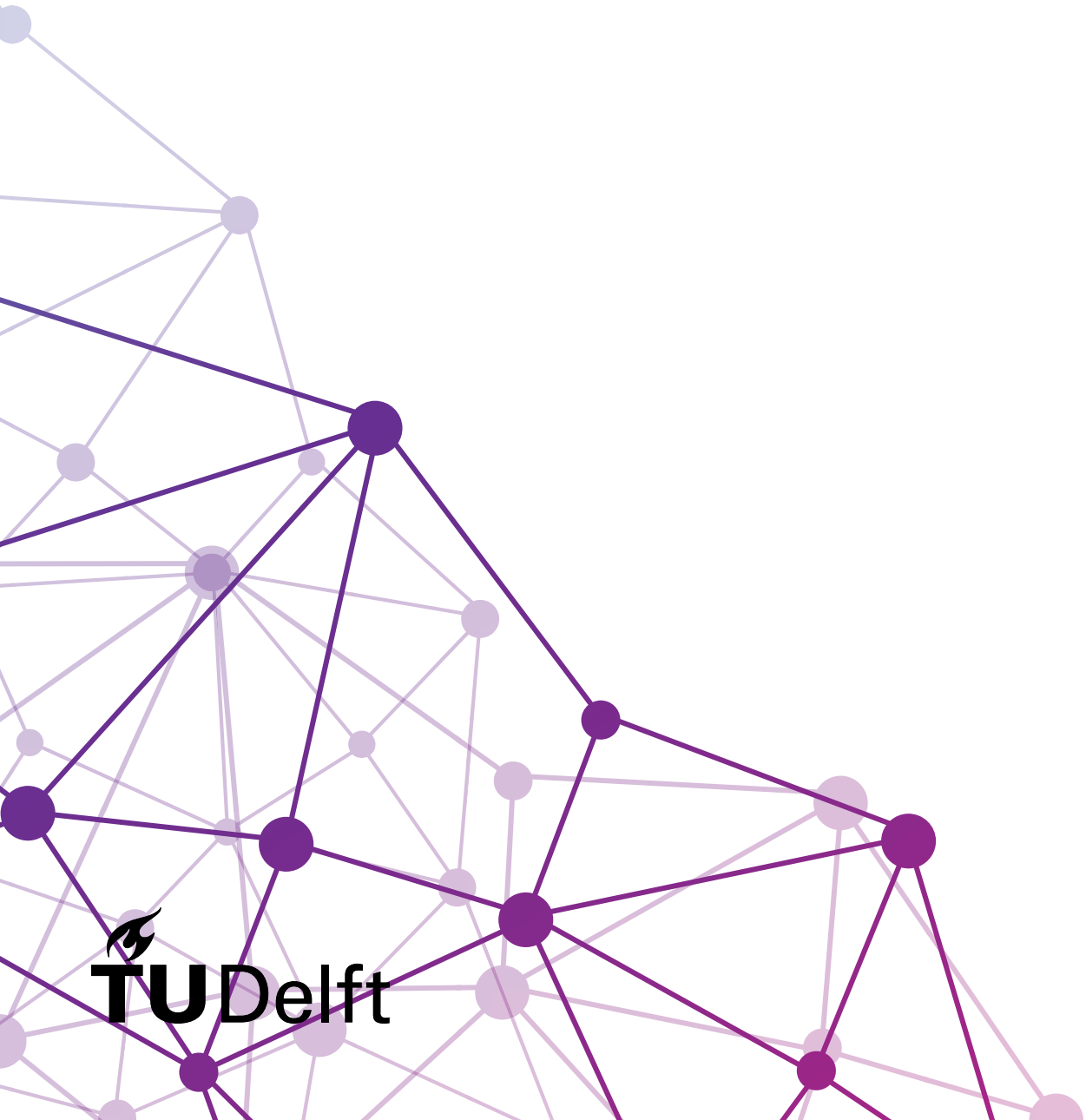
Engineering Social Technologies for a Responsible Digital Future



TU Delft

Engineering Social Technologies for a Responsible Digital Future

A research program at the
Faculty of Technology, Policy and Management (TPM)
Delft University of Technology

Program leader:
Prof. dr. Dirk Helbing
(TU Delft & ETH Zurich)

More information:
www.tbm.tudelft.nl/EngineeringSocialTechnologies

Program description

This research initiative aims at strengthening complexity science for a better understanding of socio-technical-environmental systems and to prepare for the challenges of today's globalized and hyper-connected world. The program is committed to the idea that we need to respond to the novel, data-driven construction of the social world with an operational framework that enables sustainable new modes of social, moral, legal and political thinking.

The PhD candidates in this program have a background in computational social science, data science, computer and engineering science, or relevant social sciences. They individually and jointly study complex socio-technical systems and design solutions to societal and moral problems that arise in relation to them. Understanding complex socio-technical systems in a digital world requires advanced modelling, utilizing the potential of the Internet of Things (IoT) as well as big and smart data. The program adopts participatory and crowd-sourced approaches to data collection and model validation. The program also seeks an understanding of the social and moral issues at stake. A range of issues regarding ethics, systems and governance (access, reliability, accountability and security, safety, and privacy) are therefore considered to be essential.

Digital society is shaped by software, algorithms, Wi-Fi routers, telecom backbones, smart devices, sensors, protocols, data, models and high tech systems. These tools and building blocks of our digital society are not neutral. They carry the intentions, worldviews, and assumptions, and mistakes of their makers. Digital technologies are not only enabling technologies, they are also constitutive technologies, in the sense that they change the very nature of the institutions, practices and activities they are applied to. Most often what society ends up with is digital gadgetry and social media that are very profitable to industry, but have not been crafted with the greater good of society and the flourishing of individual citizens in mind.

