

The Neighbourhood Game

From Behavioural Economics to Urban Planning

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Abstract—The rapid advances of information and communication technologies (or ICTs) and the mass online participation have increased the expectations for the long awaited visions of e-participation and e-democracy. However, there are still many challenges that need to be addressed related to privacy, data ownership and control, and various types of digital divides. Perhaps the most fundamental requirement is the need for information exchange between parties that do not necessarily share common interests, education, and cultural backgrounds. To achieve this, ICT could significantly help if designers understand in depth the way technology affects behaviour in the evolving hybrid (virtual and physical) space of modern cities, and communities are empowered to choose the tools that are most suitable for their environment and configure them according to their own values and objectives. In this paper we introduce a research framework connecting two relatively remote until today disciplines, namely behavioural economics and urban planning, through the mediation of computer science. More specifically, we describe a long-term social learning process evolved around a configurable ICT framework, the NetHood Toolkit, which will support a wide variety of hybrid interactions between people in physical proximity. The definition of a specific set of information sharing games with various configuration options can then form the basis for a real life experimentation process with potential benefits both for understanding human behaviour and for reaching important social objectives.

Keywords—*Interdisciplinary research; hybrid realm; social software; information sharing; behavioural economics; urban planning; civic engagement.*

I. INTRODUCTION

Today the information and communication technology (or ICT henceforth) is creating a rich virtual space that overlays our physical world. The numerous individual decisions of people residing this hybrid space influence its morphology. Thus social sciences, in particular those aiming to understand human behaviour, need to study this new *hybrid realm*, i.e., virtual and physical, and especially how the new institutions and design options introduced by technology can contribute to, or also may hinder, the construction of a democratic society. The key premise of this paper is that, to build an understanding of this new environment, appropriate research needs to integrate interdisciplinary knowledge from behavioural and social sciences, and to structure a learning process between theory and practice that is adapted to the new requirements.

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Behavioural (or experimental) economics¹ and urban planning are two concerned disciplines that perhaps lie at the two extremes in the spectrum of possible methodologies and objectives. On the one extreme, behavioural economists are very ambitious amongst scientists in trying to identify the most fundamental aspects of human behaviour, precisely those that are the most independent of culture, education, and other contextual variables. To achieve this end, they employ statistical arguments based on data produced through reiterations of carefully designed, but mostly artificial, experiments applied in different settings. This process has led recently to some robust results, although there is still some scepticism and debates on their level of generality (see for example the debate between Binmore and Shaked [12] with Fehr and Schmidt [25]). On the other extreme, amongst social sciences urban planning is one of the tightest to the practical world. Planners are often asked to propose solutions, here and now, for real problems whose implementation can affect dramatically the future [29]. Decision-making processes are subject to numerous hard constraints, conflicting objectives, the challenge to aggregate individual choices into collective decisions, the unpredictable role of nature, and so forth.

The contribution of this paper is a description of an interdisciplinary experimentation framework where these two disciplines of social sciences can interact in a productive way, and contribute together to the materialization of the promises of a more democratic and inclusive society, that ICT may facilitate with its immense capabilities in collecting, aggregating, and filtering information.

According to John Dewey, “Democracy must begin at home, and its home is the neighborly community” (cited in [29], p. 193). Indeed it is the hybrid space of modern neighbourhoods that we propose as the common living laboratory where experimental economics, urban planning, and computer science can interact toward the establishment of a social learning approach for bringing knowledge to action, and vice versa, under the premises of an informed practice; Fig. 1 (p.3) depicts a simplified view of the interactions envisioned, analysed in more detail in Section IV. Here, a neighbourhood is defined as a specific geographic location where a limited number of people are in close physical proximity but not

1 Camerer and Loewenstein [13] describe the differences between the fields of behavioural and experimental economics as far as their experimental methodologies are concerned. For the level of discussion in this paper these differences are minor and in the following we will use both terms interchangeably.

necessarily sharing the same interests, culture or even language. This definition includes both traditional city neighbourhoods but also "ad-hoc" neighbourhoods of people in-habiting the same public space for a certain period of time like a train, a public square or a park.

The core characteristic of social learning, according to John Dewey and others, is the continuous feedback loop between knowledge and practice. For this, the main criticism of Friedmann (see [29], Chapter 5) refers to the inherent assumption of a benevolent "Administrator of Social Change", to the natural social friction that resists change, as well as the material and psychological investments required to circumvent that, and finally to the power of expertise that could be used to manipulate decision-making. We propose to address these valid challenges by building a flexible ICT framework, which will support different variations of a *neighbourhood game*, and allow local communities to choose the configuration options that match their values, requirements, and objectives. This framework, as a product of the novel available technology acting in an evolving hybrid social realm, gives a new opportunity to address Friedmann's critique through spontaneous, flexible, and bottom-up uses of the conceptual and practical tools to be provided. It could play the role of a global shared laboratory for learning to exchange information, accept diversity, deliberate and produce knowledge at the local level, which can then form the basis for addressing more complex problems at higher levels.

To increase the chances for success it is important to build an environment that allows the exchange of experiences and best practices. This paper describes a methodology for studying human behaviour in various scenarios, by comparing the outcomes of simple, but real, ICT-mediated information sharing and other *games* to be played in different neighbourhoods across the world. Similar games, such as the public good provision, have been extensively studied in the field of experimental economics to verify (or not) some fundamental assumptions, like this of rationality and self-regarding preferences, made by models of human behaviour used in various disciplines [13][31]. But the neighbourhood game is not an artificial game. It is a *real life* game whose properties are encoded in the design options of a dedicated ICT framework, the *NetHood ToolKit*, which will be extended according to the outcome of different game instantiations.

Computer scientists from the networking field have been trained to bridge gaps between theory and practice using a sort of social learning process around the design of the most influential artefact produced by this field, the Internet. Clark et al. [16] argued eloquently in favour of the "design for tussle" principle, responsible for the distributed Internet architecture, according to which network designers should avoid to implement hard decisions in the network core, allowing it to adapt according to different social or economic conditions, and other forces (see also [45]). As this new complex organism is growing practically uncontrolled, new theories are required to understand the laws of the Net, and the behaviour of people while interacting with it and through it [66]. Especially in the case of peer-to-peer networks formed as Internet overlays, like in file sharing, and wireless technology, which enables self-

organized user owned networks (e.g., wireless community networks [15][69]), the concepts of rationality, altruism and cooperation are central since the very existence of the network depends on individual contributions in terms of computing resources, time, and content. There is a constantly growing literature on the economics of networks and the required incentive mechanisms for encouraging cooperation, most of which follow the rationality assumptions of the neoclassical economics (see [3][4][5] and references therein).

