A MATTER OF DESIGN

MAKING SOCIETY THROUGH SCIENCE AND TECHNOLOGY

PROCEEDINGS OF THE 5TH STS ITALIA CONFERENCE 2014

EDITED BY
CLAUDIO COLETTA
SARA COLOMBO
PAOLO MAGAUDDA
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LAURA LUCIA PAROLIN
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Edited by Claudio Coletta, Sara Colombo, Paolo Magaudda, Alvise Mattozzi, Laura Lucia Parolin and Lucia Rampino

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Contact: STS Italia, Via Carducci 32, 20123*, Milano.*
Email: stsitalia.org@gmail.com

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Mobility and the Smart City. Innovative Solutions for Responsive Urban Space

Marco ZILVETTI* and Fausto BREVI
Politecnico di Milano

In the late years the expression 'smart city' is being used to define sentient urban contexts, capable to connect citizens and provide innovative solutions to their everyday needs. Cities are redefining themselves as stages for innovation and pervasive technologies are gaining a growing relevance in our everyday lives. Municipalities and researchers tend to underline the crucial role of collaborative patterns, involving citizens as active stakeholders in the value-generation process, towards solutions capable to improve the quality of their urban experience. As people are called to share the same urban spaces, possible conflicts may take place between personal interests and collective requirements; social life becomes therefore a sort of peace-treaty in which the tendency towards social equality and the individual tendency to stand out ought to find a balance. This is particularly evident in the field of urban transport, since the individual is called to recast his identity in terms of flexibility, adaptability and instant transformation, in order to adjust his own interests to the social requirement for a more sustainable mobility. The following dissertation intends to introduce a transdisciplinary overview of current urban trends, and of their possible evolution towards innovative solutions for the mobility needs of our tomorrow's cities.

***Keywords**: Smart city; urban spaces; applied technologies; collaboration; individualism; social frictions; personal mobility*

1. Introduction

In recent years our cities are experiencing deep changes as technologies applied to the urban environment become more and more pervasive. In early Nineties the internet outbreak led researchers talk about 'death of distance', predicting the decease of cities and in 1995 the American writer George Gilder argued that networked communications would have become so easy and universal that people and businesses would have had no need

* Corresponding author **Marco Zilvetti** | e-mail: **marco.zilvetti@polimi.it**

to be near one another, turning cities into 'leftover baggage from the industrial era'. Despite such forecasts, urban areas are growing fast and people still flock to cities, attracted by potentially better opportunities to improve their lives than in smaller towns, even when challenged by lack of resources. Since 2008 more than 50% of the world population (3.3 billion people) live in urban contexts and this percentage is expected to grow, reaching a 70% (almost 5 billion people) within the year 2050. According to Cisco's Win Elfrink (2011), in the next decade 100 cities, mainly in Asia, will reach a population of more than 1million. Such a rapid urban growth underlines the double nature of city which may be considered on the one hand as a pivotal testing ground for technologies and social innovation and on the other hand as a battle-ground between individual and collective necessities, as far as urban population grows and the need of differentiation and the desire for change increase. Notwithstanding technological advance, the persistence of several open issues like pollution, traffic jam and fuel consumption still entail waste of time, stress and sense of frustration, underscoring how cities need a total commitment to find effective solutions capable to fix past mistakes and foster innovative solutions. In this sense, municipalities may choose between a traditional top-down policy and a bottom-up approach, the latter of which invite people to cooperate and solve open issues from a different point of view.

The starting point of this dissertation is a general outlook of the main opportunities deriving from the spread of pervasive information and communication technologies, applied to the built environment and to transportation design. To this end, information and communication technologies (ICT) often prove their potentials to support citizens' active role to enhance the perceived quality of products and services. Through an interdisciplinary overview of current urban trends and their possible evolution, the intent is to underline potential conflicts that may arise between individual and collective needs. Since urban mobility represents a crucial and often unsolved issue in contemporary cities, this paper intends to focus on this topic, highlighting opportunities about sustainable and 'tailored' solutions designed for individual commutes in the future urban spaces.