In the remainder of the 21st century we require the knowledge and capabilities that can help us to shape our digital societies in accordance with our political views, shared values and our social, legal and moral requirements concerning safety, security and privacy, openness, democracy and a range of other values. We also need methodologies to demonstrate and prove how exactly our views about a good society are expressed in the digital building blocks of organizations, institutions and smart infrastructures. Not only so-called 'functional requirements' count. This implies that we must help ourselves to the tools and methods for responsible digital innovation and design for legal, social and moral values.

Our values are often in conflict with each other. Safety costs money. Privacy and other human rights often clash with considerations of security. However, privacy enhancing technologies (PET) such as "privacy by design" are a good example of how value conflicts can be resolved by responsible innovation. Blockchain technology is another example of a digital technology with potentially vast societal and moral implications regarding trust, accountability, democracy and privacy. This PhD program sets out to explore, address these value tensions, and to develop solutions to overcome them.

The PhD projects in this program are part of a research community at Delft University of Technology, which in turn is part of an excellent EU research network and international research community. It will seek to harness the potential of Big Data, the Internet of Things, and Computational Social Science in a global context. A number of the research projects are also explicitly related to the NervousNet project of Dirk Helbing (https://www.nervousnet.ethz.ch/).

All projects are concerned with some aspect of participatory information systems, decentralized and participatory models of governance and crowd sourced solutions. These could be about: new forms of social sensing, new reputation systems, new social coordination systems, new privacy respecting technologies, gamification, augmented reality, interactive discovery, social and pluralistic information filtering, collective intelligence, online deliberation platforms, IoT-based real-time measurements of externalities, multi-dimensional value exchange systems, coordination or co-creation tools and other digital assistants, potentially using Artificial Intelligence and Virtual Reality approaches.

PhD Student Projects in this Program

Trusted Data Management in Participatory Sensing Applications using Reputation Systems

PhD student
Farzam Fanitabasi

Participatory sensing (PS) is defined as “sensing applications in which participants’ intervention is necessary in the sensing and sharing process”. This technology has three main enablers:

1) ubiquity of smart phones with built-in sensors,
2) small, low-cost and pluggable sensors, and
3) wide-spread availability of various communication infrastructures such as 3G, 4G, and Wi-Fi.

In addition to cost-effectiveness, scalability and wide coverage, PS has the following general benefits:

1) Taking advantage of the mobility of the sensing devices: due to participants having different mobility patterns, each sensor covers a dynamic and larger area than the traditional fixed-place sensing schemes.
2) No need to install and maintain sensing devices: since the sensing devices are not owned by the organization leveraging the provided data, the maintenance of the sensors is up to the owner. Also, the emergence of easily pluggable sensors and packed extensions that can be attached to phones can further enhance their sensing capabilities.
3) Widely available communication platforms: with the wide-spread adoption of high-speed communication platforms such as 3G and LTE, there is less need for separately installing and enabling communication platforms for the sensing devices. This in turn adds to the efficiency and the cost effectiveness.
4) Availability of contextual information: The context of the gathered information can enrich the value of the data and further help with the process of knowledge extraction.

However, the inherent openness of such platforms does come with its own disadvantages. Almost everyone can join these networks as a participant. This, coupled with the incentives (sometimes monetary) that are regularly offered to participants, can lead to inaccurate data entering the network. In order to tackle these challenges and provide a sustainable platform for further development of the PS, reputation systems (RS) have been proposed and recently studied in this field.

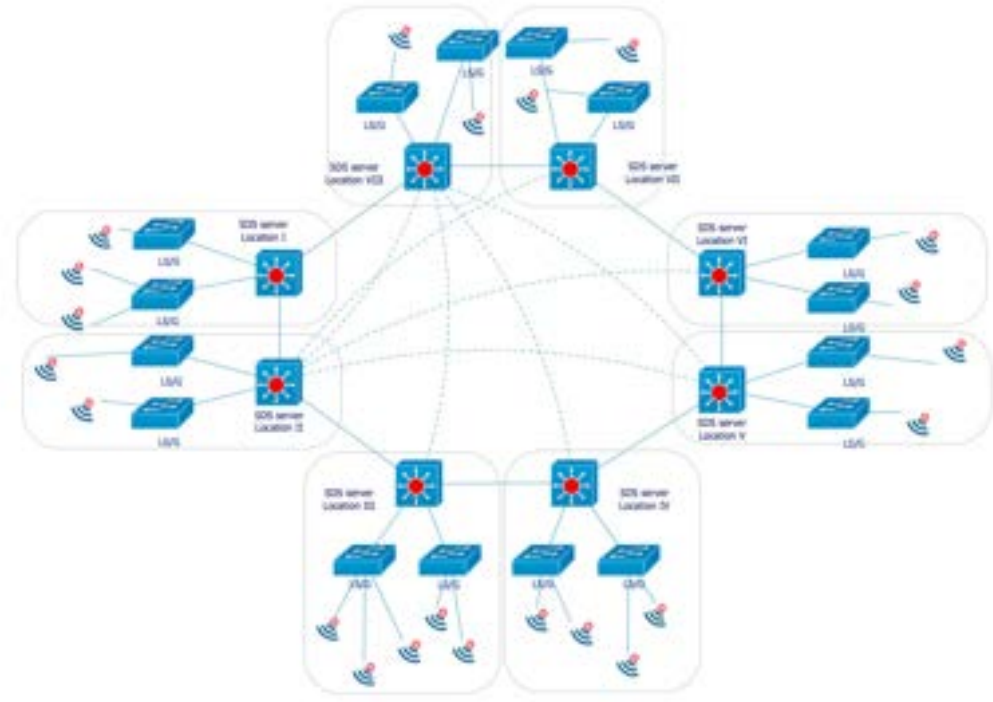


Figure 1 - Example of data flows of a PS application across network nodes

RS have already been extensively studied in other fields. Generally, such systems are built on mathematical theories such as graph theory, fuzzy systems, and most recently Blockchains. They are used to keep track of node / data reputation scores. Novel RS are, however, needed for PS due to the distinguishable characteristics of these applications.