When one wishes to stimulate more intrinsic, social, motivations for participation and collaboration the role of the user interface becomes critical. Then research disciplines like Human-Computer Interaction (HCI), Computer-Mediated Communication (CMC), and Computer Supported Collaborative Work (CSCW) take over the task of understanding and influencing human behaviour in online environments (e.g., [10][70][71]). But as the ICT technology advances and the virtual space overlays more closely the physical one, these disciplines are becoming more and more interdisciplinary in nature and play an important role in new emerging fields like urban informatics, community informatics, and ubiquitous computing (e.g., [21][28][9][15]).

Our core objective is to encourage members of diverse local communities to share information, and participate in activities toward achieving common goods, which may range from service exchanges to deliberations about important issues and shared concerns. We wish to follow the "design for tussle approach" followed in the case of the Internet itself but this time putting in the centre of the socio-economic tussles our NetHood Toolkit, which will be able to adapt to the specific environment and selected social objectives. As Hal Varian suggests [77], we intend to start with the simplest possible game: the one that invites people in proximity to "meet their neighbours", which is a fundamental requirement and the very first step toward more ambitious interactions related to consensus-building and decision making.

In the following we argue that bringing together knowledge and methodologies from the field of experimental economics and urban planning can help us to achieve this social objective (in practice), and at the same time provide invaluable data for understanding and modelling some fundamental aspects of human behaviour (in theory). We build our argument in steps, going first through the different veins of research involved in our framework and addressing the open challenges and opportunities that these scientific fields are facing today. We then describe how computer science can mediate between these two highly diverse research disciplines toward high-level scientific objectives, such as the understanding of human behaviour when exchanging information in hybrid environments, and traditional social objectives, such as the increase of social capital and civic engagement.

Note that our "real life experimentation" methodology shares some of the characteristics of similar approaches like the action research paradigm [37], living labs [61], and other co-creation models [58]. But it has also some unique elements, such as the selected combination of scientific and social objectives, and the empowerment of the users, which we further discuss in Section IV.

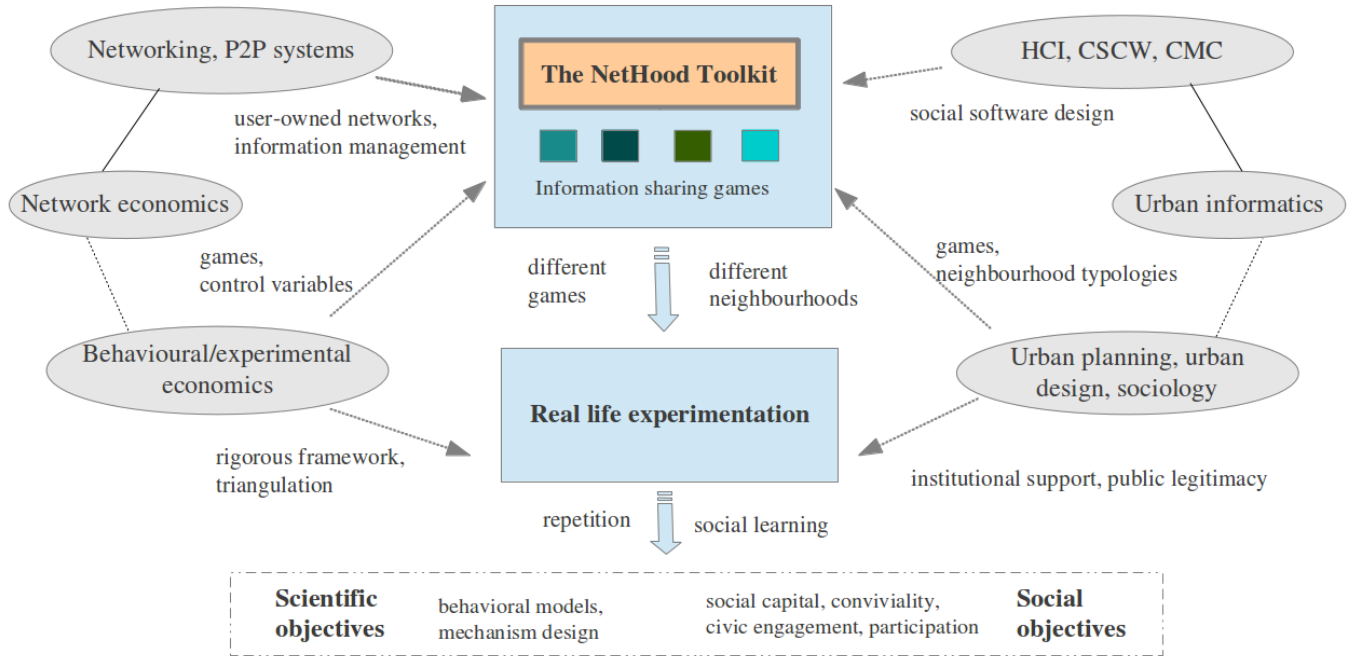


Figure 1. The NetHood interdisciplinary research framework (simplified view)

II. BEHAVIOURAL ECONOMICS

Behavioural and experimental economics are relatively new disciplines that build on concepts from game theory and, with the help of a rigorous experimental methodology, study the fundamentals of human behaviour in situations of conflict between personal and social benefits. For example, such experiments wish to test whether in a public goods scenario, in the absence of any external mechanism all participants will choose to “free-ride” [48] or in a common-pool scenario they will choose to overutilize the common resource [63]. The ultimatum game is an interesting artificial game which captures the notion of “altruistic” punishment, the desire of people to punish non-cooperative, selfish, users at their own cost [24].

After numerous experiments around the world, researchers in this area have managed to demonstrate through strong statistical evidence that people have “other-regarding preferences” built in their decision making process, challenging the widespread assumption of the inherently self-interested *homo economicus* [31]. By varying carefully the institutional environment, they can study in isolation the effect of different factors, e.g., communication, trust, and social norms, on the emergence of altruistic behaviour. In this manner experimental economics studies produce invaluable insights of the nature of human behaviour, but also regarding the direction of action to be taken to improve the level of cooperation in our societies. For instance, the 2009 Nobel Prize winner Elinor Ostrom and her colleagues [64] have identified the conditions under which certain institutions can help communities to employ a sustainable use of their common-pool resources, defying

Hardin’s pessimistic prediction of the “tragedy of the commons.” [34]

A. ICT-based Experimentation

The main weaknesses of the experimental economics methods relate to the fact that most experiments are based on artificial games played in the laboratory, typically by students offered monetary incentives. The careful definition of these games, their continuous repetition in different environments, and in some cases the availability of funding, have helped this research community to produce robust results for certain games, such as the ultimatum and the voluntary provision of public goods. But there is still significant room for improvement especially for more complicated games.

