccination-refusal. Previous studies showed that Covid-19-vaccination hesitation tends to show spatial, social and sociodemographic clustering. However, little is known about the clustering of Covid-19-vaccination-discussion networks (C19VDN).

AIMS:The objectives of this presentation are to (A1) examine the clustering of vaccination in dyads of egocentric C19VDN and (A2) simulate the sociocentric C19VDN, and (A3) examine the components and geodesic paths of the simulated network.

DATA AND METHODS:C19VDN was defined as the set of alters with whom ego discusses Covid-19-vaccination matters. A cross-sectional online survey was conducted among the Hungarian adult population from November 15 through November 26, 2022. Using a name-generator, egocentric data of C19VDN were collected. Maximum 5 alters could be named. Using dyads as the unit of analysis, Z-test and Cohen-h measures were applied. Degree-distribution preserving generation was done sampling uniformly from the set of all possible graphs. Simulations and analysis of components and geodesic paths were done in R 4.2.3 using igraph 1.4.1 package.

RESULTS:In the egocentric C19VDN, dyads showed clustering by vaccination: 67,1% (95% CI 65,0–69,2%) of dyads were homogeneous vaccinated (versus by chance : 58,1% 95% CI 54,3%–61,9%, Cohen-h=0,46), 23,4% (95% CI 21,5–25,3%) were heterogeneous (versus by chance:36,2% 30,2%–42,2%, Cohen-h=-0,28) , 9,5% (95% CI 8,2–10,8%) were homogenous unvaccinated (versus by chance: 5,7% 95% CI 3,9%–7,4%, Cohen-h=0,14). A graph was generated, consisting of 7 886 856 nodes and 8 188 551 edges. The largest component contained 83.3% of all nodes, while 498 808 components were detected in total. The biggest component was estimated to have a diameter of 47 and median geodesic distance was 27.

CONCLUSION:Our study on the egocentric Hungarian Covid-19-vaccination discussion network revealed a moderate level of clustering at the dyadic level. Additionally, in the simulated, sociocentric graph, the majority of nodes belonged to a single component, which had a larger diameter compared to acquaintance-based social networks. Regardless of the high diameter, these preliminary findings show the potential of network methods in this field.

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Changes in the acculturation strategies of foreign youth living in Hungary during Covid-19 from a network approach

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The study focuses on changes in the acculturation strategies of highly educated young immigrants living in Hungary. The acculturation processes are interpreted in relational and cultural dimensions. The composition of contact networks was investigated using the so-called personal contact network map, which allowed for an examination of the physical availability, cultural affiliation and emotional closeness of contacts. Data collection was carried out in two waves, using a combination of qualitative and quantitative techniques. Although with a low number of items (N=30), the same individuals were interviewed during the period before the first recorded coronavirus infection in the country and during a period of strict epidemiological restrictions. Respondents with favourable sociodemographic characteristics had an extensive network of contacts in both years and their network of contacts showed only a slight decrease. For the majority of respondents, the orientation towards the host country has weakened and acculturation strategies have shifted towards disintegration. In terms of the composition of egocentric networks of contacts, the proportion of contacts belonging to the host society, mainly of weaker ties, promoting integration acculturation strategies decreased, while the proportion of contacts belonging to the own ethnocultural group or to other migrant groups, promoting separation, transmigration and isolation strategies, increased. In this paper, we attempt to explore and understand these processes in more depth. The aim of the study is to provide a descriptive characterisation of the changes within each type of relationship and to understand the reasons for the disintegration processes in the sample studied, as well as to identify the relationship profile pictures that emerge from the respondents' relationship network composition. In this study, we present a snapshot of respondents' network characteristics and acculturation processes based on the data collected.

Modeling Network Dynamics (1/4)

A simple algorithm for inferential updates on relational-event data streams

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Depending on the available computational power, fitting relational event models to large networks might be a challenging procedure. Moreover, it can be particularly problematic when the network grows over time. As more events are observed, refitting the model may become unfeasible. Therefore, in this presentation, we propose a decomposition of the likelihood function that allows fitting relational event models on smaller batches. Leveraging the conditional independence of events and the constant effect assumptions of the relational event model, we treat the batches as independent and pool their estimates in a meta-analytic fixed-effect model. This procedure only requires caching the estimates and their standard errors, thus reducing the computational burden of keeping the data matrix in memory. Hence, our algorithm does not require revisiting past data when new events arrive, resulting in a method that allows for faster inferential updates. We illustrate the algorithm in a series of simulation studies.

Modeling, estimating, and simulating: formalizing attitudes towards inequality as a complex network

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Our work represents the first attempt to model attitudes towards inequality as a network of interacting evaluative reactions. This multidimensional concept is measured through people's perceptions, beliefs, and judgments about inequality, redistribution and taxation. We apply the Causal Attitude Network Model to ISSP 2019 data representative of the Italian population. This model renders survey variables as nodes of a network whose edges represent their estimated partial correlations. The network reveals the between-person structure of people's understanding of inequality. Findings show that these evaluative reactions form a fully connected network organized into two communities. Within these substructures, variables interact regardless of their nature -perceptions, beliefs, and judgments- or their topic -inequality, redistribution, and taxation. Perception of large income inequality and belief in public redistribution are the most important components of the network of attitudes towards inequality in Italy. Consequently, when targeted with simulated manipulation attempts, these nodes produce broad changes in the attitude network, affecting neighboring ones. Our results have important implications for the literature on distributive justice and attitude networks, as they offer a multidimensional comprehension of these attitudes and provide evidence on their dynamics.

A Deep Relational Event Additive Model for modeling patent citations

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The patent citation network is a complex system that reflects the diffusion of knowledge and innovation across all fields of technology. Citation networks represent an important mechanism for understanding the progress of scientific and technological innovation. However, the size of these networks presents significant challenges in their analysis, especially when considering their dynamic nature over time. Relational event models (REMs) have been employed to describe citation networks, but their application to very large networks has been limited due to their computational complexity. In this work, we propose an extension to REMs that overcomes these challenges and allows for more efficient and accurate analyses of large citation networks.

Our computational REM extension, called the Deep Relational Event Additive Model (DREAM), employs machine learning concepts to capture the relationships between cited and citing patents as events that occur over time. The DREAM models each predictor as having a non-linear behavior, which is modeled via a B-spline approach. This allows for more flexible modeling of the complex relationships between variables, while also providing interpretable results.

To fit the DREAM into a network of approximately 8 million patents and over 100 million citation events, we estimate the model through a stochastic gradient descent approach. This allows for real-time, efficient estimation of the DREAM parameters and the identification of the key factors that drive the citation network dynamics. Additionally, the spline approach can be extended to include complex relationships between predictors through multivariate interaction splines, leading to a more accurate and comprehensive interpretation of the underlying mechanisms.

Our analysis using the DREAM has revealed several interesting insights into the patent citation network. For instance, we have identified time windows in which citations are more likely to happen, which can inform strategic decisions around patent filing and citation practices. Additionally, we have found that the increasing number of citations received per patent is highly relevant to understanding the dynamics of the network.

Our results demonstrate the potential of the DREAM in capturing the complex dynamics that arise in a large sparse relational event network while maintaining the interpretability for which REMs are most famous. The use of machine learning concepts and the flexible B-spline approach allows for more efficient and accurate analyses of large citation networks, providing valuable insights into the diffusion of knowledge and innovation in various fields of technology. Overall, the DREAM provides a promising solution to overcome many computational challenges while opening REMs to larger and more complex networks. In this regard, we argue how the DREAM could be easily expanded to account for different kinds of relational networks.

Application of Stage Dynamic Detection for Detecting Community Changes in Temporal Networks

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The application of network analysis has strengthened our capacity to understand complex and dynamic societal changes. However, the complexity of the networks generated and the changes that take place during the measurement period pose challenges in detecting communities within observed networks.

In their paper, Masuda and Holme (2019) tackled this problem by devising a method that integrates a graph distance measure with hierarchical clustering. This approach allows for the detection of changes in temporal networks by measuring distances in the dissimilarity matrix between time snapshots of these networks.

Building on their work, I have broadened the method by adding more dissimilarity measures, such as differences in eigenvalues and modularity. Initial results, drawn from several different datasets containing coded text data, demonstrate that all three methods yield valid and reliable measurements. This suggests a wide range of potential applications across various scientific fields.

A notable advantage of this method is that the results can be visually represented, ensuring easy comprehension for audiences from a multitude of scientific disciplines where it could be applied.

Modeling Network Dynamics (2/4)

Content Niches & Social Interactions on Online Platforms: A Framework based on SBM and DyNAM

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Individuals use online platforms for two main functions: to facilitate social interaction and to create and share content. The content creation and groups of individuals sharing similar interests might have a dual relationship, giving origin to content niches defined as smaller-scale social groups on large social media platforms. In this work, we propose a two-step framework to investigate if and how membership to content niches affects the interaction in social media platforms. In the first step, we apply Stochastic Block Models (SBMs) to the network of the number of co-occurrences of pairs of labels keywords generated by the users to share content to uncover content niches where users can interact with each other. In the second step, we use the content-wise niches as an independent variable in a Dynamic Network Actor Model (DyNAM) to investigate whether time-stamped user interactions are associated with content-wise niches. We illustrate this framework's applicability by analyzing the posting behavior of and the interactions among the members of an online community for aspiring and professional designers.

Goodness of Fit for Multilevel Dynamic Network Models

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Procedures for assessing correspondence between a statistical model and observed data are known as Goodness of Fit ('GoF') methods. These are well known for Exponential Random Graph Models and for Stochastic Actor-oriented Models ('SAOMs'). This presentation proposes Goodness of Fit methods for multilevel SAOMs, corresponding to their Bayesian estimation by the function sienaBayes.

The Bayesian approach offers an approach to Goodness of Fit testing which takes account of the uncertainty of the parameters and which is called 'posterior predictive checking'. This operates as a four-step procedure: a sample is taken from the posterior distribution of the parameters; for each sampled parameter vector a simulated data set is generated; descriptive statistics are calculated for the observed data and for each simulated data set; finally, the value for the observed data is compared to the simulated values.

For SAOMs there are two kinds of simulation: forward simulation, starting from the first wave; and sampling of the path (or bridge) from the first to the second wave. Forward simulation is used for estimation by the Method of Moments, bridge simulation is used for likelihood estimation, including sienaBayes. For the posterior predictive checks, the sample from the posterior distribution of the parameters is obtained within sienaBayes, and the generation of simulated data is done by forward simulation.

Similar to GoF studies for single SAOMs, the descriptive statistics used in GoF testing for multilevel SAOMs are called auxiliary functions. Posterior predictive checks for auxiliary functions defined for a single group can be applied to each group separately, followed by a combination of their p-values for an overall check. Auxiliary functions can also be defined for the level of the entire data set, e.g., a correlation coefficient between a group-level variable and a network characteristic. For such descriptive statistics the correspondence between the model and the data can be assessed directly by posterior predictive checks.

These procedures can be applied for the regular auxiliary statistics used also for single networks, such as degree distributions and the triad census. Auxiliary functions at the level of the entire data set can be used, e.g., to check whether the dependence of parameter values on network size was modeled adequately.

LASSO Regularization for Exponential Random Graph Models

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A very successful class of models in the network literature is the Exponential Random Graph Model (ERGM) family. ERGMs aim to model the probability of a specific network formation with an exponential family distribution, which simultaneously allows for powerful modeling capabilities and relative ease of interpretation of the results. In ERGMs non-trivial interdependencies between network ties are taken into account by adding a number of structural statistics to the model's covariates. Such structural statistics may include the reciprocity of edges, when dealing with directed networks, or the number of triangular substructures - like triangles or k-stars - for undirected ones. In general the set of structural statistics to choose from when choosing a model is unmanageably large, and a selection is needed in order to avoid model degeneracy issues. We refer to a model being degenerate (or near degenerate) when the resulting distribution assigns high probabilties to near-empty or near-complete networks, causing completely inaccurate fits. The reasoning behind the choice of the model is rooted in heuristics, as the best fit among a set of widely popular statistics (with GWESP or alternating k-stars being popular choices, for example) is usually chosen. The method we propose is to apply the Least Absolute Shrinkage and Selection Operator (LASSO), a well-known parameter shrinkage operator widely used as a variable selector in the context of linear models, to the more complex framework of ERGMs. In particular we add a small shrinkage term to the theoretical likelihood given by the ERGM setup, and proceed to find the maximum likelihood estimation through MCMC (Markov Chain Monte Carlo) maximization. Our goal is to two-fold: on one hand the parameter shrinkage solves degeneracy issues, by helping the estimation to stay clear of critical areas in the parameter space. On the other hand, by tuning the shrinkage parameter, we achieve a variable selection algorithm for the set of structural statistics which allows us to input a higher number of statistics as model variables, and in turn reduce the amount of heuristic arguments.

Modeling Network Dynamics (3/4)

Looking beyond the local neighborhood – Analyzing less-localized processes of organizational fields in dynamic networks

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Recent developments in longitudinal network statistics have increasingly discussed the relationship between micro-mechanisms and structural macro features which they generate. The micro-mechanisms usually involve modelling local effects of the dependency on a neighborhood less than N-steps away from a tie or node with N being small. Classical examples from network theory are dyadic reciprocity (N=1) or triadic closure (N=2). Interpretations of emergent network statistics and multilevel approaches have extended the applicability to a wider theoretical perspective, but local mechanisms cannot fully capture processes which operate beyond the close neighborhood in empirical networks.

How can we model less-localized processes and test them with inferential network statistics? Less-localized network effects are endogenous consequences of features of other node or tie constellations not in the local neighborhood, but which are still antecedents of endogenous changes in a micro level process. In particular, these features could be distant clique constellations or aggregated attributes of all isolates. In this study, I want to discuss the potentials but also current limitations of dynamic models to capture less-localized processes.

To illustrate the theoretical relevance, organizational fields are a particularly interesting use case, since they are characterized by mutual awareness, where every other actor in the field might impact a focal actor regardless of whether they are closely connected. Organizational fields are inter-organizational networks with potentially large path lengths between nodes. Borrowing from new institutional theory, characteristics of organizations can be hypothesized to become more similar due to three separate processes of isomorphic change: mimetic, normative, and coercive.

While coercive isomorphism might be modelled as classic contagion, normative isomorphism can be understood as the tendency of organizations to adopt characteristics of the most central organizations in a field even though they might be distant in the network. In addition, mimetic isomorphism as the adoption of characteristics of similar organizations if measured by generalized equivalence cannot be expressed as a triadic effect but needs to consider the local neighborhoods of others. Since these hypotheses mostly focus on effects on actor attributes, I will evaluate how well current local parameterizations in stochastic actor-oriented models can identify the institutional processes with a Monte Carlo simulation.

Although organizational networks are particularly prone to be affected by non-local network mechanisms, the evaluation of the current potential and limitations to model less-localized network effects is relevant for many social and even semantic networks. Whenever nodes and relations without close connection can impact each other's dynamics, it is pertinent to be able to go beyond strongly localized network effects.

Memory in relational event networks: a closer look at real case studies

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A relational event network consists of a time-ordered sequence of social interactions among actors. To shed light on the dynamics that establish between actors in the network, social network researchers are interested in the definition of endogenous statistics, which quantify the realization of specific patterns of past social interactions. In practice, it is likely that the tendency of actors to interact with one another depends on the volume of past interactions and on the time that has elapsed since their occurrence. Generally, previous studies assumed that either long-past social interactions have the same influence on the social behavior of actors as recently occurred events, or it was assumed that the influence of past events follows a pre-specified (parametric) memory decay that is fixed a priori by the researcher. Such approaches are limiting for two reasons. First, which is a substantive argument, learning how (long) past events affect social interaction dynamics in the (near) future is scientifically interesting to understand human nature and behavior better. Second, which is a more statistical argument, a misspecified operationalization of memory decay can yield biased results, which may harm the reliability of the conclusions. Therefore, recent studies introduced novel methods that allow us to estimate the shape of the memory decay directly from the observed event sequence. In this project, we will use these novel methods in an ensemble of real case studies with the goal of getting a better, more unified understanding of memory decay that is present in relational event networks. Both directed and undirected relational event data are considered, either with or without a sentiment (e.g., positive or negative), and in different types of settings and contexts. We will consider in-person interactions among attendees at conferences, digital or in-person interactions among students (at schools or universities), email communication among employees in a working environment, socio-political interactions among countries, digital interactions among online players, and editing actions on online textbooks. These relational event data vary in terms of the number of observed events and the size of the networks.

Modeling the co-evolution of collaboration and references to prior work: RHEM for networks of polyadic, mixed two-mode events

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Scientific networks can represent the co-evolution of two-mode coauthor networks, connecting scientists to the papers they publish, and one-mode citation networks, connecting papers to their references. In this talk we propose relational hyperevent models (RHEM) for the joint modeling of collaboration and references to prior work. The model allows to include effects on the author level (e.g., triadic closure in coauthor networks), effects on the paper level (e.g., repetition of co-citations), and mixed effects (e.g., authors collaborating with those who have cited the same references or authors citing the work of those who have cited their own work). In an analysis of empirical networks comprising millions of authors and papers we assess the relative strength of these and other types of effects in explaining scientific collaboration and citation networks.

The model of dynamic cohesive subgroups

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The actors in many social networks tend to not homogeneously connect to each other, but instead organize themselves into smaller cohesive subgroups. Two features of this substructuring have received comparatively little attention in the network modeling literature. On the one hand, these subgroups can (and do) overlap. On the other hand, they can (and do) change over time.

In this study, we address these features by elaborating an extension of the Stochastic Actor-Oriented Model (SAOM) that incorporates a model of latent cohesive subgroup structures, which are allowed to overlap. The model for these latent structures is based on intuitive assumptions, corresponding to theoretical expectations, about subgroup sizes and number of subgroups per actor.

This model represents the longitudinal co-evolution of tie change processes in an observed social network alongside actors' group membership ties in a latent two-mode network expressing membership in cohesive subgroups. These latent subgroups introduce higher-order interdependencies among actors, resulting in new effects of SAOM specifications, such as maintaining ties with subgroup members or being influenced by subgroup members.

We provide an overview of the model development and explore the consequences of including these higher-order dependencies for modeling the dynamics of friendship relations between students in small classrooms.

Modeling Network Dynamics (4/4)

Outlier detection in ERGM meta analysis

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To summarize the results of ERGM analyses on a sample of networks, meta-analysis can be used.

To obtain reliable parameter estimates, each single network needs to be estimated with the same ERGM specification, with an adequate fit.

In a previous small-scale empirical study using ERGMs it was found that a meta-analysis of several goodness-of-fit statistics revealed outliers, i.e. networks for which the goodness-of-fit was unsatisfactory for at least one type of goodness-of-fit statistic. An accompanying simulation study confirmed the presence of outliers.

The behavior of three ERGM model specifications ('true', 'too simple' and 'too complex) was investigated in a simulation study with two network sizes and distributional heterogeneity (homogeneous or mixed). The results showed that bias and RMSE not only increased with using a 'wrong' model, but also in a mixed sample. Moreover, the goodness of fit statistics corresponded with the reliability of the meta-analysis.

In the presentation, the results of both studies are combined to detect the outliers in the empirical data set, and to investigate the consequences of the outlier analysis for the results.

Robustness of Centrality Metrics in Interaction-Sampled Communication Networks

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In technology supported network data (e.g. Social Media interactions), we often have to work with incomplete data. Traditionally, network sampling is done on edges and/or nodes. When interactions are sampled, the impact of centrality calculations on the subsequent aggregated network is unclear. We address the robustness of centrality measures with respect to interaction-sampled network data. Our aim is to study the effect of sampling on centrality metrics, that is, how the top central nodes in a network change when we have only a sample of the network. To do so, we need to analyze different samples of different sizes of network data, and assess, for various centrality metrics, how the list of top k central nodes in the observed network (the sample) is similar to the list of top k central nodes in the true network (the entire network). We consider 3 centrality metrics: degree, closeness and betweenness centrality; with both their binary and weighted variations. We use two types of random networks as true networks: 1. small-world networks as per Watts-Strogatz model (WS), and 2. scale-free networks generated using preferential attachment mechanism, as per Barabasi-Albert model (BA). The edges are equipped with random integer weights (representing tie strengths). We use 3 distributions from which we randomly draw the weights: uniform, normal and exponential. For each model and each weighting scheme, we generate 10 networks as our true networks (total 60), each has 1000 nodes and 3000 edges. Then, using 20 levels of sample sizes (5%, 10%, ...), we sample 10 observed networks from each true network (total 12,000 observed networks). For each of the true networks and the observed networks, we calculate the centrality, and for each case, we obtain a list of top k central nodes, which we refer to as true- and observed-centralities, respectively. To measure the robustness, we use Fagin's Intersection Metric, which assesses how two top-k lists are similar (true vs. observed centralities).

Findings: 1. BA model is always more robust than WS model, for all cases. 2. The binary variation is generally more robust than the weighted variation, except for WS model with exponential weights. 3. The normal weighting scheme with binary variation is very robust, such that the accuracy of the top central nodes is at least 90% with only a 20% sample for BA model. 4. The 3 centrality measures are generally similar in their robustness. For BA model, degree is more robust than betweenness, which is in turn more robust than closeness; the differences between those three metrics are slight for their binary variations, but big for weighted variations. Closeness centrality never wins against degree and betweenness centrality. 5. Some cases exhibit a good linearity fit, i.e., robustness is linear in sample size. Such cases include: all cases of WS model except normal weighting scheme with binary variation, and weighted variation of closeness and betweenness for BA model.

Networked Polarisation: Simulating Social Networks and Online Filter Bubbles

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Political science researchers have identified widening gaps in people's political attitudes for at least two decades (Iyengar and Hahn 2009; Li and Zhao 2021; Ross-Arguedas et al. 2022). These gaps undermine social cohesion and harm democracy by limiting the potential for compromise and increasing dislike for those that share different beliefs. Opinion dynamics simulation models can explain such gaps arising from selective exposure and avoidance to people and information to an extent. Despite the role of social networks in such selection, the implications of different network configurations and information regimes have not been thoroughly explored.

This paper presents an agent-based model that integrates realistic social networks with opinion dynamics models (Deffuant et al. 2000, 2002; Hegselmann and Krause 2004). Individuals modify their beliefs and attitudes in an attempt to resemble those with whom they interact with (Axelrod 1997; Festinger 1957). The purpose of including networks extends beyond the added realism of having a weighted multilayer multiplex network as the model environment to capture the hybrid media environment of traditional media and social media platforms. Each of the two layers has a different topology, small-world (Watts and Strogatz 1998) for offline networks and scale-free Barabasi-Albert (1999) for online networks, informed by previous literature findings and empirical data on the average node degree. This paper provides empirical evidence of the crucial role that interpersonal relations play not just in exerting social influence but also on how the dissemination of information that contributes to polarisation. Thus, we can better explain the mechanisms behind the emergence of polarisation of national identity around secessionist movements.

The national identities of 2,500 agents were initialised with a distribution drawn from the 2011 CEO survey on Catalan political attitudes. Simulation scenarios varied the amount of attitude homophily in the personal network and the level of selective exposure to confirming information in the social media network. Depending on the initial social networks and social media filter bubble conditions, we observed the emergence of consensus around dual national identity or polarisation towards distinct national identities. National identity consensus emerged, at different rates, in the absence of social media filter bubbles exposing individuals to a balanced news diet, regardless of the initial social network configuration. Yet, the presence of social media filter bubbles, promoting information that supports pre-existing views, in combination with initially homophilous social networks, resulted national identity polarisation. These findings were more pronounced for the empirically-informed version of the model representing the Catalan society. Therefore, evidencing how interpersonal networks alongside infor mation exposure can foster polarisation.

Who would I like to know? Surface and Deep level Identities in cooperation and friendship

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Friendship is often driven by demographic homophily, which refers to the tendency of people to become friends with others who share similar "surface-level" (S-L) characteristics like ethnicity, gender, and nationality. This is because these characteristics are easily interpretable and readily apparent. People assume that these shared demographic characteristics confirm the presence of similar, more hidden interests and beliefs - which I refer to as "deep-level" (D-L) characteristics. However, is this always the case? This reliance on S-L characteristics for friendship formation can limit opportunities to meet people, making it challenging to uncover D-L characteristics of those outside one's own identity group. This can be a problem when engaging in behaviour requiring fruitful cooperation and diverse skills. Sometimes, worse results are achieved due to suboptimal team composition because of a lack of knowledgeable ties. Thus, this study looks to see under what conditions D-L characteristics are uncovered and used to connect for more successful friendships and cooperative endeavours.

I empirically examine how friendship and cooperative group formation develops over time - shifting from S-L to D-L traits as more contact opportunities occur outside S-L identity groups. This is done through familiarisation within a closed group of people, where one has both friendship contact within an identity group and opportunities that might lead to cross-identity interactions. In the data used, the agents write an exam after their first year, determining their subsequent academic trajectory. As a result, voluntary study group formations are likely formed using different mechanisms than friendship formation as the upcoming exam approaches and the importance of incorporating the "best" group members grow. We hypothesise that, as time passes, friendships and cooperation increasingly depend on D-L factors due to the discovery of more similar individuals regarding D-L interests, albeit with different D-L traits depending on the agent's interests.

To do this, we analyse data from the Swiss Student Life study, which surveyed first-year university students about their demographic traits, study behaviour, and perceptions of other students. The study also recorded 20 alter nominations for friendships and studying together. Using Stochastic Actor Oriented Models (SAOM) from RSiena, we analyse 12 waves of data from 660 respondents within a closed cohort of first-year students. We look to understand factors contributing to forming friendships and cooperation and how they change over time as students become more familiar with their cohort. Preliminary results suggest that S-L factors of nationality and sex are the primary drivers of friendship and cooperative networks in early stages of familiarisation. In contrast, at a later stage, study groups are formed based on similarities in study hours, with higher homophily in students that reported longer hours of studying.

Modeling Social Influence (1/2)

Comparing peer leaders across different selection criteria: Insights from the ASSIST trial in the UK

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Background: Peer-led interventions have been shown to be effective in improving adolescent health behaviour. Often, peer leaders are chosen by teachers or by nomination, rather than through network metrics. This project investigates the characteristics of 'peer leaders' in a large social network intervention trial, comparing the attributes of the selected peer leaders to those students who would have been selected via network methods.

Methods: Data come from the 'A Stop Smoking in Schools Trial' (ASSIST) project, a social network intervention carried out across 60 secondary schools in the UK in the early 2000s. The sample for this project is composed of 3790 students from 21 schools. Peer leaders in ASSIST were selected based on nominations of being a 'good leader', with the top 20% of nominated individuals recruited as peer leaders. We compare these students with individuals who would have been selected as peer leaders based on indegree centrality, betweenness centrality, and closeness centrality. Specifically, we assess whether peer leaders and 'theoretical' peer leaders differ in demographics or smoking behaviour, in addition to measuring the proportion of peer leaders that would have remained as peer leaders across the different network metrics.

Results and implication: The extent to which selected peer leaders overlap with theoretical peer leaders will offer insight into the necessity to complete social network surveys prior to beginning an intervention. Similarly, the concordance in attributes, such as smoking behaviour, gender, and socioeconomic status, between the sets of peer leaders will highlight characteristics of students who occupy strategic network positions.

Explaining Mobilization for a Coup d'État by Private Interests and Kinship Relations

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Scholarly research has long acknowledged the role of kinship ties in mobilization for collective action that aims to improve a group's condition and achieve a common goal. In such grassroots movements, mobilization is dictated by the desire to contribute to the public good of society and by the extent to which individuals believe that their contribution is possible. A general finding is that relations to other insurgent actors increase the likelihood of participating in protests: social relations have a unifying effect.

In contrast to grassroots movements, in coups d'état people are mobilized by both sides of the conflict: the elite who defends the status quo and the rebels who contest it. Social relations can thus help both sides of the conflict to mobilize supporters. In coups, social relations can lead friends or relatives to fight against each other and thus have a polarizing effect.

Using Tullock's private interest theory, we propose an extended theoretical framework in which kinship relations in social networks determine the extent of private rewards and punishments of mobilization for each actor. We argue that in coups, actors who are related to the ruling elite, especially distant relatives, are expected to derive the most benefits from mobilization for the coup, while actors who are related to the rebels are expected to derive fewer benefits. Mobilization for coups is thus most probable among distant kin of the ruling elite. These assumptions strongly contrast the findings of the literature on grassroot movements, in which people are mobilized through close social relations to other activists.

