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Smart Citizenship: designing the interaction between citizens and smart cities

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Based on the study of recent research regarding the development of smart cities, this paper develops a critical reflection about the reasons why not every citizen in a smart city can be considered a smart citizen. We point out some of the primary causes and the role of design to help to develop possible solutions. The paper uses the concept of the network society and actor network theory in order to understand the infrastructure of smart cities and develop an analysis of the changing role of citizens into smart citizens. We propose that there is a need for new methods to generate sustainable and inclusive social engagement to solve collective urban problems. Moreover, it is speculated that smart citizenship will be an important part of the future of smart cities. In this context, design plays an important part, framing the way actors understand and interact with each other in the city ecosystem, and enabling citizens to shape the future of their cities.

smart cities; smart citizenship; open design; metadesign

1 Introduction

New forms of social organization, sometimes involving the use of technology, can reframe the interaction between government, citizens and business to be more collaborative. Smart cities may be one of the new forms of technology that can support this kind of change.

A smart city uses technology to improve the urban infrastructure in order to develop a more efficient and collaborative city. The concept of the smart city emerged during the last decade as a fusion of ideas about how information and communications technologies might improve the functioning of cities, enhancing their efficiency, improving their competitiveness, and providing new ways in which problems of poverty, social deprivation, and poor environment might be addressed (Harrison et al., 2010). From this perspective, efficiency can improve quality of life. This concept is related to one of the characteristics of the organization of the network society, which is the decentralization of operations and control, in which the effectiveness of networks is increased (Castells, 2000). Therefore, the role of citizen may need to change to the role of smart citizen.



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If cities are the key element for a more sustainable and efficient future, citizens are the key element in cities. However, some studies and projects related to smart cities subjugate the role and the importance that citizens can possibly develop, concentrating their efforts instead on the role of technology. Hollands (2008) affirms that IT working alone cannot improve urban environments. For this reason, social elements, like human capital, should develop a more active role, or even become the starting point of this process, creating (smart) civic inclusiveness.

The creation of new kinds of social organization and civic inclusiveness has been challenging more diffused design approaches, like design thinking and human centered design. Local communities are finding new ways to use existing online social networking systems to create offline local communities. Open source, P2P and new digital fabrication technologies enable new forms of relationship between users, designers and artifacts. Under these conditions, design can be characterized as the mediator in the process of co-creation, supporting the ecosystem in which the process of social value creation happens. Design activity becomes open and critical, supporting open spaces and practices, in which it is necessary to take an open (meta) design approach.

In order to develop the concept of the smart city, it is necessary to understand the differences and conflicting perspectives, principles and objectives of the various city's stakeholders (government, citizens, and companies). However, a better comprehension of the citizens' role is essential to unfold the infrastructure of urban environment' networks, which must include the articulation of interactions between human and non-human actors. Using this approach, the future of smart cities will be more sustainable in terms of both participation and engagement.

In addition to helping people better understand, develop, and mediate the interactions between human and non-human actors, design can also develop an important role in shaping the space where these interactions can happen. Moreover, by framing the interaction and space, design construed as open (meta) design, has the potential to help the movement towards smart citizenship.

With the purpose of explaining the main causes of why not every citizen in a smart city is a smart citizen, this paper will briefly explain the concepts of smart city and smart citizen, emphasizing their key elements and particular attributes. Based on these foundations concepts, it will be provided a discussion will be provided about the problematic around citizens' engagement, since it is difficult to sustain long term relationship in participatory actions. In the same sense, the paper discuss what is open (meta) design, and how the actor network theory analysis and the decentralization of human in design process is a way to understand the smart city ecosystem and improve it towards a more sustainable, open and inclusive urban infrastructure. Finally, the paper discuss what could be a transitory model from citizenship to smart citizenship, in which design can enable citizens to shape the future of their cities, transforming the relationship between people and other elements that are part of the urban ecosystem.

2 Smart Cities

The use of technology, especially the internet of things, big data, and information and communication technologies (ICT), in order to improve urban life, can be one way to characterize a smart city. As with the non-stop growth in technology use, the number of projects related to smart cities is growing exponentially around the world. For example, the Government of India (2016) has a project to build 100 smart cities and rejuvenate 500 more. Despite the number of new smart cities initiatives and researchers devoted to the concept, the definition of what constitutes a smart city can diverge in relation to several aspects, including the level of development, resources, engagement of citizens and willingness to change (Albino, Berardi & Dangelico, 2015).