This research project will:

- Provide a unified definition of PS which incorporates the innate ambiguity in data management and certification processes.
- Categorize and define the characteristics of a PS node, considering its functions and relations to other nodes, both in data collection and trust management.
- Map the relevant attacks and threats of classic RS in PS, designate new attack models and assess their impact when adopting RS systems in PS.
- Study and summarize the requirements, desired functionalities, and systems design of RS in PS.
- Design, prototype and implement RS systems in PS and while doing so apply the findings to common application domains.

Promoter: Yao-Hua Tan

Daily Supervisor: Andre Teixeira (TU Delft), Evangelos Pournaras (ETHZ)

Online Games for Meaningful Social Interaction in Public Spaces

Creating social inclusion – i.e. to give people a feeling of belonging, to help them value diversity and to confront xenophobia, racism, and violent extremism - is a challenge that today's society is faced with. The Municipalities of Rotterdam and The Hague address this challenge to achieve social resilience. As collective activities are relevant for the maintenance and promotion of social cohesion, this proposal focuses on the design of such activities - initially within and together with the Municipality of Rotterdam, followed by a comparable setting in the Municipality of The Hague.

PhD student
Francisco Xavier Fonseca

To foster collective activities this research project will design online games for meaningful social interaction in public spaces. Multi-player online games are, by nature, collective activities. "Games as social play" are games designed for individual gaming experience plus social experiences – a means to design for engagement in social interaction. As such, this research project will address the following main question:

"Can multi-player online games be designed for meaningful social interaction in public spaces?"

This research project will, in a first step, study several types of requirements that such games in public spaces need to meet in order to have a positive social impact. While continuously refining stakeholder requirements, technical requirements and other design requirements, the following step consists of designing and evaluating a multi-player online game designed to meet these requirements.

After collecting data from the usage of the game system, this research will analyse the performance of the created multi-player online game(s) and identify best practices that really support engagement and meaningful social interaction in public spaces.

The tentative outcomes of this research are therefore:

1) a list of essential needs and requirements to be taken into account while developing game systems for engagement and meaningful social interaction in public spaces,
2) a conceptual frame for system design, including game elements which best support engagement and meaningful social interaction in public spaces,
3) a system design that fulfils those requirements.

Modelling Social Agents for Policy-Makers

PhD student
Rijk Mercuur

The paradigm of agent-based computer simulation plays an important, growing role in social and natural sciences and engineering. Agents are seen as autonomous, proactive, interactive entities. A typical assumption behind agents' decision making is rationality. Rationality can be seen as holding consistent beliefs and preferences over outcomes and using those to optimize actions.

Real human deliberation does not seem to be perfectly rational though. That is, beliefs can be inconsistent, preferences undefined, and actions can be a product of neither. This limits the power of rational choice models to successfully explain human behaviour and inform policy-makers well.

As a way forward we propose the concept of sociality as the leading principle of agency. This raises the question: how to adequately use social agents to improve policy models? A first step towards answering this question is to understand the principles behind social deliberation. Based on work by Dignum et al. we propose an initial list of important concepts:

- Values: ideals worth pursuing
- Norms: rules or standards in society
- Practices: a nexus of doings and sayings
- Context: the immediate setting in which an agent acts
- Identity: position in terms of members of a social group

One possible way to integrate these concepts in a deliberation framework is by using the concept of social practices. Social practices are a template for acting that is to some extent shared between agents. Social practices are a good candidate to model social deliberation, as they capture the fact that similar actions in a similar social context are handled in very much the same way.