To test our theory, we turn to a well-documented coup d'état that took place in Basel, Switzerland, in 1691. We derive a large network of kinship relations (1,739 nodes and 80,568 edges) from a Swiss genealogical database that includes people living in Basel during the coup that could have sided with either the elite or the rebels. The network includes kinship relations that extend beyond the ancestor-descendant relations of genealogical databases. We develop a relational measure of kinship distance based on shortest paths weighted by the shared bloodline between connected individuals. This measure has two advantages. First, it assesses the proximity of two nodes according to their shared bloodline, even if they are not directly related. Second, this measure helps assess kinship relations that exist but do not have official labels in the traditional socio-anthropological kinship systems and it allows (numerical) comparisons between such unlabelled kinship relations.

Our findings show that a relational perspective can enrich the understanding of coups d'état. We find that kinship relations to the ruling elite are better predictors of an individual's mobilization than kinship relations to the rebels. We show that in coups, social relations have a different effect on mobilization than in grassroots movements: they are polarizing rather than unifying.

Modeling Social Influence (2/2)

Social selection and influence among lower-secondary students in relation to classroom communication and literacy

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It is widely established that homophily plays an important part in student relationships with students giving preferences to formation of ties with classmates having same or similar attributes. It is also established that peer relations play an important part in student engagement and achievement with good peer relations providing mental and academic support and a sense of belonging. On the other hand, having bad peer relations with classmates can have detrimental effects on academic life. Several studies have further found that having high-achieving friends improves one's own achievement with opposite effect for having low-achieving friends. However, it is yet not established to what degree it is the social selection which causes such effects and to what degree it is the result of social influence.

The present study aims to disentangle the processes of social selection and influence among lower-secondary students in relation to students' classroom communication and literacy. We aim to address the questions of "What is the influence of having good/bad relationships on students' classroom communication and literacy?" and "What is the role of social selection and influence in relation to students' classroom communication and literacy?"

We gathered data from 276 Grade 6 students in 12 classrooms from 6 comprehensive elementary schools in the South Moravian Region in the Czech Republic. We collected friendship relational data at the beginning and at the end of the school year. We further collected several student-level variables at both times including students' classroom talk and the level of literacy. We will employ Stochastic actor-oriented models to address our questions. We expect the students' behaviour in relation to their activity during lessons as well as their performance on literacy tests to be influenced by their friendship relations.

The Influence of Close Friendship among Differentially Motivated Adolescent Dyads on School Engagement: An Actor-Partner Interdependence Model Approach

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School engagement, which is crucial for students' school adjustment and functioning, can be influenced by environmental changes and contextual factors, such as peer relationships. This longitudinal study aimed to examine how close friendships may help to counter the decreasing trend in engagement during adolescent years. In particular, this study sought to examine (1) how friendship selection and socialization mechanisms are associated with changes in the academic engagement of adolescent dyads forming mutual friendships and (2) how socialization processes are influenced by the relative motivation of dyad members and the composition of classes that they attend. The study involved 457 same-gender friendship dyads who were drawn from 1685 Singapore adolescents who were asked to nominate their close friends and report their school engagement and motivation during the first half of their first year in secondary school and then one year later. The actor-oriented interdependence modelling approach was used to examine selections effects for dyads with newly established reciprocal friendship (n=214) and socialization effects for dyads with enduring friendship (n=243). Selection effects were found significant for behavioural engagement and emotional engagement, but not for cognitive engagement, of newly formed friendship dyads; socialization effects were found to be significant across the three domains of school engagement for enduring friendship dyads. Partner effects were found significant from the more motivated dyad member to the less motivated dyad member. The engagement of the dyad member with higher motivation was more likely to positively influence the engagement of the friend with lower motivation. Additionally, the partner effects were found non-significant when directed from the dyad member with lower motivation to the other dyad member with higher motivation: This means that the engagement of less motivated friends did not serve as a significant predictor of the engagement of the more motivated friend. This pattern of results was found to be more pronounced for students who attend mixed ability classes than their peers who attend classes comprising students of similar academic abilities. The results also showed that the friend with higher motivation at baseline was more likely to have a positive effect on the friend with lower motivation at the later time point on behavioural, and emotional engagements only for dyads with opposite valence in their motivation dyads but not for dyads that are both high in motivation. Furthermore, it was found that the less motivated friend at baseline tend to negatively influence the behavioural engagement at the later time point of the friend with higher motivation at baseline: This pattern of results emerged only for dyads who were both highly motivated but not for dyads with different valence in their motivation.

Using a multi-outcome and multiplex network lens to study social influence processes in a student population

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Social influence underpins many problems we face in society: spread of misinformation, as well as increasingly polarized political parties and elections, have impacted our ability to cope with crises such as the Covid pandemic and climate change, and have compromised trust in institutions. Understanding the role of social influence in the spread of beliefs and behaviors is a key step in addressing such problems. Existing literature often studies social influence processes through the lens of single outcomes within a given social context, investigating the adoption of a single behavioral variable through a single network variable. Although such studies provide key insights into the micro-level processes occurring in a given social context, this single-outcome and uniplex network lens make it challenging to gain insights into the overarching process of social influence. We aim to build on such work by studying social influence through a multi-outcome and multiplex network lens.

Drawing from the unique longitudinal dataset of the Swiss StudentLife study, collected across three cohorts of university students (N1=226; N2=244; N3=652), we study social influence across some of the key aspects of student life: studying behavior, free-time behavior, and mental health outcomes. We consider social influence on these outcomes through students' multiplex social networks (co-studying, free-time, social support), and hypothesize, in line with literature on selective disclosure and social circles, that social influence on a specific outcome occurs primarily through outcome-related networks (e.g., a person's studying behavior is likely to be influenced by their studying network, rather than their leisure network or more general network such as friendship). We present results from cross-sectional and longitudinal analyses (with Stochastic Actor-Oriented Models), testing for social influence and selection processes on the given outcomes through outcome-related networks, and comparing these with results from the friendship network, a more general network measure often used in literature, which we take as a baseline.

This study aims to contribute to social theory and a body of empirical insights by challenging the assumption that it is sufficient to study general networks (e.g., friendship) when investigating social influence processes across outcomes, arguing that an outcome-related network measure is more appropriate. Specifically, we argue that outcome-related interactions facilitate social influence processes through outcome-related networks. We claim that social influence effects observed on friendship networks may be a byproduct of social influence occurring on outcome-related networks, and expect them to be weaker in turn. Furthermore, we contribute to existing literature by studying social influence through a multi-outcome lens, which we believe will help us draw more meaningful and general insights into the social processes that facilitate social influence.

Multilayer and feature-rich networks

Business transactions and ownership ties between firms

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We investigate the creation and persistence of interfirm ties in a large-scale business transaction network representing 33,919 firms buying or selling products or services to each other.

In contrast to social relations, driven by popularity, homophily and reciprocity, business transaction relations are driven by economic motives. Because of the economic mechanisms of complementarity, instead of formation of closed triads, open triangles or square-like structures appear. In this sense, business transaction networks are rather similar to functional networks, e.g. protein networks. On the other hand, economic sociology emphasize the crucial influence of embeddedness on economic activity. A key dimension of this is trust, as business operations can be characterized by a multi-layered structure of principal-agent relations, involving high levels of risk and uncertainty. Therefore, the social connections of owners or the geographical proximity of firms also influence the development of business relations.

In this study, we take a multilayer network approach considering ownership relations and business transaction relations as two layers of connections between firms. We argue that direct and indirect relations in this network may convey trust and control relations, therefore they may contribute to creation and maintenance of business relations. For this purpose, we define network motifs of direct ownership, indirect ownership, indirect transaction and indirect mixed relationships. To test the influence these motifs (together with the impact of geography, and industrial similarity) on creation and persistence of business transaction relations, we use log-linear models. In contrast to methods like ERGMs or SAOMs that are applicable on small networks, and even compared to regression frameworks, log-linear models are much more efficient to assess occurrence of links in very large networks if the predictors are nominal variables, as they are based on estimation of contingency tables.

The business transaction and the ownership networks of Hungarian firms are constructed from two administrative datasets for 2016 and 2017. Information on business transactions come from official VAT declarations, while ownership connections are identified from the OPTEN firm information database. Our sample is created by the overlap of these two networks including 33,919 firms.

We find that direct and indirect relations between companies in this two-layered network largely increase the likelihood that firms create and maintain business relationships. As all the tested network motifs supported the creation and persistence of business transaction ties, our work demonstrates that embeddedness in and across network layers has a significant role in business connections. Moreover, when we compare the coefficients of indirect ties to direct ownership ties, we find similar magnitudes, suggesting that trust created by embeddedness has a similarly strong impact as direct control.

Flexible inference in heterogeneous and attributed multilayer networks

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Community detection is one of the most popular approaches to define and identify the mesoscale organization of real-world networks. Recent studies have shown that accounting for node attributes can improve prediction performance. Moreover, the interplay between edge structure and nodes metadata can yield significant insights into the underlying organization and functional relations in the network. Current approaches mainly focus on integrating metadata and the structural information of single-layer networks. Multilayer networks, nevertheless, allow for a more complex and nuanced understanding of real-world data. However, despite few contributions, how to perform inference on multilayer networks together with node attributes (known as attributed multilayer networks) is still an unexplored topic. In particular, it is not clear how to combine conveniently and in a principled way various sources of information, together with the network topology, and assess how these impact downstream inference tasks.

Here we present ADLALM, a probabilistic model to perform community detection in attributed multilayer networks, that takes in input any number of layers and attributes, regardless of their data type. Our approach differs from previous studies in that ADLALM flexibly adapts to any combination of input data, while standard methods rely on model-specific analytic derivations that highly depend on the input data type. Our formulation assigns mixed community memberships to nodes, and transforms the parameters into a shared space where their distributions can all be modeled with Gaussians, both priors and posteriors. Using ideas from probabilistic Machine Learning, we derive an inference procedure that is simple to utilize–it is based on automatic differentiation and does not need any explicit derivations–and scales efficiently to large systems. ADLALM estimates full posterior distributions and, thanks to the Laplace Matching technique, it conveniently maps them to different desired domains to ease interpretation. For instance, to provide a probabilistic interpretation of the inferred communities, our method properly maps the parameters of a Gaussian distribution to that of a Dirichlet distribution, that has positive domain and enforces a normalization on a simplex.

We validate our algorithm through a variety of experiments. Via synthetic studies with known ground truth, we find that ADLALM accurately recovers parameters and successfully reconstructs previously unseen data in link and covariate prediction tasks. Furthermore, we provide a thorough investigation on the choice of the prior distributions and transformations of the posteriors. To conclude, we conduct a comprehensive study of a real-world social support network that describes interactions between individuals in an Indian village. Here, we highlight how using different combinations of interactions and attributes leads to identify different sets of communities.

The manuscript is in preparation.

Kinship and conflicts between mercenary families and regional states from the 15th to the 16th century in Italy. A multiplex network study

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The employment of mercenaries by Italian states between the 15th and 16th century reflects a profound military transformation: the shift from a medieval organization of military power, feudalism, to the emergence of standing armies. The transition from a free to a mediated market of force is releaved by in the fact that contracts between mercenaries and states tended to stabilise over time, with fewer betrayals and longer periods of service to the states. The content of contracts started to include benefits beyond monetary and territorial rewards in order to disincentivise defections: for instance, the Republic of Venice included some family welfare benefits. However, increasing dependency from to mercenary companies, fluctuating patterns of rivalry and expedient partnerships, made contract breaching and sudden changes of sides relatively frequent.

Our hypothesis is that kinship ties played an important role in stabilising relationships between family-run mercenary enterprises and states. For instance, the decision to break a contract by a family member led to emulation by his relatives. Here, we want to examine whether a family's reputational capital was considered by states and whether this cost was, among others, a driving factor for the establishment of stable armies.

To test this hypothesis, we used a large online-database (condottieridiventura.it) which included more than 4000 biographical notes and contractual specifications of condottieri, Italian mercenaries active in Italy between 1330 and 1600. From this database we built a dataset consisting of a network of 1594 condottieri. We analysed a total of 15,682 contracts signed between condottieri and the 238 states that populated the political landscape between the two centuries. The dataset is time-stamped: for each mercenary, data included the dates of the contract and any defection. We reconstructed and defined kinship ties between mercenaries, along with more detailed information on family roles. We also reconstructed all date for any alliance between regional states.

We then built a multiplex network composed by two layers. The first one consists of a two-mode network representing employment contracts between regional states and condottieri. The second layer consists of a one-mode network representing kinship ties among condottieri.

We will provide the first preliminary results of our analysis at the conference with a specific focus on the interplay of contracts and kinship ties.

Multilevel networks

Homophily in bipartite networks

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Modeling homophily, one of the most important and well-researched mechanisms in social network analysis, is fairly straightforward in one-mode networks. However, when analyzing two-mode networks, this is no longer the case. So far, the incorporation of homophily into the analysis of two-mode networks has been mirroring the one-mode network approach of counting all connections to homophilous nodes. But two-mode networks, which are often used to depict affiliations, such as between directors and firms, offer the opportunity for an important differentiation: After all, there is a fundamental theoretical difference if homophily is estimated by counting (1) to how many different homophilous firms a director connects a focal firm, or by counting (2) through how many directors a focal firm is connected to another homophilous firm. Our paper introduces a method to incorporate homophily in accordance with these two different theoretical perspectives, which we call the node- and edge-centric view on homophily. Providing the option to specify one of these views in a curvilinear fashion offers multiple mathematical advantages over the current linear perspective and allows for a deeper integration of social science theories and network models than is currently custom. As an illustration of this new method, which is incorporated in the ergm package for R, we examine two real-world applications: First, a competence network, in which employees were asked to list up to three core competences, through which we showcase the node-centric view in regard to homophily between hard and soft skills. And second, a large network between directors and the firms with which they are affiliated, through which we showcase the edge-centric view, illustrating the role of gender. Our findings suggest that the first few women serving on corporate boards are more important for female directors to obtain a board seat at said firm than later female directors who join the firm. These illustrations help to elaborate how this new method provides a novel perspective on homophily in two-mode networks that lends itself to a wide range of applications and allows to engage with pressing questions in the fields prone to network research, such as sociology or management research.

Network augmentation of population register data

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Population registers contain information about citizens' affiliations to organizational or institutional units like municipalities, occupations, workplaces, et cetera. Some exceptions notwithstanding, they do not contain information about social relations between citizens. However, affiliation data capture much of the external conditions under which social interaction takes place. This way, they carry information about the opportunity structures for social network formation, and determine the likelihood of interpersonal ties to form. Friendship, trust, support, et cetera, are known to arise in activity foci where for a certain time, people share the same space for doing the same things: concurrently sending children of the same age to the same school, paying dog license fee while living in the same neighbourhood, working at the same workplace at the same time, et cetera.

In research on residential and labour mobility, it is accordingly not uncommon to study the effect of former sharing of affiliations on individual outcomes. For example, when a citizen's former colleague works at a new workplace, it is more likely that the citizen will start working at the same workplace in the future. These studies often invoke social network reasoning in their theoretical understanding: citizens who have worked together may have formed enduring social relations, which facilitates information flow about potential new workplaces, eventually resulting in a change of employment. In the absence of proper, i.e., inter-individual social relational data, these explanatory accounts cannot be validated empirically, they remain social network storytelling. Empirical testing relies on the observed, shared affiliations, which play the role of social network proxy data.

In our contribution, we show how stochastic network models can be used to augment observed affiliation networks with artificial networks of social relationships. We discuss strategies to find plausible parameterizations for the augmentation model and propose a simulation-based validity check of social network storytelling. The procedures will be illustrated on the basis of sector-specific labour mobility data from Swedish municipalities.

QAPCSS - A new Method for Analyzing Cognitive Social Structures

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Given their complexity, cognitive social structures are very difficult to analyze (cognitive social structures are data where all members of a network report not only about their own ties, but also about the ties they perceive the others to have, creating a n x n x n 3-dimensional data cube). So far, no advanced network-generative model like ERGM or SAOM exist for this type of data. A lot of research focuses thus only on perceiver levels (e.g., how do we define accuracy? what predicts accuracy of perception?), analyzes each perceived network separately to find communalities in social perceptions, or employs multi-level models with distinct perceiver, sender, and receiver effects. While the latter is statistically quite sophisticated, it naturally ignores the dependencies of perceived ties (e.g., transitivity), and assumes conditional independence of observations.

We propose a combination of multi-level modelling with a QAP permutation.

While such a model also does not properly model the dependencies (like an ERGM or SAOM would), it maintains the 3-dimensional graph structure. The presentation will explain the model, give an example application, and show how it is implemented in R.

Whose Norms do Multilevel Networks Promote? The Importance of Vertical Linchpins in the Construction of a New Outsourced Market Institution

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This paper identifies the importance of normative choices made by key institutional entrepreneurs called “vertical linchpins” in the multilevel institutionalization of a new type of market. Substantively we focus on a population of financiers, industrialists, public servants, and professionals involved in negotiating special long-term (30 years) public procurement contracts in which public authorities outsource the design and enforcement of ‘public-private partnerships’ to private business consortia. We measure the extent to which these actors’ norms of risk allocation have an effect on the structure of two different kinds/levels of networks following the linked-design format: an advice network between individual players and a contract network between the companies in which these individuals are affiliated. As predicted by theory, multilevel ERGMS prove that only the normative choices promoted by specific vertical linchpins shape the alignment of institution-building activities at both levels simultaneously.

Multimethod approach / mixed method approach

A New Methodology of Measuring Social Segregation

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Socio-economic segregation is one of the most persistent problems in modern societies across the globe. Policy makers and scholars have therefore developed a range of methods to measure the level of segregation. Newman's assortativity index is perhaps the most popular empirical measure of segregation in social networks. It considers the structure of the social network and the distribution of categorical attributes over the nodes. However, to evaluate the degree of socio-economic segregation under continuous attributes, like income, Newman's assortativity has at least three shortcomings we want to remedy with an alternative measure.

First, we prove through multiple network simulations that this measurement is easily affected by tie positions, which discriminate against nodes in the middle group. For instance, newman's assortativity gives larger values to a tie that connects the most poorest or the most richest nodes compared to a similar tie that connects nodes in the middle of the distribution. On other words, if we order nodes on a line following their attribute value such as income) and assume two networks with similar sum of tie weights and the density, the network where the ties are located in the center of the line will have a larger assorttativity value than the network where the this exist at the extremes of the line.

Second, Newmans Assortativity is not sensitive to isolates. If isolates change their attribute values, the whole assortativity value remains the same. However, we propose that to consider a level of segregation for a whole society, every node should be taken into consideration.

Third, Newmans Assortativity turns into a meaningless value when ties are all between same-value nodes and the nodes all have the same values. Although in empirical networks, this situation is unlikely to happen, we still regard it as a drawback in terms of a comprehensive measurement of social segregation.

To remedy these shortcomings, we suggest a new methodology for measuring the level of social segregation in a network based on continuous attributes. The core idea that informs our method is that when people connect more to similar others, the network has a higher level of social segregation. We therefore calculate our social segregation index as the sum of the node attribute value difference of all node pairs connected by edges in the observed network, divided by the range of the maximal and minimal sum of such value differences over all possible networks of the same size and/or degree distribution.

Based on multiple network simulations and linear models, we compare our approach with Newman's assortativity and illustrate the advantages of our approach.

Analysing Chinese Rural-background students' habitus transformation through Mixed-Method Social Network Analysis: A Critical Realist Approach

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Social Network Analysis (SNA) scholars tend to apply statistical models to explain the correlation and predict social events. This quantitatively-oriented SNA research has been accused by critical realists of focusing too much on the prediction of exceptionless regularities at the expense of the explanation of the mechanisms by which social events occur. SNA is therefore considered ontologically incompatible with critical realism. In this paper, I will argue that an engagement with critical realism could be productive for SNA, both in rethinking SNA's ontological assumptions and in allowing new insights to be generated about the interaction of networks with other structural elements. Referring to the concept of "norm circle" in the context of critical realism, this paper relates findings from a study that used Mixed-Method Social Network Analysis (MMSNA) to explain the causal mechanisms of habitus transformation among 46 rural-background students attending an elite urban university in the Chinese context. I argue that even where the relational structure and/or attribute characteristics of alters is similar in respondents' personal networks, their habitus may be impacted in different ways due to the different specific norms they are exposed to. This finding contributes to the understanding of the role played by social networks and the social actor's agency in the transformation of habitus. In addition, the application of MMSNA has implications for ontologically reconciling SNA and critical realist theory.

Identifying different kinds of network prominence: The case of the New Education Movement

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Social network analysis is becoming increasingly popular for studying the past. However, during the last decades, studies have applied pre-collected datasets for social network analysis, which limits the use of the method to cases where such data is available. This paper presents another approach whereby two-mode network data are collected from less structured documentary sources, and the findings are enriched with documentary evidence. The approach is used to analyze how 42 notable members of the British New Education movement between 1905 and 1935 were affiliated with 31 organizations. The analysis provides empirical support for the previously proposed idea that there were two kinds of prominence within the movement: that of conveners, who formed close-knit groups with like-minded people, and that of mediators, who built bridges between such groups. Moreover, we discuss how this structure helped the movement to achieve its goals of more up-to-date, equally available education.

Negative Ties and Signed Graphs (1/2)

Balance, Status, and Negative Tie Dynamics in A High Propinquity Network Context

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Negative ties can be characterized as the anti-fabric of the human social network. They represent the rifts, frays, and tears amongst a set of socially interlinked actors. Antagonistic relationships have consistently been found to adversely affect psychological and physiological health outcomes in varying subject populations. Although negative ties have been suggested to be more potent drivers of attitudes and behaviors than their positive counterparts, much about their particularities remains unknown. Balance and status theory have typically been used to understand and explain negative tie dynamics. The support in the literature for these two theories as principal drivers of negative tie dynamics is mixed. We claim that this empirical indeterminacy is partly a consequence of the way in which people prefer to solve their negative ties, for two reasons: First, when possible, people will prefer to have as few interactions with disliked others as possible. As such, negative ties have a tendency to cease to exist over time. Second, both balance and status mechanisms assume that structural information travels through the network, i.e., assume that our dislikes are visible to the ones disliked as well as to third persons. However, humans tend to hide their dislikes. We argue that the efficacy of avoidance as a mechanism for solving negative ties and the visibility of negative ties both depend on the degree of propinquity in the network. In negative networks where propinquity is high, actors are forcibly confronted with disliked others, while simultaneously being made aware of incoming negative ties, so that a highly visible and interconnected negative tie structure is likely to take shape. We suggest that balance and status theory are better able to elucidate negative tie dynamics in networks where the structure of the network is highly visible and interconnected - as in negative networks with high propinquity – as opposed to in networks where such dynamics are diffuse or have failed to form at all - as is often the case in negative networks with low propinquity. Applying balance and status theoretic principles to a high-propinquity network may shed new light on how both operate in real-world negative networks. To this end, we study a social network that can be characterized as having extremely high propinquity: the Sampson monastery network. We theorize and model unique balance and status effects in a stochastic actor oriented modelling framework, in order to synthesize these two paradigms into one, more encompassing model. We model new, previously unspecified parameters to elucidate the theory. The contribution of this study is twofold: it seeks to provide an integrated theoretical model on negative tie dynamics and a statistical approach to study this. It additionally gives initial empirical insight into its applicability in a high propinquity network structure with negative ties.

Group Effects for the Emergence of Structural Balance in Signed Networks

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Recently, some longitudinal network studies (e.g., Daniel et al., 2016; Rambaran et al., 2015; Stadtfeld et al., 2020; Steglich & Snijders, 2022) have analysed the formation of positive (e.g., friendships, liking) and negative (e.g., dislike, bullying) relationships simultaneously through stochastic actor-oriented models (Snijders et al., 2010). While there is an increasing understanding of the micro-processes that leads to tie formation considering signed networks in longitudinal networks, less is known about the effect of perceived belongingness to groups in the tendency of creating positive or negative ties and achieving structural balance in the network. One of the main issues of not considering the groups is that they are often not directly observed, and their effects tend to be indirectly estimated (e.g., Zaretckii et al., 2022). To unfold the combination of the three interwoven levels (i.e., the tendency to create positive or negative ties, the effect of groups, and the combination of effects to achieve structural balance at the network level), we consider the effect of groups directly. To identify the effect of groups in the formation of social networks, we use data from the Swiss StudentLife Study (Vörös et al., 2021). This effect was captured by asking each student to name the informal social groups in the cohort that they felt they belonged to and the peers in their cohort whom they perceived to be co-members of these informal groups. From a methodological perspective, we use some features for signed networks to evaluate the micro-macro linkage through the usage of empirical simulations by using statistical goodness of fit for social networks (Snijders & Steglich, 2015; Stadtfeld, 2018; Steglich & Snijders, 2022). From a substantive perspective, we investigate micro-processes to identify whether shared enemy, friends' agreement, reinforced animosity and/or enemy's enemy tendencies (Rambaran et al., 2015) lead to structural balance at the network level. Likewise, we explore the mediating effect of groups in these tendencies. Our preliminary results of this ongoing project shed some light on the connection of the different levels and the effects of groups on the tendency to create positive and negative ties and maintain the structural balance of the network.

Mechanisms that reinforce and counter religion-based subgroups in school classes: A longitudinal study of the network processes which involve the interaction between positive and negative ties

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Small and medium groups, such as school classes, are often confronted with subgroup formation, which can be (partially) overlapping with a level of segregation based on individual characteristics such as gender, ethnicity or religious beliefs. In signed networks, this involves a high proportion of positive ties inside and negative ties between subgroups. Most studies have focused on the emergence of such subgroup structures, and various network processes have been proposed to explain the emergence of such a macro-level structure. Relying on identity theory, the focus has been on the befriending of people with same characteristics and the dislike of people who belong to different categories. Social identity theory has been used to explain the reinforce of such attribute-based subgroups. However, far less attention has been paid to how actor-level patterns might counter such subgroups from emerging. Therefore, in this paper we ask the question, which actor-level processes might reinforce, and which ones might counter attribute-based subgroups from forming. We use a stochastic actor-oriented (SIENA) model to study the co-evolution of dislike and friendship among 1,204 students in creating subgroups along religious lines. To explain the emergence of such subgroups, we focus on patterns, such as whether a (non-)Muslim being enemy with a non-Muslim(Muslim) might increase the chance that this (non-)Muslim either ends its friendship tie with a non-Muslim(Muslim) and maintain or create dislike ties with other non-Muslims(Muslims) (because this makes religion a more salient characteristic). On the other hand, to understand counter-mechanisms which might reduce interreligious subgroups from forming, we focus on network patterns, such as whether a friendship tie between a (non-)Muslim and a non-Muslim(Muslim) might increase the chances of either interreligious dislike ties convert into neutral or even friendship ties and new interreligious friendship ties emerge (because this makes religion a less salient characteristic).

Investigating the effect of indirect negative ties

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Negative social ties are a common reality in many social networks, and they are associated with negative outcomes for individuals and groups. However, even individuals who do not have direct negative ties can still be affected by the negative effects of negative ties in their social network. Structural balance theory suggests that when a person's friends have negative ties with each other, it can be stressful for the individual, even if they themselves have no direct negative ties.

More recent research has investigated the impact of indirect negative ties on individual well-being and social network dynamics. For example, studies have examined the role of indirect negative ties in the spread of negative emotions and behaviours, and the influence of indirect negative ties on the formation and dissolution of social ties. Overall, research on indirect negative ties highlights the importance of considering not only an individual's direct social ties, but also the broader social network context in which they are embedded.

This presentation aims to build on the idea of the effects of indirect negative ties on individuals. We differentiate between three types of indirect negative ties: 1) when an individual has a friend who has a negative tie, 2) when there are negative ties within an individual's network community but between people to whom the individual is not directly connected to, and 3) when there are negative ties in the wider network outside of the individual's community.

We hypothesize that the existence and number of indirect negative ties will negatively impact individual well-being and how they perceive their friends in the network. We suggest that closer negative ties will have a greater impact on well-being and perception of friends than more removed negative ties, but that information about indirect negative ties will still contribute significantly to the explained variance of individual outcomes of interest.

We test our hypotheses using cross-sectional network data about friendship and animosity among adolescents in five schools in Scotland (N>1000), using the General Health Questionnaire-12 scale as a proxy measure of individual well-being and seven items capturing different aspects of perception of friends. Our analytical strategy consists of two complementary statistical procedures to test the hypotheses: multi-level models and auto-logistic actor attribute models.

We will present the preliminary findings and discuss their relation to our hypotheses, methodological challenges and limitations, and their potential to inform school interventions.