The ICT revolution brings today the potential for more realistic and low-cost experimentations. On the one hand, researchers have access to a much wider population of potential subjects for their experiments, either on custom experimental sites or using sites like the Amazon’s Mechanical Turk, games-with-a-purpose, or in general what has been recently called “technology-mediated social participation systems” [71]. Such online behavioural experimentation suffers from limited control over the attention of the subjects, but minimizes the contextual factors that affect behaviour. Nevertheless these are still artificial environments, which are not adequate to study more complicated cooperation problems like public deliberations over the common good.

Another attractive option is the deployment of *real* web sites. The fact that online interactions can be recorded while users are often behaving unbiased, and actually unaware of

being observed, has indeed offered a great new opportunity for researchers who can try to set up sites that can offer value to Internet users and attract a critical mass. Today there are many research groups that create such websites with real value for users, with the goal to study their behaviour online. For example, the *GroupLens* group has built the *MovieLens* recommendation site, in order to experiment with strategies for motivating contributions studied in the field of social psychology, e.g., goal setting and self-efficacy [10]. To perform in a more controlled experimental environment, other researchers have built a successful website on health issues [14], which was purposefully designed to study the role of the network of ties structure in information dissemination, ensuring the anonymity of users and forbidding any additional social interaction that could influence the results.

Note that in principle every successful website can be used as an invaluable source of data for studying human behaviour, like the numerous studies on the motivations behind the contributions to *Wikipedia* based on the history of the articles (e.g., [47]). This is especially so for the site owner, who has access to the exact information of all activity performed on the site and thus, if there is enough activity, can easily measure the effect of small variations in design choices (what is often called A/B testing). If carefully done, such studies could lead to very robust causal relationships between design choices and behaviour. Here lies the tremendous power of corporations like *Amazon*, *Facebook*, and *Google*, which can perform studies on human behaviour of unprecedented scale and realism. However, this knowledge is today kept private and is already being used for commercial objectives or even political ones.

Nevertheless, this raises some important concerns related to privacy (we return to this later in Section III.A) but also to the openness of the acquired knowledge. Although there are voices from scientists requesting access to this information [39], it is unlikely that this will happen soon, not only because it is against the commercial interests of these corporations, but also because there are serious privacy issues at play [19]. Nevertheless, even if this huge amount of data were publicly available for researchers, the object of study would be limited to the people's behaviour in the specific virtual environment created by the professional software designers of *Facebook* and *Google*. This means that there would be no opportunity to try alternative options, a necessary process to make scientific sense out of this huge amount of information and design space.

So a big challenge is to provide online systems that generate real value for its users, and are transparent regarding the type of data collection, while they allow users to easily opt out and, most importantly, guarantee the privacy conditions for the shared information and the data collected. Of course, this sounds like a utopian objective, and for such a website or group of websites to acquire the necessary critical mass of users, while competing with corporations like *Facebook* and *Google* seems like a lost battle. However, we have many examples of grassroots initiatives that managed to design highly competitive products, for instance the *Linux* operating system, which prove the possibility of open and safe collective endeavours. Moreover, despite the numerous efforts in the past (*i-neighbors*, *Everyblock*) and more recent dynamic initiatives like *NextDoor*, which on February 12th 2013 announced that it

has raised \$21.6 million (www.reuters.com), there is still a lot of room for innovation in the area of hybrid neighbourhood communities.

In context, our strategy in producing an ICT framework for research purposes is to follow an incremental approach within a long-term not-for-profit project, and to make sure that each of the individual efforts will be designed in ways that produce value for a community, even if this group of people is the only one having access to the deployed system. The experimentation methodology proposed here brings a novel aspect, which could have significant impact over time. For local communities at different scales, urban planners, public authorities, even researchers who want to do artificial experiments with real users, the experience gained from our experimental efforts can add to the improvement of our NetHood Toolkit, which will then offer a low-cost solution to build and operate local hybrid communities. Then the willingness of these groups to partly share the data produced in a common repository would provide an invaluable source of information for our understanding of the social impact of social software and its informed design. It is very likely that this information will respect the privacy requirements of its producers, and will be freely available to the scientific community, unlike the datasets analysed internally by corporations like *Facebook* and *Google*.

B. Information sharing

The majority of cooperation games studied in the experimental economics literature concern the provision and allocation of *resources*. Today information is one of the most valuable resources but the underlying incentives for producing, sharing, and consuming are much more difficult to model and analyse. For that we witness a fierce battle between the market and the "commons" for the rights to own and share it (see Benkler 2006). While the Internet community has some notable successes in collaborating toward a common outcome at a global scale under the peer-to-peer paradigm, this is not the case at the more local levels. The extreme capabilities of ICT to bring together people living in distanced locations, based on a common interest, reduce significantly the motivation to face and deal with diversity in physical proximity. However, sharing information with neighbours is a critical requirement for creating convivial physical, and not virtual, communities [76] and for a more informed and cohesive participation in public affairs [6].

In our view, this situation brings the game of information sharing at the local level in the front-line of the challenging cooperation problems that western liberal democracies face today. The flexibility of ICT to employ a wide variety of information management rules, and to mediate in different ways between the game players, creates a novel environment with new rules and potential "strategies." Hence one of our objectives is to study in a rigorous way this new *neighbourhood game* that can shed light to the fundamental aspects of human behaviour in the hybrid realm, which was previously impossible to achieve due to the complexity of the involved contextual variables. In addition, and in parallel, it can help the achievement of social objectives discussed in the next section.

The idea here is to extend the notion of the standard public good provision game studied extensively in the experimental economics literature, and adapt it to a simple information-sharing scenario. Of course, the analogy is interesting when there are no network effects [43], and when information revelation is not strategic [17] as in the case of consensus-building and/or decision-making scenarios. Otherwise the resulting game becomes much more complex and difficult to analyse using simple models. For non-experts in the vast field of information economics, Lord [53] provides a nice overview of such strategic information games, seen from the point of view of an urban planner and thus very relevant to our interdisciplinary perspective.