2. Smart Urban Spaces

Cities have always attracted people by promising three main things: security, prosperity, and quality of life, as underlined by Glaeser, Kahn and

Rappaport (2000). At a time when the spread of electronic devices seems to be increasingly dematerializing the world around us, urban environments gain a growing relevance as pivotal testing grounds for the conception and the implementation of innovative strategies to enhance connectivity opportunities and urban living standards. The resulting space can be seen as multi-layered complex systems where the digital and the physical worlds are intertwined and feedback loops become crucial (Resch et al., 2008) in the so-called 'smart city': a sort of 'open air computer' where information-processing capabilities are embedded throughout urban infrastructures and interactions take place as computing activities 'leave the desktop and spill out onto the sidewalks, streets, and other public urban spaces' (Shepard, 2011). Furthermore, the increasing presence of web-connected urban infrastructures and affordable mobile devices strengthens urban sensing capabilities, giving birth to what Mark Shepard (2009) describes as 'sentient cities', using a term that foregrounds the subjective aspects of the urban capability to feel and perceive data, without necessarily include the faculty of self-awareness. The production of a huge quantity of data is becoming a crucial factor for a better quality of life for all citizens, thanks to the pervasive 'sentient' equipment, recalling the theory of Ubiquitous computing (also known as 'Ubicomp'), developed by the American computer scientist Mark Weiser (1991), who argued that in the coming future, miniaturization and ubiquity of sensors would have eventually lead to the integration of computers into the world at large, through technological solutions that 'disappear', moving into an invisible background.

3. Towards a Responsive Urban Body

At a first glance, future cities may not differ so much from today's ones, but the most changing feature will surely be the way people use spaces, live and interact with each other and with the surrounding urban spaces, thanks to new forms of information-sharing.

The traditional debate between architects, policy makers, engineers and planners is set to a broader level, focusing on urban and social improvements with their impacts on the society at large. Municipalities are called to take actions to provide citizens greener and more connected spaces, with high-quality services, where people can work together, interact and exchange data, thanks to efficient and pervasive web-based technology networks. As underlined by Richard Dorsey in a recent interview (Palis,

2012), the best technologies are those that disappear in the physical environment and city planners and local administrators need to conceive solutions capable to ease people's lives, without making them feel the presence of pervasive technologies.

It shall be said that even brilliant technology is not much use if cities are badly managed or their politics are dysfunctional. As John Day of IBM Research argues ('Open-Air Computers', 2012), it is crucial to focus not only on single areas – such as traffic or policing – but also on improving the quality of cities as a whole by drawing on data from multiple sources and use them to solve various open issues related to the personal and the collective urban experience.

Unlike what is happening in Asia, where several cities are being designed and built from scratch, in Europe we often need to face existing infrastructures and 'reinvent' them. Possible improvements may simply deal with late information and communication technologies applied to existing equipment, like streetlights, platforms and screens applied to urban furniture. They may also affect systems of energy distribution and other strategic urban services, with consequences not only on urban planning but even on citizens' everyday lives.

The resulting metropolitan areas are no more just mere geographical entities: as Resch, Britter and Ratti (2012) suggest, they turn instead into 'vibrant knowledge-network hubs, rich in high-potential connections and cooperating people', and the resulting smart city may look like a responsive body, where people get online almost everywhere thanks to an efficient ICT.

4. Individualism versus Collectivity

The mixture of collective intelligence and pervasive communication capabilities may be considered through a fresh interpretation, as personal mobile devices connected to the web are widespread and technologies become more and more performing on the move. Traditional limits tend to fade and our daily life changes, since work and spare time tend to be intertwined and a growing amount of work-related activities can be easily managed out of office, with deep impact on job management and other social activities.