Negative Ties and Signed Graphs (2/2)

Balance Theory, Microstructures, and World Order: The Structure of 150 Years of War and Peace among European Nations

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There is no more commonly referred to theory in network research than Heider's Balance Theory. The theory prompts a set of 8 prime theoretical statements about combinations of positive and negative ties among three actors (e.g., "a friend of a friend is a friend", "a friend of an enemy is an enemy", "an enemy of a friend is NOT a friend", etc.). We propose to expand this set of statements to include "agentic zeroes", that is, ties that are neutral (absent of positive or negative character) that are conscious choices, perhaps even strategic. We develop a coding scheme that includes these agentic zeroes, expanding the original set of 8 statements to 27 different possible balance and imbalance statements. We further develop a measure, a "Balance Correlation", that assesses the extent to which there is evidence for each statement, and a null model to derive the statistical significance of each correlation. We draw on the Correlates of War dataset to apply this analytical model to positive, negative and neutral relations among the countries of Europe from the year 1816 to 2007. For these European countries over this period of history, we find strong and stable support for only one of the original 8 Heiderian balance statements but considerable support for several of the balance statements that include agentic zeroes. Furthermore, we find these balance conditions are punctuated by European international events, such as the dissolution of the Austro-Hungarian empire in 1867, World War I and World War II.

Difficult alters across Europe - evidence from a new survey

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Using unique, newly collected survey data across 12 European countries, this paper sets out to describe and explain variation in difficult relationships. There is very limited evidence on how many difficult relationships individuals have, and with whom these are. Given that most people may want to avoid difficult relationships, we can expect them to be rare. However certain network members may be more difficult to avoid. Recent evidence for the United States suggests for instance that family members are more often perceived as difficult. With probability samples of 1,000 individuals across 12 European countries from all regions, I will explore how many, and with whom, difficult relationships individuals have. I will furthermore assess whether gender, age, education and employment status are related to number and types of alters with whom one has a difficult relationship.

Gender differences in how social capital is related to negative ties in Academia

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Negative relations in professional organizations can create significant liabilities for individuals. In fact, the impact of negative ties on workplace outcomes appears to be greater than that of positive ties. High centrality in adversarial networks can reduce performance, hinder progress, and lower organizational attachment and satisfaction. Despite these findings, little is known about how workplace conflicts influence social capital, particularly in terms of network structure and gender differences.

To address this gap, our study analyzes the relationship between negative ties and brokerage capital, with a specific focus on gender differences among Hungarian young academics. Previous research has examined the relationship between gender and network structure, particularly brokerage capital in professional networks, and the effect of gender composition on network structure and carrier outcomes of men and women. However, our study extends this research by assessing the role of conflicts in shaping network structures.

We analyze survey data from a 2021 comprehensive online questionnaire conducted among under-45 Hungarian academics. The survey covered aspects of publication and application activities, income, job satisfaction, international mobility, and professional network (signed one-step ego networks of conflicts, mentorship, advice, and personal help). The survey data is linked to the Hungarian scientometric site's data (number of articles, citations, co-author network characteristics) and analyzed together. Our final sample includes 1,135 responses. We measure closure and structural holes through local clustering coefficient and density, and brokerage using Burt's constraint.

Our findings reveal significant gender differences in the relationship between negative ties and network structure. For women, the number of cited negative ties correlates negatively with the local clustering and the constraint. This suggests that women having more bridging social capital experience more negative ties. In contrast, men's professional network structure does not appear to be influenced by perceived workplace conflicts. Further, women with lower academic rank tend to report more conflict relations, while men cite more conflicts if they have more connections or a higher scientific impact.

Overall, our study highlights the importance of considering gender differences in understanding the effects of negative ties on network structures and social capital outcomes in professional organizations.

Networks and crime (1/2)

Analysing and visualising criminal career pathways

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Social network analysis is a valuable tool for understanding the structure and behaviour of criminal networks. These networks can be complex, with numerous interconnections between individuals and groups. One particular area of interest in such structures is the study of characteristics of criminal trajectories and how they can be analysed and visualised. By applying network analysis to examine these networks, we can gain insights into the intricate pathways and structures associated with criminal career trajectories in order to understand the development of criminal careers. This approach might enable us to identify the underlying patterns and dynamics of criminal behaviour, which have significant implications for understanding the broader societal impact of criminal activity.

In this context, the objective of this study is to gain insights into criminal career paths and to develop efficient mapping techniques. Specifically, we will be following up on the question of whether criminal behaviour can be depicted as a progression along pathways involving different types of crimes, potentially leading from lesser offences to more severe ones over the course of criminal careers. Accordingly, our investigation seeks to determine whether criminal behaviour, including the commission of specific types of crimes, undergoes changes over time. Alternatively, we will explore the possibility of certain offenders specialising in a particular area of crime throughout their entire criminal trajectory, thereby not revealing pathways between different types of crimes.

On a methodological level, this paper is centred around aspects of visualising crime pathways within social networks. A key focus lies in illustrating and examining the distinct characteristics of conventional criminal trajectories and their disparities from less commonly observed paths. Additionally, our objective is to explore whether there are shared path attributes that define such network structures. This will be done by devising and implementing methodologies for effectively visualising and mapping these complex crime pathways within the social network context.

Our study draws on a unique dataset from the Greater Manchester Police (GMP), comprising all crimes recorded by the police between April 2008 and July 2019. Covering a population of 2.6 million, the GMP area is one of the largest police forces in the UK in terms of population. Through this investigation, we hope to gain a better understanding of the role of social influence in the commission of crimes and its impact on society.

Follow the Money: Tracing the Role of Cryptocurrencies in Financing the German Far-Right, the Anti-Vax 'Querdenken' Movement and Conspiracy Theorist Scene on Telegram

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For protest movements, digital communication channels offer new ways to generate support. One important way to support political activism is donating to organizations, alternative media outlets and political influencers. In addition to regular donations or crowdfunding, cryptocurrencies offer a way to digitally transfer financial resources. In recent years, cryptocurrencies have been of interest to researchers and policymakers, particularly in relation to their potential use to finance illicit activities, including terrorism and extremism. However, there is still limited empirical evidence on the use of cryptocurrencies by radical and extremist groups.

In our presentation, we will explore the role of cryptocurrencies in financing actors within the German far-right, the anti-vax "Querdenken" movement and the German conspiracy theorist scene on Telegram, a hotspot for extremist propaganda and crypto exchange. Furthermore, we are interested in whether the actors support each other financially or whether there are recurrent, major financial transfers external financiers of the scene.

Starting from a manually generated initial sample, we created a communication network, which we expanded using a non-discriminatory snowball sampling approach based on their forwarding behavior. In this way, we currently monitor around 3400 actors from the above-mentioned milieus. To answer our research questions, we search about 20 million messages for cryptocurrency fundraising appeals to investigate its use by these actors. In this way, we are able to assign the wallet addresses they mention to the respective actors. In a second step, we extract their transactions from the blockchain to analyze the extent to which they use cryptocurrencies, whether they support each other financially, and whether there are external financiers sponsoring multiple channels in our monitoring. To operationalise the latter and represent the flow of funds, we create interaction networks consisting of both the actors in our sample and the users of cryptocurrencies to whom they send remittances and, more importantly, from whom they receive remittances.

The acquired insights into the exchange of cryptocurrencies allows us to better understand the interconnectedness between different actors and the role of cryptocurrencies in financing extremist activities.

Network dynamics of Outlaw Motorcycle Gang co-offending networks: The utility of relational hyper event models

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OMCGs have been implicated in a range of organised criminal activities specifically, including narcotics manufacture and trafficking, prostitution, firearms trafficking, extortion and money laundering. Approaches to the study of OMCGs tend to focus on offending at the individual level, with limited focus on the nature and extent of co-offending among these affiliates. This project examines the positioning of OMCG affiliates in co-offending network structures. The de-identified data contains crime/arrest incident data for affiliates of OMCGs in New South Wales, Australia, including their rank and club affiliation. The data comprised 2,364 nodes and 12,564 arrest events. We argue that Relational Hyperevent Models (RHEM) is the optimal analytical strategy for co-offending data as it overcomes some of the limitations of traditional co-offending analyses. We conducted RHEM modelling and found that co-offending networks are stable over time (actors tend to repeatedly co-offend with the same partners).. Lower ranked affiliates were more likely to co-offend, and office bearers were less likely to engage in public order co-offences. Overall, there was a tendency against closure. We draw implications of the results for law enforcement policy and practice and for the scholarship of OMCGs. Finally, we offer some recommendations for future research on OMCG co-offending and for co-offending research more broadly.

Networks and crime (2/2)

The growth and contagion of homegrown terrorism in an ecological setting

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Drawing on open-source data, we collected data on Australian violent extremists over time, focusing on a number of salient terrorist attacks and activities. To study the potential of different types of ties (TofTs) and different foci to act as either risk factors of protective factors, relational ties were coded as seven distinct TofTs, including family and friendships as well as more instrumental associate ties. Foci were coded as affiliations to schools, prisons, mosques, etc, and the time of radicalisation was recorded for each node. In total the network consists of about 200 individuals between 1970 and 2020 with about a third of actors ending up radicalised. Our study attempts to turn the data, which are unstructured both in time and scope, into a form that is amenable to analysis using available approaches, in particular, stochastic actor-oriented models. Our results indicate that different TofTs and affiliations played different roles in the pathways to radicalisation. Social TofTs, such as friendship, were neither associated with a homophily on radicalisation nor acted as pathways of radicalisation contagion. As such, these TofTs provide a scaffolding of potential protective factors that connect individuals to civic society. However, we found evidence for instrumental TofTs to evolve out of these social ties, and the instrumental ties being subject to both selection on, and contagion of radicalisation. Different foci do not seem to act as loci of radicalisation but individuals joining already radicalised may erroneously give this impression. We further subject our results to a sensitivity analysis, to ascertain how contingent our conclusions are on artefacts of the both the data collection process as well as unobserved heterogeneity and ambiguity of the phenomena at hand. It seems, at least, that we can conclude that radicalision is not exclusively happening online, nor are perpetrators (in our material) acting as lone wolfs.

The Influence of Police Officer Networks on Perceived Audience Legitimacy

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Scholarship on American police culture and socialization into policing have long highlighted how the social environments to which police are exposed influences their orientation to the job. Extant works have not adequately explored how the social environment of an officer may impact their attitudinal outcomes, particularly from a network perspective. Such concerns are especially salient given recent calls for change in American law enforcement, which police culture is particularly resistant to. Some recent works call particular attention to developing an understanding of the extent to which police believe they are perceived as legitimate by the public, also known as perceived audience legitimacy (PAL). PAL may influence a host of officer outcomes, including adherence to procedural justice and the use of force. One factor theorized to influence officer PAL is interactions with one's peers, colleagues, and supervisors. However, most works rely on officers' formal networks (e.g., connections based on shared assignments), missing informal relationships that span formal boundaries. The current study aims to fill this gap by mapping the informal (i.e., friendship) network of a police department to discern the social mechanisms that drive officer attitudes.

This work uses a mixed-method approach to examine whether officers' friends influence their PAL. Quantitative data for the study come from a longitudinal network survey administered to nearly all officers employed in a mid-size police department in the Southwest United States (n = 302). The survey data provide information on officers' self-reported friendships and proxy measures of their PAL across two waves of data collection, among other measures (e.g. demographics). Stochastic Actor Oriented Models are used to estimate peer influence effects on PAL development, allowing us to identify whether officers' positions within the friendship network are associated with PAL levels . Qualitative data for the study come from approximately 100 officers across four departments in the United States, including officers who took the network survey in the mid-sized Southwest department. In addition to contextualizing the quantitative findings, the interview data aim to better understand officer views of legitimacy, as well as how an officer's social connections play a role in their professional development.

This study is one of the first to directly assesses peer influence on officer attitudes by mapping a police department's friendship network. Second, the study shows how informal social structures within which officers are embedded may influence their self-assessed legitimacy outcomes, suggesting police leaders leverage these networks to better understand the spread of officer attitudes and behaviors. In leveraging informal networks, police leaders may strategically target certain officers, or groups of officers, for additional trainings or reassignment to curb legitimacy-deteriorating behaviors.

White-Collar Crime and Networks over Time: Understanding Relational Events Dynamics in Corruption Networks

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Despite early theoretical emphasis on the dynamic nature of criminal networks, most of the research has treated these networks as static due to the paucity of data that would enable researchers to shed light on how criminal networks change over time. However, recent advances in collecting and storing criminal network data allow us to examine their dynamics with considerable granularity – at the level of relational events. In relational event data, every single tie between a pair of actors has a specific time-stamp indicating when it was formed.

Utilising data on two dynamic corruption networks from the UK, this study tests the mechanisms that drive their evolution by modelling the sequence of relational events and the actors decisions that gave it rise with recently developed dynamic actor-oriented model. Specifically, hypotheses about the effect of different relational mechanisms follow from efficiency/security trade-off. This theory postulates that actors in criminal networks change their ties based on how they navigate the dilemma between remaining undetected (security) and reaching their goals (efficiency). The data contains information about the changes in opportunity structure as it specifies when there were new contracts susceptible to manipulation or when there is an investigation taking place. This allows to test whether actors become more inclined to pattern their ties for greater efficiency when opportunities arise or whether they tend to form their ties to maximize security when threats such as investigation become prominent.

Networks and knowledge production (1/6)

Analysis of bibliographic networks of scientific articles on handball

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The talk presents a systematic literature review of published papers about scientific research in the field of handball (sport) using social network analysis. The networks were constructed from metadata about the bibliographic units obtained from Web of Science and Scopus. Several networks were created (e.g., citation network, co-authorship network, keywords co-appearances, journal citation network). The research questions are (1) Which are the most important journals publishing about handball, (2) Who are the most important authors in the science of handball, (3) Evolution of handball research topics through time, and (4) Which are the most influential papers through time.

International dimension of Russian science in Sociology: bibliometric analysis

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Dissemination and globalization of knowledge is an important prerequisite for development of national science. Russia is not an exception since competitiveness of research resides strongly on the collaborations, both within the country and internationally.

The current study is devoted to the analysis of the international dimension of Russian science in the domain of Sociology. The original dataset includes all publications from Web of Science (WoS) with country data field containing "Russia" (up to May 2022) with 1,383,996 bibliographic records in total. The subset in Sociology consists of 7915 entries and was singled out according to SC (WoS research category). Bibliometric analysis was conducted through VOSviewer with preliminary data cleaning through creating thesauruses for authors, keywords, and organizations.

According to co-authorship analysis, Russian sociological community is rather dispersed. 8494 authors are present in the dataset with at least 3 publications. With the threshold of 5+ papers, only 234 authors meet the requirement. Overall, the sociological community's core is rather small and has 4 interconnected clusters of cooperating authors.

With total of 63 collaboration countries, only 27 countries meet a threshold of 5+ publications. Top-5 collaborating countries (representing a "traditional" collaboration geography) are the USA, Germany, England, Italy, Netherlands, but at the same time 90% of documents' co-authorship is attributed to Russia. The "new" collaboration geography includes China, Switzerland, Australia, Sweden, Spain, and others.

Co-authorship analysis of organizations structures the collaboration patterns as core-periphery with the core represented by 2 dominant institutions – Russian Academy of Sciences and National Research University Higher School of Economics. Collaborating organizations also may be analyzed through temporal assumption: (1) traditionally represented institutions due to their history, reputation and geography (mostly Moscow and St. Petersburg); (2) new rising stars manifesting institutional transformation of the scientific landscape due to changes in national educational and research policy.

Co-occurrence of keywords shows 6 distinct clusters as scientific areas for Russian researchers in Sociology. Cited authors in co-citation analysis are represented by both international researchers and Russian researchers. This leads to an assumption that Russian sociological community has formed domestic scientific schools which are visible for international research community.

Despite the fact that international dimension of Russian sociological research is mostly represented by Russian authors, it was possible to identify patterns of collaboration both within domestic and international research teams (co-authorship, co-occurrence, co-citations). Further research will be devoted to analysis of other scientific disciplines of Russian science as well as constructing temporal networks.

Structures of collaboration in local scientific community: case of Russian sociologists

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Modern science research proceeds from the importance of studying social interaction between scientists and their teams to determine their effectiveness, and successfully uses the tools of bibliometric network analysis to study networks of co-authorship and collaboration.

Our study is aimed at studying collaboration networks in the scientific community of Russian sociologists in the period from 2010 to 2019. The community of Russian sociologists is an interesting case for research, as it is characterized by weak integration into foreign sociological science and selective representation of researchers in the world scientific discourse due to the peculiarities of its formation, as well as disintegration at the local level. To build networks of collaborations between Russian sociologists, the methodology of bibliometric network analysis is used. As sources of bibliographic information, we use data from the national scientific citation database eLibrary, as well as data of Russian authors who published articles in journals indexed in Web of Science.

In addition to the substantive interest, the scientific novelty and practical significance of the project lies in the area of development of an integrated methodological approach for the analysis of bibliographic data in Russian language, which has not yet been presented.

Temporal equivalence of structures: comparing patent citation and investors' syndication in technology subdomains

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Stability of social network structures over time is a function of the underlying behavioral patterns, and endogenous to a social network. An example of such networks are relationships, where patterns in behavior coincide with network structure. If a relation between behavioral patterns and a behavioral relationship can be established, then the resultant stability on a network level can be predictive of future behavior outcomes. In this paper a systematic assessment is made of two types of social networks that hold this feature–patent citations and investor's syndication. The relevance of these networks is that both play an important part in the development of sustainable alternatives for energy transition. The patent citation network structure signals the speed of development for a technological domain. The structure of the investor network is indicative of the speed of scaling innovative technologies and their potential to achieve impact. As such the structure of these networks is predictive of the impact innovative technologies can have, even before inventions materialise. These insights are important for researchers, investors, and policy makers alike. Using relational event modelling it is demonstrated that different structural dimensions reflect endogenous behavioral patterns. In conclusion, we assess the implications of this for several key stakeholders.

Networks and knowledge production (2/6)

Co-authorship and scientific productivity: updated evidence on Statistics scholars in Italy

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Over the last decades, scientific collaboration has been considered an important driver of research progress and innovation. Collaboration is increasing in all disciplines, and government policies in national and international programs aim to promote collaboration among researchers.

Although collaborations are developed in a mix of informal mechanisms (e.g., advice, face-to-face contacts, and exchange of personal knowledge) and formal activities (e.g., writing papers and participating in research projects), most of the empirical studies on scientific collaboration mainly refer to the analysis of co-authorship, used as a proxy of scholars' collaborative behavior. More specifically, most of the wide variety of studies adopting the network perspective to analyze collaboration usually extract co-authorship information from bibliographic databases. In the analysis of specific scientific community co-authorship networks, that is collaboration among scholars tied to a given field within institutions in one country, the choice of the data source is crucial in order to avoid under-coverage of authors and selection bias in retrieving co-authorship relationships in the community of interest.

In this contribution, we propose new results on the co-authorship networks of Italian academic statisticians, a scientific community of more than 700 scholars distributed in 5 distinct scientific subfields. The community has been previously analyzed collecting data from several available databases with different characteristics. In this updated study, data on scientific production is obtained from the Scopus platform using author Scopus IDs as scholar unique identifier.

Co-authorship structures and productivity over time will be analyzed and compared with previous results from other sources, underlining new co-publishing behaviors with respect to individual characteristics (e.g., academic position) and time periods.

Co-authorship networks of leading young universities: is the structure similar?

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There is a broad research question about the most effective ways and models of university development. Several studies show that the development of universities is connected with the development of human capital. Co-authorship networks are the proxy of scientific collaboration between scholars. The structure of universities' networks, as well as the way in which new connections are formed, may have a significant impact on the development of human capital. In our work, we analyze the collaboration structure of leading young universities. This study is motivated by the following question: Do leading young universities have the same collaboration structure? What parameters are similar and what are different?

In this work, we analyze the co-authorship network of leading young universities to investigate similarity of their collaboration structure.

The sample includes 8 young universities which placed leading positions in the world universities ranks in 2017-2019. Despite their different location, these universities have common goals with orientation on research and have comparable resource capacity. The data about publications attributed to the universities' profiles in Scopus was used. For each university the co-authorship networks were constricted (8 networks as a result). In this network nodes are authors and links are co-authored publications. We start our analysis with non-normalized and unweighted networks. We analyze the size of the networks, its density, the value of lines, the distribution of degree centrality and diagonal values, the number of loops and the size of the main components.

We reveal that analyzed universities have a big variation in the size of co-authorship networks (the number of authors in the network). According to the network size, analyzed universities may be divided by three groups: universities with less than 20 thousands of vertices (Pohang university, Pompeu Fabra university, and the HKUST); universities with 20-30 thousands of vertices (KAIST, UTS, Hong Kong Polytechnic university), and the universities with 30-40 thousands of vertices (NTY, Maastricht University). With that, the density of the networks, the distribution of loops and degree centrality are also different. The observed difference is not proportional to the number of authors. We also detect that the universities have a high value of isolated nodes, with that the size of the core (well-connected nodes) is quite similar.

In previous work mentioned that scientific collaboration (international especially) is a determinant of young universities success. Our preliminary results reveal that leading young universities have different characteristics of co-authorship networks which represent different collaboration strategies. For the next step of analysis we plan to take into account the size of the universities and analyze attributes of the nodes (e.g. affiliation and citation).

The formation of co-patent and co-publication networks in Chinese regional systems of innovation

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Drawing on the multiplex relationships between co-patent and co-publication networks in equipment manufacturing in the Yangtze River Economic Belt (China), we explore how repetitive activities, and triadic and quadratic closure shape network structures over time. Beyond pure empirical consideration, we offer a theoretical argument on how four-step cycles that we call quadratic closure are developing over time in the context of co-publication and co-patent activities. We also illustrate the important role of brokers between the academic world of publications and the world of patenting for regional systems of innovation. Our results on 'quadratic closure' contribute to theory development regarding the formation of coherent subgroups in networks. Especially, state-owned firms and universities are recognized as important facilitators of relations in the observed network structures. We complement our quantitative findings with qualitative insights from interviews in the field. In sum, our analysis contributes to the debate on the formation and development of network formations in regional systems of innovation.

Strategic coauthorship: Prior coauthorship predicts successful funding in Kazakhstani academia

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Public funding for scientific projects is a common topic of research in the sociology of science. While intended to be merit-based, the actual selection process reveals—studies document—a variety of biases including the effects of prior collaboration and institutional proximity and brokerage. This paper builds on this line of research to analyze the system of public funding for scientific projects in Kazakhstan. Our data comes from two waves of grant competitions in 2015 and 2018 and covers more than 8000 applications. We augment the data with detailed information on projects' principal investigators, including the content of their proposals, institutional affiliations, publication activities, and prior collaborations. We show that net of previous publishing activity, success significantly depends on co-authoring academic papers with the selection committee members.

Networks and knowledge production (3/6)

Combined Capital – Integrating Bourdieus' forms of capital, social networks and psychological research to analyse students' university success

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Bourdieu's theory provides an ideal framework for linking psychology and sociology to analyse academic success in university students. It provides researchers with the opportunity to understand the interplay of forms of capital. We know that social capital has an influence on career-relevant factors especially for first-generation students. Other studies show that students' habitus is vital for fitting into university, and both economic and cultural capital fuel academic success. In addition to these traditional capital forms, psychology offers the possibility to integrate further factors that are related to an individuals' success: attractiveness (physical capital), psychological capital (hope, self-efficacy-beliefs, optimism, resilience) and - borrowing from Bourdieu's habitus - students' social identity. While there is evidence for all capital forms to individually increase students' university performance and psychological well-being a combined model of capital forms is still rare and to date there is no combination of sociological and psychological capital.

We assume that students with pronounced social capital, cultural capital, economic capital, psychological capital, academic habitus, and high physical capital are more successful in their studies and thus are less prone to burn out.

In a mixed methods approach (social network analysis, psychometric scales, attractiveness rating), we analyse capital in accordance with Bourdieu's theory of capital. We used an online sample of N=144 university students. Students were first asked to give information on their economic and cultural capital, filled out psychometric scales on their psychological capital as well as their academic identity, perceived social support and their self-reported attractiveness. To verify the self-reported physical attractiveness of students, a subsample was rated by N=27 raters using pictures of the students in comparison to averagely attractive faces from the FACES database. For more detail we analysed network maps from N=25 students from the online sample to gain further insights into the social capital that is accesible to them and how they mobilise it.

The results show effects of all forms of capital on subjective career success, of psychological capital on the intention to drop out, life satisfaction and intrinsic motivation, and effects of physical capital on physical and mental health, as well as students' self-efficacy expectations. Especially social network parameters had an impact on students' self-reported burnout.

Our results highlight the benefit of combining psychological and sociological theories and constructs in higher education research. We find that focussing on supporting students with only one form of capital is not enough: the combination is important. Particularly, universities must form a discrimination free atmosphere and decrease stereotypes to achieve an unbiased grade systems unaffected by physical looks and social background.

The patterns of scientific collaboration between the doctoral students and their mentors

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Doctoral study plays a crucial role in the socialization of young people in the field of science and set the stage for their future academic or non-academic careers. The relationship between mentors and doctoral students is an essential part of this process, which can take different forms and intensities.

Understanding how and when mentor-mentee collaboration occurs is critical to developing effective higher education strategies for recruiting new doctoral students. In a recent study, we examine the different patterns of scientific collaboration between mentors and mentees, focusing on bibliographic publications as a measure of collaboration.

To uncover different types of collaboration patterns, we analyse egocentric networks using a symbolic data clustering approach. We then apply descriptive discriminant analysis to the obtained clusters, taking into account several explanatory variables such as scientific field, age of mentees and mentors, gender homophily, year of completion of doctoral studies, number of mentors, and whether the studies were funded by governmental financial scheme called the Young Researcher Program. We use national data from the Slovenian information systems Cobiss and Sicris for the period between 1990 and 2020.

The results show that the clusters with very low level of scientific collaboration or collaboration focused only on the years around the PhD are more common among younger students and STEM, compared to the clusters characterized by intensive collaboration with other researchers but not with mentors. The more "stereotypical clusters" (i.e., intensive collaboration with mentors during doctoral study and intensive collaboration with other researchers after the end of doctoral study) were more common in former years and among younger doctoral students.

Perspectives of mentors and mentees on the impact of mentoring relationship characteristics on knowledge production in higher education and science

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In higher education and science, the mentoring relationship refers to the dynamic and reciprocal collaboration between mentor(s) (usually researchers and professors) and mentee(s) (doctoral students) (Lee, 2008). This relationship is important not only for achieving common research goals, but also for training new researchers and experts, and for the exchange and potential production of knowledge (Mali et al., 2012). According to Csikszentmihalyi (2009), the mentoring relationship in higher education is primarily a learning relationship that involves the acquisition of research skills and career-related knowledge by the mentee, while the mentor acquires a working knowledge of the mentee to promote the mentee's academic and professional growth. In addition, both parties must strike a balance between respecting tradition and being open to change in order to advance the scientific field (Csikszentmihalyi, 2009). To date, most research that has examined the mentoring relationship and its impact on knowledge production in the context of higher education and science has focused on the mentors' or mentees' perspectives. This study fills this gap and aims to explore the views and perspectives of mentors and mentees regarding the characteristics of mentoring relationships and their impact on knowledge production in higher education and science. A qualitative research design was used for the study, in which semi-structured in-depth interviews were conducted with mentors (n=12) and mentees (n=12) who have been involved in mentoring relationships in Slovenian higher education over the past 20 years. Respondents were recruited using a multistage purposive random sampling method and were from the fields of natural sciences and mathematics, engineering and technologies, medicine, biotechnology, social sciences, and humanities. Inductive thematic analysis was used for data analysis. Preliminary results show that mentoring relationships that have the characteristics of a partnership relationship and include mutual trust, co-decision-making, listening, and active collaboration lead to a more effective way of transferring knowledge. These include more opportunities for discussion and brainstorming, participation in (international) research projects, exchanges at conferences, and informal gatherings of researchers. The above methods of knowledge transfer led to the formation of tacit knowledge among both mentees and mentors. Tacit knowledge manifests itself in the form of key skills that are internalized and mastered by mentees and are central to the creation of explicit forms of knowledge (written articles, books, or papers) that contribute significantly to the dissemination of (cognitive) knowledge in scientific groups and networks. The research has important implications not only for mentors, who are key actors in the implementation of the mentoring relationship, but also for policy makers and organizations, institutions in higher education, and science.

STEM Undergraduate Students' Social Integration and Its Impact on Students' Academic Achievement

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Social integration plays an important role in undergraduate students' academic trajectories. Through their social networks, students obtain information about studying and extracurricular activities, find collaboration partners, and provide and receive social support, which helps them to solve learning difficulties and persist in higher education. Only very recently, empirical studies started paying attention to students' social network development and influence. Studies are still scarce in the higher education context. Our study aims to explore the formation of social networks between previously unacquainted university students and how emerging individual differences in terms of social integration may affect their academic success. Specifically, our study focuses on two research questions: (RQ1) How do STEM undergraduate students develop their social networks, specifically co-studying, friendship, and pleasant interaction networks; (RQ2) To what extent do social integration factors explain STEM undergraduate students' academic achievement at the end of the first academic year, after controlling for individual variables?