The model that we will use as our starting point assumes that information sharing incurs a certain cost only because of the effort required to generate information or due to privacy concerns regarding its exposure to third parties. In this sense our take is closer to work on privacy economics; see [1] for a short overview on the behavioural economics of privacy, and [50] for a related experiment. What makes the game different than the simple public good provision one is that in reality there exist people who derive significant value from self-exposure, and ignore the corresponding costs. When there are numerous such people in the game, instead of leading to a more desirable equilibrium, information revelation can lead to a "parallel" common-pool game [64], due to information overloading.

The most obvious information sharing activity of this type in a traditional or ad-hoc neighbourhood is the simple "meet your neighbour" game, in which people are invited to contribute personal information to the "community identity pool," to introduce themselves to their neighbours, and so the outcome being a collection of local identities as a public good or a shared collective identity. Additionally, the information sharing game could refer to the collection of information about a set of external elements. For instance, the neighbours may be asked for reviews of neighbourhood places, or for more sophisticated data including the collection of information about the social life in the neighbourhood, while respecting others' privacy [6]. New elements brought by technology include, among many others, the possibility for anonymous communication, the rich multimedia options and the ability to rate and designate artificial constraints, but also, in our scenario, the presence of hybrid elements connecting the virtual with the physical space.

How can one characterize the "selfishness" and "altruism" in this context? Is there any general lesson that one can learn to design social software that can improve cooperation in such simple scenarios? Can we devise a formal definition of self-interest and altruism in the game of information sharing, and the identification of the contextual variables and institutions (i.e., the rules of the game) that could lead, or not, to increased levels of "cooperation"? Answering these simple questions will provide a basis for building an understanding of more complicated and competitive games related to conflicting interests in decision-making processes that are central to the e-democracy project.

To simplify the social exchanges and isolate the most important factors that influence behaviour in the neighbourhood are among the most important challenges. However, this may be a long process, and its success will depend on the number of different experiments that the research community will be able to perform in a coordinated fashion. For instance, Levitt and List [52] show how the experimental research community slowly achieved today's level of formalization and collaboration, yet over time enabling some robust results and interesting cross-cultural comparisons across the world. In the case of information sharing rigorous experimentation is more difficult to achieve and most efforts today are not based on formal models; see for example the work of Leslie et al. [50], for the context-specific privacy concerns and Rains [72], on the effect of anonymity.

Note that although we do not share the ambition of experimental economists whose ultimate goal is to identify a universal equation that captures human motivations, even if it is for a specific scenario like the ultimatum game (e.g., [24]), we do believe that it is very valuable to pursue such objectives. The reason is that even if the outcome may not qualify as the absolute truth, in trying to eliminate contextual variables that can hide what is general and universal one can identify important variables and causal relationships, revealing shared preferences, which become potential targets of design decisions and institutions building toward the common good. In this sense, economic models may be regarded as a formal way to improve the methods of action, and produce convincing and valid arguments within a social learning process.

III. URBAN PLANNING

Urban planning generates guiding knowledge for concrete visions of the future through the integration of various schools of thought in the social sciences and design disciplines. The planning expertise concentrates on practical challenges, and for instance, one of its constant focuses is to accommodate the growing urban population, together with the increasing diversity of interests, lifestyles and cultures in one locality. For that, the core "resource" is information, which becomes relevant for action if particularized within the local context. More importantly, the distribution of power and control over this information is a decisive factor within the planning process in general, and in particular, for beneficial outcomes in terms of quality of life and spatial appropriation at the community level. To address the increasing level of complexity and demand for engagement of citizens in decision-making processes, the concepts of participatory democracy and public deliberation at scale are in the front line (see for example [26][27][41][36]). Nonetheless, planning research requires appropriate ways to apply the existing methods of spatial investigation, as well as imagination in translating theoretical insights into action, and in designing empirical inquiry that can engage with the practical world.

A. *Participatory planning and civic engagement*

The tremendous capabilities of ICT for collecting, filtering, and processing information have generated many possibilities and promises toward the materialization of on-going planning objectives such as civic engagement and deliberations of public concerns. The concept of e-democracy, and visions of

augmented, smart or intelligent future cities dominate today the ICT-related research agendas of top universities across the world, as well as those of major national and international funding agencies.

To materialize this potential, numerous efforts are underway. Citizens' online interventions could influence governmental decisions of broad interest (e.g., *change.gov*, *gopetition.com*, *zebralog.eu*), as well as signal local problems concerning their everyday life in the neighbourhoods (e.g. *sourcewatch.org*, *fixmystreet.com*). The opening of the available government data around the world (*data.gov*), a part of the so called "open data initiative", is providing an additional degree of transparency, and is creating many opportunities for interesting services and applications.

In a decision making process, although such ICT infrastructures facilitate the information flow with the grassroots, they fail to provide either direct connections of these platforms with the physical settings or virtual spaces for social activities that are an important complement to user participation in the debates (see [15] for some exceptions). At present there are e-planning initiatives, which use privately owned and operated global online social networks like *Facebook* (see [23] and the example of Plaza Diaz Vález in [6]) or *Twitter* (for example *dis.urbaninformatics.net*) and try to take advantage of their popularity as platforms for social exchanges to engage citizens in participatory processes.

In parallel, there are many practical efforts for bridging the virtual and the physical and enable neighbours to meet, create social capital, and exchange services. For instance, generic platforms like *i-neighbors* in the US, or *peuplade* in France promote district-wide networking by inviting people to join a specific virtual neighbourhood of their city. Research work related to such communities is concerned mainly with the social impact in the neighbourhood in terms of social capital following on earlier experiments (e.g., [32] [33]). In practice, these platforms and many other proprietary small scale solutions mostly serve mainstream uses as announcement boards by a minority of enthusiasts, local advertising, or in the best case informal discussions about local issues. The result is that dominant social networks like *Facebook* and *Twitter* make these local sites appear as redundant today. However, we believe that they are not the right platforms to mediate for such sensitive, context-aware and inherently local activities. First, because of the tremendous power acquired over the hosted content raising significant concerns related to privacy and control [19][42], but also because of the uniformity of their design, which sacrifices diversity and identity for simplicity and efficiency.