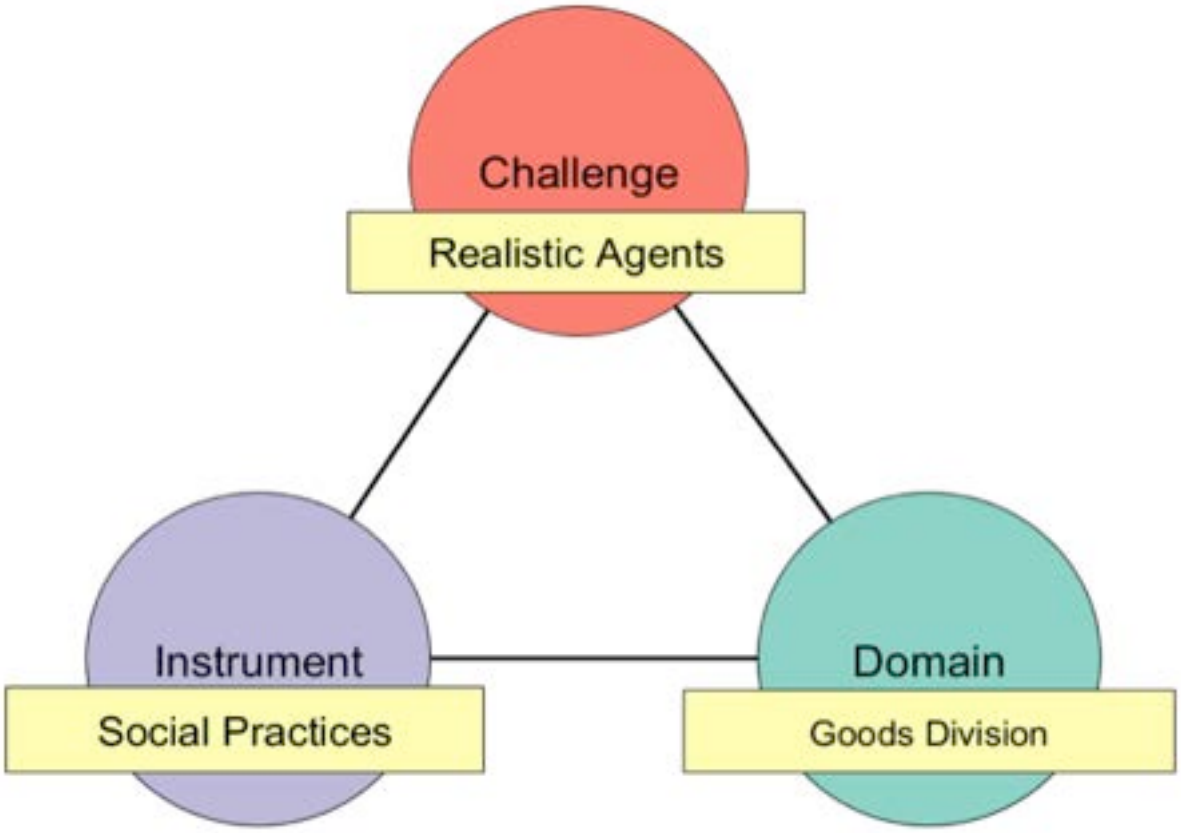


Figure 2 - An overview of the research project

The aim of this research is to build and test such a framework while balancing parsimoniousness and realism. We focus on two methodologies that can help in designing an adequate framework: formalizing (e.g. in logic) and simulating (e.g. programming in some agent language). Both methods

1) force the designer to be precise about the model choices and
2) help to make inferences from these choices.

The resulting defining model propositions can then be compared to other models, empirical research or intuition – or serve as guidance to design empirical experiments.

We aim to test our framework primarily in case studies related to the division of goods. One such case study could be NervousNet, an open source, distributed, privacy-preserving 'digital nervous system'. It promotes itself as an alternative to a single institution collecting and monitoring personal data. An important question for the success of NervousNet is how to motivate people to share their data and divide the resulting profit. The described social agent framework can help to answer this question, as it aims to integrate some important determinants for sharing and cooperating (e.g. context and values).

Promoter: Catholijn Jonker

Daily Supervisor: Virginia Dignum

Managing the Crisis within the Crisis: Harnessing Social Network Rumours in Crises with a Collaborative Approach

PhD student
Amir Ebrahimi Fard

Rumours can have malicious impacts on society. They can shake financial markets and cause a lot of turbulence, they can disrupt aiding operations within a natural or man-made disaster which might lead to loss of lives, they can make people whose acquaintances, family or friends are engaged in a disaster nervous and they can degrade the value of social networks to something just for fun. If such rumours can be harnessed within a proper time, none of these negative impacts will happen. Although theoretically preventing rumours from emerging seems the best way forward, this has its own drawbacks - like need to intervene in established systems and restricting users' freedom on the internet. Thus harnessing potentially harmful rumours in a collaborative manner is the most viable and at the same time the least invasive approach.

This research project is going to protect online social networks from rumours in times of crisis and lets exposed users react in an informed way. A mobile assistant is proposed which provides additional information and tells social network users to what extent the flagged message looks like a rumour. In this collaborative solution the goal is to fill the information dearth that is the most important reason for rumours to emergence. Adoption of the mobile application on a large scale will prevent rumours from spreading and creating serious damage.

In order to build this solution, the first step is to build a model of the behaviour of rumours that is based on their collective nature. To do that rumours will be studied through the lens of network science and their topological and epidemiological aspects will be clarified. To enable computers to recognize rumours we are going to identify those features with the highest capability of describing various aspects of rumours. Besides their pre-specified features we also extract their network characteristics.