Regarding RQ1, we hypothesize that students tend to create or maintain a co-studying tie with someone whom they already consider a friend, or with whom they had pleasant interactions before. We further hypothesize that students tend to create or maintain a friendship tie with someone whom they studied together with, or with whom they had pleasant interactions before. Regarding RQ2, we hypothesize that not being isolated in terms of co-study indegree two and a half months before the first-year qualification exam is positively associated with students' academic performance. Further, we expect that the number of friends (indegree) two and a half months before the exam is positively associated with students' academic performance.

We use a longitudinal data set collected as part of the Swiss StudentLife study. The participants consist of two study cohorts of a science or engineering subject, n1 = 244, n2 = 652. We use data collected in their first year at university, i.e., from the Fall Semester of 2017 to the Spring Semester of 2018. To examine the dynamics and coevolution of students' social networks (RQ1), we implement stochastic actor-oriented models (SAOMs). Network autocorrelation models are applied to analyze the social integration effect on academic performance (RQ2). Based on findings from a previous study (Stadtfeld et al, 2019), we expect the present study to indicate the coevolution of friendship and co-studying networks over the first academic year and that the co-studying and friendship ties are associated with better learning outcomes. We anticipate the research findings to enrich empirical evidence of the social integration impact on STEM undergraduate students' academic performance. Besides, the study contributes to a deeper understanding of the dynamic processes of students' social network formation.

Networks and knowledge production (4/6)

Combining Online and Offline for Scientific Collaboration

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International collaboration is an increasingly important part of scientific research. Accumulating capacity in technical expertise and know-how enables deployment at scale, while diversity of experience, disciplinary approaches, theory and methods provide catalysts for novelty, creativity and innovation. Examining the case of an international network of plant pathologists and entomologists, we consider the ways in which in-person events and online interactions combined to develop scientific collaboration among members on these different dimensions.

We map the networks of meetings, Twitter interaction and co-publication among 1447 members of this collaborative network over a four-year period and deploy community detection methods to identify critical expertise combinations in the development of the collaboration. We find an 'hourglass' divergence-convergence pattern over the period, with two particular epistemic communities playing important brokering and closure roles in this. Interactions between online and offline channels also reinforce collaboration.

Connecting the dots in International Branch Campuses research: A Social Network Analysis approach

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The opening of International Branch Campuses (IBC) abroad is one of the most recent traits of an internationalised higher education (HE) sector. The growth of IBCs worldwide stimulated a vibrant debate involving academics, politicians and HE managers, often with conflicting views. While some argue IBCs are a way to improve access to education and can be promoters of social justice, others see them as a form of exploitation and cultural imperialism. From an empirical point of view, IBCs connect different regions in complex global relational networks; the distribution of IBCs, however, is geographical uneven and influenced by historical and contextual factors. For all these reasons, recent reviews called for further studies capable to link micro and macro levels of analysis and identify exciting research gaps in this domain.

An original dataset consisting of almost 300 IBCs is analysed using Social Network Analysis (SNA). The evolution of the global networks linking different countries is visualised and commented through a specific set of network indicators. Structural properties of the network (e.g. its tendency to evolve towards core-periphery configurations) are discussed together with actor level (e.g. centrality) metrics. An exploratory approach is employed at this stage of the research and interpretation is rooted in fundamental theories from sociology and international business. The paper provides contribution to knowledge in the field of IBCs studies and the broader domain of internalisation of HE. Furthermore, results from the study have the potential to inform managerial and political decision making.

Does management and organization studies consist of microtribes?

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Multiparadigmatic sciences, espeically the social sciences, tend to become more fragmented over time due to a lack of consensus regarding the ”correct” theories and methods to apply on a given field of research. The lack of consensus increases the likelihood that academic tribes emerge, which are unable or unwilling to communicate with each other. The process limits the ability of a discipline to accumulate knowledge and to solve societal problems that might otherwise be addressed, even adequately solved.

We expect to find this dynamic to an even greater extent in an interdisciplinary science, which is established around a narrowed subject area. If this expectation holds, then microtribes, namely subgroups, and sub-subgroups of specialists, would form. These microtribes increase the dynamic of framentation, and entail a more finely internal differentiation regarding subject boundaries, fashionable topics, theories, or methodology.

To test this assumption, the development of management and organization studies (MOS) is examined in a diachronic co-citation analysis. This is done on the basis of 27,188 articles published in the 14 central journals between 1980 and 2019, each divided into five-year periods. In addition to co-citation analysis, a node-removal strategy is applied, removing the nodes with the highest betweenness centrality. Last, we examine the extent to which the flow of cited documents between communities changes over time.

The results suggest that there is a limited, tribal structure. There is a small set of central communities that are relatively open to each other in terms of knowledge sharing. Removing central from nodes with the highest betweenness centrality results in the largest component of the network not becoming significantly smaller. At the same time, this proceedure leads to the fragmentation of smaller components, whicle the total number of detected clusters increases. This indicates that primarily bridgeing nodes are removed, which are the scientific glue of the discipline. Over all, findings indicate that the knowledge base of MOS is relatively coherent over time, but at the same time has a small number of central publications that carry the cohesion of this discipline.

Policy driven change of scientific networks. Human Brain Project and neuroscience

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The proposed research aims to tackle a question about the role of a large centrally designed funding program in reshaping neuroscience's local and global scientific community. Between 2013 and 2023 European Commission and EU member states have invested at least 1 billion euros in neuroscience research and neuroscience infrastructure under the Human Brain Project (HBP) umbrella. The aim was to strengthen and consolidate the European neuroscience community and tap into the potential of the European scientific community by integrating different approaches within neuroscience, other fields of science, and loosely connected scientific groups. The core group of HBP is constituted of leading neuroscientists based in Europe but with strong ties across continents, especially with the leading US neuroscience community. The new HBP funding has enabled the building of new laboratories and the growth of existing labs across Europe. These laboratories can be described as local hubs for neuroscience research and infrastructure, and they compete with other leading labs across the world. The HBP funding also stimulates the emergence of new ties between the local hubs and between hubs and other European research institutions, which have been less central for neuroscience. The proposed research tackles two questions. Firstly, how does the designed funding schema stimulate the growth of the collaboration networks of neuroscience in Europe? Secondly, do the new collaboration networks reshape the global core of neuroscience research? The analysis is conducted with the bibliometrics data from the Web of Science.

Networks and knowledge production (5/6)

Semantic Relationship Between Keywords: Appliying DPRel, HeteSim, and Path-Sim Algorithms on “Network Analysis and Big Data” Literature

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Keywords of documents (whether determined by authors or extracted by researchers from relevant texts) are widely used to reveal the themes, structures, and evolution of a scientific field. In addition to the frequency-based use of keywords, the increase in the popularity of network analysis has brought about a development towards network-based metrics. As a result of this development, co-word analysis has been started to be used in a wide variety of scientific fields. Co-word analysis has become an effective tool in exploring both the cognitive structure of the relevant field and the themes reflecting the gap in the field. In addition, it has been possible to follow the conceptual change in the field with co-word analysis. So called traditional co-word analysis is based on the co-occurrence of words, and these relationships are formed by the authors’ behavior of using words together. In other way, the relationships between two words is evaluated according to whether they are used in the same document. However, recently, co-word analysis depends on semantic relevance between words calculated by different algorithms such as DPRel, HeteSim, and PathSim. In this study, two approaches on which co-word analysis is based were tested empirically in “network analysis and big data” literature. Web of Science Core Collection, a widely used database in fields related to social sciences, was preferred to define relevant literature. The authors searched for all articles written in English with the words “network analysis” and “big data” as the query to search the following fields within a record: Title, Abstract, and Author Keywords. The retrieval strategy is illustrated as follows: TI=(“network analysis” AND “big data”) OR AB=(“network analysis” AND “big data”) OR AK=(“network analysis” AND “big data”). A collection of 453 articles published between 2011 and 2022 was obtained. Articles without keywords (41), articles with one keyword (1) and articles with more than eight keywords (8) were excluded. In consequence, 1,223 keywords from 358 articles were entered into the analysis scope. The Keyword-Article-Journal (KAJ) path as called meta-path was followed and relevance between keywords based on the semantic relationship of the meta-path was calculated by DPRel, HeteSim, and PathSim. As a result, three separate word-to-word semantic relevance matrices (dimension of 1,223x1,223) were created. Additionally, a word frequency co-occurrence matrix (has the same dimension of 1,223x1,223), which traditional co-word analysis based on, was constructed. Four matrices were compared regarding relationships between keywords and network analysis was carried out at the micro and macro levels.

Topic Modelling – An Analysis of SNA & Network Science

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This study provides a topic model analysis of journal articles associated with the search terms “social network analysis” or “network science” in the title, abstract or keywords. Topic modelling is used to identify trends and patterns within social network analysis, network science and applications of these methods. This analysis is combined with Scimago journal classification data. Scimago provides data on core disciplines for each journal. The topic modelling procedures result in each journal article being associated with a particular topic; therefore, the Scimago data is used to create discipline descriptions of topics. We analyse a two-mode topic-discipline network to examine which disciplines are observed across multiple topics and represent salient themes within social network analysis and network science.

Using Psychometric Networks to Explore the Relationship Between Teacher Burnout and Technology Use: A Survey of Educators Across Different Schools and Grade Levels

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The use of technology in education has become increasingly prevalent in recent years. While technology has the potential to enhance the learning experience and improve educational outcomes, there are also concerns about its impact on teachers’ well-being and job satisfaction. Several studies have explored the relationship between technology use and teachers’ burnout, which is a syndrome characterized by emotional exhaustion, depersonalization, and reduced personal accomplishment. Some research suggests that teachers who use technology extensively may be at a higher risk of burnout due to factors such as increased workload, lack of training, and difficulties in managing technology-related issues in the classroom. Our study employs a psychometrics network approach to explore the structure of high-dimensional data obtained through a survey distributed to educators of different backgrounds and locations, across various schools and grade levels. The objective is to identify the key factors that contribute to teacher burnout, such as workload, stress, and job demands, and explore how these factors are related to the use of technology in the classroom. In addition, through psychometric network analysis, we can provide powerful visualizations of patterns of statistical association between variables related to teacher burnout and technology use. The results of this study are expected to shed light on the complex interplay between teacher burnout and technology use and provide valuable insights for improving the well-being of teachers and the effectiveness of technology integration in the classroom.

Investigating Financial Behavior Through Self-control: Accessing the Role of Financial Literacy and Mental Accounting

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The present study investigates the determinants of financial behavior by identifying some key factors that affect the financial behavior of the general public in Pakistan. By taking a stratified random sample of 230 respondents according to the recommendations of item response theory the study reports its findings. The OLS results show that self-control, financial literacy, and mental accounting positively and significantly affect financial behavior. These results broaden the scope and application of Behavior Life Cycle (BLC) theory far beyond savings behavior. The findings of the study also enhance the understanding of the positive effects of mental accounting and the role of mental accounting in daily life decisions by the general public. On the basis of the results, the study concludes that people with more self-control, more financial literacy, and who segregate money into imaginary mental accounts are more likely to possess sound financial behavior. These results are imperative in understanding heterogeneity in financial decision-making.

Networks and knowledge production (6/6)

Rating, Coding and Ranking: Evaluating the Reliability of Human Judgment using graph theory and ERGMs

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1. Introduction

Prominent methodological journals in Social Sciences have been alerting the research community about the need for more rigor and transparency, regarding the reliability with which researchers code or rate unstructured data (e.g., Lamprianou, 2018, 2023; Benoit et al. 2016; Horn 2018; Mikhaylov, Laver, and Benoit 2011). In the era of big data, there is an increasing need for the quantification of unstructured data, to be used for visualization or other quantitative purposes (e.g. projection of trends).

Manually coded unstructured data, are still necessary, as fully automated methods are not yet ready to replace humans (Grimmer and Stewart 2011; Nelson et al. 2018). For purposes of quality assurance, researchers usually report reliability indices such as Fleiss's k, Krippendorff's a, and Cohen's k. These indices have faithfully served the research community for decades, albeit with varying degrees of success (Compton, Love, and Sell 2012:354-58).

2. The aims of this study/presentation

Responding to literature's urgent calls, we designed an elaborate method to assess the reliability with which, a group of coders (or a group of raters), codes (or rates, or ranks) unstructured data such as responses to open-ended questions in interviews, student responses to essay questions in examinations etc. Lamprianou (2018, 2023) proposed this new approach, in order to equip researchers and practitioners with new tools by which to monitor the reliability (but also the validity) of their manually coded/ rated/ ranked data.

3. A Conceptual Approach to Graph Theory and ERGMs for Coding/Rating/Ranking

Graph Theory has been used for many years in order to model relationships between individuals, events, or other entities in Sociology and neighbouring disciplines (see Snijders, Van de Bunt, & Steglich, 2010).

Depending on the nature of the study, one may generate graphs using various rules. If, for example, the aim of the study is to evaluate rater disagreement, then, an edge (i.e., a "link," or else, a "tie") between Rater A and Rater B could suggest that there was a substantial disagreement (i.e., a "discrepancy") between their ratings.

Fundamental network statistics such as degree may be computed with simple mathematical operations over yij. At the level of the whole network, one might be interested in statistics such as the density etc.

4. Data

To illustrate our methods, we present examples from pertinent datasets.

The first dataset is the one used by Lamprianou (2018).

The second dataset is the one used by Lamprianou (2023).

5. Discussion

The aim of this is study is to illustrate how Social Scientists can use Graph Theory and ERGMS in order to assess big data produced by groups of coders/raters. This tool is extremely useful in empirical cases and can supplement, if not substitute existing methods.

The Changing Landscape of Knowledge Production: A Blockmodel Analysis of Research Projects in Switzerland

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We utilize data on a sample of research projects supported by the Swiss National Science Foundation to describe the evolution of the field of scientific knowledge production during the last two decades. We use successful grant applications as our main source of information. In each application, scientists assign their project to multiple knowledge categories that are adopted to organize the production of scientific knowledge and simplify the project evaluation process. These knowledge categories are hierarchically organized into a limited number of broader institutionalized classes, which provide an antecedent and at the same time represent a consequence of the global division of scientific labor.

In this study, we are interested in understanding if and how the accelerating trend toward research cross-cutting institutionalized knowledge categories (“interdisciplinary” research) is changing the global structure of knowledge production. We exploit the dual relation linking research projects and institutionalized knowledge categories to represent the global structure of the space generated by decentralized knowledge production activities. We apply blockmodeling techniques to detect and examine changes that occurred in the structure of the field of knowledge production in Switzerland during the last two decades.

Changes in knowledge networks through training

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In today's era of disruption and rapid technological advancement, the demands for organizational competence development are on the rise. The acquisition of new competencies and successful competency management of employees are crucial for the survival of organizations that faces rapid transformation. However, in order for the effects of formal training to unfold, knowledge and skills acquired in a training context must be applied to the job or real-world situations at the workplace. This process is named training transfer. Often, due to time and financial constraints, it is not possible to include all employees in a training program. So, while individual training is important, it is crucial that the knowledge and skills acquired are effectively shared with other employees and integrated into the organization's processes.

There is substantial research on the antecedents of knowledge-sharing behavior, such as trust, motivation, personality traits, and knowledge network mechanisms but there has been little research on knowledge sharing after attending a training program. But in general knowledge is often not passed on effectively and depends on the intensity of the social relationship. The more intense the social relationships, the more knowledge is shared. Therefore, the purpose of this interview study is to investigate changes in knowledge networks after training.

Knowledge networks of 51 participants were retrospectively recorded before and after attending a training. Participants were required to complete a questionnaire immediately following the work-based training. In the questionnaire, the subjects were asked to set goals for their learning transfer and knowledge sharing. Approximately one month later, participants complete a second questionnaire to evaluate the extent to which they had achieved their goals. Additionally, one month following, semi-structured interviews were conducted with participants to explore their knowledge networks specific to the topic of the training attended. The networks were recorded retrospectively for before (pre-networks) and after (post-networks) attending the training.

All the interviews were coded and 10% of all the interviews were double-coded. Cohen's kappa of .78 showed a valid interrater reliability.

First results show that Out of the 51 individuals who participated in the training program, 28 showed changes in their knowledge network after attending a training, such as changes in the number of alters, alterations in their importance, or variations in their frequency of interaction. The subjects' exchange relationships intensified after attending a training course and knowledge was shared mostly with other employees of their company. Training transfer could be identified as a predictor for the difference in the number of Alteri (post-pre) $F(1, 74) = 4.03$, $p = .05$, $R^2 = .08$ witch means, that more knowledge was shared when training transfer were high. The results of further analyses will be presented.

Networks in history and archaeology (1/3)

Research themes, databases and network analysis in business history

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This paper discusses the application of Social Network Analysis (SNA) to corporate networks in a long-term and historical perspective. Starting with the basic concepts of corporate networks and the main research themes it has addressed in business history, the paper then introduces how historical quantitative archival data can be played with and turned into excel data suitable for the study of social networks by using software such as UCINET. The paper then provides some examples of how this methodology has been used at the macro, meso and micro levels: national corporate networks in Argentina, Chile and Italy from 1900 to 2017; business networks and permanence of economic elites in Southern Italy in the 19th century; and social club memberships, partnership ties, and interlocking directorates of J.P. Morgan & Co. in the early twentieth century. Finally, the paper discusses new perspectives for the application of SNA in business history, including the study of other networks than those of directors, i.e., shareholders' networks, networks that are created by joint membership of think-tanks, syndics, policy-planning group, university board, employers' associations, philanthropic associations.

Premodern sales and conflict networks: developing a proper database model and extracting missing data from highly unstructured historical sources

Tihana Kuster

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Discovering and researching the social networks of a 17th-century small-town community enables us to hyper-contextualize the past and historical change. More precisely, the methodology of social network analysis helps us to discover parts of past human praxis which was so far not possible to investigate in a large scope. This presentation will refer to issues of database modeling and semi-automated and manual extraction of incomplete and uncertain data for the research of sales and conflict networks of inhabitants of the town of Varaždin based on the 5000 Latin entries in the records of the headship of the city, created from 1587 to 1715. From a praxeological standpoint, by using the social network analysis this research attempts to discover what was common for 17th-century people; what kind of patterns in human praxis are distinguishable from these records. Although records consist of a large number of different types of entries, most of the entries usually give us the data about the inhabitant's name and surname, their title, family/kinship connections and occupation, and in sales contracts a place where their real estate and land were located as well as their neighbors. Since most of the entries are sales contracts, litigations, and court protests, the main aim of the research is to find the patterns in the sales and litigation praxis of the 17th-century people by connecting sales and litigation networks with family/kinship, neighborhood, and occupation networks. Also, since the entries give us the titles used to address the inhabitants, titles that do not refer to the inhabitant's social class, the research aims to discover the patterns behind the use of these titles. In this presentation, I would like to discuss the development of a complex data model based on around 20.000 entities (inhabitants, record entries, places) which can be represented in a graph database model as thousands of various nodes, each connected with various parallel edges. Due to a large amount of data and various parallel edges, a relational database model was chosen to collect the data. Also, I would like to discuss the issues of extracting the data from various types of record entries that contain a large amount of missing, incomplete, and uncertain data (name and surname duplicate without a distinguished attribute such as occupation or kinship connection, missing name and/or surname, inconsistencies in Latin written names and surnames) which made manual extraction of parts of the data necessary. Despite the above-mentioned difficulties, I argue that it is possible to develop and conduct historical network research even when the historical sources are highly unstructured and contain plenty of missing data. Moreover, developing a proper database model and conducting a social network analysis based on this type of source allows us to reach knowledge that was unreachable by using traditional historiographical methods.

Networks in history and archaeology (2/3)

Roman Emperors as Gods. Statistical methods to analyse the spread of Roman Imperial Cult in the Roman Province of Asia

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This paper aims to establish the relationship between the consolidation of the Roman rule and the development of the imperial cult in the cities of the Roman province of Asia.

Most scholars agree that the imperial cult was one of the most important instruments employed by Roman emperors to ensure the loyalty of their subjects and, at the same time, one of the most significant transformations to the public life of the Roman cities.

In the Roman Empire, the imperial worship spread widely under the influence of political and cultural customs. For instance, the idea of a divine ruler was a political and religious novelty in the western part of the Empire. Therefore, it required more involvement from the Roman government. In contrast, in the East the groundwork had already been laid by religious precedents established through cults honouring rulers dating back to the Hellenistic period. Following Alexander the Great's conquest, these cults developed into a legitimate political tool that preserved the relationship between ruler and subjects across the Greek world.

In this paper we show and examine a few elements of the worship of the Roman emperors (cult places, festivals, priesthoods) in the cities of the province of Asia. The evidence demonstrates these cities' propensity to include the emperors into all spheres of their political, social, and cultural life. Indeed, pre-existing holy structures were re-dedicated to the emperors, imperial competitions were introduced to ancient Greek festivals, and the emperors were frequently assimilated to traditional gods in inscriptions, coinage, and statues. Members of local aristocracies played a crucial part in organising various events of emperor worship, especially through the assumption of the office of priest of the imperial cult, which was often held by prominent and wealthy individuals.

The relationship between the elements related to the worship of Roman emperors represents an example of a complex data structure for which it is possible to carry out a network analysis. More specifically, the data at hand can be structured by considering the emperors, the Anatolian cities and the aspects of the worship of the emperors as nodes, and the presence of evidence of the worship of the Roman emperors in an Anatolian city as the link between the nodes.

Modelling regional dynamics and Roman pottery supply using network analysis and GIS: the sanctuary of Kalapodi in central Greece as a case study

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Dimitris Grigoropoulos and Vassilis Evangelidis.

Kalapodi in central Greece is home to one of the most spectacular Greek sanctuaries, mentioned in numerous ancient textual sources, which is now identified as the oracle of Apollo of Abai. The sanctuary has yielded rich diachronic evidence and has been the focus of long-standing excavations by the German Archaeological Institute, Athens department. This paper offers an integrated approach to modelling commodity flows and transport routes to the sanctuary in the Roman period by analyzing pottery distribution data from the entire region and exploring Kalapodi within regional and global distribution and infrastructural networks of the Roman period. Based upon the preliminary results of the ongoing finds analysis and by integrating published and reported evidence from other sites in the wider region as well as unpublished data available to us, we investigate first the role of the sanctuary as a central place in the distribution network of pottery imports from close-regional and more distant sources. Pottery distributions are analyzed as a weighted (non-directed) unimodal network, in which the sites appear as nodes and the pottery wares attested as edges, in three different datasets for the Early Roman (1st c. BC – 2nd c. AD) Middle Roman (2nd – 4th c. AD) and Late Roman period (5th – 7th c. AD). The analysis reveals several key issues of historical interpretation, highlighting amongst others the shifting significance of the sanctuary as a destination/ place of consumption of imported pottery wares and bringing forward questions regarding the site's access efficiency, directionality of imports and transport routes. The above questions derived from network analysis provide the backbone of a GIS-based simulation of the sanctuary's pottery supply. This involved the creation of a huge dataset which allowed for a detailed GIS-based simulation of the sanctuary's pottery supply, utilizing and experimenting with the results of the network analysis. By analyzing the network of potential trade routes and shipping lanes, the study was able to simulate the transportation of pottery imports to Kalapodi. The incorporation of shipwreck evidence and experimentation with alternative scenarios added depth and complexity to the research. The findings shed light on the patterns of trade and exchange in the region, providing valuable insights into the economic and cultural dynamics of maritime trade networks in Kalapodi. This multidisciplinary approach contributes to the understanding of ancient trade patterns and offers a robust framework for future studies in the archaeology of the area and network analysis suggesting alternative routes in ancient trade, considering factors such as navigational features, wind patterns, and other variables.

Memories of heresy: The networks of German Waldensians in the late 14th century in inquisition records from Stettin (1392–4)

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Medieval inquisition records reveal an unprecedented wealth of information on pre-modern non-elite people. They are of course prone to different selection and recording biases, some of them comparable to those of contemporary police protocols from depositions about criminal activity. Nevertheless, they provide glances at valuable and otherwise largely undocumented social underpinning of religion at a level of detail often missing for the orthodox populations of medieval Europe. In this study, we look at data collected from all 195 extant protocols from the minute inquisition led by Peter Zwicker against German Waldensian in Stettin (modern Szczecin in Poland) in 1392–4. We present the data and analyse the network of about 530 persons who engaged in ca. 1,000 recorded dissident interactions of different kinds (introduction to heresy, conversation about heresy, dissident moral education, co-attendance of Waldensian sermons, housing, etc.), as well as in other kinds of relations (incrimination, exculpation, etc.). We are looking for potential predictors of the dissident interaction network, esp. gender, close kinship relations, and spatial proximity. We find that the network of interactions is neither assortative nor disassortative according to gender, which suggests that dissident religion was lived in the predominantly familial social fabric rather than performed in any dominant way in gender-based communities of same-sex neighbours or friends, even if we want to inspect further whether this lack of gender assortativity holds true if we control for the strong involvement of married couples. We expect strong influence of spatial proximity, showing the network as a comparatively local one, but with some persons bridging the spatial gaps. It could have been expected that these spatial brokers will be the dissident ministers – wandering preachers – but our preliminary results show, by contrast, that the ministers' role in connecting the communities mapped by the Stettin protocols was minor, probably due to the fact that we are looking at a covert network in a state of comparative, if recent, disintegration, which provides interesting insights in questions of resilience and the role of religious specialists for keeping covert Waldensianism alive, and thus allows us to better understand the social aspects of medieval dissident religion.

Notarized Loans in 18th-19th Century Milan: a Credit Market Equilibrium? A Social Network Approach

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This paper investigates the private credit market intermediated by notaries in Milan in mid eighteenth century and the first decades of the nineteenth century. The research is based on a dataset of loan contracts drawn up by the city's leading notaries in a period in which the city was undergoing a remarkable economic modernization. New ventures both in manufacturing and infrastructure required lively flows of capital whereas the massive redemption of public debt by mid eighteenth century provided a vast multitude of individuals and families with hot money.

Compared to institutionalized credit providers (private bankers and later Savings Banks), this 'informal' lending market proved its capability to financing innovative ventures with not exclusively land-backed collateralized loans. Thanks to the dominance of a great deal of reputational information, notaries were able to make the private credit market avoid rationing.

Social Network Analysis evidence demonstrates that a pooling equilibrium was averted in this market and a separating equilibrium was reached. Such a market was conducive to the rise of a modern financial-deepened society. A large share of high-middle-sized capitals were employed for financing the most innovative ventures, new partnerships, and the creation of infrastructures, paving the way to economic modernization, while a vast part of minor loans were used for meeting everyday needs, i.e. new consumption, asset management, debt rescheduling.

Networks in history and archaeology (3/3)

Martí de Burguès (1756-1809): An exploration of his personal network through his epistolary exchanges

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Drawing on the 205 letters addressed to Martí de Burguès (Catalan military, lower noble, and politician) between 1799 and 1803 by 67 different people, we analyzed the dynamics of his personal network with the aid of relational hyperevent modeling (RHEM). The analysis shows how Burguès' personal network is comparable to contemporary high-mobile individuals regarding the geographical distribution of contacts, composition, and structure, opening a venue for historical comparisons.

Networks of inter-ethnic relations and integration

Roma Undergraduates' partner selection attitudes and social embeddedness

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Research has shown that underrepresented minority students' partners have an important role in students' adjustment to college. This study investigates Roma undergraduates' partner-selection attitudes and analyses whether the ethnic and educational background of students' partners is relevant in students' social embeddedness. We rely on data from semi-structured life-narratives and contact diaries of 67 Roma undergraduates. Three main partner-selection types were distinguished among Roma students: 1) Roma and non-Roma partners with low educational attainment, 2) non-Roma partners with secondary or higher education, and 3) Roma partners with secondary or higher education. Partners' sociodemographic background shows correspondence with the size of students' egocentric networks and indicates ties from the same social group with higher probability. Our results imply that in the choice between a typically low-status Roma environment and a high-status university environment, or in the delicate balancing act between the two, the chosen partner plays a key role.

Integration beyond the natives: the complete network of inter-ethnic family ties in Sweden, 1990-2009

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Focusing on a classical indicator of inter-group integration, this paper explores the patterns of family formation within and, particularly, between different immigrant groups in Sweden. Transcending the typical native-centrism of previous studies, i.e. where the notion of integration primarily has been concerned with relations between the native vis-à-vis one or many immigrant groups, a more inclusive conceptualization of ethnic integration is proposed that considers the complete complex network of inter-ethnic heterosexual family formation ties.