So, even ignoring the issues of privacy and manipulation, the role of the social software in mediating democratic processes can be subtle yet critical, thus requiring informed and responsive design, adapted to the specificities of each environment. For instance, cyberspace places were imagined twenty years ago by William Mitchell as being constructed "virtually by software instead of physically from stones and timbers, and they will be connected by logical linkages rather than by doors, passageways, and streets", with the help of "bitsphere planners" ([57], p.24). Since then many studies

(such as [51][11][75], among many others) have highlighted the inherently interdisciplinary nature of software design, and its importance in shaping our society.

Today the "bitsphere planners" of our time are researchers of disciplines like HCI, CMC, and CSCW who have produced very helpful guidelines for building better systems, from virtual communities [70] to technology-mediated social participation sites [71], but also specific HCI artefacts, like the visualization of group participation based on the level of activity [22]. Until now planning experts have not been involved closely with the development of place-based social software. Although there is some research targeted to the specificities of the design of *place-based* virtual communities it originates mainly from fields closer to computer science (see [21][28]). However, the very idea of democracy depends on the exposure of people to other opinions and their ability to deliberate and make decisions, at least at a local scale. Systems like *Facebook* and *Twitter* owe part of their success exactly to their ability to facilitate interconnections of common interests across the world. Despite its importance, this capability generates the danger of creating virtual silos that reinforce disparities, and hinder people's disposition to accept and embrace diversity (see [59][65][2][18] for the importance of diversity and the possible positive and negative role of the Internet)

As Apostol, Antoniadis and Banerjee have recently argued [6][7], the collaboration between planning and computer science can be fruitful in both directions. First, planners could participate actively in cyberspace design, and evaluate its use and quality employing planning methods like Lynch's taxonomy of images [54], and Whyte's observations of social behaviour in public spaces [78]. Then, they could identify spatial elements through analogies between the virtual and the physical social environments, in order to derive alternatives for future (hybrid) spatial design [7]. Second, planners can collaborate with computer scientists to build intelligent social software that can contribute significantly toward improving the quality of the information from and to citizens. For example, the practice of *flânerie* in the physical and virtual space could be encouraged as a method to produce representative images of contemporary social life [6].

B. Conviviality and breaking the ice

In a multicultural city there are issues related to the limited choice of neighbours and possible cultural, ethnic, or ideological differences, which may lead to social exclusion or create tensions when it comes to sharing values and preferences. How can scientific knowledge, as well as researchers' engagement in practical activities in the city, work toward shaping convivial communities? Lisa Peattie defined conviviality as "small-group rituals and social bonding in serious collective action, from barn raisings and neighbourhood cleanups to civil disobedience that blocks the streets or invades the missile site" ([68], p. 246). To fulfil "the search for a space to deliberate about the common good" ([73], p. 341), and to accommodate civil and convivial diverse communities, planning practice must encourage deliberation of public concerns also in the hybrid environments.

The ICT can add to this practice by providing an online space for communication, information exchanges, and

ultimately deliberations of public concerns. The possibility to make contacts and engage in dialogue in the online neighbourhood community can motivate citizens to be more active in their neighbourhood (see the study by Harris and Flouch study that reports that “conversational democracy” in neighbourhood online networks may lead to civic action [35]). Seen from this perspective, online activity may help build social capital and add “eyes on the street” [44] toward enhancing neighbourhood conviviality, and that has become a reality in some hybrid spatial practices (Peuplade in Paris).

Moreover, within urban studies on spatial exploration, Kevin Lynch believed that the method to elicit personal spatial information from citizens through asking them to draw their own cognitive maps of the city has a principal value: to “break the ice” [55], in other words to engage people to talk about their environments in the context of their everyday urban spatial practice. Hence simple research inquiries on the neighbourhood “imageability” [54] are capable also to open communication processes that can strengthen social ties and neighbourhood conviviality, and further build a sense of shared urban community. It is possible that the same or similar effect would have the launching of a neighbourhood game as a scientific experiment inviting the residents of a small neighbourhood to participate, perhaps with the support of the municipality, acting this way as a “triangulation” element [78].

IV. AN INTERDISCIPLINARY RESEARCH FRAMEWORK

Playing with the title of a well-known work by Schelling [74], experimental economics study the “micro-motives” of humans while planning studies the “macro-behaviour” of complex ecosystems. In addition to the positive role of ICT in the independent agendas of these two fields, our proposed research framework can enable further productive interactions. First, behavioural economists can build on the institutional support of planners to produce a realistic experimental environment and use their experience in public deliberations to model interesting information sharing games. On the other hand, urban planners can benefit from the analysis of such models to build hybrid spaces that encourage people to participate and share information and treat behavioural experiments as effective “ice breakers” to transform today's apathetic neighbourhoods into places of conviviality and deliberation. In the following, we describe briefly four main components of our proposed research framework (see Fig. 1).

A. The NetHood Toolkit

Rather than performing bilateral interactions between different disciplines raising competition and often-questionable results (see [21], p.65-74), we propose to concentrate all the intended collaboration into a single artefact –the NetHood Toolkit– that allows its software and underlying network rules and functionality to be customized to a specific scenario. The exchanges across the different disciplines will then be mediated through this ICT framework.

The NetHood Toolkit is being developed as an ICT framework offering a rich set of configuration options at different levels. It will extend its functionality in a continuous loop between theoretical analysis, software design,

experimentation, and data analysis based on a) suggestions for appropriate configuration variables, b) the identification of trade-offs of possible values with respect to a list of evaluation metrics, and c) the definition of different neighbourhood games. We follow the Free and Open Source Software (FOSS) paradigm, which is transparent, and thus can build trust and prevent manipulative practices from authorities, provides cost-efficient customized solution for local communities, and enables a global social learning process based on experiences across the world.

Some important variables for which we wish to allow flexible customization options include the following:

- 1) **Context setup:** The type of place, location, number of people, demographics, time horizon.
- 2) **Framing:** The objectives of the game, its rules and process, use appropriate wording (templates will be available, which will be updated as more and more people get involved and share their experiences).
- 3) **Identity management:** User profile, representation, different levels of anonymity, roles.
- 4) **Content management:** Input constraints (e.g., size, rate, type of content), rating, filtering, and visibility of activity).
- 5) **Data gathering:** Information to be stored and shared for scientific or other purposes (with a selected aggregation level).
- 6) **Hybrid interactions:** Entry and exit points, templates for flyers and posters, functionality for organizing and reporting on physical meetings.