Elliott and Urry (2010) underline that various social theories underscore the emergence of a 'new individualism' seen both as a set of institutional processes and as novel kind of identity-formation, related to the demand for instant change and the desire for continual self-invention.

More than a century ago, Simmel's study (1904) analysed how social life might be seen as a sort of 'battle-ground', every inch of which is stubbornly contested and the social institutions may be looked upon as peace-treaties, according to which the constant antagonism between the tendencies towards social equality on the one hand and the desire to stand out have been reduced externally to a form of cooperation.

Researchers like Bauman (2005) tend to use terms like 'Individualization', 'reflexive self-identity' and 'liquid life' to define trends, processes and lifestyles of contemporary society that Elliott and Urry (2010) see as marked by transitory rather than permanent, immediate and utility as prior to other values, underscoring the variable patterns, as well as the splitting of identity between a subjective and an objective dimension and between individual creation and system dependency.

As the Internet has become incorporated into everyday life with the implementation of pervasive mobile technologies, the growth of the web and the spread of social networks lead to the rise of 'networked individualism' (Wellman, 2001), based on connected individuals and personalized services. At the same time, as Greenfield (2006) argues, the rising patterns of the current urban evolution tend to hinge on the concepts of community, social communication, digital collaboration and networking.

5. Collaborative Patterns

The introduction of the term *Web 2.0* defines a computing paradigm that outlines the tendency to use the Web as a common space to collaborate and share information among users through wikis, blogs and social network services. This behaviour, also labelled as 'technology-mediated social/civic participation' (Preece and Shneiderman, 2009), shows the ability of masses to achieve common goals through participation and collaboration on the Web – goals that no single individual or organization could achieve alone. Users are now able to engage themselves in a more critical and direct way on Web-based activities, with an attitude tending to subvert the traditional top-down approach with a breaking-down process of the system's big picture. In this sense, individuals may cooperate to achieve great results for the benefit of the whole community.

Several studies (Jenkins, 2006; 2009) underline how urban communities tend to behave as interwoven structures of widespread awareness and users tend to move from spectators to direct actors and even co-authors of contents. Coalitions and networks are increasingly turning out to be pivotal

to successful change (Murray, Caulier-Grice and Mulgan, 2010), and the word 'collaboration' is gaining a crucial relevance for people-to-people communication patterns, considering that in a 'smart' city people, businesses and other stakeholders may easily communicate and cooperate.

Collaborative networks have now a big potential to exercise the citizenship, while information and knowledge sharing is becoming an ordinary attitude across society (Lévy, 1999), as digital technologies trigger a constructive and innovative dialog among citizens, administrations and urban environment (Büscher et al., 2009). Social production of space becomes an open process and much of the gathered data related to transport, housing, pollution and use of spaces is held by city government and agencies to enhance the quality of urban services (Hemment and Townsend, 2013).

A bottom-up approach becomes crucial, as citizens overcome their individualism to actively engage in the creation of cooperating communities, using the so-called 'collective intelligence' (CI) as a meaningful tool to enhance product and service quality. At the same time, also firms and public institutions explore the use of such approach for tackling systemic problems, fostering innovation and developing useful social interactions (Maher, Paulini and Murty, 2010). To this end, the so-called 'wisdom of crowds' can be crucial to reach fast and effective results, as people may have a more direct perception of problems and may share and report issues in real time through their mobile devices and eventually turning into sources of information to solve issues concerning the whole community.