Singapore is considered one of the most successful example of smart cities. The island has a huge number of sensors and cameras, which do not only control the traffic, but also the cleanliness. However, Singapore goes beyond the wireless connectivity and sensors, and has an open data platform related to data collected by sensors located on the island for sharing all the information

that is collected. Furthermore, almost all of Singapore's government services are available and accessible online and citizen-centric mobile health, municipal and transport apps were recently rolled out. Therefore, Singapore is one of the unique cases in which the city provides residents with behavioural feedback that helps them to reduce their energy and water consumption and drive down costs. In addition, the government analyses the data generated by these sensors to improve the design, planning and maintenance of these and future public housing estates.

Most studies and self-nominated smart cities argue that the use of technology enables real-time analysis of the urban environment, new forms of governance, and provides material (data) for envisioning a more efficient, sustainable, competitive, productive, open and transparent city. The use of technology should support learning processes, knowledge exchange, technological development and the rise and application of innovation to improve the urban space and facilitate people's lives (Komninos et al., 2013; Woods, 2013). Thus, a smart city can be related to the use of information technology to assist the building process of transforming a city into a sustainable and inclusive territory, based on citizens' needs and creativity.

It is clear that the concept of a smart city is far beyond the application of technologies to improve urban environments. Cities can only be smart if there are intelligence functions that are able to integrate and synthesize data to some purpose, such as ways of improving the efficiency, equity, sustainability and quality of life in cities. In other words, the provision of intelligence functions is what will make this possible in the most effective and equitable ways. Some of the self-nominated smart cities and researchers have faced criticism for being too concerned with hardware rather than with people (Saunders & Baeck, 2015). To overestimate technology's importance is to forget that a smart city is an intrinsic and well-connected network environment, that relies upon the interaction of its many elements to achieve sustainable development.

Like the concept of the term smart city, its key elements and a possible methodology to study and research it has different and, sometimes, divergent approaches and definitions. Even though the technology is an enabler for the development of smart cities, it is not necessarily the most critical factor in defining a smart city (Paquet, 2001). Concerning the key elements of a smart city, Albino, Berardi, & Dangelico (2015) claim that "people" are the missing component. Although, it is people who shape the cities through continuous interactions while making the most of the growing potential of collaborative technologies (technologies that enable greater collaboration among urban communities, citizens, government, and companies) (Albino, Berardi & Dangelico, 2015), little has been said about smart citizens.

The fact that someone lives in a smart city does not mean that she/he is a smart citizen. A smart citizenship can be identified when people become active stakeholders, engaged in long term relationships in the process of planning, developing, testing, implementing and evaluating urban decisions, actions and policies. The "smartness" is not only related to the use of technology: it is the participation, engagement and how it changes the citizen's attitudes concerning the urban environment. Moreover, becoming a smart citizen is not just about being a data provider, but it is to use data and translate it into actions to improve the urban ecosystem. Thus, the connectivity, which is exponentiated in the urban network infrastructure, can enable small (bottom-up) initiatives to have an enormous impact on the ecosystem.

3 Smart Citizens

The technology in smart cities is not always synonymous with equitable access or democratization. Many cities have auto-nominated themselves as smart cities for self-promotional purposes. Moreover, government, when joined to private companies, has been shaping and controlling the use of technology and the data produced through its use. Further, some of the largest and most commercial business in hardware, software and infrastructure sectors, such as IBM, General Electric, Cisco Systems, Hitachi, and Siemens have been developing projects related to smart cities. In addition to the development of new technologies to improve the urban space, these companies also

have research departments specialized in studying the different aspects and key elements of a smart city (Sadoway & Shekhar, 2014). As a result, the majority of the concerns and actions implemented are related to the interests of big and controlling corporations.