A key feature of NetHood is its capability to be run locally through the use of wireless technology, in isolation from the Internet, either as a dedicated infrastructure [69] or through ad hoc interactions [40]. This communication option can create feelings of ownership and independence, and ensure privacy and *de facto* physical proximity of participants [3]. Moreover it allows for cost-free solutions and immediate deployment, which is a critical requirement for most local communities. Finally, it enables the ubiquitous participation of all people in physical proximity through whatever device they carry, without the need to install a certain application, provide any credentials, or even have access to the Internet. They can just join the local wireless network and get redirected automatically to a local web service supporting the neighbourhood game selected and configured by an individual, a group of residents, or even a local authority (the municipality or even a railway company for the ad hoc scenario). This gives the ability to citizens to freely define their own neighbourhood games and, if they wish, become experimenters themselves, instead of simple subjects of experimentation, as in the case of living labs [61], or of information sources as in the case of citizen science [67]. As a result, the amount and the quality of data that can be collected over time may multiply significantly.

B. Economic Modelling

In order to be able to produce robust theoretical results from the experimentation process one needs to formulate

economic models that are simple enough to be studied analytically but expressive enough to give us some useful insights for the problem under consideration. These models will form the basis of the game theoretic analysis and verification through the statistical analysis of the data made available during the different experimentation phases. More specifically, we can use as a starting point an analogy with the public goods game studied extensively in the experimental economics literature, as discussed above. For example, we can assume that information contributed during a game incurs a personal cost (e.g., privacy) or benefit (e.g., self-exposure) with different weights for different people, while the collected information is valuable for everyone. More complicated games could also take into account the information overloading effects and try to capture this interesting difference between our information sharing with standard resource provision games.

Then, we can build on the idea of mechanism design for classic economic models [62] but extend them to include in the utility functions considered “other-regarding” preferences like in the experimental economics literature. To escape from the restrictions of the classic mechanism design we consider preferences as dynamic, subject to social or other motivations that in our case can be stimulated by specific design variables (a sort of “social mechanism design”). Then how different variables affect the outcome, and how generic the causal relationships are, should be studied through experimentation.

C. Qualitative analysis

An important contribution of urban planning is a comprehensive analysis of the conditions under which specific neighbourhood games can have positive social, political, or psychological impacts in different types of neighbourhoods. A first step toward this direction is to study the history of hybrid neighbourhoods around the world, and identify some important types of target neighbourhoods for NetHood experiments based on their size, diversity, existing institutions, pace of residence change etc. By analysing available data sets, personal online participation, and field research, we can draw insights on the online behaviour of users in this context in terms of anonymity, leadership, the formation of clusters, and the like.

The urban planning practical perspective on places and communities is also instrumental in defining appropriately the neighbourhoods and their limits, in the description of the environment and contextual elements that would characterize a certain game. In this context, it is important to study possible evolution paths for advancing from simple neighbourhood games to more sophisticated setups that encourage public deliberation respecting diversity and allowing all voices to be heard. For this, we will compare and contrast theoretical work on citizen participation (e.g., [73]) and deliberative planning (e.g., [27][41]) with the design and performance of various e-democracy and e-participation platforms (see objective II.A). This is meant to identify potential gaps between theory and practice, and possibilities for improvement in the context of the neighbourhood game.

Finally, analytic narratives, a rational-choice approach to explain political outcomes [9], will connect the outcomes of the games with knowledge from archival research and from

various field observations (it may be also information from written field notes, visual and audio records, cognitive mapping etc.). By employing rational-choice and game theory, the method proposes a way of extracting empirically testable, general hypotheses from particular cases. The results can then be both empirically relevant and theoretically sophisticated.

D. Real-life experimentation

The scientific objective through the interaction of the experimental economics and the urban planning disciplines is to build a conceptual framework used to help the selection amongst different versions of the neighbourhood game at a high-level, aiming to reduce the design space and the possibilities of success. It will include a functional classification of variables, their possible values in different real scenarios, and causal relationships between them, and evaluation metrics (e.g., [64], Chapter 12). The role of social learning is then to contrast and integrate the insights from qualitative analyses, the experimental results, and the economic models, and transform them to guidelines for design and experiment configurations.

Previous experience has shown that behaviour can differ significantly in different cultural and political environments (e.g., [38]), no matter how simple is the game to be played. In addition to the selected configuration of the NetHood Toolkit, and the definition of the high-level neighbourhood game, the “administrator” of a specific instantiation of NetHood needs to decide the duration, the bootstrapping strategy (i.e., how people will be invited to participate), and most importantly the “framing”, which has shown to play an important role in behavioural experiments (see [52]). Such decisions, some of which are listed above, will affect people’s participation in the experiment, while others might be found to influence their behaviour during the game; in the latter case, they will be included in the variables that need to be taken into account during the design of the neighbourhood game itself and the corresponding economic models.

A particularly interesting framing option is whether people will be invited to participate in a scientific experiment, from a simple questionnaire to a hypothetical scenario of social exchange, or just to play a real social game. In the latter case, it is more difficult to constrain the free variables and draw safe conclusions while it is not sure that the participants will be willing to share the data generated for scientific purposes. In the former case, it is more difficult to encourage participation unless if there is some external motivation provided by a local authority, which would play the role of the monetary rewards that are given to the subjects of behavioural economics experiments. Equally important is the decision on the level of anonymity. More anonymity can address issues of timidity and elicit more genuine behaviour, but at the same can also raise the feelings of insecurity and attract inappropriate content.

V. CONCLUSION

In this paper, we introduced a novel interdisciplinary research framework, responsible for supporting a wide variety of local interactions between neighbours. We are aware of the important difficulties that such an endeavour might face both in theory and in practice (see also [20]). However, the tremendous power of corporations such as Facebook and Google, that own

the software and the information exchanged online, while mainly commercial objectives orientate their action, make the “right to the hybrid city” advocated in this paper an urgent objective.

There are some new developments that make us optimistic. First, the experimental and behavioural economics methodologies have matured, and can be applied to model and analyse more sophisticated collaboration games, including the voluntary sharing of information, as a basis for more democratic and bottom-up decision making processes. Second, the technological digital divide is being closed in many areas of the world forming a hybrid space where we can explore real life case studies, and bridge the virtual with the physical space. Finally, the FOSS and creative commons paradigms are producing today impressive results in terms of information collection, knowledge, and tools that exploit efficiently our collective intelligence. It is critical to engage in this effort scientists from different research disciplines and address the important challenges through repetition, knowledge sharing, and collaboration.