6. Towards Innovative Solutions for Personal Transport

Mobility is one of the most important activities regarding citizens' everyday life and it also represents an often unsolved topic that needs a total commitment to find ultimate solutions since, despite technological advances, several cities still suffer from traditional problems like traffic, congestion, parking lot scarcity and consequent rising costs, health disease and pollution. According to Elliott and Urry's study (2010), the social structure of individual tasks is increasingly constituted through systems of movement and it is possible to see a paradox in contemporary mobile lives and analyse the '*intensive and extensive dimensions (real, imagined, virtual) of people's movements and travel in order to unearth the novel textures of*

individual life, [but] *today few social forms are more predictable, routine and uniform than those of the mobile denizens of this global age'.*

According to this assumption, we have two different points of view:

- the first one allows a glimpse of common features in the way people move and use public and private means of transport, to cope with their day-to-day lives;
- the second one underscores the subjective dimensions of travel activities, noticing that people tend to move in different ways, organizing their trips in terms of contrasting time-space modalities, from daily commuting to once-in-a-life escape.

In their contradictory urban experience, individuals are called to travel recasting their own identity in terms of flexibility and instant transformation, adapting to the different situations in which social and collective requirements must be taken into account. Mobile patterns are hard to summarize and deeply depending on social and geographical factors, while several issues can be analysed about user experience, vehicle design and service implementation.

Public Authorities have the mandatory mission to grant the right to mobility, making it more efficient, secure, reliable, cost-effective and environment-friendly, considering at the same time the requests coming from the population.

The main efforts of local administrations tend to push people towards a wider suite of options including ideas vehicles for personal mobility capable to reconcile individualism and community in a sustainable and cost-effective way. For this reason, we need a total commitment to innovate and improve the current situation and in this sense, the enhancement of public transportation systems is the first step to make urban mobility more efficient, reducing the number of vehicles on the roads and consequent stress and pollution.

In this sense, the individual will be more and more often called to recast his own identity in terms of flexibility, adaptability and instant transformation, in order to adjust his own interests to the social requirements.

In Italy, for instance, the 1998 Urban Mobility decree by the Italian Ministry of the Environment invited local administrations to foster alternative and shared forms of mobility, to reduce the impacts deriving from the use of private cars and consequent traffic, fuel consumption and pollution.

Considering that in several cities it is impossible to conceive a total shift towards public solutions – either because of inefficiencies of public transport or because people have specific requirements (mainly related to time, space and objects to carry) – there will be a consequent demand for efficient and flexible means of transport and local administrations are called to develop a multimodal transport system in which private, shared and public vehicles can be easily and effectively combined.

7. The Future of Cars

The experience of urban mobility entails inequalities by class, gender, age, ethnicity and capacity, as well as the demand for social adaptation since, despite several current alternatives for urban travels, many of them are clearly unsustainable from a either collective or environmental point of view. Car (intended as vehicles for personal commutes) might disappear from the metropolitan landscape only in a far-distant future, through great changes in urban mobility entailing implications and potential conflicts between environmental sustainability and community on one side and desired freedom of choice on the other (The City of the Future, 2012). In the meanwhile, it is mandatory to design innovative solutions capable to provide effective answers to local urban needs and constraints, taking advantage of actual and forthcoming innovations in the field of ICT and mobile devices, towards sustainable, integrated and more confortable vehicles. As established by several studies and transnational directions (European Commission, 2011), future urban transport systems shall act on few main factors, in order to achieve solutions capable to merge individual, collective and environmental requirements in a more efficient and sustainable way, providing as well striking solutions to current urban open issues.

Clean efficiency

First of all, future solutions shall be really capable to reconcile personal and collective dimensions but also to encourage more sustainable and clean behaviours, towards post-carbon futures. Whitelegg (1993) underlines in his study that the existence of air quality guidelines is useful in giving focus to environmental objectives which represent the first stirrings of progress towards sustainability. To this end, in late years many ideas are brewing in several cities to support real-time data-exchange, travel information systems and instant reports of urban issues, related both to street

maintenance, traffic and transport delays, but also to air quality, turning users and vehicles into sources of information. For example, air quality can be continually monitored by cyclists and cross-checked with time, place and weather and gathered data may represent a source of inspiration for taking action (Resch et al., 2011).