That new form of control leads to top-down initiatives and can produce a social domination and exclusion. Thus, there is a problematic in the definition and employment of smart cities, in which the modes of urban governance have clearly been "(...) shaped and steered by large and influential commercial players in hardware, software and infrastructure sectors" (Hollands, 2008, p. 314). Moreover, the misuse of the smart city label, only for commercial purposes, can enhance this discriminatory process. Commercially-driven "Smart Cities" can be too much focused on providing returns to shareholders, neglecting previous findings that these ephemeral solutions, based on the technology use, are "wicked-problems" (Sadoway & Shekhar, 2014). However, the smart city environment and the proper use of technology can transform the industrial capital domination into a new form of organization focused on knowledge (Hollands, 2008). A smart city organization based on knowledge can result in a more participatory and inclusive environment.

Since people play a fundamental role in the development and the success of smart cities, they should have a more leading and participative role in all smart cities actions. Although top-down initiatives led by governments and big tech companies may aim to improve citizens' lives, bottom-up actions and technology democratization should be a common practice as a way to engage citizens and enable them to become smart citizens. Bottom-up initiatives, together with open and participatory approaches, can create the sense of community necessary not only to engage citizens, but also to provide the necessary tools to empower them. Kitchin (2014) affirms that technology can be used in cities to empower citizens by adapting those technologies to their needs rather than adapting their lives to technological exigencies.

Although this form of participation called "empowered participatory governance" (Abers et al., 2003) shifts the role of the citizen from a passive actor into an engaged citizen involved in the public domain (Schaffers et al., 2012), there is always unintended consequences in which some citizens will be included, while others will be excluded (Turnhout et al., 2010). Moreover, citizens' motivation to engage can be different, while some of them can have a natural motivation to participate in shaping their environment through a sense of place (Horelli, 2013), others can be less interested in this kind of participation.

In this context exists a gap that could be filled by open design practices. Design has been researching and practicing open and participatory approaches, and using open technology in order to engage different stakeholders to solve, or to try to create, possible solutions to social problems. Forlano (2016) explains that design could fill this gap, mediating top-down plans and interests in order to meet bottom-up actions and needs. Design, when working strategically and using open and participatory practices, is more about problem setting than problem-solving. In other words, it means that design deals with the complexity of the inter-relationships that happens in the ecosystem in which it is involved. Given this capacity, design can strengthen the smart cities ecosystem where it is currently weakest, concerning its elements and interactions, and especially the role of citizens.

Furthermore, it is important to point out that the majority of the studies about smart cities usually do not talk about maker spaces. The maker culture, even outside the context of smart cities, has been changing the role of citizens in the urban spaces, providing workspaces and tools to empower them. In the maker spaces, citizens can create their own things, decentralizing the traditional manufacturing system. Fab Labs and maker spaces offer access to low-cost digital fabrication equipment, and they are becoming increasingly common in the post-industrial cityscape (Van Abel et al., 2011). In summary, technologies, practices and communities of makers have been evolving rapidly in the last few years. Design is highly connected to this evolution, creating and developing methods and platforms for collaboration and sharing.

Advocates of do-it-yourself (DIY) approaches, hackathons and fablabs – in other words the maker movement, have argued that without the building blocks of open ICT infrastructures and platforms for smart citizens (Townsend, 2013; Diez, 2014) including open access, open source software and net neutrality (decentralization), the construction of the smart city and its social economy will be highly unlikely (Sadoway, 2012). In this regard, it is possible to argue that open and decentralized practices, like open design, can help in developing not only smart cities, but also smart citizens. Moreover, design can shape the rise of smart citizens avoiding more exclusion due to the differences on the access of technology.

4 Unfolding the infrastructure of smart cities: ANT and decentralization of the human in design

Sensors, hubs, cameras, location-based services, transports, sewers, water, electricity, heat, communications systems, roads, buildings, museums, parks, restaurants, shops, billboards, lights, skyscrapers, bridges, cell towers and people: these are some of the examples of the elements that compose the network infrastructure of a smart city. The functionality of an ecosystem is highly dependent on the connection and integration of all these multiple systems. In fact, no system, as part of a bigger ecosystem, can work in isolation (Albino, Berard & Dangelico, 2015). In other words, the effectiveness of a smart city network can be measured in terms of how well connected are the different elements.