Using full-population register data to identify first-child births of all cohabiting hetersexual couples in Sweden between 1990-2009, determining the migration background of all parents, the complete network of intra- and inter-ethnic family ties is obtained. To control for individual preferences and social exposure, a large-scale spatial simulation based on pre-family residential location, educational attainment levels and age preferences provides plausible null models of inter-ethnic relations. This yields a network of inter-ethnic preferences from which a more inclusive notion of integration can be operationalized and analyzed.

To explain why certain groups seem more or less inclined to form families with each other, a cultural similarity hypothesis is tested. Using corresponding pair-wise similarity measures from the World Value Survey, a QAP analysis finds that integration between different non-native groups in Sweden is partly explained by cultural similarity between groups. This analysis indeed highlights the importance of integration policies that more explicitly foster integration between seemingly disconnected groups in Sweden.

Inter-ethnic relations in personal networks: Shifting the lens toward the majority population

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Researchers have often studied migrants' personal networks to understand their processes of embedding in a new society, the continued importance of their transnational relationships, and how their local and transnational relationships shape their sense of belonging. Nonetheless, migrants' integration in a society also depends on the majority population's acceptance of migrants in their social circles.

Therefore, in this presentation, we shift the lens toward the majority population, and explore the extent to which they have social relationships with migrants, in which contexts they have met them and how strong these relations are, and what characterizes the people most connected to migrants. Furthermore, – based on contact theory – we tested whether knowing more migrants is associated with respondents expressing more lenient opinions about migration and migrants in their society and to what extent the type and strength of relationships moderate this association.

We use the "Bridges" survey to meet these goals. The survey was administered face-to-face in Spain in 2021 to a random sample of 1,500 citizens of Spain. We enquired about respondents' core networks of a maximum of five alters, and in addition, we asked respondents how many people they knew who were born in five world regions but resided in Spain, using Network Scale-Up Method questions. If respondents indicated they knew at least one person from a region, we followed up with alter interpreters and alter interconnectors to know, for instance, how they knew the person and how close they felt with them (in case they knew multiple people from one region, we asked about the person they felt closest to). We further measured respondents' opinions toward migration with a battery of items from the European Social Survey.

Whereas the vast majority of respondents had entirely homogenous core networks concerning the country of birth, we found that most people were in contact with migrants via weaker connections. The total number of contacts with migrants was estimated to have a skewed distribution with a long tail in the population, with roughly a sixth of the sample reporting not knowing any migrants, and on the other side, a sixth knowing more than 30. People who worked, had lower incomes, had children of minor age, and participated in neighborhood associations, sports or recreation clubs, and charitable organizations knew more migrants than others. The number of migrants a person knew had only a weak association with their migration attitudes, with the strength and type of relationship altering these associations quite strongly. To better capture this complexity, we present a cluster analysis to show different profiles of people's connections to migrants.

Socio-Economic Segregation of Students' Social Networks in Highschool

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If socio-demographic groups are segregated, initial differences can increase over time. A particularly interesting context for the study of segregation is the school context because success in the educational system largely determines later success on the labor market. If segregation is primarily the result of a lack of opportunities, inequalities could be reduced by creating meeting opportunities for actors. If segregation exists despite meeting opportunities, other measures must be taken.

A number of studies focused on homophily in the school context and showed that students tend to interact with other students when they have the same ethnic background. Although scholars interpret this tendency as evidence for segregation, few studies provide evidence based on actual segregation. Moreover, while ethnicity and SES are often in focus, relatively few studies have investigated segregation based on SES in schools.

We test whether students' friendship networks are segregated by SES and what factors moderate a possible SES segregation. Our data stem from the Trends in Student Achievement study 2018, a large representative, cross-sectional study of 47,354 students in 1,981 classes in Germany, which includes measures of friendship and informal help networks. We analyze segregation using the Spectral Segregation Index (SSI), which measures segregation on the individual level and considers how segregated ego's friends are. We compare the SSIs for multiple measures of SES, namely parental EGP, HISEI, and ISCED. Given that home possessions and family affluence are important predictors of adolescents' friendships that correlate with SES, we also measure segregation regarding these dimensions.

We compare segregation between friendship networks and informal help networks and expect stronger segregation for the friendship networks given more intimacy in these. Finally, considering that the consolidation of multiple socio-demographic attributes can increase segregation, we analyze the moderating effect of the consolidation of SES and ethnicity on SES segregation.

Initial results show strong gender and ethnic segregation. Student networks are segregated very weakly by parental education, homepossesions and HISEI while essentially no segregation can be found for indicators of cultural capital as well as for parental EGP. In help networks, segregation seems to be similar to that in friendships. With increasing diversity, segregation shrinks. Consolidation of SES variables with ethnicity or gender seems to have little impact on segregation. The analyses shed novel evidence on socio-economic segregation in school networks and add to the sparse literature on SES segregation by investigating multiple SES measures and testing for differences between network types.

Networks, Culture, Interaction (1/2)

Communities of Style: Artistic Transformation and Social Cohesion in Hollywood, 1930-2000

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How do social and stylistic relations structure cultural fields, and how do historical transformations shape these interdependent relations? Art worlds cohere through collaborations and stylistic affinities among artists, but we know little about the interdependence of these relational processes. In this study, we examine the interplay between artists' collaborations and shared artistic references and ask how a cultural field's historical evolution influences this link. Using data from the Internet Movie Database (IMDb), we analyze the co-evolution of cinematic collaboration and co-reference networks among 10,325 Hollywood filmmakers that participated in 45,947 films between 1930 and 2000. We complement prior sociological efforts through a longitudinal perspective on social and stylistic cohesion across three meaningful historical periods: the Golden Age (1930-1959), the New Hollywood (1960-1979), and the Blockbuster Era (1980-2000), i.e., before, during, and after Hollywood's artistic transformation.

We model the co-evolution of collaboration and co-reference networks using relational hyperevent models (RHEM). The underlying rationale for using RHEM in studies of collaboration networks is that artistic collaboration is inherently polyadic which means that it typically involves teams of any size. Therefore, RHEM specify film release rates associated with hyperedges representing groups of filmmakers of any size. To examine if collaboration or co-reference tie formation in the Golden Age differs from the New Hollywood or Blockbuster era, we include interaction effects for each period.

Our findings suggest that the cultural field of Hollywood filmmaking is mostly characterized by relational continuity across all historical periods. Filmmakers tend to use the same references as their past collaborators, and they also tend to collaborate based on previously shared references. However, during Hollywood's major phase of artistic transformation in the 1960s and 1970s filmmakers become less likely to collaborate if they have previously used the same references. We argue that historical transformations can momentarily shake the continuous interplay between social and stylistic relational processes when new cultural frames challenge the existing ways of a field's social and symbolic organization. In the case of Hollywood, this new cultural frame revolved around auteur cinema which implies an artistic understanding to filmmaking and highlights the director's autonomy in the creative process. Our research speaks to sociologists of culture and organizations interested in the underlying social and stylistic principles of cultural change.

GLOBALIZERS. Agents of Territory and Topology in the Global Art Field

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The present study is among the first to provide an empirical model of the multi-scalar global art field. To approach this model, we investigated structural conditions of artistic consecration. Through building a dynamic model of the global institutional network –as it structures through exhibiting artists from Central-East Europe based on 100,000 exhibition events of 3500 artists over nearly 30 years–, we compared the strength of various institutional positions in affecting the likelihood of consecration of artists from peripheral regions by the pinnacle museums of Tate, MoMA and Centre Pompidou. We identified the functioning of a new form of capital, geo-capital, and a corresponding new position, the globalizer position. The strategy of venues occupying a globalizer position is based on building an ego-network structure such that alters in the topological realm (due to their synchronicity and simultaneity in exhibition practice) are scattered across the territorial core-periphery spectrum in a balanced way. We provide robust evidence that the globalizer position is not only important, but it more strongly effects artists' likelihood of consecration than positions of either purely territorial or topological centralities.

Networks Are Like Rainbows

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Social networks have been studied since the 1940s, identifying numerous effects of networks. This led to the idea that social networks are not only formal instruments, but also substantive units or structures in the social world. Social networks are now taken to be real – they have become "objectified" (Pierre Moscovici). They are conceptually declared as real objects, in tandem and in relation to other aspects of the social like "culture", "power", or "field". This has led to questionable language in the social sciences: individuals are now supposed to "have (better or worse) networks", or they "connect networks" as brokers. Especially in network physics, networks are supposed to have universal properties (like the power law) or to show universal tendencies (like balance or homophily), simply because they are networks.

The presentation argues for taking a step back and for questioning our use of the term "network". Social networks can be seen as similar to rainbows: Rainbows only appear as objects but consist of small-scale processes: falling raindrops bending the different parts of light as small prisms. In the same vein, social networks consist of small-scale interaction rather than hard concrete structures. Rainbows are dependent on the standpoint and perspective of the observer: they only become visible from a particular angle, and the standpoint determines their location. Similarly, our conceptual and methodological repertoire renders networks visible when we look for them, depending on our point of view and perspective. Finally, we identify different colors of the rainbow depending on our perceptual apparatus and our linguistic categories for colors: different cultures depict rainbows with varying numbers of color shades. Something similar happens in network research, with our methods of measurement and analysis leading to structures with particular properties (e.g., density).

I conclude that we should move away from the idea of networks as fixed objects with objectively existing properties, and that we have to reflect on the construction of social relationships and networks both in our research and in the outside world.

A relational approach to adverb use

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Individual language use is a matter of choice in particular interactions. But what are the factors and constituents of such a decision? And how can the language vary from one interaction to another? The presentation proposes a conceptual and theoretical framework with methodological consideration to develop how language produced in dyadic relations is to be considered and situated in the larger social configuration the interaction is embedded within. An integrated and comprehensive view is taken: social interactions are expected to be ruled by a normative context, defined by the chain of interdependences that structures the personal network. In this approach, the determinants of discursive practices are not only constrained by the moment of production and isolated from broader influences. Instead, the position the individual and the dyad have in the personal network influences the discursive practices in a twofold manner: on the one hand, the network limits the access to linguistic resources available within it, and, on the other hand, the structure of the network influences the agency of the individual, by the social control inherent to particular network characteristics. Concretely, we investigate how and to what extent consistent ego is from one interaction to another in his or her use of adverbs. To do so, social network analysis (SNA) methods are mobilized. The personal network of significant ones of each individual is created using name generators and edge interpreters, with a focus on social support and conflict. In terms of analyses, two are envisaged: First, OLS regressions including network-level measures, such as density and reciprocity, and individual-level measures, such as centralities, are performed to understand the tenets of linguistic similarity from one interaction to another. The second analysis considers each social tie as nested within ego networks. Multilevel models are performed to investigate how the different types of ties may influence the likelihood to use adverbs, by controlling structural properties of the personal network. Primary results suggest that the more cohesive the network, the less likely is the individual to change his or her manner of speaking, and social support increases the use of adverbs in interactions.

Networks, Culture, Interaction (2/2)

The two sides of the Environmental Kuznets Curve: A socio-semantic analysis

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Since the 1990s, the Environmental Kuznets Curve (EKC) hypothesis posits an inverted U-shaped relationship between pollutants and economic development: after an initial period of degradation, the state of the environment should mechanically improve. We aim at mapping the development of EKC research which, over the last three decades, generated thousands of papers. We trace the transformation it has undergone from its beginning to the present, both in term of actors and of content. To that end, our analysis combines two computational methods in an integrated fashion respectively aimed at semantic and network analyses. For the former, the use of Semantic Hypergraphs (SH) enables us to formulate compact yet intelligible patterns aimed at extracting positive and negative claims about the validity of the EKC hypothesis from abstracts. SH makes it possible to infer a useful classifier from a small number of cases – which is not only important because of the human effort required to annotate training datasets, but perhaps even crucial because our dataset is relatively small. For network analysis, using degree-corrected stochastic block-modeling reveals the structure of the author citation network as a compact meta-graph made of a few blocks and easily-interpretable connections between them, also in a longitudinal manner. The combination of topological and semantic features, and a variety of other metrics, both temporal and structural, converges on a characterization of the field that reveals, in essence, the existence of two epistemic communities. The first wave and epistemic community, centered around Stern, a long-lasting expert of the field, is on the whole less positive on EKC, publishes less often and is less endogamic and is more focused on oxides of sulfur and nitrogen (SOx and NOx pollutants). The second wave and epistemic community, centered around Öztürk, a more recent expert that also currently dominates the field in terms of citation counts, publishes more positive results and more results overall, is more focused on greenhouse gases and energy and is more endogamic. Notwithstanding, we observe on the whole that the share of positive results as reported in abstracts has consistently increased over the years, yet remains of the same order of magnitude as negative results – the debate is not closed, in either of the structural communities. Beyond EKC research, the socio-semantic workflow we propose could be straightforwardly applied and replicated to the study of controversies in other fields.

Non-Binary Cultural Diffusion: Statistical Modelling of Interaction Between Semantic Networks

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Similarity of knowledge systems, discourses, and tastes across human societies is often associated with diffusion of culture between interacting social groups. Analyses of cultural diffusion tend to rely on binary mechanisms implying either acceptance or rejection of cultural elements. Meanwhile, social systems generating culture are operationally closed, and therefore, culture is rarely adopted at face value. Rather, it is adapted. Cultural configuration involving the reproduced cultural element and/or the cultural context reproducing this cultural configuration transform to fit each other. In cultural structures, this changes the very essence of the element being diffused: its meaning. Stable patterns of such transformations can be expected to signal cultural diffusion mechanisms that are no less focal to cultural dynamics than mechanisms such as selection or triadic closure are to social networks.

Based on conceptual reflections and a mixture of computational and qualitative analyses of ethnographic data, we propose a set of cultural diffusion mechanisms. Then, we develop extensions of Stochastic Actor-Oriented Models (SAOMs) to statistically model these mechanisms. In doing so, we draw on a cross-European multi-wave dataset that investigates how knowledge of local flood-prone communities is influenced by professional expert knowledge on flood risk management as local communities and experts interact with each other. In line with our theoretical perspective, local communities seldom adopt professional knowledge as it is or merely reject it. Rather, they re-interpret and re-appropriate – adapt – it, aiming to account for the peculiarities of social, natural, and technical contexts for more effective regional flood risk management practice. In doing so, they juxtapose professional cultural structures to locally developed cultural structures embedded in these contexts much deeper.

The proposed approach and findings can change how cultural diffusion is viewed and studied, would it be diffusion of innovations, sharing of cultural tastes, or knowledge transfers. Furthermore, the non-binary mechanisms of cultural adaption are likely to operate not only at the intergroup level of knowledge systems, discourses, and symbolic systems but also at the interpersonal level of individual perspectives, tastes, or cognitive structures. Finding whether these mechanisms are different from the ones operative at the intergroup level is a direction for further expansion of the approach.

The Dual Clustering of Tastes and Ties: Network Motifs for Cultural Consumption

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Although cultural sociologists have long theorized about the associations between cultural tastes and social relationships, the interconnections between the two remain elusive. Building on Breiger (1974)'s foundational insight that persons and (social/cultural) groups are mutually constitutive of each other, we elaborate and formalize two types of network motifs that characterize the dynamic coupling of music tastes and friendship ties in a multilevel framework: (a) degree-based measures that quantify actors' cultural profiles and genres' structural features, and (b) triadic and quadric structures that quantify the social and structural embeddedness of genres.

Analyzing longitudinal data collected in a university student cohort (N=253), we employ these network motifs to describe the distributional features of this evolving socio-cultural system. We show how micro netork processes — such as selection and influence — could be linked to structural characteristics of such a socio-cultural system via an actor-based modeling approach. We assess the fit of our model by comparing the simulated and empirical counts of those network motifs. We further validate our approach by comparing our findings with previous work. We find that, even when micro network processes that are commonly assumed to produce cultural differentiation turn out to be weakly significant, the model still reproduces the structural characteristics of the socio-cultural system very well. Through this case study, we argue that those network motifs serve as building blocks for understanding the social foundations of cultural tastes, and we discuss the implications for social network research and sociology of culture.

The Duality of Ties and Attributes in School Classes

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In the past, peer networks have mainly been studied in a non-subject-specific way, i.e. without considering the specifics of individual subject cultures. Against the background of previous research on social networks in schools (e.g. McFarland et al., 2014), the question arises to what extent typical teaching scenarios in physical education influence the type of relationship formation and which types of relationships are linked to which student characteristics.

In the present study (N = 10 school classes, 205 sixth graders), affective (e.g. sympathy) and instrumental types of relationships (e.g. sports play) were recorded in three different school domains (physical education, mathematics and class management lessons) using peer nomination procedures. Additionally, relevant student attributes (such as gender, peer ratings about motivations and capabilities, foci of extracurricular activities) were collected to examine the interrelations between different kinds of network ties statistically, but also what kinds of ties form between students with what attributes, and around which foci of activity (e.g., shared leisure activities). Our analysis takes advantage of a fundamental principle that has been little studied and not been formulated before: the duality of network ties and the attributes of ties and individuals. Given the problematic nature of our multiplex data set, we cannot expect monocausal relationships and therefore use multiple correspondence analysis (MCA) with directed network ego-alter ties as cases to explore the duality of network ties and attributes in the school domain. MCA is an exploratory approach to reduce and visualize a large categorical dataset to a low-dimensional space (Greenacre & Blasius, 2006).

The resulting topology of network relations shows the meanings of affective ties like sympathy and friendship, and of instrumental ties like collaborations in sports and in mathematics to be strongly related, but also their gradual differentiation. The MCA revealed that liking is a fundamental prerequisite for collaboration in school-related activities. Furthermore, affective ties tend to be most strongly influenced by gender and by extracurricular foci of activity like the neighborhood, whereas instrumental ties are more strongly tied to attributions of motivation and capability. We also find one-sided nominations for friendship and sympathy to differ from reciprocated ties chiefly in terms of graded strength, rather than as an asymmetry of interest.

With practical considerations in mind, these findings give valuable insights to teachers about the potential benefits for the use of goal-oriented cooperative learning forms to optimize the quality of teaching. For example, some intervention studies have already demonstrated improved learning outcomes when learning dyads were formed on the basis of liking rather than performance in computer science classes (Hartl et al., 2015).

Networks, employment and the labour market

Out of sight, out of mind: effect of changes in the workplace on personal networks

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The present research explores the transformations of personal networks that occur due to changes in the workplace within the same professional sphere. The study is based on interviews with individuals who experienced a change in workplace in higher educational sphere in Tashkent (Uzbekistan) within 2022-2023 years. Uzbekistan has undergone significant changes in its higher educational sphere. One of the major changes has been the shift towards a more market-oriented system, with an increased emphasis on vocational and technical education. This has been driven by a recognition of the need to provide students with the skills and knowledge necessary to succeed in the modern economy.

Another key change has been the expansion of higher education opportunities, with the government investing heavily in the sector. This has led to the establishment of new universities and colleges, as well as the introduction of new programs and courses. In addition, there has been a growing focus on internationalization, with universities seeking to establish partnerships and collaborations with institutions around the world. This has led to an increase in the number of international universities in Uzbek market and opened the path to professionals who work in academia.

The results indicate that changes in workplace or job position can have a significant impact on personal networks. Specifically, individuals who experienced a change in workplace reported a decrease in the size of their personal networks, as well as a shift in the composition of their networks. The study also found that the extent of these changes varied depending on the nature of the change in workplace and the role the person assumes in new organization. These findings have implications for individuals, organizations, and policymakers seeking to understand the impact of workplace changes on social networks and social capital.

The role of social capital in the "discordant" unstable labour market trajectories of individuals with a low educational level. An exploration using mixed methods

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The communication presents an analysis of youth labour market trajectories from a mixed methods approach that combines longitudinal quantitative and qualitative data and personal network data. In a first phase, quantitative techniques are used to classify these trajectories and, later, qualitative techniques are used to deepen them. In this phase, the relationship between these trajectories and the educational level of the individuals is analysed. Accordingly, it is necessary to proceed to the quantitative selection of cases, depending on whether the cases are illustrative or not of the statistical relationship with the covariate. This procedure allows us to identify “discordant” cases that can be interpreted as counterexamples or divergent cases. In the second phase, we select the discordant cases and, using an exploratory approach, we qualitatively analyse what makes them counterexamples or divergent cases. The causal role of social capital in these counterexamples or divergent cases is then analysed.

Networks, practices, and beliefs: relational and neo-structural approaches to institutional processes

Does federation imply fragmentation? A network analysis of decision citations in the German legal field of patent litigation

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The establishment of the European Unified Patent Court (UPC), which will operate in a spatial division of labor with multiple regional chambers spread across the European Union, has prompted discussions on achieving judicial harmonization and legitimacy in a geographically dispersed judicial system. However, since the UPC has not yet started operating, this paper focuses on the German legal patent system, which features a federalized structure at the subnational level and has been the subject of debates on judicial variation and its implications on forum shopping. Our study builds on a mixed-methods approach that is grounded in 22 interviews with judges and a dataset of citations of judicial decisions on patent litigation cases among 12 regional courts, 12 higher regional courts, the German Federal Patent Court, and the German Federal Court of Justice over the last 20 years. Using relational event models, we investigate how the hierarchical structure of courts, their specialization, and reputation in the bifurcated German patenting legal field, as well as their spatial division of labor, affect the flow of legal authority and legal arguments through references to prior decisions. Our analysis aims to contribute to the ongoing discussions on achieving judicial harmonization in Europe and sheds light on the potential implications of a federalized legal system on legal reasoning and outcomes within a single jurisdiction.

Collegial decision-making in specialized courts: Does judge familiarity lead to more decisive outcomes?

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While judges have for a long time been treated as more or less atomized in their decisions, more recently their social embeddedness into settings of collegial decision-making has received increased attention. This paper assesses collegial decision-making at the German Federal Patent Court (BPatG), which at more than 100 judges is Europe's largest specialized patent court and which plays a key role in the German patenting legal system. As decisions at the court are made by panels combining both technically and legally trained judges, they are of special interest for investigating characteristics of collegiality. Using a database of 1,722 collective decisions on patent validity and building on recent findings showing that increased familiarity among judges improves judicial deliberation in collective decisions, this talk investigates the hypothesis that higher familiarity panels reach lower-entropy distribution of costs among plaintiff and claimant, i.e., that they are more likely to find a clear winner.

Innovation Cooperation in the Bioeconomy: A Network Analysis of the Innovation Space BIOTEXFUTURE

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Cross-firm collaboration involving public research institutions is becoming increasingly important for firms seeking to access novel knowledge. However, such collaborations also entail the risk of opportunistic behavior by partner firms, and publishing joint research results raises concerns about the ability to gain intellectual property rights. Despite the significance of cross-firm collaboration, there is limited empirical research on the key factors for successful collaboration between organizations. In this paper, we examine the impact of governance interventions on collaborative innovation by analyzing BIOTEXFUTURE, a publicly funded innovation project aimed at transforming the crude oil-based textile industry into a bio-based one. We use a Situational Organizational Network Analysis (SONA) approach and conduct a network survey of over 100 members (86% response rate) as well as semi-structured interviews with all project leaders. Our investigation reveals three types of knowledge exchange in the innovation space: type 1 intra-project interactions, type 2 interactions with governance parties, and type 3 cross-project interactions. We identify three drivers for type 3 interactions: endogenous factors (e.g., regular project collaboration and peer referrals), events (e.g., organized serendipity or cross-project events), and governance (e.g., project management office induced contacts). Our analysis suggests that project governance plays a crucial role in facilitating new contacts for cross-fertilization across projects, with over half of the survey participants receiving critical input from cross-project collaborative relationships. However, we found that work-related contacts were more bottom-up, driven by member initiatives, and less by the governance structure of the collaborative project. In contrast, knowledge sharing across projects was stimulated more top-down through knowledge relationships with the coordination team. Project governance appeared to play a crucial role in 60% of the reported knowledge relationships and only 27% in project events.

Organizational networks (1/4)

A complexity science approach to measure “joined up working”: Collaboration networks for substance use, sexual health and blood borne virus service provision

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The Scottish Government’s alcohol and drug strategy emphasises the importance of partnership working and service integration to achieve the best outcomes for people who use drugs. Integration and effective partnership in health and social care is a complex problem, but it is often difficult to understand this complexity.

Among many complex systems methodologies, Social Network Analysis (SNA) provides a ‘whole system’ view of service provision. Our study used SNA to examine patterns of collaborations among organisations providing substance use, sexual health and blood-borne virus services in one health board in Scotland. We collected data from 36 services, obtaining information about the features of each organisation and about the network of relationships each service has with other services. Five different kinds of collaboration were explored: 1) joint operation, 2) work delivery, 3) joint appointments and outreach, 4) co-location, 5) referrals.

We employed social network visualisation and Exponential Random Graph Models (ERGMs) to investigate the structure of collaborations and identify potential issues regarding service integration that need to be addressed.

Our findings highlighted various patterns within the data, e.g., two services that consistently appeared to be the most highly connected within the network and the clustering of certain services. The analysis provided a series of network visualisations that we used to offer suggestions about where different network interventions could be implemented. The findings informed the local public health team’s needs assessment.

Collaboration and proximity. The influence of different forms of proximity on the collaborative network of projects in teacher education

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This study was carried out at the University of Kassel (Germany) as part of the PRONET project (Professionalisation through Networking) supported by the BMBF. PRONET consisted of 35 sub-projects. The key idea of PRONET was to encourage active collaboration between the participating sub-projects, to bring them together and to jointly develop new products such as concepts, materials, seminars and workshops in order to promote research, teaching and practice in teacher education.

The evaluation of the collaboration between the sub-projects was carried out via an online survey at three points in time (winter 2015, summer 2017, winter 2018). The resulting links between the sub-projects were examined using network analysis. The aim of the evaluation was to show the impact of the cooperation on the activities of the sub-projects.

In the research on collaboration, there is mixed evidence on the effect of proximity on collaboration. The degree of proximity (too little or too much) can be detrimental to collaboration. The forms of proximity also have different effects on collaboration. Since the network data can provide insight into network proximity such as reciprocity and triadic closure, the interesting question is how different forms of proximity and their extent influence network proximity. In this paper we try to operationalize different forms of proximity proposed in Boschma (2004). We distinguish between cognitive, geographical, organizational and institutional proximity.

The first question addressed in this presentation is whether there is a direct influence of the different forms of proximity on network collaboration. The second question is whether there is an influence of different forms of proximity on the network proximity (reciprocity, triadic closure). The longitudinal analysis was translated into a stochastic actor-oriented model (SAOM). A main finding of the first question was that organisational proximity has a direct impact on collaboration. Regarding the second question, cognitive and geographic proximity were found to affect triadic closure and reciprocity respectively.

Building up “social” and “epistemic” status: the case of entrepreneurs in the French biotech industry

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Entrepreneurs network centrality has an important effect on performance, for example, in the flow of opportunities and resources. Although the link between centrality and innovation performance has been broadly studied in knowledge intensive industries, such as biotechnology, little research has been focused on the “social mechanisms” (attributes) that would allow innovators to reach such a central position in the field. In this research, we aim to explore the factors that may lead or prevent entrepreneurs from reaching a central position in their professional networks as they are granted “social status” (i.e., recognized as friends) and “epistemic status” (i.e., recognized as advisors) in French Biotech.

In two observation waves and using a unique quantitative and qualitative database comprising 138 and 126 biotech entrepreneurs in 2008 and 2013 respectively, we explore entrepreneur’s centrality across time and in two impersonal exchange systems: friendship and advice. While the former accounts for entrepreneurs’ position in the social sphere, the latter accounts for their position in the knowledge domain. We draw on three dimensions through which entrepreneurs build up their central position: professional experience, inter-organizational engagement, and sociodemographic attributes related to both the company and the entrepreneur.

In terms of experience, differences associated with industry, entrepreneurial and educational backgrounds were identified. For example, in relation to industry experience (i.e., the number of years working in the biotech field), we found that in 2008 central entrepreneurs corresponded to those with more experience in the healthcare system; while in 2003, central entrepreneurs were those with a CEO/CFO background, suggesting a possible influence exerted by VCs. In relation to entrepreneurial experience, we found that being the founder of the biotech company was a strong factor associated with a central position in social and advice networks. In relation to education experience, entrepreneurs with a scientific background were valued as epistemic authorities in 2003, but as social authorities in 2008, which may indicate that advice exchanges can turn into friendship relations.

In terms of political engagement, we found that actors with current or former presence in other firm’s boards had high levels of centrality.

Finally, in terms of sociodemographic attributes related to the company, we found that if an entrepreneur was working at an IPO company, s/he was very likely to be recognized as epistemic authority and as a friend in both populations. In terms of attributes related to the entrepreneur, we found that actors living in Paris were highly valued by their peers.