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REFERENCES

- [1] Acquisti, A. 2010. From the Economics to the Behavioral Economics of Privacy: A Note. In Proceedings of ICEB.
- [2] An, J., M. Cha, K. Gummadi, and J. Crowcroft. 2011. Media Landscape in Twitter: A World of New Conventions and Political Diversity. In Proceedings of the Fifth International AAAI Conference on Weblogs and Social Media.
- [3] Antoniadis, P., B. Le Grand, A. Satsiou, L. Tassioulas, R. Aguiar, J. Barraca, and S. Sargento. 2008. Community building over Neighborhood Wireless Mesh Networks. *IEEE Society & Technology*, 27 (1): 48-56.
- [4] Antoniadis, P., S. Fdida, C.H. Griffin, Y. Jin, and G. Kesidis. 2012. Distributed Medium Access Control with Dynamic Altruism. In Proceedings of ADHOCNETS.
- [5] Antoniadis, P. 2009. Incentives for resource sharing in ad hoc networks: going beyond rationality. In Boon-Chong Seet (ed.), *Moble Peer-to-Peer Computing for Next Generation Distributed Environments: Advancing Conceptual and Algorithmic Applications*. IGI Global Publishing.
- [6] Apostol, I., P. Antoniadis and T. Banerjee. 2013. Flanerie between Net and Place: Promises and Possibilities for Participation in Planning. *Journal of Planning Education and Research (SAGE)*, 33 (1): 20-33.
- [7] Apostol, I., P. Antoniadis and T. Banerjee. 2013. Cyberspace design: a new challenge for planners. *ICE Journal of Urban Design and Planning*. DOI:10.1680/udap.11.00004.
- [8] Aurigi, A. and F. De Cindio (eds). 2008. *Augmented Urban Spaces: Articulating the Physical and Electronic City*. Aldershot, UK: Ashgate.
- [9] Bates et al. 1998. *Analytic Narratives*. Princeton University Press.
- [10] Beenen, G. et al. 2004. Using Social Psychology to Motivate Contributions to Online Communities. In Proceedings of CSCW.
- [11] Benkler, Y. 2006. *The Wealth of Networks: How Social Production Transforms Markets and Freedom*. Yale Univ. Press.
- [12] Binmore, K. and A. Shaked. 2009. Experimental Economics: Where Next?. *Journal of Economic Behavior and Organization*.
- [13] Camerer, C. and G. Loewenstein. 2003. Behavioural Economics: Past, Present, Future. In *Advances in Behavioural Economics*, C.F. Camerer et al. (Eds.), Princeton Univ. Press.
- [14] Centola, D. 2010. The Spread of Behaviour in an Online Social Network Experiment. *Science* 329: 1194-7.
- [15] De Cindio, F., Schuler, D. 2012. Beyond Community Networks: From Local to Global, from Participation to Deliberation. *The Journal of Community Informatics*, 8(3).
- [16] Clark, D., J. Wroclawski, K. Sollins, and R. Braden. 2005. Tussle in Cyberspace: Defining Tomorrow's Internet. *IEEE ACM Transactions on Networking* 13(3): 462-475.
- [17] Crawford, V., and J. Sobel. 1982. Strategic Information Transmission. *Econometrica* 50: 1431-1451.
- [18] Davies, T. and S. Gangadharan (eds.). 2009. *Online Deliberation: Design, Research, and Practice*. CSLI Lecture Notes.
- [19] Debatin, B., J. Lovejoy, A. Horn, and B. Hughes. 2009. Facebook and Online Privacy: Attitudes, Behaviors, and Unintended Consequences. *Journal of Computer-Mediated Communication*, 15(1): 83-108.
- [20] Dini, P., M. Iqani, and R. Mansell. 2011. The (im)possibility of interdisciplinarity: lessons from constructing a theoretical frame-work for digital ecosystems. *Culture, theory and critique*, 52 (1).
- [21] Dourish, P., and G. Bell. 2011. *Divining a Digital Future: Mess and Mythology in Ubiquitous Computing*. MIT Press.
- [22] Erickson T. and W. Kellogg. 2000. Social translucence: Using minimalist visualizations of social activity to support collective interaction. *ACM Transactions on Computer-Human Interaction*.
- [23] Evans-Cowley, J. 2010. Planning in the age of Facebook: the role of social networking in planning processes. *GeoJournal* 75 (5).
- [24] Fehr, E. and K. Schmidt. 1999. A theory of fairness, competition, and cooperation. *Quarterly Journal of Economics* 114 (3).
- [25] Fehr, E. and K. Schmidt. 2010. On Equity Aversion: A Reply to Binmore and Shaked. *Journal of Economic Behavior and Organization*.
- [26] Forester, J. 1989. *Planning in The Face of Power*. Berkeley: University of California Press.
- [27] Forester, J. 1999. *The Deliberative Practitioner: encouraging participatory planning processes*. MIT Press.
- [28] Foth, M., L. Forlano, C. Satchell, and M. Gibbs, eds. 2012. *From Social Butterfly to Engaged Citizen: Urban Informatics, Social Media, Ubiquitous Computing, and Mobile Technology to Support Citizen Engagement*. Cambridge, MA: MIT Press.
- [29] Friedmann, J. 1987. *Planning in the Public Domain: From knowledge to action*. Princeton University Press.
- [30] Gächter, S. and B. Herrmann. 2009. Reciprocity, culture and human cooperation: previous insights and a new cross-cultural experiment. *Phil. (Trans.) R. Soc. B* 364: 791-806.
- [31] Gindis, H. 2009. *The Bounds of Reason: Game theory and the Unification of the Behavioural Sciences*. Princeton Univ. Press.
- [32] Hampton, K., C.-j. Lee, E. Her. 2011. How new media affords network diversity: Direct and mediated access to social capital through participation in local social settings. *New Media & Society*.
- [33] Hampton, K., and B. Wellman. 2003. Neighboring in Netville: How the Internet Supports Community and Social Capital in a Wired Suburb. *City and Community* 2 (4): 277-311.
- [34] Hardin, G. 1968. The tragedy of the commons. *Science* 162 (3859): 1243-48.