Regarding the network of a smart city, the authors Allwinkle and Cruickshank (2011) claim that smartness is a way to be sufficiently innovative to connect “villagers” to “neighbors” based on creative partnerships in natural communities, facilitating the generation of collective knowledge. Moreover, the infrastructure of these networks can become a platform for innovation and creativity, in which the different aspects of the urban environment – social, environmental, economic, and cultural are developed through enabling technologies (Allwinkle & Cruickshank, 2011). Therefore, the networked form of organization is an opportune and qualified environment for smart cities and for the emergence of smart citizens.

The study of smart cities’ infrastructure is essential, since successful smart cities should combine the best aspects of technology and infrastructure to find new models of participatory operation. To illustrate, Forlano (2016) and others have discussed Latour’s work on actor network theory, which describes how society is constructed by the collective organization of human and non-humans, in which agency can be delegated, especially from a human to a non-human, as well shared among multiple entities. Actor network theory seems to be relevant to better understand urban networks because it changes the way the materiality of the objects is analysed. Moreover, it is not only citizens who shape technology; instead, technology can shape citizens and the multiple interactions that happen in their network (Niederer & Priester, 2016).

Regarding the fact that technology and objects have the power to affect other elements of the network; it is possible to say that non-humans also have agency. In this perspective agency is anything that modifies a state of affairs. Moreover, agency is not provided by humans because they cannot control the non-humans, and the non-humans have their own agency. Thus, agency arises from the relationships, the interactions and how things are brought together, and this is how a social organization network is created.

Social can be a way to describe a connection between things. In Latour’s perspective (2005), the social comprised of collectives, it is not only just about people but is also about things that are brought together and build a relationship with one another. Thus, it is possible to say that the social is constructed. Therefore, some design researchers have been arguing for the decentralization of the human – in other words, a non-anthropocentric approach (DiSalvo & Lukens, 2012; Forlano, 2016). The human is one element among others in a vast ecosystem, and non-human elements also develop an important role. In this large system of interactions, all elements have legitimacy, based on the plurality of the system (DiSalvo & Lukens, 2012). This approach seems to be effective when

the study of the interactions is more relevant than the simple knowledge about the different elements in isolation.

Human centered design (HCD) is one of the most diffused design approaches, widely applied and commoditized. Many areas use the HCD approach as a way to solve problems, understanding what humans want and need. Although some fields have had success applying HCD, it has limitations when disruptive and sustainable solutions are expected, or when the complexity of the ecosystem in which the project takes place is a prime consideration. Thus, HCD practices can be accused of complicity in increasing the number of disposable solutions, and the scenario in which the problems that we are solving today will return as problems to be solved again in the future. The decentralization of the human in design is a way to break the dichotomy between human versus technology. Moreover, it can be a way to break the assumption that "(...) possibilities for framing and solving problems are bounded only to human imagination and capabilities" (Giaccardi et al., 2016, p.377).

Smart citizens should be aware that the social is constructed based on the relationship of different network's entities. Smart cities – together with Design – should consider working on the development of possible entities' articulations, to enable new forms of relationships for the social improvement.

Design has been operating as a facilitator in many activities and spaces, developing an expertise in navigating among inter and multidisciplinary fields and creating more participatory and inclusive spaces. About these possible articulations, Forlano (2016) points out that designers can be mediators, calling attention to the importance of the non-human stakeholders, empowering them with values, ethics and politics. As mentioned before, this is related to a non-anthropocentric idea, in which all entities have the same power to modify the network.

The use of actor network theory to study smart cities is a way to develop a more holistic view, in which all actions have an effect, and these effects are exponentiated due to the network infrastructure. Thus, to visualize and to make tangible the connections that exist in a network, the different actors' interactions and the possible future interactions, can be a possibility for having both smart cities and smart citizens working together to have an open system to allow smart citizenship. All this should lead to transforming the urban environment as a platform, in which municipalities, citizens, and business could act and interact with each other. These platforms should be open spaces in which the knowledge exchange is a fundamental piece. The relevant knowledge is not only personal, but it is also related to data produced by the people, and it must be used for the people. This platform is neither about top-down initiatives nor bottom-up ones; it is a circular and systemic approach in which all the elements are intrinsically connected. Ideally, in this ecosystem all data should be open, and the use of technology should enable all stakeholders to understand and use open data.