This research accounts for the social processes, that may allow entrepreneurs to build up their career as legitimate entrepreneurs, through “epistemic” or/and “social” status, in the field of biotechnology in France.

Organizational networks (2/4)

Dynamic Network Analysis of organizational communication structures during a post-merger integration

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This study investigates how the organizational communication structures change in a dynamic network during a post-merger integration. For this purpose, multi-theoretical perspectives are adopted, including social exchange theory, homophily, proximity theory, and structural hole theory. As part of this research organizational network analysis were conducted based on email metadata of approximately 250,000 emails between 3,800 employees of a global chip and semiconductor manufacturer. In order to analyze the intra- and inter-organizational communication of the newly created organization, the overall networks are analyzed as well as the networks within the former organizations over the period of six months. This study examines, the change in network density, degree centrality as well as betweenness centrality and E-I index of the organizational members within and across the former organizational boundaries and the newly created organization.

To be successful as an organization, informal communication between individual employees and the formal communication structures within the organization are essential. These structures evolve and change organically over time but can also change profoundly when organizations decide to engage in mergers and acquisitions (M&A). M&A's continue to be the most common decision made by leaders to grow their organizations and remain competitive. However, these changes also pose a variety of threats to an organization, such as restructuring and downsizing, which create a great deal of uncertainty for all affected organizational members. Understanding the changing informal communication structures is critical to a successful post-merger integration, but it is also one of the biggest challenges during an integration. An organizational network analysis allows to reveal the informal communication side of a merger or acquisition and to identify potentially threatening informal changes as previous research has shown.

Therefore, with this presentation we will introduce the key challenges of post-merger organizational integration. By applying organizational network analysis, we can illustrate the dynamics of inter- and intra-organizational communication within the newly created organization, providing essential insights into communication changes. Additionally, we will also study and discuss both practical and theoretical implications to be considered in a successful post-merger integration.

Fractals Beyond Hierarchy - Analysing the Temporal Patterns of Interaction Networks in a French Public Sector Organisation

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Nature is organised in complex patterns, defying the description by calculus in their roughness. Fractals describe structural details at arbitrarily small scales, but are mathematically not necessarily complex, presenting a pragmatic way of describing nature. They are also common in social settings, including the organisational space. Researchers have identified fractals in organisation's structure and supply chains, or the self-organisation of social movements. However, most of the research on fractals in the organisational context focuses on structure and hierarchy. Little attention has been devoted to temporal fractal patterns in heterarchical or networked organisations. This article leverages data on face-to-face interactions collected by the SocioPatterns collaboration in a public sector organisation, to investigate temporal fractal patterns in interaction networks between employees. Such patterns can be described with a spectral density function modelling different interaction frequencies activity at different scales, delivering insights into the relative influence of each scale in the system. Three types of processes can be identified from this. White noise exhibits no correlation in time with rapid, chaotic changes. Brown noise entails a diffusion process with stable, structural patterns, but no quick adaptation. Pink noise exhibits an equilibrium between the two, producing dynamics which maintain stable patterns of interactions, remaining flexible to regulate interaction. The fluctuation in pink noise processes is invariant to scale and therefore fractal.

After describing the structure of the interaction network with metrics of social network analysis, such as centrality, clustering, or density, detrended fluctuation analysis (DFA) was used to detect such temporal fractal patterns within the three largest departments as well as for the whole organisation. Results indicate high levels of pink noise with traces of white noise in the departments as well as pink noise with traces of brown noise on the organisational level. Despite the original hypothesis of discovering more brown noise processes due to the more rigid framework of interaction within a structured organisation with clear processes, the levels of brown noise within the two departments analysed at this stage are in fact lower than those in self-organising social networks. While previous research found pink noise processes in self-organising networks, this article extends them to structured intra-organisational networks. The low levels of brown noise question the influence of rigid organisational structure and processes on the temporal structure of interaction. Hence, the fractal temporal structure of the interactions themselves is a factor that contributes to the stability of interactions between individuals over time. The research delivers valuable insights into the intangible temporal structures of contact networks beyond the formal structure of the organisation.

Referral networks among employers

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Employers use referrals by other employers to assess candidates before hiring. However, forming such a referral network also poses a cooperation problem to employers. After all, employers are potential competitors. How does an employer know she can trust a reference? A competitor may wish to get rid of employees that do not perform well or may not want well-performing employees to switch employers. Building a referral network is a classical cooperation dilemma: All employers would be better off if referrals would convey trustworthy information to make sure non-performing employees are excluded from the labor market. However, every individual employer has an incentive not to provide such information to its competitors. This paper analyzes the referral network of employers in the Swiss fiduciary sector, based on exponential random graph models and examines which exogenous and endogenous dynamics play a role in such referral networks. Preliminary results show that more prestigious organizations are better connected as well.

With a little help from … whom? Personal support networks in a hierarchical, multinational context

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For seafarers on international commercial vessels, social support from fellow crew members is important for physical and mental health, as well as for coping with everyday job demands and the additional challenges presented by crises such as the COVID-19 pandemic. However, the antecedents of social support are still poorly understood. In particular, previous qualitative studies on multinational and multilingual crews suggest that informal social relations may be largely formed within, rather than across, subgroups. Such a tendency towards homophily might limit the availability of social support to seafarers, who tend to work in multinational settings with marked hierarchical structures.

This raises questions about the social support available to seafarers, and the factors that facilitate or hinder the provision of social support between crew members belonging to different subgroups. Here we examine whether group divides might be reduced by organizational and/or individual characteristics that reduce risk and facilitate communication, notably psychological safety, and proficiency in English, the maritime "lingua franca".

The purpose of this study is to (1) identify the types of support provided by fellow crew members, (2) analyze the composition of personal support networks, and (3) examine the role of psychological safety and English proficiency in the provision of support between crew members at different hierarchical levels and with different nationalities. To address these questions, we analyze personal network data from 437 seafarers on international commercial vessels, collected during the COVID-19 pandemic in summer 2020 through a cross-sectional survey.

Preliminary analyses suggested that fellow crew members provided instrumental support, informational support, emotional support and companionship support. The type of support provided was associated with the helper's hierarchical level: those at higher hierarchical levels were more likely to provide informational support, while those at the same or lower hierarchical levels provided companionship support. "Helpers" tended to be co-nationals and were at the same or a lower hierarchical level as the respondent. Multilevel multinomial logistic regression suggested that the tendency towards homophily was reduced by psychological safety, which increased the likelihood of support from those at higher hierarchical levels. Proficiency in English increased the likelihood of support from crew members of a different nationality in higher (but not in the same or lower) hierarchical positions.

Organizational networks (3/4)

Shared Understanding and Task-Interdependence in Interdisciplinary Collaborations in Internship Networks

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A key objective of internships in vocational education programs is to nurture shared understanding among collaborators in the workplace. However, little is known about the process through which interns develop a shared understanding with their collaborators or how such understanding varies between collaborations. This study aims to assess the conditions under which students perceive a shared understanding in their collaborations with others within five "learning network" contexts in the Dutch care sector.

These "learning network" internship programs are created to foster collaboration between students and professionals from diverse backgrounds within the internship organizations, promoting intra- and interdisciplinary collaboration. This study examines several conditions that may impact the shared understanding perceived by students in their collaborative relationships, both on an individual level and on the level of their collaborations. Collaborative factors analyzed include interdisciplinary and cross-hierarchy interactions, cooperation frequency, and task interdependence. Individual-level factors include individual motivation, attitude towards interdisciplinarity, and perception of organizational collaborative culture.

We use survey data collected from 188 students participating in five different types of "learning networks" in the healthcare sector in the North of the Netherlands. The questionnaire included name-generator questions to obtain information on collaborative relationships, as well as individual questions about workplace perceptions. The data result in four interconnected networks of internship collaborations, while the fifth case featured students working in separate locations, resulting in a set of disconnected networks.

The disconnected ego-networks were analyzed using multilevel modeling to identify factors impacting shared understanding. The results show that task interdependence and cooperation frequency positively affect shared understanding in both intra- and interdisciplinary collaborative relations. On the individual level, attitudes towards interdisciplinary collaboration were significant and positively impactful, while motivation and perceptions of collaborative culture had no significant effect.

To address the interconnectedness of the four overlapping learning networks, a Multiple Regression Quadratic Assignment Procedure will be employed to analyze the data and ascertain how the collaborative conditions affected shared understanding. The results of these analyses will be presented at the conference.

Overall, this study aims to understand the conditions under which students in secondary-level vocational education in the healthcare sector perceive shared understanding with others in their internships. By differentiating between individual and collaborative characteristics, this study aims to demonstrate how vocational internships can nurture students' shared understanding.

The coevolution of leader effectiveness and advice seeking networks

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While interest in leader effectiveness has been a mainstay in leadership research, scholars engaging with this construct typically take a dyadic perspective, for instance by applying a leader-member-exchange lens. Yet network research has long established that many characteristics of individuals – leaders or not – working in organizations are influenced by the combination of connections they entertain and differ in who they choose to connect with. In this paper we take a network perspective on leader effectiveness and argue that an actor's leader effectiveness is both a product of contagion through their network ties and, at the same time, influences how actors shape their network. To conceptualize this co-evolution process, we develop three hypotheses and test them in the context of an advice-seeking network: First, we propose that individuals whose colleagues exhibit high/low leadership effectiveness, see an increase/decrease in their leadership effectiveness; thereby becoming more similar to those they seek advice from over time. Second, we propose that the higher an actor's leadership effectiveness, the more likely they are to add new advice relationships. We reason this is due to a higher awareness of the importance of obtaining the best possible advice when making decisions. And third, we propose that the lower an actor's leadership effectiveness, the more likely they are to drop existing advice ties because they see the benefit of breaking inert ties to free up networking capacities. Our study features a unique data set of 158 employees of a Danish boutique consulting firm, whose advice network was captured at three time points over the course of 13 months. These employees do knowledge-intensive work, where strategically choosing who to consult for advice is a crucial prerequisite in effectively leading the day-to-day projects the employees are concerned with. Our main variable of interest, leader effectiveness, has been surveyed through employee's supervisors to avoid biases. Using stochastic actor-oriented models, we find support for all three of our hypotheses. Our findings make two major contributions. First, we contribute to the leadership literature by providing evidence for a contagion effect on leader effectiveness, thereby challenging the predominant perspective of leader effectiveness being a product of individual characteristics. And second, we contribute to the network dynamics literature by showing how effective leaders strategically choose whom to consult for advice and consequently are less prone to let mechanisms such as homophily or inertia guide how they design their advice network.

Determinants of cooperation among hotels in Venice: an ERGM approach

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Tourism destinations are usually defined as networked systems where different types of actors (e.g., hotels and similar accommodations, services, and gastronomy) offer similar or complementary activities. The actors are interdependent since they must cooperate to deliver a comprehensive product to their visitors: the tourism experience. In this work, we analyze data about formal and informal collaborations among the hotels in Venice. We collected information about formal collaborations through local business associations and informal collaboration using a recall design based on a name generator asking hotels with whom they collaborated before and after the pandemic. We also collected information on the relationships' importance, reason, and frequency. We complement this information by interviewing the hotels that did not fill in the entire survey, particularly the network part. We apply and develop weighted ERGMs to investigate the determinants of formal and informal collaboration among the hotels in Venice and describe how patterns of collaborations affect land management for sustainable development.

Organizational networks (4/4)

Social networks, external and self-assessments of performance in physical education

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Athletic performance plays an important role for social integration and recognition in subject-specific peer-networks in physical education (PE). A significant aspect of this involves evaluating and comparing the performance and skills of others to their own. Social comparisons - besides temporal and dimensional comparisons - are essential for the formation of academic self-concepts (ASC), whereby systematic biases and reference group effects such as the big-fish-little-pond-effect also occur in PE. While the formation of a positive academic and physical self-concept is a normative goal of PE in Germany and the association with grades and performance have been considered many times, the role and accuracy of peer-assessments have rarely been discussed.

This work examines the relationships between ASC, peer and teacher assessments in PE as well as how those perspectives matter for social integration and network structure in context-specific peer networks. For this purpose, 373 students filled out standardized questionnaires containing both items about students' attributes such as ASC or gender, and nominations for peer networks such as friendship and desired group work and games partners in PE. They were also asked to indicate up to five high-performing and five low-performing peers which were used in network analyses as well as to calculate a "peer-score" for every student by subtracting the low-performing from the high-performing standardized indegree. Their respective PE teachers also filled out questionnaires evaluating the level of physical ability of their students on a six-point scale. This was done because PE grades in Germany generally are on a high level and possess very little variance due to motivational and pedagogical aspects of grading which makes them hard to use for scientific analyses.

The results show an expectedly high association between ASC and teacher evaluation and very high correlations between teacher evaluation and peer score. At the overall group level, the students who have a high peer-score are particularly well integrated into physical education networks (by indegree). For individual nominations, on the other hand, the individual assessments of the students dominate. The results of MR-QAP show that students choose their peers in PE mostly by liking and by whom they personally think is very good, but are also influenced by class consensus of ability. Interestingly, the students' choices are neither dependent on teacher evaluation nor ASC of recipients. It is evident that although students can generally evaluate the physical ability of their fellow students fairly well, individual assessments diverge from the general consensus, possibly because of differing performance norms.

Teachers' networks and school processes

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Applying Social Network Analysis to relationships among teachers can open new perspectives for the sociological study of education, allowing us to investigate the effects of colleagues interactions in an occupational group that is of key importance in the educational processes. Several research has in fact highlighted how certain characteristics of teachers' networks are linked to different aspects of their work: for example, we know that the density of the school relationship network is positively related to the effectiveness of the school, that personal network size is positively correlated with job satisfaction and motivation, and that the resources exchange between teachers is associated to best students' outcomes.

The objective of the following work is to analyze the teaching network of a school, in order to evaluate possible associations between the position occupied by teachers within the school network and their professional outcomes. A first objective is therefore to evaluate whether teachers' satisfaction and self-efficacy towards students are related to their position in the school networks, estimated by means of different measures of centrality: degree centrality, betweenness centrality, effective size and embeddedness, the latter measured by Moody-White cohesive blocks.

In this case study, a school population of approximately 70 teachers, working for the same school institution in the North of Italy, was asked to answer questions relating to their characteristics and relationship network. They reported their status characteristics (gender, age, level of education, job seniority…) and a number of outcomes related to their work, as self-efficacy and satisfaction (which have been later synthesized through measurement scales). As regards the network questions, they were asked to name the colleagues with whom they have the most frequent contacts, both from a professional point of view, therefore exchanging advice, materials and opinions related to their work, and from a personal point of view, as meeting during breaks or outside of school. In this way three different network of relationships between colleagues were reconstructed (advice network, relational network inside school and relational network outside school). The aim is to estimate network autocorrelation models in order to discover possible correlation between teachers' measures of centrality in each network and their work outcomes.

Following previous results in the literature using Social Network Analysis in organizational contexts, we expect that teachers who occupy the most central positions in the different networks are also the ones with the highest levels of self-efficacy and satisfaction.

This study is positioned among the research that employs Social Network Analysis in the working and organizational contexts, and specifically it is part of a limited number of Italian research related to teacher networks. The use of original data is an additional novel element.

Mapping amateur investors' social networks in Italy: financial platforms and social inequalities in the digital era

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Our study focuses on remote investment in financial assets (online trading - hereinafter referred to as OT) in Italy, one of the most growing industries in the Fintech area. According to recent research, Italian independent traders are approximately 250.000, while the global population is estimated at around 15 million. OT is becoming increasingly popular mostly because of the rapid growth of digital financial services, which have become increasingly accessible and easy-to-use. OT is indeed an extremely risky activity so much that, according to recent studies, about 90% of amateur traders loose money consistently. The main objective of this study is to understand how and why ordinary people enter into the world of "do-it-yourself" finance, exposing themselves to a considerable risk of financial failure. To this end, we developed a survey-based analysis (n=540) by which we investigated independent traders' motivations, operational attitudes and socio-economic backgrounds. Our survey also included a position-generator questionnaire, which allowed us to map traders' social capital endowments. Preliminary results show that the group of the most disadvantaged investors (in terms of income, occupational status, financial wealth and social capital endowment) are the most active in the market (in terms of number of trades and overall time dedicated to OT). For these traders investing appears to be a sort of "social lift" that might compensate lacks in their personal networks, providing them a concrete - but risky - opportunity of a quick advancement in their socio-economic status. The implications of these findings will be discussed, with a focus on the social inequalities framework.

A social network model to violent extremist mobilisation: a study of young jihadist sympathizers in Spain

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The aim of this paper is to theoretically develop a social network model of jihadist mobilization, examining how social ties intervene in this multi-stage process: first contributing to create the potential for jihadist mobilization among young people, then generating motivation and opportunities for participation, and ultimately fostering the favorable decision to become involved.

The model is grounded on the analysis of the roles and dimensions of social ties that impacted the mobilization, between 2012 and 2019, of a sample of 44 young people in Spain connected to militants of the global jihadist movement. Among this group, 23 individuals participated in jihadist activities. Information on their ego-networks was drawn from interviews with several of these youths, their relatives, police experts and first-line practitioners, as well as from police reports and oral trials.

The model assumes that not all ties that generate mobilization potential (primarily creating and sustaining collective identity, frame alignment and emotional awakening) seek to promote involvement, and pre-existing ties may even try to constrain it. Weak ties, which tend to be short-lived, may fail to facilitate structural connection, whereas strong ties are more effective because of their ability to generate incentives and sanctions. The model also proposes that young people with a greater number of ties with jihadist militants are more likely to have ties that promote involvement and, therefore, to end up participating. Finally, the model assumes that countervailing ties create obstacles during the mobilization process, but jihadists participants can overcome them partly by leveraging ties that facilitate mobilization.

Political Networks (1/2)

Mission-oriented innovation for reaching net zero emissions from heavy industry: analysing the role of main emitters in a policy-driven Swedish R&D networks

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In response to global climate agreements, many countries have committed to legally binding net zero emission targets by mid-century, including the decarbonization of the industrial sector responsible for producing metals, cement, chemicals, refined fuels, and other basic materials. In the light of progress being made in transforming the energy and transportation sectors, the basic materials share of emissions is expected to increase and can be as high as 30-40 % in industrialized countries with relatively clean energy mixes.

As a response to climate change, more and more countries are formulating challenge-led missions (Mazzucato 2016), setting net-zero emission target and implementing policies for transforming industry. In this paper, we investigate the role and position of main emitters in the Swedish industrial network for reaching net zero emission, financed by the national mission-oriented program, the "Industry Leap". The program aims to scale up key activities that can contribute to Sweden's net-zero and negative emissions target. We build on the innovation systems and transitions literature to gain insight into the innovation dynamics created by missions and the response of main emitters and how they chose to position themselves in the emerging network and thereby how these main emitters decide to relate to the national target of net-zero emission.

The main emitters consist of firms which hold a dominant position within their industry and markets. In previous literature on innovation and sustainability transition (Köhler et al 2019), these have been conceptualised as "market incumbents". Previous research has highlighted that incumbents tend to favor incremental innovation, react poorly to technical change, and take a defensive position against new policy instruments. However, they can also be at the forefront of innovation under certain conditions and manage both exploitation and exploration as simultaneous processes. Our paper aims to contribute to this literature by examining how main emitters position themselves in relation to the implementation of mission-oriented innovation policies and associated industrial networks. In the paper we test if main emitters assume a significantly different network position than other actors in the network in relation to key network metrics. Overall, our study has important implications for policymakers and industry actors alike as they seek to navigate the complex landscape of sustainability transitions and decarbonization goals.

Reputation, Cooperation, and the Emergence of Political Segregation in Networks

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Reputation systems have powerful effects on cooperation and tie formation in social networks. But how reputations affect cooperation and the evolution of networks is less clear when societies are characterized by fundamental, identity-based, social divisions like those centered on politics in the contemporary U.S. Using a large web-based experiment with participants embedded in networks where ties represented the opportunity to play an iterated prisoner's dilemma, we investigated how cooperation and network segregation varies with whether and how reputation systems track behavior toward outgroup members, i.e., members of the opposing political party. As predicted, when participants knew others' political affiliation, early cooperation patterns showed in-group favoritism. As a result, networks became segregated based on politics. However, we were able to reduce such favoritism and network-level political segregation by revealing to everyone how participants had behaved towards participants from both their own party and participants from the other party. These findings have implications for our understanding of reputation systems in polarized contexts, and for reducing the tendency for societies to segregate based on fundamental social identities.

Political Networks (2/2)

From Pizzagate to the Reichstag: A Multidimensional Analysis of the Coevolution of QAnon and Querdenken on German Telegram

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QAnon and Querdenken are two of Germany's most prominent and influential fringe political narratives. The sheer number of followers Querdenken and QAnon have calls for research on both movements. This study aims to measure the coevolution and spread of QAnon and Querdenken on German Telegram channels at an unprecedented scale.

In particular, we want to understand if both movements converge on the network and the content level.

We obtain the data for this study via the tdlib-API and iterative network expansion. Starting with 23 channels, we add new ones whenever they are mentioned at least 500 times, yielding 282 channels. For the scope of this analysis, we consider the 3'000'000 messages between Jan. 2019 and Apr. 2021 that contain at least five characters of text. We label each channel by hand as part of either Querdenken or QAnon.

We analyze the network structure and content.

For the former, we employ classical network analysis to understand the genesis of both networks on a structural level.

In particular, the fraction of inter-network links in the form of message forwards is compared in both channels over time, as well as their reach and level of connectedness. Both networks appear scale-free, considering the connectedness, the number of incoming and outgoing citations, and the average number of views per node.

Further, the networks grow more strongly connected within themselves but remain at a steady level of inter-network links.

On the content level, Topic-Modeling in the form of classical LDA and a BERT-based embedding model are employed and checked against a test set of well-known terms to see which yields the highest coherence within the corresponding categories.

Combining BERT-embeddings with PCA and UMAP for dimensionality reduction and DBSCAN for clustering generates the best topic assignments.

Around April 2020, during the first lockdown in Germany, and January 2021, after the US-Capitol attack, we observe growing synchronization between the content in both clusters. In particular, Querdenken channels post more QAnon-related content, yet often without linking to the corresponding channels, leaving the network structure intact.

On the network level, the clusters remain separated, whereas, on the content level, both clusters appear to synchronize, indicating a slow diffusion of QAnon narratives into Querdenken. However,

members of Querdenken seldomly link to the corresponding QAnon accounts.

Querdenken, a movement with many supporters adopting QAnon ideology, might significantly challenge Germany's democratic institutions, as Querdenken started with protests against acute measures, whereas QAnon is anti-statist per se.

It may allow parties like AfD to successfully cast doubt on the security and fairness of public elections, instilling distrust in governmental organizations.

On the other hand, if Querdenken repels QAnon, the latter might still implant itself in German society in groups like the Neue Rechte or Reichsbürger.

Protest Networks

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Protests are a collective affair. Those who take to the streets for a demonstration necessarily do not do so alone, but together with many other people. However, those who demonstrate do not simply do so together with everyone else who is also taking part in the same demonstration. The decision to go to a demonstration is often influenced by specific others. People often go to a demonstration together with friends, acquaintances, colleagues or family members, i.e. with people to whom a more or less close social bond already exists before the demonstration.

This basic observation about the network structure of protest participation has become part of the widely shared general knowledge in protest research. However, research on mobilization networks focused primarily on the mobilized, asking what factors contribute to some people being more likely than others to participate in protests. Mobilization efforts, on the other hand, have mostly only been studied from an organizational perspective: What do organizations have to do to turn interested but passive sympathizers into active participants? At the individual level the focus was mostly on information sources and mobilization channels of protest participants. Individual recruitment strategies – that is, who approaches whom for what reasons and tries to convince them to join a protest - have almost never been analyzed. Yet this side, the question side of the mobilization process is just as important as the response side.

This part of the mobilization process, which has been insufficiently studied so far, will be the focus of the proposed paper. The empirical basis will be the data from the surveys of the participants of the Fridays for Future protests in 2019, in which, for the first time, systematic questions were asked about recruitment activities. In the paper I will analyze the mobilization networks to identify a number of distinct mobilization patterns. The results of this analysis will lead us to rethink some long-held assumptions of protest mobilization.

Towards pillarization? Networks of coalitional protests in Poland, 2020

Daniel P Platek

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Grzegorz Ekiert (2020) argues that the organizational trajectory of civil society in Poland has fundamental features directing it towards cultural and political polarization, which in effect facilitates the current turn of the country towards authoritarianism. According to the author since the country's transition to democracy in 1989, Polish civil society has evolved into an organizational form that can be described as the "pillarized civil society". This phenomenon concerns the vertical segmentation of civil society into sectors that have their own organizational resources, normative orientations and, consequently, their own patterns of building protest coalitions. As Ekiert demonstrates after 2015, this process has continued to deepen. The electoral support for anti-liberal and anti-European parties defined political conflicts and protest politics, reinforcing the vertical segmentation of civil society. The support of the Law and Justice for the extreme right-wing organizations further consolidated the cultural polarization of Polish civil society.

Despite the formulation of a strong thesis about "pillarized civil society," it has not yet been empirically verified. Using a selection of protest events from daily newspapers, I use social network analysis to map the protest coalition in 2020. Assuming that the variable number of actors behind the organization of protest events reflects the nature of collective identities in the civil society I pose the question whether and to what extent coalitions of protest in Polish civil society form a pillarized, vertical structure. The article proposes operationalization and empirical analysis of the "pillarized protest" linking the conflict taking place in the parliamentary arena with the organization of protests at the level of collective street actions.

To describe the global shape of protest coalitions, I refer to the concept of cohesion of the protest coalitions. Social network analysts have long argued that cohesion between network actors is a prerequisite for agreement on how and why they should act together. Cohesion is typically measured by the degree to which actors are connected through meaningful relationships. In cohesive networks, the members are usually more involved in the activities of the organization, and the possibilities for coordinated and long-term actions are increasing. I also identify the specific role that political parties can play in integrating protest groups within pillars. I build upon an analytic strategy designed by Gould and Fernandez to identify five types of brokers in directed networks. From the point of view of this analysis, the roles within the network can be either vertical or horizontal. Here, I assume that political parties within analysed pillars will play primarily vertical roles, being the main integrators between various organizations taking part in the 2020 protests.

REDES panel: promoting collaboration and new studies in the community (1/2)

¿Have the pandemic lead to a political or economic sovereignty era? Evidence from global networks of capital and interlocking directors

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Interlocked capital markets can be defined as an empirical evidence of economic globalization, and a characteristic of modern capitalism, especially from the late XX century, when political and economic barriers from the USSR and other communist countries vanished. Nevertheless, the Covid19 pandemic and the latter Ukrainian war lead to a global capital markets shock and investors moved towards other markets. Since then, some argue that a new sovereign era has begun, and therefore we are assisting to the end of globalization. Nevertheless, other authors argue that transnational capital is increasing its power from the retreat of national elites, which gained political power from the multiple membership in different companies, lobbies, or political, civic, or social organizations. This paper explores how global investors still interlocked most of the companies in the world by analysing the global capital networks in two times, before and after the pandemic. Therefore, four networks will be analysed for this purpose: capital and ownership networks of public global firms in 2020 and 2023; and interlocking director networks of this corporations in these two periods of time. This research will show the importance of interlocking investors, and the persistence of a global markets block, which still manage a significant quota of global political and economic power. In contrast, national elites are still reducing their importance in the global economic networks.

Characterising the personal networks of young people in Spain. What are the differences according to sociodemographic features?

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In recent times, several empirical studies have provided evidence on the increase of social isolation among young Spaniards, but this isolation is evaluated from a "subjective" point of view. There are no data on the personal network of connections, which is a very good indicator of the “objective” isolation. The main objective of the presentation is to quantitatively describe the main characteristics of the personal network of connections of Spanish youth, including the differences in its composition and volume. To do so, data will be used from our own survey representative at Spanish level of the young population between 18 and 29 years old. The analysis of these data will make it possible to link the characteristics of the personal network with the sociodemographic features of young people and highlight the important inequalities existing in this regard.

Dynamics of international migration networks of Spaniards living abroad

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International migration flows can be conceptualized as valued directed networks with countries as nodes and the number of migrants from origin to destination as the tie weight. Migration Systems Theory has focused on the factors at a macro level that explain to some extent the dynamics of the flows between countries. In this research, we based on that theoretical approach to model the international migration flows of Spaniards among 181 countries across the world between 2011 and 2021. However, the interest was about migration patterns between countries others than Spain, experienced by Spaniards many of whom might not have even been born or lived in Spain (acquired citizenship because of Spanish ancestors). For instance, Spaniards born in Argentina who never lived in Spain and moved to the United States from Argentina.