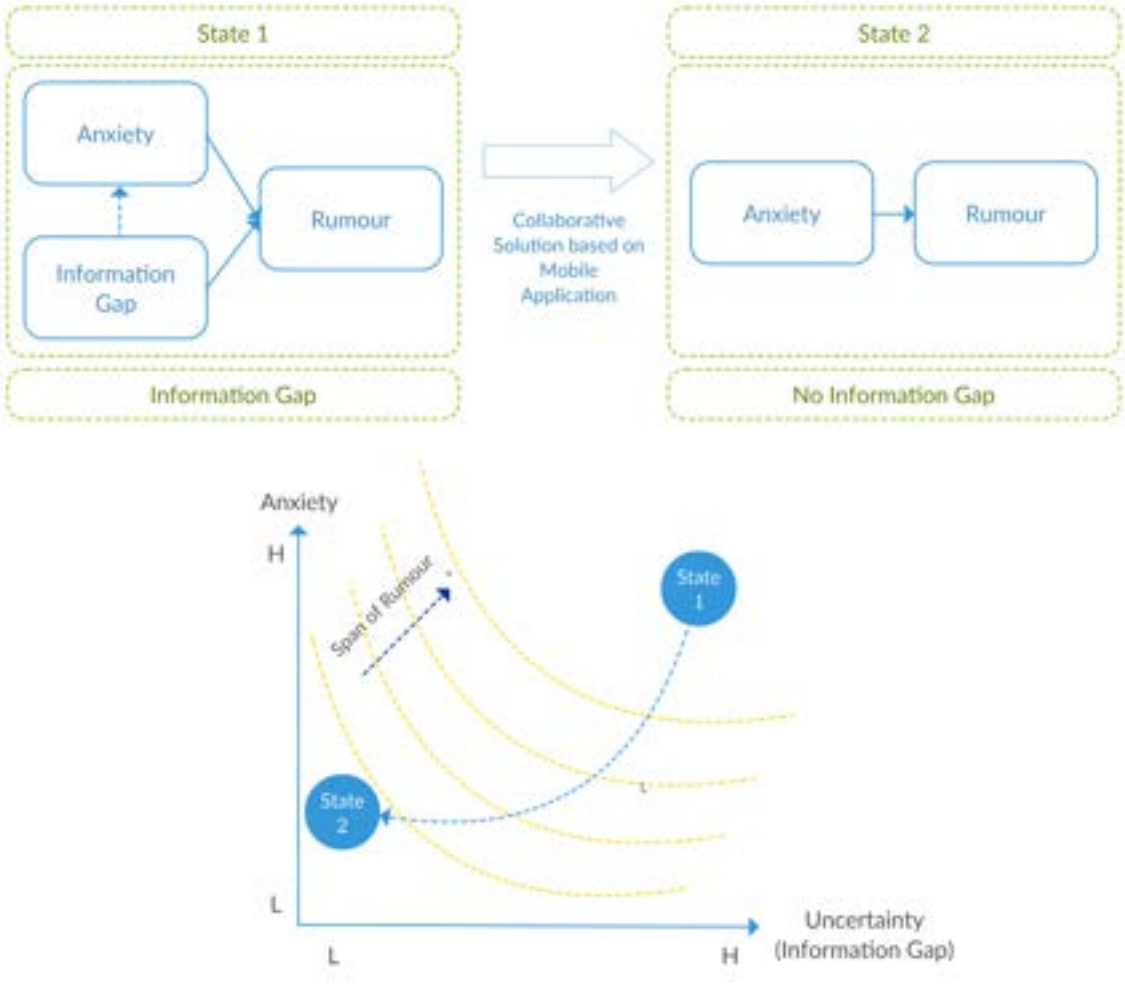


Figure 3 – Harnessing rumours by filling the information gap

After modelling a rumour as a collective phenomenon, in the next part of the research the impact of context will be measured. In this part we will see how different features of rumours behave in a crisis context. It will lead us to detect critical and redundant features. Also, it will let us identify features with same and features with different behaviour within different contexts. In the final stage of the project, in order to have an assistant, a dashboard will be designed and implemented which will provide a map of any chosen rumour and show similarities between the flagged message and known rumour patterns. This novel mobile application will provide the opportunity of harnessing rumours in social network in a cheap, non-invasive and democratic way.

Open Source Urbanism: Adaptation of Open Source Principles for Urban Commons Initiatives

PhD student
Sergei Zhilin

Nowadays more than 50% of the world's population lives in cities, and this percentage will increase by 1.5 times in 30 years. We may thus safely say that life in urbanized areas has become the dominant mode of living. As a result urban development (i.e. the social, economic, cultural and physical development of cities) plays a crucial role in producing economic growth and realizing innovations.

In the traditional paradigm of city management local governments regulate open access urban resources, such as streets, empty plots, and public parks in a top-down fashion of prohibitions and restrictions. Althoug citizen participation in urban development is increasingly considered to be important by city officials and experts, urban space is still a highly contested space. In many cities corporate control of urban space transforms the "small and/or public" into the "large and private." Contestations over the right to be involved in urban development are at the heart of the many grassroots movements for reshaping cities which have emerged in recent years.

Some of these movements demand the right to create and govern city spaces as urban commons – city spaces which are collectively governed by communities, irrespective of formal ownership. There are already projects that fit the definition of urban commons. Often they emerge as showcases which are initiated, tailored and facilitated by local government or architectural studios. Grassroots urban commons projects are still rare, because the development of such projects is a long lasting, complex process during which community members have to deal with a constellation of problems: project alignment with a municipality; poorly organized self-governance, a lack of resources such as funding, volunteers or space.
Although urban commons communities differ from one another, all face these types of problems in a similar way; they often reinvent solutions because they have no effective mechanisms for collaborative creation and sharing. The proposed research will design a collaborative tool set for the urban commons domain, which will help the actors involved to solve before mentioned problems together.

Similar tools already contribute to the success of other communities also working with commons, namely open source communities (e.g. groups of geographically distributed volunteers collectively working on the production of knowledge commons). The term Open Source Urbanism is shorthand for “open source urban commons co-production”, which we define as: “citizen-driven co-production of urban spaces as urban commons and their design documentation as freely used and shared knowledge commons”. Open Source Urbanism is a local community practice facilitated by an ICT-platform for OSU-practice, which will help to collaboratively create open design knowledge (see the conceptual framework in figure 4).