The openness demands a decentralized approach, in which it is possible to integrate different stakeholders, including the human and non-human. It also enables design to shift the focus from one user to a local community – which can also be online, and from isolated "solving specific user problems" projects to design whole complex systems. From the moment that design starts to take into consideration all entities, and the complexity of different interactions and their connectivity in the ecosystem with which it is involved, new forms of design practices arise – like open design. Although open design is not a new practice, it changes some of the current paradigms of design practice, like authorship, the use of human-centered design and the idea that every design project should end with a commodified outcome, such as a product or a service. However, one of the most important changes required is to the role of the designer.

5 Open (Meta) Design

The development of open design is connected to the rise of computers and the internet, just as in other fields influenced by the open movement, such as open source software, open science, and

open technology (De Mul, 2011). The introduction of digital technologies has enabled new forms of organization and distribution of resources, or it has modified obsolete forms (Goetz, 2003). Therefore, new spaces and conditions for practice are developed regarding the openness of projects, participatory practices, the sharing of knowledge and information, and collaborative interactions.

Open design is more than just a new way to create products, or a new design method. As a process, and as a culture, open design also changes relationships among the people who make, use and look after things (Van Abel, 2011). Since open design breaks the boundaries between different entities, it is possible for non-designers to become “designers”, allowing end users to share projects and access to digital fabrication technologies to manufacture the products they want locally (Menichinelli, 2016; Stappers, Visser, Kistemaker, 2011). Therefore, open design supports the development of new forms of value, expanding existing relationships, power and responsibilities between suppliers, consumers, and competitors in a given ecosystem.

From this perspective, the designer has to become a metadesigner, shaping environments in which unskilled users can design their own objects. The metadesigner resembles the scientist who no longer creates a linear argument, but instead develops a model or simulation that enables the user to explore and analyse a particular domain of reality, or a successful game designer who designs a game space that facilitates meaningful and enjoyable play (De Mul, 2011).

Meta-design is a broader concept with several meanings and no single definition; here we refer to Giaccardi's (2003) overview of the topic. Meta-design is not an established design approach and practice, but rather an emerging design culture (especially related to interaction design) that intersects with net art. The interest on the meta-level shifts the focus from objects to process, from contents to structures, from design as planning to design as seeding or emergence.

Regarding the idea of thinking and/or reflecting critically about the discipline, meta-design can be considered critical and reflexive thinking about the boundaries and scope of design, aimed at coping with the complexity of natural human interaction made tangible by technology, with the goal of transforming this complexity into an opportunity for new forms of creativity and sociability (Giaccardi, 2005). Similar to open design projects, meta-design does not require a final and tangible product or service as an outcome. Thus, meta-design is able to develop a free space for creativity and reflection. Moreover, in those meta spaces, designers can move away from the simple goal of developing a product or a service and be more critical about their activity and their creations.

6 The development of Smart Citizenship

According to the Merriam-Webster dictionary, citizenship can be described as “the status of being a citizen or the quality of an individual's response to membership in a community”. Therefore, citizens should want (but also to have the empowerment necessary) to develop an active part of the discussion for local, national, and even international issues. Based on that definition of citizenship, governance should be about the people, their lives and values and constant evolution. Moreover, all the entities of the networks that constitute the urban ecosystem, should be transparent, participative, and open.

A smart citizenship should consider the use of technology to enhance the power of communication and to create a more participatory ecosystem. A Smart Citizenship framework situates citizens, civic organizations, and open and participatory processes as drivers or steering devices for ICT-linked applications and praxis (Sadoway & Shekhar, 2014). Moreover, in the smart citizenship process, the use of technology and ICT should be used to facilitate, complement and support civic engagement, instead of drive or be a conditional factor for it (Sadoway & Shekhar, 2014).

Smart citizenship should also not be dependent on companies and government if the tools are available, like open technology and a smart cities environment. All the entities of the urban ecosystem must be able to keep track of policies, decisions, and their results. In other words, smart citizenship is the feasible use of innovation to minimize, or even extinguish, the divergence between

citizens' inputs and political output, which is called as democratic deficit (Sevinc, 2016). Thus, this approach can be considered a disruptive way to exercise citizenship.