Ordered SAOMs, which simultaneously model the evolution of various networks in which each tie in one network is dependent upon the existence of the tie in another network, were run. In order to set this nested structure three different thresholds were used, according to different flow intensities (above 10 cases, above 50, and above 100). This sort of models have been rarely applied so far to empirical data.

Preliminary results (with four time-point observations) showed a significant positive tendency to reciprocity, transitivity and in-degree popularity for low intensity migration networks, although they were not clearly significant for higher intensity migration networks. The negative outdegree coefficients across the low and medium intensity migration networks indicate that flows are relatively infrequent. The positive indegree popularity effect point to the fact that countries with larger numbers of receiving ties tend to attract additional in-flows. Also for the low intensity migration networks, ties tended to be reciprocated. The significant positive effect for transitivity together with the negative effect for 3-cycles suggest that it is more likely that main destinations are reached both through a third intermediate country or through a direct emigration, than return migration flows are observed from those destinations.

Finally, and again for the low intensity migration networks, having English as an official language at destination increases the likelihood of receiving a flow, whilst the effect is negative when the language is Spanish. Increases in the number of Spaniards already living in the destination country are also related to the likelihood of receiving a flow.

Further research will add the effects of border sharing, regulatory frameworks and population structure. Furthermore, other thresholds will be tested and more measurement times included.

Dynamics through the time of care and social support networks of older people

Francisca Ortiz

Millennium Institute for Care Research MICARE, France

This research seeks to understand older people's care and support networks in Santiago de Chile. This study aims to identify/describe older people's care (perceived) and support (experienced) networks, emphasizing gender and age inequalities. In addition, it will be evaluated the relevance of the time elapsed in maintaining older people's care and support networks. This presentation will be drawn on fieldwork in a community centre between May and September 2022 in three different waves of interviews. Then, information was collected about the complete network inside the community centre; and their ego networks outside the institution. In this presentation, I will share the first exploration of this data divided into two main aspects. First is the theoretical and methodological approach to the care and social support concepts from a network perspective. Secondly, it will explore the changes in the care and support networks through time.

REDES panel: promoting collaboration and new studies in the community (2/2)

Las redes de apoyo social en los cuidadores más mayores durante la pandemia

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Los cuidadores de personas con demencia, sufren las consecuencias derivadas del cuidado prolongado como el aislamiento, la soledad y la disminución de las relaciones sociales. Durante la pandemia por COVID-19, el confinamiento, las medidas de distanciamiento social y el cierre de centros sociosanitarios, puso de relieve la importancia del apoyo social informal disponible en los cuidadores. La prevalencia e incidencia de demencia aumentan con la edad, dando lugar a más años de vida con enfermedad debido al envejecimiento progresivo de la población, subrayando de este modo, la importancia de la situación de cuidado y recursos de apoyo en los cuidadores más mayores.

El objetivo de este trabajo es conocer las características de las redes de apoyo de cuidadores de personas con demencia durante la pandemia, especialmente en el caso de los cuidadores más mayores. Mediante el Análisis de Redes Personales y un muestreo de conveniencia en Centros de Salud, Centros de Día y de Salud Mental en Cantabria (España), se han recogido las redes de apoyo por vía telefónica con el programa Egonet. Participaron en el estudio un total de 78 cuidadores (egos). Se estudiaron 658 relaciones (alteri) con el propósito de conocer la composición y funcionalidad de las redes personales en cuanto al apoyo social recibido, así como su variación durante la pandemia.

Los cuidadores eran mayoría mujeres (n=65, 83%), con una edad media de 61,9 años (rango 38-89). La variable edad se recodificó en tres categorías con el objetivo de estudiar el efecto su efecto en el resto de las variables estudiadas: <60 años (n=32), entre 60-69 años (n=32) y =70 años (n=14). Las pruebas bivariantes han mostrado que, en relación con los cuidadores más jóvenes, los más mayores cuidaban en su mayoría a sus conyugues (73,3%), padecían demencia hacía más tiempo (8,14 años) y eran más mayores (media 80,71 años; rango 68-97) y más dependientes (Barthel medio 52,5). Estos cuidadores más mayores, llevaban más tiempo siendo cuidadores (6,79 años), dedicando más horas al cuidado 15,64 horas/día, y en su mayoría convivían con las personas cuidadas (71,4%). Contaban de media con menos alteri convivientes (2,21), la distancia geográfica con ellos era mayor que en cuidadores más jóvenes y durante la pandemia contaron con menos apoyo de tipo instrumental (media 0,29) e informacional (media 0,17) que los cuidadores más jóvenes. En cuanto a la variación del apoyo recibido de sus alteri durante la pandemia, un análisis multivariante, ha revelado que, en el clúster caracterizado por la disminución del apoyo recibido de los alteri, se encontraban los egos más mayores con una edad media de 66.07 años.

Estos resultados, muestran la necesidad de avanzar en el conocimiento sobre el contexto y recursos de apoyo social informal disponible en los cuidadores más mayores y en su caso, la necesidad de complementariedad con otros recursos formales debido a su contexto personal y de cuidado específico.

The effects of migrant corridors on migrants' self-identification. The case of Dâmboviţa (Romania) and Castelló de la Plana (Spain)

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This work aims at deepening our understanding of migrants' social integration in (and identification with) the destination country from a transnational perspective. In this case we focus on the role of the transnational structures that emerge during the migration process on migrants' national identification.

Through the network analysis of the migrant corridor that connects the Romanian district of Dâmboviţa (Romania) with the industrial one of Castelló de la Plana (Spain), in which there is a Romanian ethnic enclave, we show how high mobile migrants exhibits a more plural and inclusive identification than those with a more peripherical role.

This analysis will consider not only the perspective of migrants in both sending and destination places, but also that of non-migrants. Indeed, analyzing both perspectives is of critical importance, as it allows us to better understand the patterns of coexistence between migrants and locals.

The data was collected by the projects ORBITS (MINECO-CSO2015-68687-P; 2016-2020, Spain), and ICONIC (PN-III-P4-ID-PCE-2020-2828, Romania).

Social media, online networks (1/2)

Do Diversity and Context Collapse Kill an Online Social Network?

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Our social lives are segmented into various circles including family, friends, and colleagues. Differences in social norms and expectations between these circles can create tension, especially on large online social networks (OSNs), where their boundaries are blurred. It is unclear whether such phenomenon, called context collapse, outweighs the convenience of having diverse communities in one place for users of OSNs. To better understand this trade-off, we analyze whether ego-network characteristics suggestive of context collapse can explain exit choices from iWiW, a defunct Hungarian OSN with over 3.5 million active users at its peak. We measured context collapse with the presence of two conditions: the first is that communities of the user are non-overlapping, measured by the modularity score of the ego-network, while the second is that these communities are different from each other in terms that may indicate different values, such as age, gender and urbanization. We find that users having highly modular communities were more likely to stay on the site. This result suggests that the benefits of being connected to diverse communities outweighs the tension from context collapse. Differences in gender composition of alter communities were associated with leaving, while having geographically distant connections were associated with staying longer on iWiW. Our results suggest that the tradeoff between access to diverse contacts and the stress of context collapse is a salient dimension in predicting user churn.

How to analyse research data that was captured using commercial social listening APIs with Latent Dirichlet Allocation Topic Modelling to support your Social Network Analysis

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The recent decision by Twitter to remove its free academic researcher's application programming interface (API) has left many scholars in a quandary. Web scraping tools are not the answer because most social media sites have legal terms and conditions restricting such practices: which means that journal editors are unlikely to accept such articles. All is not lost; researchers can continue to capture this Twitter data. Unfortunately, they now have to pay to do so. This raises the question: should we start considering other commercially available social listening APIs to maximise our return on investments?

This presentation discusses the options that are available to academics and researchers. It uses a case study that analyses the conversations relating to "diabetes structured education" that have taken place on blogs, internet forums, Facebook, Instagram and Twitter over six months using Keyhole's social listening API (www.keyhole.co).

The presentation critically reflects the methodological/methods consideration researchers must adopt when embarking on such projects. It starts by discussing what commercially available options are available and how the prices of these options differ dramatically. It then provides a brief overview of the philosophical paradigms that should be considered and the legal, ethical and moral duties of embarking on such projects. A key facet of this presentation is what to do when the API does not provide you with recognisable 'edges' (links between actors/nodes). More specifically, the diabetes case study demonstrates how 25,568 posts can be quickly analysed using the Latent Dirichlet Allocation (LDA) topic modelling technique to extract topics through BigML's machine learning platform (www.bigml.com). These topics were then used to create the network edges. They were first analysed as undirected models, then as directed models: first from actor to topic, then from topic to actor (note: the actor, or node, is the handle on the social media platform that made the post). The graphical outputs were presented and compared using Gephi (an open-source visualisation and exploration software for graphs and networks) and NodeXL (a network analysis and visualisation software package for Microsoft Excel).

Limitations: the processes presented can be adapted further to consider the impact of engagement (i.e., the number of likes, comments, and shares) of the post. Unfortunately, conference timings have restricted the author's ability to cover the methods.

In conclusion, restrictions to social media APIs are limiting how social researchers can access good quality. Adopting web scraping techniques may constrain your ability to get published. Commercially available social listening platforms are growing in prominence, but they don't always give you the data in the format that you need. This presentation demonstrates how the LDA topic modelling can be used to support your social network analysis when faced with such dilemmas.

Arabizi on Twitter: Uncovering Hidden Patterns in Personal Networks through Hybrid Language Usage

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Arabizi, a phonetic transliteration of Arabic words into the Latin alphabet and Arabic numerals, has emerged as a popular form of communication on social media platforms such as Twitter. While this phenomenon emerged partly due to the lack of support of Arabic letters in earlier mobile and internet technologies, such as Short Message Services in mobile phones, it became a prevalent way of communication not only among the youth using newer technologies, but also on social media among most Arabic-speaking people. This paper analyses the interpersonal networks of 10,000 Twitter users, who use both Arabic and a mix of Arabizi and English, with the aim to unveil the hidden layers of relationships through the lens of mixed-language communication. Within the context of this paper, we model the interpersonal relationships through follower and following connections on Twitter. We construct a personal network for each user based on who they mention or retweet in their recent tweets, taking into account both user-level and tweet-level attributes. Among those are the patterns of Arabizi usage in all tweets as well as only those that contain communication between the two users in question. Identification of Arabizi can pose some challenges, specifically it not being standardised, the differences in dialectal writing, loan words such as Ramadan, taxi, etc. to name a few. To alleviate the hurdles of extracting Arabizi from mixed-language tweets such as Arabizi and English, we manually annotate around 500 tweets and train a Conditional Random Fields model to leverage the context of words while classifying each word in a sentence into Arabizi or English with 95.6% accuracy. Capitalising on the said model and the derived network, we perform edge classification via a Graph Neural Network to construct the multi-layer relationship graph from the elicited retweets and mentions. The results show that Arabizi usage patterns are indicative of deeper connections leading to more accurate predictions of interpersonal relationships among Arabic-speaking Twitter community.

Mapping social interactions in online communication conflicts

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Misogyny, defined as hatred or prejudice against women is expressed linguistically in a variety of ways, including social exclusion, discrimination, hostility, threats of violence, and sexual objectification. Based on a review of theories on and detection methods for misogyny, we present a classification schema that incorporates eleven explicit and implicit layers of online misogyny. Capturing implicit or indirect forms of hate in language and text is challenging. Language is highly dependent on context, and negative tones can be expressed without explicit negative keywords. Implicit sentences also rely heavily on non-linguistic signals.

We collected tweets of one case of online misogyny from 2019, 2020, 2021 from Twitter. We present a schema that captures syntax, semantics and pragmatics in the context of online misogyny. The dataset contains 15000 annotated tweets providing information on interactions, implicit and explicit categories of misogyny and the corresponding keywords in text. A network will be presented to visualize the mapping of misogynistic concepts and social interactions.

Our research aims to build upon existing studies investigating the linguistic differences between implicit and group-specific hate rhetoric. From a network perspective, we ask how and why are different sub-classes closely connected? To better understand tweets that are identified and classified as implicitly misogynistic, additional theorizing and analysis is required to provide context. Given the inconsistent definitions of hate speech, it is essential to understand how the harasser constructs the context of interactions, which may reveal implicit forms of hate. To comprehend the harasser's implicit actions, we want to understand how they stage, convey, or conceal the adversarial context of their attack. For instance, the difference between irony and sarcasm could account for different ways of constructing context. Constructing the context of interactions is one definition of systemic power in sociology. Thus, the issue is how implicit hate overlaps with how the harasser structures and stages their exercise of power. Analyzing the subnetwork of co-occurrence of implicit classes without explicit categories may reveal other traces of contextualization outside of the same utterance's explicit part.

The contextualization of information, which results from considering relationships, allows us to gain a closer understanding of the connections between words (syntax), the social use of language (pragmatics), and the meaning of statements (semantics) (Bernard and Ryan 1998; Carley and Palmquist 1992; Doerfel 1998; Mohr 1998; Woods 1975). This enables us to examine texts, their structure, and their meaning at both a microscopic level (individual words, nodes, edges) and a macroscopic level (triads, clusters, networks), switch between these perspectives, convert symbols or data into information and knowledge to understand complex relationships (Diesner 2010).

Social media, online networks (2/2)

Don’t You ’Like’ Me? Negative Psychological Impact of Rejection on Social Media

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More than 4.59 billion people worldwide utilise online social networks to interact with their peers, by, for example, following each other or exchanging likes and comments. These activities do not only enable users to express their own content preferences and strengthen their relationships, but also produce social cues indicating the user’s popularity within their respective networks.

However, the experience of social networks online presents itself as a double-edged sword. For some, social media and their online network constitute a positive environment, a place to share their everyday life with their network and receive feedback on it. When their engagement is met with positive interactions, it can cause feelings of validation, and positive status. This experience may change for users whose social circle remains silent towards them.

Past research has already illustrated some consequences of social media interactions or their lack thereof. Results from short-term studies, concentrating on several minutes of user interaction, illustrated, that receiving fewer likes in comparison to peers leads to feelings of stress, sadness, anxiousness, and lower self-esteem. Despite substantial research on the field of likes and their effect on users and their emotions it remains unclear how the lack of (positive) interactions within a social network over a longer duration of time affects users.

By utilizing network interactions as the independent variable, we analysed the impact of online social network interactions on users’ emotional experience as well as on their self-esteem. In an experimental study, we let users interact with others on a Facebook-like system over the course of a week while controlling the reactions they received from their peers. We found that experiencing little to no reactions from others did not only reduce the joy of consuming social media but elicited emotional distress amongst users. The number of network interactions carried even further reaching implications influencing users’ perception of their own social status within the group, leaving them feeling rejected, less belonging, and less appraised by their peers when receiving no interactions of others. Even more, the users’ social network engagement extended past their perception online and influenced their self-esteem as well, causing them to feel less worthy when being excluded.

On a societal level, our study can help to better understand the mechanisms through which social media use may lead to consequences such as loneliness, distorted self-perception or social media addiction.

Networks of lateral thinkers during the Corona pandemic

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With the beginning of the Corona pandemic and the first government contamination decrees in Germany, political resistance emerged quite quickly in the public discourse. The resulting protest movements and protest groups began to meet in March 2020 to publicly position themselves against the Corona measures. These were heterogeneous groups from different social and political groups that described themselves as "lateral thinkers". In such protest groups, expert knowledge was questioned and doubting the government's decisions was particularly strongly emphasized. In addition to gatherings in public spaces, the Internet provided different platforms for these critics to exchange views on Corona relevant topics, such as YouTube channels, specially created news portals, and the use of Telegram. The exchange of communication of information and opinions, as well as the arrangement of public protests, was easiest via Telegram, as access here is low-threshold and has a wide reach. It can be assumed that since the beginning of the pandemic, networks have been formed in which critics of the system have come together to support each other in their opinions, their criticism, and their intention to oppose the political situation. As part of a project seminar, we investigated whether the participants in such protest groups form a network and what the underlying structure looks like. To do so, we collected data from relevant Telegram groups and channels in November-December 2022 and examined both networks and content. As a result, we found a weakly connected network structure with some very central actors controlling the flow of information.

NLP meets SNA - Injecting Social Network Knowledge to Language Models

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The ubiquity of the contemporary language understanding tasks gives relevance to the development of generalized, yet highly efficient models that utilize all knowledge provided by the data source, including social network embedding about the author of the message. We investigate possible models for injecting social network information into language models and successfully show that embedding this information maintains a good generalization, with an increase in the quality of the baseline model for a set of applied tasks.

We select 310 thousand groups and 43 million texts that describe nearly all topics being discussed in the entire network. The proposed model demonstrates its effectiveness by improving the value of perplexity for the Masked Language Modelling task by up to 7.5%. The model has the best results for new texts of already seen social network actors, still showing good transfer learning for texts of earlier unseen groups.

We believe that the proposed model can be useful as a basic model for text analysis of Online Social Network texts and lead to author-aware generative models.

Online social life and offline social life: two disconnected worlds?

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The effects of ICTs on social relationships are widely debated, with limited empirical evidence supporting claims of social isolation and networked individualism. Some studies focus on the maintenance of weak ties or the dynamic aspects of online networks, while others highlight homophily in online behavior. However, there are few studies that examine both online and offline social life, and even fewer that explore the connectivity between online and offline social circles. This study aims to address these research gaps by comparing French young adults' online and face-to-face communication networks and tackle two key research questions: 1) With whom one has online and/or offline relationships? 2) Do online and offline relationships know each other? Through these two questions, it will be possible to provide insights into the extent to which online and offline social lives are embedded?

For this purpose, we analyzed data from a survey conducted in 2017 on a sample of 125 young adults aged 18 to 30 in France. This survey contains information on extended personal networks based on 15 name generators focusing on strong and weak ties. The network structure of each respondent was reconstructed by asking them to indicate whether two alters knew each other well. The sample contains 3340 alters - on average 26.7 alters per respondent, and 20232 alter-alter relations.

Regarding the analytical method, we first developed an ego-alter communication-based typology. We classified all ego-alter relationships according to the mode and frequency of communication, obtaining 3 types of communication: online, mixed, offline. Second, we conducted multinomial multilevel logistic regression analyses to determine which ties are more likely to be part of the online or offline social life. Third, to examine the connectivity we modeled the probability of existence of a relationship between alters through multilevel binary logistic regression.

Our study shows that the socio-demographic characteristics of the respondent barely explain the mode of communication with their relations. The dimensions that seem to influence online and/or offline communication are those at the alter level: type of relationship, geographical distance, emotional closeness, generational gap, length of relationship, and embeddedness. More precisely, we found that intergenerational and family relationships are mainly face-to-face. In turn, mixed relationships are closer emotionally and geographically, and more embedded in networks.

As for connectivity, it seems that two ego's non-kin relationships are more likely to know each other than one family member and one non-family member. Moreover, two alters are more likely to know each other if they have more similar online activities. Finally, we conclude that face-to-face social life is clearly more cohesive, but at the same time it appears that there are relatively cohesive groups, and above all homogeneous in terms of online social practices.

Social networks and health (1/3)

Individual, situational, and social network perspectives on sources of worry in adolescence

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The prevalence of poor mental health in adolescence has steadily increased over the last two decades. A better understanding of the sources of mental distress and how young people respond to them may inform preventive approaches to support wellbeing. Understanding the individual and social dimensions of worry may play an important role in promoting positive mental health and wellbeing in adolescence.

Worrying is a socially situated phenomenon. There are various individual, interpersonal, wider societal, and environmental situations that individuals may experience, and responses to these situations may vary from person to person and situation to situation. Sources of worry may also be socially transmitted, with the discussion of certain issues in peer groups leading to effective resolution of the worry on one hand, or leading to co-rumination and diffusion of worries on the other.

This study aims to identify between-person variation in the tendency to worry, variation in the salience of specific worries, the patterning and co-occurrence of specific worries, and to assess whether worries are socially structured across school peer friendship networks.

The Net4health study collected information on health, worries and friendship networks from adolescents in Secondary 2 (age 12) and Secondary 4 (age 14) in four secondary schools in Scotland. There were 1,111 participants representing 74% of the 1505 students across the eight school year networks.

The presentation will give an overview of how multilevel modelling, latent class analysis, network metrics, graph visualisation and Exponential Random Graph Modelling can be applied to take various perspectives on individual variation in worry and how worry is distributed in school peer networks.

School connectedness and adolescent mental health

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Given concern about the rising prevalence of poor mental health amongst adolescents internationally, it is unsurprising that schools have attracted considerable attention for their potential to promote or impair mental health. Within this field of research, adolescents' school connectedness – sometimes referred to as school attachment or belonging – has been found to be a protective factor against mental ill-health. This became of particular interest during and after the COVID-19 pandemic, as adolescents' school lives were unprecedently disrupted at a time when they faced additional challenges to their mental health.

Despite this, school connectedness remains a somewhat nebulous concept, encompassing several measures of association with and attachment to the school institution and environment. This project will add to existing literature by exploring three components of school connectedness – attachment to teachers, attachment to friends, and integration into the school social network – and their relationship to mental health in a post-pandemic adolescent population.

The project will use data from Net4Health, a 2022 survey of 12–15 year-olds composed of two year-groups within four secondary schools in Scotland, which included both individual and peer network measures. This is somewhat novel in this field - despite peer relationships being a well-established aspect of school connectedness, relatively few studies have used social network data or methods to understand school connectedness or its relationship to mental health.

We will use logistic regression to examine the effects of self-reported attachment to teachers and school friends on having a low level of general mental health (GHQ-12 caseness), before employing auto-logistic actor attribute models to simultaneously explore these and network-positional effects.

The results will identify which components of school connectedness are more closely related to adolescent mental health, thus informing school-based interventions which seek to improve connectedness as a means to support mental health and wellbeing. The project will also lay the groundwork for future longitudinal studies to establish the causal pathways involved in these relationships.

Dual perspectives in social support relationships

Heike Krüger*, *Thomas U Grund

RWTH Aachen University, Germany

Prior research in the area of social support suggests that it is an important determinant of mental health. Yet, it often remains unclear how much overlap there is between provided support and the perceived availability of support resources, and the factors that account for discrepancies. We analyze dual-perspective networks of over 3000 adolescents at 37 schools in North Rhine-Westphalia in Germany using the second wave of the SOCIALBOND study. The analysis is based on full network data from teenagers of the eighth grade, differentiating between the nomination of adolescents who provide support and those who receive support on the grade level. On the one hand, this study aims to capture the discrepancies in the perceptions between givers and receivers of support. Second, we aim to analyze to what extent the individual attributes mental health and loneliness as well as gender are relevant predictors.

Social networks and health (2/3)

Connecting Ego-nets Typologies with Adult Attachment Styles

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Attachment development is based on the activation of a motivational system that guides human behaviour towards the achievement of goals, and explains the search for security based on proximity behaviours towards affective figures, and the feeling of anxiety or discomfort in the face of separation. Attachment styles guide and condition how emotions are regulated during development, and how we perceive, feel, and manage relationships with others over the life course. Research links affective attachment styles to psychological well-being and participation in the social world, being important for the quality of interpersonal relationships, stability of ties, satisfaction with perceived social support, and the overall adjustment of the individual. In the last two decades, many researchers have looked into the relationship between structural measures of ego-networks and different individual psychological attributes. On this premise, we explore the connection between affective attachment styles and the structure of the individual interpersonal environment by proposing a typology of personal networks. For this purpose, we interviewed a total of 189 people, men and women over 18 years of age, and residing in Spain. We generate structural indicators of personal networks to assess cohesion and the existence of subgroups, and we propose a classification of ego-nets based on K-means cluster analysis. The relationship between affective attachment styles and the suggested types of personal networks is studied. The contributions of the study in terms of health and psychological well-being are discussed.

Social influence in the adoption of mosquito bites preventive measures in Meghalaya, India: Exploring policy interventions through an empirical agent-based model

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The global incidence of malaria has substantially decreased in the last two decades, although not uniformly, rather resulting in a disproportionate risk of infection among hard-to-reach populations. Most studies that measure uptake of personal protections look at the relationship between individuals' characteristics to preventive and treatment behaviours. Less attention has been paid to the endogenous social influence dynamics possibly preventing the diffusion of protections. Understanding the role of social networks is important to shed light on the micro-level dynamic of diffusion. Moreover, testing possible interventions in virtual contexts is key to design efficient policy that could change adoption behaviour. This study aims to understand the impact of social influence on the rate of adoption of complementary mosquito bites preventive measures in three indigenous (tribal) villages in Meghalaya, a rural and remote area in North East of India where malaria is still endemic. We asked each eligible villager to name the people within their village they talk to about health-related matters and those they avoid talking about such matters. For each villager we collected information about their individual characteristics (i.e. gender, age, educational background, occupation, etc.). They also had to indicate if they ever use measures to prevent mosquito bites. In order to study the diffusion dynamics within the observed networks, we built an agent-based model of the observed networks. We then ran computer simulations by assuming various implementations of diffusion mechanisms to generate the best fit of the observed adoption rate. Finally, we plan to simulate possible public policy interventions to identify the most efficient measures to increase the adoption rate.

A Systematic Review of Antecedents of Academic Achievement and Student Psychological Wellbeing from A Social Network Perspective

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Student academic achievement and their psychological well-being are top priorities in education. It is undisputed that adolescents' capabilities, characteristics, and predispositions are critical determinants of how well they do at school academically and how they feel mentally. Similarly, the impact of contextual factors such as school climate, classroom size, socio-economic status, among other factors, is well-documented. Less appreciated and often less accounted for are the role of social networks in shaping students' academic achievement and student psychological wellbeing. Even though most of the literature agrees that relationships do matter for adolescents' outcomes, insight into limited number of studies apply proper methods and models to account for how relationships in terms of structure and processes truly account for students' outcome above and beyond impact of ones' individual attributes is limited. The goal of this systematic review is to provide an overview of how and to what extent social networks influence academic achievement and student psychological wellbeing with a goal of critically evaluating methods used in studies and moving the field forward. A systematic search of the main databases for educational research as well as social network research resulted in 17,155 articles. Subsequent screening of these articles based on PRISMA guidelines using inclusion and exclusion criteria led to the final selection of 38 articles. Findings focus on what network structures or processes specifically relate to better/worse adolescent academic outcomes and psychological wellbeing. These findings can, in turn, be used to design network interventions to boost adolescents' academic outcomes and psychological wellbeing.

Gathering, drawing and using social networks: A review of network methods on data collection, visualisation and interventions

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Network research methodology is a constantly adapting field, and whilst the research has gained strength from being an interdisciplinary field, innovations are not always disseminated across disciplinary communities.

We adopted a two stage approach to evidence synthesis to bring together key innovations across multiple disciplines of network science and health improvement.

The first stage involved literature searches of key data bases to focus on the developments in network methods since 2009, focusing findings on the period of most recent developments. Studies were conducted in 2020 and were restricted to those published in English (due to translation availability) and were completed in three searches, with cross-checks across searches to minimise the risk of missing papers not captured within each search: Search one focused on data collection methodologies; search two, visualisation and search three, implementing interventions. Abstracts and full paper texts were screened for inclusion and categorised into three blocks for data extraction. Due to capacity data extraction was limited to papers published since 2018. Final numbers for data extraction are as follows: Block 1 (Data collection): 41 papers, Block 2 (Visualisation): 22 papers and Block 3 (Interventions): 30 papers.

The second stage will present these initial findings to a core group of experts within the network research field within a workshop setting to gather feedback to enhance these initial findings. These workshops will bring together the leading experts and trainers active in NHI capacity building globally to discuss what could be covered in methodological training. It is hoped that these workshops will facilitate discussions regarding whether and how to develop a set of NHI core competencies, including competencies beyond methods studied in this review, that would support an NHI career pathway.

We will present preliminary findings discussing methods published between 2018-2020 in relation to how networks are being elicited, methods for visualising networks during data collection, analysis and intervention and finally ways in which networks are being used within intervention development and implementation.

Social networks and health (3/3)

Structure and flow of caregiving support networks for people living with dementia in a resource-constrained rural South African setting

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Background: Care for people living with dementia (PLWD) is often conceptualized as a dyadic process with a primary caregiver doing the great majority of care. However in settings where formal dementia care is absent and families are multi-generational or multi-household, notably in lower-income parts of the world, it is likely that more complex caring structures are necessary or beneficial to both care giver and recipient. However, evidence on caregiving in such resource-constrained settings is scarce.

Study design: Drawing on an existing population-based aging cohort study, we conducted interviews in 108 households with a PLWD, in rural Mpumalanga province, South Africa between July and December 2022. We interviewed all household members and anyone else identified as providing care to the PLWD, a total of 1028 individuals. Each interview captured self-reported care provision and its impact on their wellbeing, as well as asking about core personal social networks using exchange-based name generators and name interpreters – including directed support provision between egos and alters.