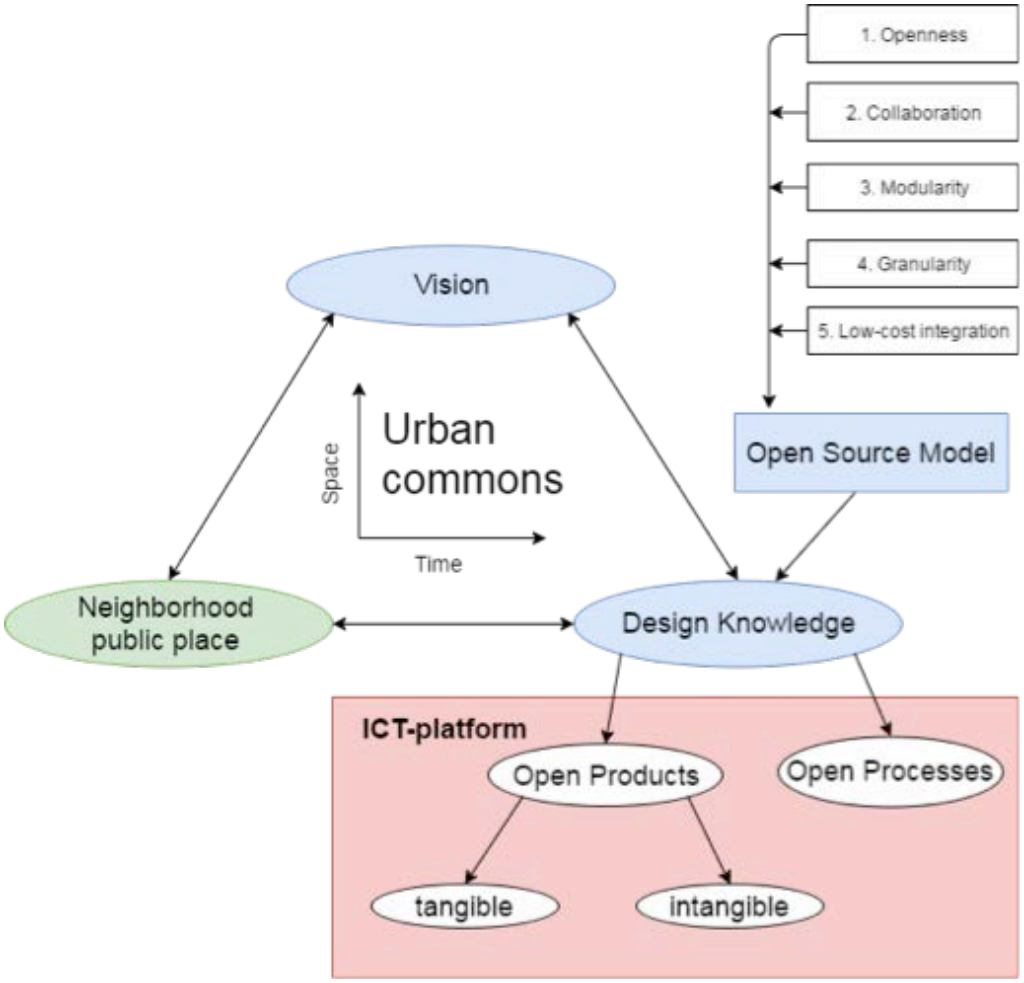


Figure 4 - Conceptual framework of Open Source Urbanism

This research takes an interdisciplinary perspective, combining computer science and social science. Contributions to academic debates will be made by theorizing on urban commons, a phenomenon that, despite growing popularity, is still undertheorized in many aspects. Moreover, the proposed research aims to combine the concept of urban commons with the open source model of decentralized co-production in the form of an ICT-artefact. No such adaptation of the open source model has been made so far, although some scholars have argued for its possibility and even its necessity for increasing grassroots initiatives in urban development.

Facilitating Sustainable Community-Based Urban Governance Systems

PhD student
Arthur Feinberg

Cities are presently hosting more than half of Earth's population, with their related anthropogenic greenhouse emissions and strong social issues such as spatial polarisation, social equity and well-being. Most current scientific work focuses on smart cities and the technological and economic opportunities they offer. However the social side of city transition is often neglected. Many cities flourish with community governance, probably in response to a deficient representative democracy when dealing with local issues. An emergent practice – "shared resources in an urban context" (Foster and Iaione 2016) – is the collective management of urban commons by local urban communities. However very little theory, if any at all, has been developed on urban commons and especially their governance.

This project aims to provide more theoretical background and practical tools. Elinor Ostrom's (2009) Social-Ecological Systems (SES) framework offers a very useful list of variables to frame urban commons community governance systems and include them in their natural environment. This framing requires understanding the institutional diversity in cities, along with possible material and energy flows. The overall methodology to analyse the feasibility of urban-commons community governance (UCCG) follows the three levels of analysis proposed in the book Working Together (Poteete, Janssen, and Ostrom 2010):

i. individual human behaviour
ii. factors affecting individuals' willingness to collaborate
iii. social-ecological context

This project will

1) study people's incentives to enter a scheme of collaboration,
2) identify the institutions in place and how roles should be distributed among the involved entities and with what level of autonomy,
3) test the effect of communication technologies on the ability of such systems to thrive and
4) evaluate the socio-ecological impact of such bottom-up initiatives.

After a thorough literature analysis empirical knowledge will be gathered through two different European Online Community Platforms (OCP), used as an enabling communication technology. In parallel quantitative data will be collected from case studies located in Rotterdam, Paris and Bologna. This will serve as input to build an Agent-Based Model (ABM) which will enable testing various hypotheses in order to both understand the dynamics of institutions and social structures and evaluate their resilience.

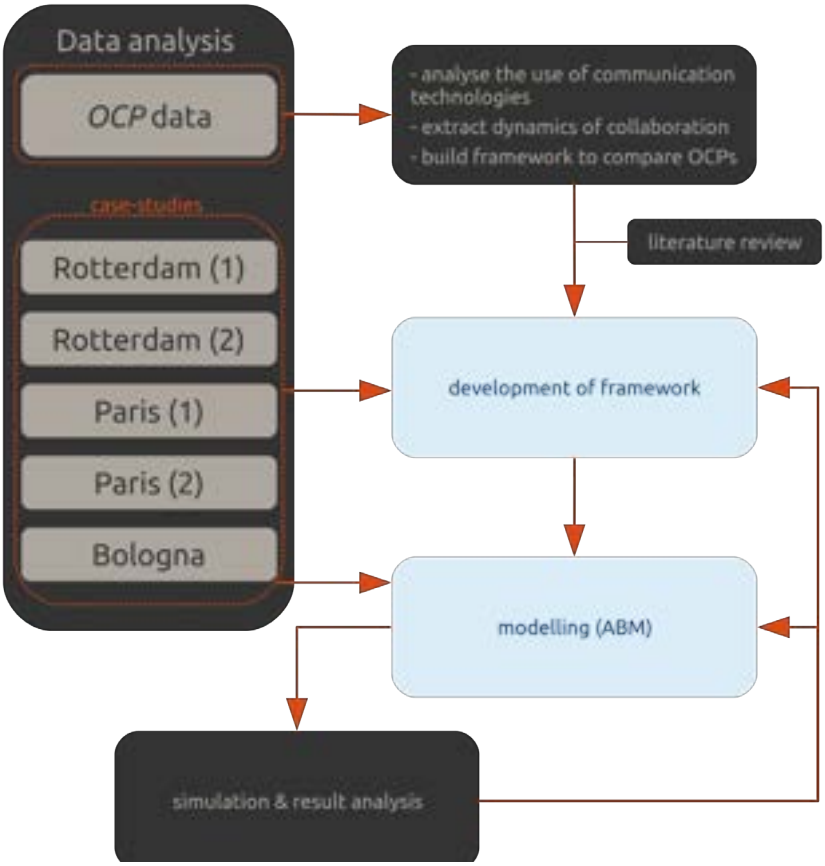


Figure 5 - Diagram of the research approach

The final output of the project is an ontological framework that shows the dynamics of urban commons community governance (UCCG) systems. It will analyse people's incentives to cooperate, the typical bonds between formal and informal networks, and discuss the effects of the inclusion of local businesses on the ability of bottom-up initiatives' to thrive.