Several initiatives have been developed around the world. Although they are not characterized as smart citizenship projects, the development of smart citizenship is one of their primary goals. Thus, in order to develop a "civic-cyber space", it is necessary to have the engagement and involvement of different social stakeholders (e.g. civic hacktivists, local associations and community groups), which goes beyond the participation of scientists, engineers, and coders (Sadoway, 2012). Moreover, it is also necessary to adapt and develop new forms of interaction, new platforms and infrastructure that could support this emerging phenomenon.

One example is the Fab City Global Initiative, which aims to empower citizens to be the designers and the owners of their own destiny. The expected result is an increase in citizens' resilience, and the establishment of a more ecological system, as consequence of the reduction in materials and energy consumption. The idea of the Fab City aims to transform the way people live and interact in urban spaces, using fab labs and other maker spaces as a global infrastructure for knowledge sourcing. This concept was created by the MIT Center for Bits and Atoms, the Institute for Advanced Architecture of Catalonia and the Fab Foundation (Fab City Global Initiative, 2017). In this context, a smart citizenship is practiced through an open decision-making process, collaborative learning, and knowledge exchange that happens in a Fab City. Furthermore, smart citizens are not invited to engage or participate; rather, it is the openness of the environment that empowers them to act. Nowadays, the Fab City Global Initiative movement counts the following members: Barcelona, Boston, Somerville, Cambridge, Ekurhuleni, Kerala, Georgia, Shenzhen, Amsterdam, Toulouse, Occitane Region, Paris, Buthan, Sacramento, Santiago de Chile, Detroit, Brest and Curitiba. To become aware of the size of this initiative, 15 more cities will join in the next two years, and a further 25 during the years of execution of the project, with a total of at least 56 members by 2021. A smart citizenship proposal is related to a systemic approach, not just bottom-up initiatives. Thus, it is a circular flow in which transparent and open participatory practices are able to arise. Smart Citizenship is to turn in action the ideas of urban ecosystems' entities in order to improve the system. Since all data in this ecosystem must be open, the use of technology should allow and enable the stakeholders to use open data in a feasible way.

Therefore, it is possible to speculate that smart cities of the future are related to development of smart citizenship, and in that sense they can be compared to living laboratories for innovation (Veckman & Van Der Graaf, 2015) using open (meta) design practices. Although these laboratories enable the development and improvement of technologies that take into account equity, fairness and improve quality, their goals are only achievable through open participation, enabling the creation of shared knowledge for democratic city governance.

7 Final Considerations

The development of smart cities and smart citizens is not mutual and dependent. The concept of smart cities is not well defined because it is surrounded by different definitions and approaches, based on the stakeholders' goals and interests. However, it is the complexity and multiplicity of the different entities interaction that constitutes the smart city ecosystem. In this sense, the smart city movement is less about technology and more about improving interactions of the different entities. Although, the smart city movement working together with Design, can be able to increase citizens' engagement and help the technology democratization, there is still space for working on how to develop new models for the implementation of new ideas, and how to reframe (complex) problems in new ways of socio and economic organizations.

The use of Latour's ANT as a theoretical lens to analyse the smart city ecosystem, combined with the open (meta) design approach, can provide a framework towards the transition from smart cities to smart citizenship. Although technology has its own agency, the author claims that technology (i.e. non-humans) contains ideas and attributes from the humans who made them. Therefore, it is

necessary to accept that technology (as a non-human actor) can affect us in order to have a better and complete understanding of society's functions (Latour, 2005).

Smart Citizenship should not simply represent a new form of urban engagement based on technology use. It is about the urban environment stakeholders' empowerment and sustainable engagement in long-term relationships. To achieve this goal, strategies for meeting the complexity of the different actors' needs should be developed, and this is the gap for action on which design should concentrate its effort.

Further research is necessary to better understand the infrastructure of smart cities in practice, and to develop ways to measure decentralization as well as the engagement of different actors and stakeholders. A better understanding of decentralization, its implications and implementation, has potential to become a new turn in design practice. Moreover, a framework for the open (meta) design approach should be developed and implemented.

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