Analysis plan: We will build directed sociocentric networks for each PLWD-household based on reported ties and calculate properties at individual (e.g., degree, betweenness centrality) and network (e.g., density, clustering) levels. We will visualize these by building 'typical' networks based on summary statistics, and summarize the distribution of care across: 1) primary caregivers; 2) other household family members; 3) non-household family members; 4) non-family members. We will use multilevel regression models (respondents nested within PLWD) to identify predictors of self-reported care provision including individual socio-demographics, relationship to PLWD, support received from others, PLWD characteristics including gender and dementia severity, and individual- and network-level properties.

Expected findings/discussion: We expect our analyses to show that caregiving is far more widely distributed than in higher-resource settings, but also, that care provision constellations are typically densely connected and mutually supportive. These findings will help inform future interventions to support PLWD caregiving in settings where formal care is largely or entirely lacking.

Social network characteristics associated with physical activity in adults aged 55-75 living in two deprived communities in Scotland

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Background: Physical inactivity is detrimental to healthy ageing, and evidence suggests that social networks can be used to improve physical activity. Despite a higher prevalence of physical inactivity amongst older adults with low socioeconomic status, research has rarely investigated the role of social networks in physical activity in this demographic.

Methods: This project uses data from the Physical Activity, social ConnectednESs and health ageing (PACES) study to identify the key characteristics of networks related to physical activity. The PACES study focuses on two geographic regions of Scotland where there are relatively high levels of deprivation. Ego/personal networks are collected from 100 participants aged 55-75 between August 2022 and August 2023 (study ongoing). Bivariate analyses will be used to explore associations between network characteristics, including composition, size, and constraint, and physical activity. A series of regression models will then be used to measure variation in physical activity by multiple network and socioecological predictors.

Findings and implications: Preliminary findings will be presented, as data collection continues until Autumn 2023. Results from the bivariate and regression models will be complemented by a discussion of data collection issues, network visualisation, and next steps. Results will inform the development of a social network-based intervention to improve physical activity and support healthy ageing.

Health Discussion Networks among middle-aged and older adults

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BACKGROUND – Previous research has shown that individuals activate relationships in their social network to discuss health-related matters and seek health-specific advice. These activities may also involve contacts that go beyond an individual's direct contacts. Social network theories highlight the particularly beneficial role of weak ties in collecting nonredundant information. While previous research has mostly relied on egocentric network data that exclusively target close confidants, the present study inquires whole health discussion networks that include weakly tied contacts and their respective health.

OBJECTIVE – The aim of this study is to identify under which conditions individuals activate their network to seek health-related advice. Because different kinds of health topics might be discussed with different kinds of people in the network, we explore a variety of predictors of health, particularly self-rated, mental and physical health.

METHODS – We collected sociometric data among middle-aged and older adults in three local social clubs in Germany, from 2022-2023 (N=40—50). ERGMs test the aforementioned health predictors and social network characteristics, such as relationship strength and quality, and betweenness.

RESULTS – The three health discussion networks were characterized by high reciprocity. The likelihood of a health-related advice tie was higher among strong relationships in all clubs, while the likelihood was lower among difficult relationships only in one club. High betweenness and low self-rated health was associated with an increased activity in the health discussion network.

CONCLUSION – This paper closes the previous gap between theory and empiricism by examining health discussion networks as a whole. Doing so is crucial to identify where individuals get health-related advice from, and how their own health and the health of others tie into their information search.

Spatial networks

Analysing the geography of young people's personal networks in Switzerland

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While social network research more widely recognises the importance of space and place, it is often limited to the analysis of dyadic physical distance and has generally failed to consider that both networks and spatial environments affect opportunities for social ties. It is well known from urban studies that youth living in disadvantaged and remote areas are more likely to experience social isolation. However, most studies have examined the role of spatial contexts (neighbourhoods, schools) and largely ignored the personal network context, possibly leading to misattribution errors. This project aims to bridge this divide and examine how the structure and spatial patterns of young people's personal networks vary according to where young people live. We analyse a large survey sample of young adults aged 18-21 living in Switzerland (n=16,000), including the full national cohort of young men of this age, using personal (or egocentric) network data and complete residential data of both respondents (ego) and their network members (alters). We use a novel typology to analyse alters' clusters in and scattering across places defined as Swiss employment areas and foreign places. We finish our presentation by discussing the significance and limitations of our approach to integrate geographical information into the analysis of personal networks.

Of “good” and “bad” neighbors. Examining cross-pressures on political participation in neighborhood networks across spatial contexts

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Neighborhood contexts and localized networks make a difference for people’s views and their decision to take part in the political process (e.g., Goldberg and Sciarini 2023; Huckfeldt 1979; Shapiro et al. 2020). Meanwhile, the underlying social mechanisms often remain ambiguous. While some point to neighborhood heterogeneity (e.g., Bellettini et al. 2016; Putnam 2007), others stress the importance of localized networks and interaction (e.g., McClurg 2006; Shapiro et al. 2020). Although theorizing different mechanisms, existing studies rely on similar long causal chains to test them: They use aggregated compositional measures at different predefined geographic scales, for example, census blocks. Doing so fails to directly assess specific mechanisms (e.g., information diffusion in networks) and it doesn’t allow us to discriminate among different mechanisms. This is especially true when it comes to the role of often hypothesized political cross-pressures in the local context (Berelson, et al. 1954; Mutz 2002; Therriault et al. 2011).

Using unique, representative (panel-) data from Switzerland with egocentrics neighborhood networks from more than 4000 respondents, this paper directly assesses both perceived as well as “true” political cross-pressures among neighbors in various geographic contexts. Besides the collected egocentric neighborhood network, the data further allow for the identification of up to 30 door-to-door neighbors of a particular individual. What is more, since these data are geocoded, other contextual information based on 100m x 100m grids can be added as additional neighborhood characteristics at varying geographic scales in urban, suburban and rural settings. Using – among other approaches – spatial econometric models to account for both social as well as spatial network processes (LeSage and Pace 2009; O’Sullivan 2014), preliminary analyses suggest a complex interaction of political views in one’s own neighborhood network with the wider neighborhood context on an individual’s decision to participate in the political process.

Swamps and Sluices: Mechanisms of Internal Re-migration Flows of First-Generation Immigrants in Denmark

Kristian G Kjelmann

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Previous studies highlight the significance of neighborhood effects with regards to the integration of immigrants into the labour market as well as into the immigrant-receiving society as a whole. The socioeconomic status, ethnic composition as well as geographical location of a neighborhood are all important determinants of how well first-generation immigrants integrate into the labour market. In research as well as in policy, there is however a tendency to characterize neighborhoods by their aggregated demographic characteristics without paying attention to how transient the neighborhoods are with regards to their immigrant population. As a consequence, neighborhoods with a consistent low socioeconomic status population are seen as equivalent to high transient neighborhoods with short-term low socioeconomic status residents.

This study explores re-migration patterns of first-generation immigrants in Denmark. The purpose of the study is to analyze differences in neighborhood-level migration patterns with emphasis on first-generation immigrants. The study focuses on two archetypes: Neighborhoods characterized by a stable immigrant population ('swamps') and neighborhoods characterized by high transience with regards to the immigrant population ('sluices'). The aims of the study are to both explore structurally equivalent re-migration patterns of different ethnic groups as well as estimating the effect on labour market integration of having migrated to 'sluice' neighborhoods rather than 'swamp' neighborhoods.

The population of study is first-generation immigrants arriving in Denmark between 2007-2017. Algorithmically delineated microareas are used as proxies for neighborhoods and individual-level administrative data including data on migration are used to map re-migration patterns of first-generation immigrants. Network analysis is used to analyze the re-migrations patterns of first-generation immigrants, treating each microarea as a node in a spatial network with directed edges indicating migrations to and from the microareas in the period of study. Each microarea is categorized based on demographic information on socioeconomic status and ethnic composition as well as by transience (the level of in- and outdegree of the microarea). Clustering the individual migration paths, migration paths with structural equivalence and similar trajectories with regards to types of microareas resided in are identified. Finally, the effect of a type of migration path (as given by its cluster) on labour market integration (time to first job as well as occupational status) is estimated.

A network analysis of food aids and food waste in Rome

Laura Prota

The American University of Rome, Italy

In 2022, the number of hungry people in the world increased to almost 850 million, equivalent to the levels registered in the 1990s. Rather than a spike, this food crisis indicates a new long-term pattern of increasing food insecurity due to climate change and conflicts. A possible solution to respond is a further intensification of agriculture with the application of cutting-edge technologies. However, evidence shows that increased agricultural productivity has led to increased food waste and is independent from food poverty. According to FAO, approximately one third of all the food produced for human consumption worldwide is lost or wasted. In this view, distributional issues rather than productivity should be at the center of food systems transformation.

The analysis of food aids programs reveals the increasing tensions between alternative trajectories of food system's transformations. This study usees social network analysis to investigate these tenstions and identify emerging beliefs and institutional patterns shaping food aids policies. The study takes Rome as a case to evaluate the different relational structures of public and private food aids.

According to the mainstream view, industrial food surplus should be recovered to feed the poor and food insecure. This belief shapes a number of programs that involve thousands of non-profit organizations, supermarkets, corporations and charities all across the chain. Critiques highlight that this approach legitimates the current industrial food system, providing a moral fix that in practice overlooks the nutritional, social and cultural needs of the food insecure. Public programs, by contrast should aim at protecting the right to a nutritious food per se.

We used archival data to trace the public flow of food aids from the government agency AGEA through non-profit organizations to final beneficiaries in Rome. A survey was then conducted to gather specific data on private food donations. Focus groups and in-depth interviews with key actors were used to gain the overall context of the food aid system. The data include geographical locations, organizational typologies, and varieties of food exchanged.

Preliminary results shows that the productivity targets of the industrial food system deeply influence the relational patterns of both public and private food aids in Rome, reinforcing the belief that food waste, rather than be a net social cost, can have some positive societal value. An analysis of the typologies of food exchanged reveals some of the fallacy of this approach and its potential negative implications for public health.

Sustainability and Social Network Analysis

Diffusion of Circular Economy ideas in Emerging Markets: A Network Analysis

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Recently the idea of moving from a traditional linear system of production and consumption to a circular model based on the 3Cs (reduce, reuse, recycle) has become increasingly popular. The transition towards a Circular Economy (CE) system is widely discussed by policymakers and businesses in Europe and the United States: however, while new regulations and policies are implemented at different institutional levels, companies are still divided between those who strongly commit to this novel approach, and have the resources to do it, and those who are less equipped to support such change. In this vein, companies in Emerging Markets are facing more challenges, compared to those in developed economies, in implementing CE solutions – due to differences in resource availability, government policies, and consumers' behaviour. A common strategy to overcome these challenges is to rely on networking and hence fairs and conferences dedicated to CE are becoming more and more popular globally. Main purpose for organisations is to explore new business opportunities and specific policy initiatives. Research shows that knowledge diffusion is vital in the transition towards CE, however business literature has not investigated in depth this phenomenon when it comes to understanding business dynamics in Emerging Markets.

This study concentrates on four large events for businesses and practitioners, in terms of participants, dedicated to CE in Asia, Africa, and South America, respectively: the India Circular Economy Forum 2022; the Indonesia Circular Economy Forum 2019; the African Circular Economy Forum 2022; and the World Bioeconomy Forum 2021 (in Brazil). These events have seen the participation of small and large enterprises, but also policymakers, institutional actors, and non-governmental organizations. While interacting in the physical space, these actors have also interacted online via Twitter using a series of hashtags characterising the conversations occurred during each event. We collected English-language tweets using Twitter search API, and we use such data to understand what CE-related topics emerged and were particularly influential among actors – while mapping out how they spread throughout social media. To achieve this, we use Social Network Analysis, focusing on the analysis of the retweet network by looking at the centrality of topic and account, and we search for subgroups or communities created around specific topic – to investigate the presence of recurring patterns characterising specific groups of actors. The research team is still working on the data collection and cleaning process, and we aim to present the first results to the EUSN2023 conference in Ljubljana.

Sustainable Dynamic Capabilities: a Bibliometric Analysis

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Recently, a renewed research interest for the Dynamic Capabilities (DCs) framework occurred to explain how companies are able to innovate their Business Model (BM) to respond to the sustainability challenges. The result is a deeper integration of these traditional management research topics with the sustainability one. These new research directions are due to the increasing importance that corporate sustainability has gained in consideration of the recognized impact that business activity has on the environment and society. Consequently, BM Innovation towards sustainability has achieved growing attention by academics (Bocken et al,. 2014; Barth et al. 2017; Geissdoerfer et al., 2017; Minatogawa et al. 2022: Pan et al., 2022), since it provide a framework to analyse how corporations maintain their competitive advantage and, meanwhile, reduce their negative effects. Scholars have progressively focused on identifying factors that support the development of these models: e.g. the capabilities that fuel the transition and speed up this long-term mutation (Inigo et al, 2017; Bocken and Geradts 2020; Scarpellini et al. 2020; Santa-Maria et al, 2022; Dressler, 2023). Precisely, the DCs Framework (Teece, Pisano, & Shuen, 1997; Teece, 2018) has gained more centrality in studying and explaining the transition toward sustainability. These high-order capabilities (Teece, 2018) have an important role in developing proactive socio-environmental practices and related economic performance (Annunziata et al., 2018) and a growing number of studies are talking about "Dynamic Capabilities for Sustainability" (Wu, He, & Duan, 2013; Oranges Cezarino et al., 2019; Zhang et al, 2020; Buzzao and Rizzi, 2021). Researchers have placed DCs in relation to some other topics such as for example Circular Economy (Bag et al., 2022; Wade et al., 2022; De Angelis et al., 2023; Coppola et al., 2023), Sustainable Supply Chain (Beske et al. 2013; Chari et al., 2022; Bag and Rahman, 2023), or Green Product Design (Dangelico et al., 2017; Ahmad et al, 2022; Bhatia and Jakhar, 2021). An analysis of the evolution of the debate, its sources, and current trends, can help to understand the state of the art of the literature and future research. We applied a bibliometric approach and our analysis – which comprehends 602 scientific documents published during the last twenty years - uses bibliometric techniques to map the cumulative scientific knowledge (Donthu et al., 2021). This kind of analysis has the potential to show how specific disciplines, scientific domains, or research fields are conceptually, intellectually, and socially structured (Cobo et al., 2011) and, thus, it enables to identify knowledge gaps and potential avenues for future research. Our study reveals the existence of some main thematic clusters, identified through the application of the bibliographic coupling technique (Donthu et al., 2020) enriched through Co-Word analysis (Chang, et al., 2015; Donthu, et al., 2021)

Using a social network approach to improve and understand community energy initiative (CEI) participation: A case study

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Against high expectations of the EU CEIs rarely succeed or enable a just energy transition. This illustrates that CEI participation is not yet well enough understood to provide effective interventions and policy advice. While scholars acknowledge that CEI participation is a special case of collective action, which is influenced by community and individual factors which are embedded in the local social network, most neglected the network embeddedness of CEI participation. As social movements/behaviors spread via social networks over time, neglecting the network embeddedness of CEIs over time cannot only hinder the spread of CEI participation, but also lead to the exclusion of certain citizen groups, which in the past led to polarization and opposition to the energy transition. We propose that citizen groups with close ties to the initiative takers are easily reached, while other groups with less social ties/centrality remain underrepresented.

To study CEI participation from a social network perspective we investigate a CEI in a dutch village of 1400 households for two years. Our aim is to understand how this perspective can help to explain and improve participation of different citizen groups. During the summer of 2022 we collected data on individual, community and social network factors that affect CEI participation. Based on the outcomes we constructed a local associational network consisting of e.g., the football club, school etc., in which the CEI and citizens are embedded. With that network we identified promising target groups for interventions based on their network centrality, attitudes, resources and ties to the CEI. Similar to the group of CEI initiators the CEI consisted of a homogeneous group of high SES citizens older than 45. Those renting their home and those younger than 45 were underrepresented in the CEI and our sample. This is first evidence that CEIs spread via social ties. To get a picture of the structural embeddedness of underrepresented groups we will apply an adjusted survey during the summer of 2023. It adds measures on CEI participation circumstances of different citizen groups and addresses issues such as energy poverty and social integration as potential burdens for participation. Again we will create a local associational network to determine the structural positioning and ties of the CEI to underrepresented groups. Together these outcomes will enable initiators to design participation packages targeting underrepresented groups through already existing social ties, to prevent local opposition. Based on previous research showing that ties to initiators positively relate to CEI participation, we hypothesize that there will be less (direct) social ties between the CEI and underrepresented groups. We aim to show that taking the underlying social network structure of CEIs and their spread over time into account can significantly improve our understanding of CEI participation and guide intervention development.

Teaching Social Network Analysis

Teaching Social Network Analysis to Independent Distant Learners

Yasaman Sarabi

Edinburgh Business School, Heriot-Watt University, United Kingdom

When teaching students new to Social Network Analysis (SNA), there is a need to provide a balanced curriculum of theory and practice. In normal, face-to-face settings, teaching the practical element may involve hands-on computer lab sessions, where students can work with an appropriate software to formalise their learning. For distant learners, this opportunity to engage with the practical element is far more limited. This presentation reflects on issues and challenges when teaching SNA to distant learners, in particular those on business-related programmes. We will also reflect on the development of SNA teaching material for distant learners.

Round table: The Future of Teaching SNA

Panel discussants: Christina Prell, Isabella Gollini, Juergen Lerner and Riccardo De Vita.

Round table organized by Dr Yasaman Sarabi, FHEA.

A panel discussion on “The Future of Teaching SNA”. Each panellist will talk for around 5 minutes on emerging issues in the field (such as the rise of AI technologies and the challenges it poses to teaching SNA). This will be followed by a Q&A discussion of the issues and challenges associated with teaching SNA, and the implications for the future. We will then conclude the panel by a ‘call-to-action’, where we will discuss, with any interested parties, whether they would like to co-author a collective article on teaching SNA or be part of a special issue.

List of abstracts – posters

A study on global technological hegemony competition and collaboration networks analysis: Focusing on semiconductor technology

Sejung Ahn, June Young Lee

Korea Institute of Science and Technology Information, Korea

Recently, as competition for global technological hegemony has intensified, centered on the United States and China, Korea's flagship industries such as semiconductors and displays are greatly affected. This study aims to analyze the global technological hegemony and collaboration networks in the field of semiconductor technology by using the Web of Science database. For this, the networks among Citation Topics were constructed by mapping and clustering. By employing the activity index and the excellence score based on the number of citations, we analyzed the level of semiconductor-related technologies in major countries and the temporal changes of the core research topics in each country. Especially, through the analysis of the global research collaboration network and bilateral collaboration relationships among major countries, it was confirmed that international collaboration is accelerating, and the research collaboration relationships of each country are undergoing changes.

Acquisition of knowledge on research and development trends of vaccines against emerging infectious diseases by network analysis

Eunsoo Sohn, Chang-Hoan Lee, Taehoon Kwon, Jae-Min Lee

Korea Institute of Science and Technology Information, Korea

Emerging and re-emerging infectious diseases, including the COVID-19 pandemic, continue to occur and the appearance cycle of new viruses is getting shorter. R&D trend of vaccines against six noteworthy emerging infectious diseases(EID)(COVID-19, Ebola, SARS, H1N1 influenza, MERS, and Zika) were examined through a bibliographic network analysis. The research fields of major countries and the research status in Korea on the development of these six types of vaccines were investigated through scientometric indicators and keyword network analysis. 755,343 academic literature data were collected from SCOPUS through an elaborate search strategy. Data preprocessing, statistical analysis, clustering, and network mapping were performed using software such as KMplus, thePhi, and VOSviewer. Through these various analyzes, it became possible to acquire knowledge about global vaccine R&D trends and Korea's research competitiveness, suggesting implications for vaccine R&D policies against EID.

Alcohol consumption as a socially contagious phenomenon in the Framingham Heart Study social network

Maarten van den Ende

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We use longitudinal social network data from the Framingham Heart Study to examine the extent to which alcohol consumption is influenced by the structure of the social network. We assess the spread of alcohol use in a three-state SIS-type model, classifying individuals as abstainers, moderate drinkers, and heavy drinkers. We find that the use of three-states improves on the more canonical two-state classification, as the data show that all three states are highly stable and have different social dynamics. We find that both abstainers and heavy drinkers have a strong influence on their social environment; for every heavy drinker and abstainer connection, the probability of a moderate drinker adopting their drinking behaviour increases by 40% and 18%, respectively. Using simulations, we find that while both are effective, increasing the influence of abstainers appears to be the more effective intervention compared to reducing the influence of heavy drinkers.

Analysis of Inter-organizational Scientific Collaboration in the Vaccine Research by Bibliographic Network Analysis

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In this paper, we examined inter-organizational research collaboration in the field of vaccines through bibliographic network analysis. In order to achieve this objective, we utilized a dataset comprising 77,915 papers sourced from Dimensions DB, which were published between 2003 and 2022. The dataset was specifically collected by focusing on six distinct vaccine types: "Live attenuated (weakened)", "Killed (inactivated) whole organism", "Subunit (Purified protein, Recombinant protein, Polysaccharide, Peptide)", "Protein-polysaccharide conjugate", "Viral vectored", and "Nucleic acid vaccine (DNA vaccine, RNA vaccine)". We compared the research activity and attractiveness of institutions that have published over 100 papers in the vaccine field with their collaboration relationships. Additionally, we investigated the correlation between institutional research similarity, based on keywords extracted from paper titles and abstracts, and the actual collaboration relationships.

Analyzing the Network Dynamics of Social Problems in the Literature

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In this study, we collected existing academic papers dealing with various social problems, extracted keywords meaning social problems and their solutions, and constructed a keyword network based on them. This study aims to understand the current status of research and development (R&D) for solving social problems through network analysis. As a specific case study, 63,362 aging-related articles published from 2018 to 2022 were analyzed to investigate the trends of major issues and their solutions over time. Using a language model, we extracted keywords representing social issues and solutions from the articles, and constructed a social issue network based on these keywords. Then, we used time series analysis to understand how the key issues in the network change over time. This allowed us to explore how social perceptions and responses to aging issues have changed over time. The results will help us to understand aging issues more deeply and develop effective response strategies.

Coupled dynamics of node and link states on an adaptive network: An agent based model of language competition

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Motivated by an observed disappearance of minoritarian languages in the recent years, a great deal of attention has been given in the modelling of language competition in order to understand the factors that promote the disappearance of a language and the dynamics that lead up to it. With this in mind, we build on an existing model of language competition, where a coupled evolution of node (language preference) and link (language use) states was studied. We extend the model to allow for the case where agents have the freedom to adapt their local interaction topology in accordance to their language preference. We find that permitting this freedom to agents results in a polarized network. What is more, we also study numerically the effect of the network size on the probability to reach consensus on the language usage, as well as on the relative size between the minority and majority language groups in the case of polarization.

Exploring the possibilities of using social media data and network analysis to study emotions tied to a place in the city

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In recent years, social media platforms have become rich sources of user-generated content, providing valuable insight into people's emotions and feelings. This research aims to explore the potential of social network data and network analysis methods to study emotions associated with specific locations in a city. Using the vast amount of data available on social media, we may gain a deeper understanding of how people experience and express their emotions in various urban settings. Despite an increasing number of studies using various NLP algorithms to evaluate the sentiment of social media posts with geotagging, a number of questions remain open. Are emotions tied not only to place, but also to time? How do different emotions relate to each other in a geographic context? And how network approach can enrich such research? By exploring these questions, we hope to gain insight into the emotional dynamics of urban spaces, which can help inform urban planning, design, and social action.

Financial data-based early warning system for global supply chain problems and alternatives

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Along with the US-China trade conflict, global supply chain issues are a serious problem facing the world. It can be solved through diplomatic methods and understanding between countries, but if we can predict and prepare for supply chain problems in advance based on data, we can minimize the damage from this problem. In this study, we tried to solve this problem by building a supply chain early warning system using trade data based on Korea, international news, and various financial data including exchange rates, gold prices and industry-specific ETFs. In the preliminary step, we selected 6 industries that are highly affected by the problem in Korea. The algorithm proactively detected the Russia-Ukraine war and provided warnings about problematic raw materials and suggested companies and countries that could be substituted in case of problems. We expect that only by creating and integrating detection methods based on various causes can solve the global supply chain problem.

How to Measure and Compare Brands in Online Social Media

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Technological advances and development of online social media leaded to demonopolisation of brand creation process. Traditional brand owners and managers nowadays co-create brand meanings with audiences of customers [Swaminathan V. et al, 2020]. This circumstance has increased the importance of brand measurement and comparative analysis approaches based on social media listening. This research present review of network and non-network types of such approaches. Non-network approaches were rapidly developed in recent years, however network analysis methods, based on centrality measurements and other indicators, remain its significant role in brand position analysis.

Inluence maximization and a unified framework of community detection

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In recent years, many papers have focused on community detection and influence spread or maximization in social networks. The influence maximization problem is about determining those k nodes starting from which the maximum expected value of influenced nodes are produced by a given influence process. Our intuition was that in social networks, entities with important community roles might also be crucial when dealing with the influence maximization problem. We have developed a general community detection method that can use any influence model as its input, and based on the found communities, it can narrow down the search space of the influence maximization problem. We only select nodes from the best candidates sorted by their community roles and try to maximize the expected final infection value. With our proof of concept approach, we show the efficiency of our algorithm on small benchmark graphs and two popular influence models, the independent cascade and linear threshold model.

Novel Approach to Analyzing Patent Citation Dynamics using Relational Event Models and Latent Variable Inference

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The complexity of patent citation networks poses a significant challenge for traditional analysis techniques. We propose an approach that integrates REMs with latent variables for an in-depth citation dynamics analysis, interpreting patents as nodes within a multidimensional latent space. Guided by machine learning optimization methods, our top-down model-based clustering strategy simplifies network dynamics interpretation, revealing innovation diffusion patterns at different scales. We use the Stochastic Gradient Relational Event Additive Model (STREAM) to model temporal citation events and a B-spline approach to handle complex non-linear behaviors. This research offers insights into knowledge diffusion, highlighting the key factors that drive innovation. The findings aid stakeholders in identifying high-potential innovation areas, thus informing strategic decision-making for technological advancement.

Patterns of close contact networks among the Hungarian working-age adult population and their perceived changes during the Covid-19 pandemic

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In a survey of the adult working-age Hungarian population in the winter of 2021 (N=1000), we applied a new name generator question to map the most important adult relationships of individuals. This network is expected to be broader than the core discussion networks that have been investigated several times before. We describe the egocentric networks that emerge as well as their variation across sociodemographic groups, and the changes in the mode, frequency and quality of relationships before the Covid-19-pandemic and in 2021 as reflected by the personal experience of the respondents. 4.6% (95% CI 3.3–5.9%) of respondents were completely isolated, and respondents named an average of 5.5 (IQR=2–8) persons important to them. The dominance of close family ties is very strong. Based on participant recall, the proportion of personal contacts dropped significantly during the quarantine periods, with the quality of the contacts remaining largely unchanged or deteriorating.

Shared Leadership in Sports Teams – A Social Network Approach

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Our study explores the concept of shared leadership within eight high-performance German sports teams (N = 148 team members). Building on the work of Fransen and her colleagues (2014; 2015), we firstly aim to extend their research by investigating the statistical overlap among four distinct leadership roles. Secondly, we determine whether teammates, who are perceived to have strong leadership qualities, also fulfill these roles in practice. Lastly, our study explores whether shared leaders receive higher rankings in terms of leadership qualities associated to their coaches. The data analysis differentiated the four leadership roles. A comparison of the rated leadership qualities and realities shows moderate to high network overlaps. Regarding the comparison of leadership qualities, shared leaders achieved higher indegrees compared to their coaches. Our findings suggest the rationale for considering sociometric choices in practical decisions related to determining leadership roles.

Yiddish Chronicles: Unraveling Soviet-Era Intellectual Networks

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This study focuses on leveraging metadata and Social Network Analysis (SNA) to examine influential author collaborations within the Soviet Yiddish newspaper Eynikayt, an important 1940s Yiddish-language publication promoting Soviet propaganda. The extraction of valuable metadata from the National Library of Israel's Index of Yiddish Periodicals (IYP) and other sources highlights the challenges and opportunities of digitization. Using Python, a co-authorship network of Eynikayt contributors is created, providing a visualization of intellectual interactions among writers based on metadata. Analysis of the co-authorship network reveals key figures, clusters, and sub-communities, illuminating the Yiddish intellectual landscape under Soviet influence. The potential applications of SNA for other Yiddish periodicals and historical resources are discussed, stressing the significance of interdisciplinary approaches in digital humanities.

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