- [35] Harris, K., and H. Flouch. 2010. *Online Neighborhood Networks Study*. Available at http://networkedneighbourhoods.com/?page_id=409.
- [36] Healey, P. 2010. *Making Better Places: The Planning Project in the Twenty-First Century*. Palgrave.
- [37] Hearn, G. and A. Tacchi, M. Foth, and J. Lennie,. 2008. *Action Research and New Media: Concepts, Methods and Cases*. Hampton Press.
- [38] Henrich, J. et al. 2005. "Economic man" in cross-cultural perspective: Behavioural experiments in 15 small-scale societies. *Behavioural and Brain Sciences*, 28: 795–855.
- [39] Huberman, B. 2012. Sociology of science: Big data deserve a bigger audience. *Nature* 482.
- [40] Hui, P., A. Chaintreau, J. Scott, R. Gass, J. Crowcroft, and C. Diot. 2005. Pocket switched networks and human mobility in conference environments. In *Proceedings of WDTN*.
- [41] Innes, J., and D. Booher. 2004. Reframing public participation: strategies for the 21st century. *Planning Theory & Practice*, 5(4).
- [42] Intra, L., and H. Nissenbaum. 2000. Shaping the Web: Why the Politics of Search Engines Matters. *Information Society*, 16(3): 169–85
- [43] Jackson, M. 2008. *Social and economic networks*. Princeton University Press.
- [44] Jacobs, J. 1961. *The Death and Life of Great American Cities*. NY: Random House.
- [45] Kalogiros, C. A. Kostopoulos, and A. Ford, 2009. On Designing for Tussle: Future Internet in Retrospect". EUNICE 2009 – The Internet of the Future, LNCS 5733.
- [46] Klein, M. 2012. Enabling Large-Scale Deliberation Using Attention-Mediation Metrics. *Computer Supported Cooperative Work*, Springer.
- [47] Kriplean, T., I. Beschastnikh, D. McDonald, and S. Golder. 2007. Community, Consensus, Coercion, Control: CS*W or How Policy Mediates Mass Participation. In *Proceedings of ACM GROUP*.
- [48] Ledyard, J.O. 1994. Public goods: A Survey of Experimental Research. *Social Science Working Paper* 861.
- [49] Lee, J., P. Antoniadis, and K. Salamatian. 2010. Favoring Reciprocity in Content Sharing Communities (A Comparative Analysis of Flickr and Twitter). In *Proceedings of ASONAM*.
- [50] Leslie, J., A. Acquisti, and G. Loewenstein. 2011. Strangers on a Plane: Context-Dependent Willingness to Divulge Sensitive Information *Journal of Consumer Research*, 37(5): 858-873.
- [51] Lessig, L. 2006. *Code, Version 2.0*. New York: Basic Books.
- [52] Levitt, S., and J. List. 2007. What Do Laboratory Experiments Measuring Social Preferences Reveal about the Real World? *The Journal of Economic Perspectives* 21(2): 153-174.
- [53] Lord, A. 2012. *The Planning Game: An information economics approach to understanding urban and environmental management*. Routledge.
- [54] Lynch, K. 1960. *The Image of the City*. MIT Press.
- [55] Lynch, K. 1984. Reconsidering The Image of the City. In *Cities of the Mind*, ed. L. Rodwin and R. Hollister, 151-162, NY: Plenum.
- [56] Mason, W., and S. Siddharth. 2011. Conducting behavioural research on Amazon's Mechanical Turk. *Behav. Res. Psychono-mic Society*, Inc.
- [57] Mitchell, W. J. 1995. *City of Bits: Space, Place and the Infobahn*. Cambridge, MA: MIT Press.
- [58] Mukhtar, M., M. Ismail, and Y. Yahya. 2012. A hierarchical classification of co-creation models and techniques to aid in product or service design. *Computers in Industry*, 63(4): 289-297.
- [59] Munson, S. and P. Resnick. 2010. Presenting Diverse Political Opinions: How and How Much. In *Proceedings of CHI 2010*.
- [60] Mutz, D. 2002. Cross-cutting Social Networks: Testing Democratic Theory in Practice. *American Political Science Review* 96(1): 111-126.
- [61] Niitamo, V-P., S. Kulkki, M. Eriksson, and K. Hribernik. 2006. State-of-the-Art and Good Practice in the Field of Living Labs. In *Proceedings of the 12th International Conference on Concurrent Enterprising Innovative Products and Services through Collaborative Networks*.
- [62] Nisan, N., T. Roughgarden, E. Tardos, V. Vazirani. 2007. *Algorithmic Game Theory*. Cambridge Univ. Press.
- [63] Ostrom, E. 1990. *Governing the Commons: The evolution of institutions for collective action*. Cambridge University Press.
- [64] Ostrom, E. et al. (eds). 2002. *The Drama of the Commons*. Washington, DC: National Academy Press.
- [65] Page, S. 2007. *The Difference: How the power of diversity creates better groups, firms, schools, and societies*. Princeton University Press.
- [66] Papadimitriou, C. 2001. *Algorithms, Games, and the Internet*. In *Proceedings of STOC*.
- [67] Paulos, E, R. Honicky, and B. Hooker. 2008. Citizen Science: Enabling Participatory Urbanism. In Foth, M. (ed), *Urban Informatics: Community Integration and Implementation*.
- [68] Peattie, L. 1998. Convivial Cities. In *Cities for Citizens*, 247-253, ed. J. Friedmann and M. Douglass, John Wiley & Sons.
- [69] Powell, A. 2011. Metaphors, Models and Communicative Spaces: Designing local wireless infrastructure. *Canadian Journal of Communication*.
- [70] Preece, J. 2000. *Online communities: Designing usability and supporting sociability*. John Wiley & Sons.
- [71] Preece, J. and B. Shneiderman. 2009. The Reader-to-Leader Framework: Motivating Technology-Mediated Social Participation. *AIS Transactions on Human-Computer Interaction* (1)1: 13-32.
- [72] Rains, S. 2007. The Impact of Anonymity on Perceptions of Source Credibility and Influence in Computer-Mediated Group Communication. *Communication Research* February, 34 (1).
- [73] Roberts, N. 2004. Public Deliberation in an Age of Direct Citizen Participation. *The American Review of Public Administration* 34.
- [74] Schelling, T. 1978. *Micromotives and Macrobehavior*. NY: W.W. Norton & Company.
- [75] Shirky, C. 2008. *Here Comes Everybody: The Power of Organizing Without Organizations*. Penguin Press.
- [76] Turkle, Sherry. 2011. *Alone Together: Why We Expect More from Technology and Less from Each Other*. NY: Basic Books.
- [77] Varian, H. 1997. How to build an economic model in your spare time. In, M. Szenberg (ed.), *Passion and Craft. Economists at Work*. University of Michigan Press.
- [78] Whyte, W. 1980. *The Social Life of Small Urban Spaces*. Washington, D.C.: The Conservation Foundation.