Aside from reinforcing theoretical foundations on the urban commons, the project aims to provide understanding of community governance dynamics, independently from social-economical contexts. The resulting ABM can be used to create guidelines for successful future bottom-up initiatives and community governance. It also intends to computationally validate Ostrom's design principles for the co-management of the commons, which were induced from examples.

Policy Process Theories and Agent Based Modelling

PhD student
Amit Ashkenazy

Recent advances in complexity theory and political science have led to a growing recognition of their inter-connections. Departing from the traditional view of policy as a top-down instrument controlled by one central authority, it is increasingly being described as a self-organization process in which self-conscious actors play different roles. Following this recognition, there is a need for better tools to analyse policy problems, using more advanced methodologies that can reflect the heterogeneous preferences and non-linear interactions involved in the policy process, such as agent-based models (ABMs).

While ABMs are already being used to produce insights to inform public policy, the process of how certain policies come to be often remains implicit within model design. Models typically assume a certain policy was assigned, and then examine its effects on different agents and the environment. In modelling terms: there is an insufficient endogenous representation of the policy process within agent-based models.

This project argues that policy process theories can become the basis for creating better informed ABMs: models that make the policy process endogenous and explicit, reflect the complexity embedded in policy making, and rely on established causal relations to describe the policy system at hand. Such models can support policy practitioners in designing more resilient policies, and provide policy scholars a useful tool to examine the inner workings of the policy world.

The main research question is:

"How can policy process theories' conceptualization and formalization improve policy analysis in a complex systems paradigm, explicitly and endogenously simulating policy formation?"

The project further elaborates a set of epistemological questions such as

- How is policy described and captured in terms of complexity theory?
- What are the advantages and disadvantages of using agent-based models to simulate the policy process, and when is it appropriate?

- Can ABMs overcome the inherent “unknowable” facets of the policy process, and is this challenge unique to computer simulation of policy?
- What efforts have already been made to endogenously integrate insights and theories from political science and policy analysis into agent-based modelling?

An additional set of operational questions is also raised:

- Which policy process theories are most compatible with complexity theory, and with agent-based model design?
- How can the rationales and behaviours described in policy process theories be translated into agent-based models?
- What information is required to build an ABM with endogenous representation of the policy process in varying degrees of specification and granularity?
- What is the most cost-effective approach for integrating policy emergence in ABMs?
- Does policy process simulation affect the outcomes of ABMs aiming to capture energy systems, mobility systems, and their transformation?
- What is the additional value that policy process simulation adds to the modelling effort?

In order to meet the research goals, so far a review of existing policy-centric agent-based models was conducted, policy process theories were chosen that are compatible with agent-based modelling, a meta-model was created that uses a common language for each of the theories, the meta-model was implemented in a Netlogo code, and the resulting model was used in several case studies relating to environmental, energy and smart city policies. Finally, the project will develop a methodology to guide modellers and policy scientists in how best to use and expand the model in the future.

Promoter: Paulien Herder

Daily Supervisor: Igor Nikolic

Energy Resilient Self-Organized Communication Networks

PhD student
Indushree Banerjee

The power outage in India in July 2012 left more than 700 million people without electricity and caused the failure of all major infrastructures. Base stations and access points of the backbone infrastructure for mobile communication networks were left without power for days. This resulted in mobile communication being congested, unreachable and useless.

Similarly, in November 2012, as Hurricane Sandy made landfall in the United States, wireless communications coverage in the western half of the Rockaway Peninsula, in New York was almost non-existent. Communication providers struggled for weeks, as more than 300 (wireline) offices were flooded and around 25% of their wireless towers were either uprooted or severely damaged. As one-fourth of the infrastructure became unavailable, sudden surge in traffic (or flash crowds) pressured existing communication infrastructure and eventually made them crash.

Such disrupting events have accentuated the vulnerability of infrastructure-based communication networks and drawn attention towards the need to design infrastructure-less communication networks. The literature has focused on utilizing the wireless capability of end-user devices (e.g. smart phones or tablets) as an approach to do this. In this approach information exchange between mobile phones does not require a base station or tower. Instead mobile phones use their inbuilt wireless interfaces, such as blue-tooth and Wi-Fi, to form direct communication networks on-the-fly.

As the use of mobile phones skyrockets, designing mechanisms that allow the formation of an on-the fly network during disrupting events becomes a possibility. Besides, their widespread reach in remote locations makes them an easily available solution for communication. Further, these mechanisms can be beneficial in many developing countries, which always lack infrastructure and have region specific pockets of zero network connectivity.

Using mobile phones to form infrastructure-less on-demand wireless mobile ad-hoc network (MANET) however also presents certain challenges. To work in an infrastructure-less mode phones need to route information instead of base stations. Routing, sending, receiving and relaying information increases the energy consumption of participating nodes. However, phones have limited battery life and therefore cannot keep doing this for a longer period of time.

Thus specific mobile nodes may run out of battery and eventually leave the network. This sudden removal of nodes causes segmentation of the network and affects the robustness required to support connectivity for a larger area. This can inevitably impact the performance and longevity of the overall network. Additionally, to conserve energy, individual nodes may leave and or start dropping messages thereby impacting reliability of message delivery. Furthermore this problem can affect the scalability. Scalability determines the number of mobile nodes that can participate or be benefited by the network without affecting the performance. Lack of thresholds and limitations for energy constraint nodes affects the quality of service and prevents the formation of a scalable communication network.

To mitigate these challenges and to design a robust, reliable and scalable infrastructure-less mobile communication, energy resilience needs consideration. So far this has not been investigated. This project looks into the many trade-offs involved between network adaptivity and energy consumption. A conceptual model is designed to study these trade-offs, designing and comparing different protocols and mechanisms that allow mobile nodes to decrease their resource consumption or maximize their battery life by adapting their routing behavior..Routing is adapted based on individual nodes resource constraints and surrounding parameters. Furthermore the project investigates if designing adaptive, energy-efficient mechanisms or communication protocols leads to a robust, scalable and reliable communication network.

The mechanisms and protocols will be based on the property of self-organization for designing distributed adaptive communication protocols that will run on mobile nodes as software agents. Once deployed in a given environment (infrastructure-less resource constrained) it will self-organize and adapt in a decentralized mechanism to meet a global emergent functionality of a bigger connected network.

CVs

Amit Ashkenazy

Originally from Israel, Amit specializes in environmental policy and its application on local, national, and the international arena. Before commencing his PhD at TU Delft, Amit graduated a master's degree in environmental management from Yale University, and has worked as Director of the Social-Environmental Caucus in the Israeli Parliament. Amit has gained years of experience in research and consulting to government ministries, foundations and scholars on matters of environmental policy and sustainability initiatives. His PhD studies on simulating policy emergence is supervised by Dr. Igor Nikolic and Prof. Paulien Herder at the Energy and Industry section.

Indushree Banerjee

Indushree Banerjee is a postgraduate from the University of St Andrews, UK and specializes in Networks and Distributed systems. Originally from India, she graduated from West Bengal University of Technology in Computer Science and Engineering. She has worked as a Network engineer and as a senior Web developer previously. Gathered research experience as an assistant and published work on immersive learning through 3D virtualization, disaster management using wireless technologies, scripting languages for simulated environments and on network resilience and SLA. Her current research interests are catered around facilitating network resilience for the sustainable development of society.

Amir Ebrahimi Fard

Before joining Faculty of Technology, Policy and Management of TU Delft, Amir did his BSc in software engineering and MSc in business and economics. He is highly interested in modelling social phenomena using mathematics and data science which is one of his most important reasons for joining to NervousNet. Now, Amir is doing his PhD under supervision of Dr. Scott Cunningham, Prof. Bartel Van de Walle and Prof. Dirk Helbing in the broad topic of rumour studies.

Farzam Fanitabasi

Farzam is a PhD candidate at the faculty of Technology, Policy and Management (TPM) of Delft University of Technology (TU Delft). He obtained my M.Sc. in Information Technology Engineering from Sharif University of Technology (Iran) in 2015 and has been at TU Delft since May 2016. Currently, he is part of the TU Delft NervousNet team in collaboration with the team at ETHZ. His research interests involve distributed algorithms, reputation systems and their adoption in participatory sensing applications, and new communication paradigms such as fog computing. He is currently researching the adoption scenarios and novel algorithms for providing a web of trust as well as a reputation score in highly volatile and mobile applications, such as participatory sensing.

Arthur Feinberg

Originally from Grenoble (France), Arthur completed his BSc and MSc in Environmental Sciences and Engineering at the Swiss Federal Institute of Technology in Lausanne (EPFL). He worked as a Research assistant at the EPFL on novel usages of a snow cover model. At the University of Utrecht he developed practical methods for evaluating the biodiversity of Dutch grasslands. He acquired a growing interest for Big Data and online platforms to engage local communities towards the protection of the biodiversity while working 6 months as a Technology Developer in an ETH Zurich spin-off. He is now a PhD researcher at the Energy & Industry section, Faculty of Technology, Policy and Management at Delft University of Technology.

Xavier Fonseca

Xavier Fonseca is a researcher and PhD candidate at Delft University of Technology. His current research covers serious game design for social impact in several problematic neighbourhoods of the Netherlands. Previously, he did research on high-performance computing (in medical applications), and embedded software in the Internet of Things. His professional experience abroad covers Portugal, India, Germany and the Netherlands, from which steams an extensive professional network.

Dirk Helbing

Dirk Helbing studied physics and mathematics at the University of Göttingen. He completed his doctoral thesis at Stuttgart University on modelling social processes by means of game-theoretical approaches, stochastic methods, and complex systems theory. In 1996, he completed further studies on traffic dynamics and optimization. In 2000 he became full professor and Managing Director of the Institute for Transport and Economics at Dresden University of Technology. Helbing was elected as a member of the German Academy of Sciences Leopoldina in 2008 and of the World Academy of Art and Science in 2016. In January 2014 Prof. Helbing received an honorary PhD from TU Delft. Since June 2015 he is affiliate professor at the faculty of Technology, Policy and Management at TU Delft, where he guides the PhD school in “Engineering Social Technologies for a Responsible Digital Future”.

Rijk Mercuur

Rijk Mercuur has a bachelor’s and master’s degree in Artificial Intelligence. He graduated on using agent-based simulations to get insight in the choice to eat vegetarian. His research focusses on bringing together computer science and social science. Before Rijk became a PhD student at TU Delft he worked as a data scientist at the municipality of Utrecht, The Netherlands.

Sergei Zhilin

Sergei Zhilin is a PhD researcher at the Faculty of Technology, Policy and Management of Delft University of Technology, at the Policy, Organisation, Law & Gaming section. Sergei holds an MSc-degree in Computer Science and an MSc-degree in Urban Studies. His research focusing on self-organizing communities involved in bottom-up urban development. Before Sergei became a PhD researcher at TU Delft he worked in several software development companies as a web-developer and a CTO.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