Intermodality

This is a first step, but companies, administrators, designers and programmers can do much more to improve the actual situation towards more sustainable and more efficient solutions. To this end, according to a common sense logic, in our future urban mobility we will be increasingly called to combine several means of transport during the same journey. According to this assumption, it is possible to imagine a wider suite of options – including micro electric vehicles for the so-called 'last mile' mobility and for rapid transits, as well as other personal mobility devices – to make the conventional transport neither suited nor cost-effective, bridging the gap between public and private transport and creating an intermodal system of mobility. To this end, technologies may be supportive, helping individuals to reduce travel costs, finding travelling companions through carpooling services, while at a broader level, many contemporary cities are quite literally saturated with various sources of real-time data that may help improving mobility experience and influencing demand transport service supply (Amey et al., 2009).

Crossbreeding

In the same way, possible evolutions of actual standards may result from a crossbreeding process of traditional vehicles, merging the best features of each, towards compact and optimized solutions for urban environments capable to meet individual and collective requirements. Every year in the main international motor shows it is possible to notice concept cars that experiment technologies and investigate alternative ways to provide innovative answers to specific urban mobility issues.

Just to mention two examples that hit the market in different years, we have the Smart Fortwo, launched in 1998 and the Renault Twizy, launched in 2012. The first one was the result of a research lasting nine years, focused on providing an innovative compact 2-seaters layout, capable to maximise safety and interior space, designed to fit packed urban spaces, marked by traffic jam and parking scarcity. The Renault Twizy is an all-electric quadricycle, half-way between a car and a scooter, intended to be

individually used and designed for an urban purpose, as it intends to provide an agile and clean solution for short-range daily commutes. Both examples show the growing interest towards innovative solutions in which the vehicle is reduced to a minimum size, in line with its exclusively urban purpose. At the same time, both vehicles are currently applied to flexible car sharing services and may represent considerable solutions for the so-called 'last-mile mobility'.

Sharing

We have to keep in mind two factors: we are in a service economy, and environmental topics are driving the agenda. Considering current trends in big-sized european cities, we can notice how a growing range of of flexible car sharing solutions are blooming, like Autolib', Car2go, Enjoy and Zipcar among others. Furthermore, bicycles and bike-sharing services are increasing their presence in city-centres, alongside with a new generation of electric bicycles and other crossbreeding vehicles.

This represents a clear message about the growing interest about shared, flexible and sustainable solutions, many of which are enabled by web-based services, accessible from any mobile device connected to the Net and capable to give birth to real-time data management.

Local peculiarities

In this process we need to keep in mind that great cities have a soul and that their peculiarities, traditions and socio-cultural background affect how people behave and interact. It is therefore necessary to conceive solutions customizable for specific urban environments, capable to provide effective answers to local open issues. Customization plays a key role in the conception and implementation of products and services aiming to improve current urban standards.

Autolib' is an example of car sharing service, inaugurated in Paris in 2011, deploying all-electric Bolloré Bluecars, specifically conceived and developed to be applied to this service.

Collaboration

As introduced above, cooperation and bottom-up approach make it possible to subvert traditional habits, turning potential users into active actors in the value-creation process towards sustainable behaviours and efficient services. The **collective creativity** (CC) may be used by car manufacturers and technological companies to enhance the design practice,

showing how the most creative outputs can result from social processes involving many individuals (Amabile, 1996; Fischer, 2004).

Almost any object can tell a story and there is an even richer seam to be mined as people are invited to engage themselves, provide their opinion and eventually work together. As underlined by Fagone (2012), a striking example of such direct involvement is represented by the participatory approach adopted for the Fiat 500 project. To this end, Fiat Automobiles created a well-structured communication project called '500 Wants You', based on a multimedia platform mixing marketing and design tools, to involve people – ranging from users, brand supporters and other representatives – in order to collect useful feedbacks and suggestions for designers, engineers other stakeholders, in order to adjust and enhance the project.

Connections

Information and communication technologies are expected to play an increasing role in the coming years, redefining well established manufacturing standards and traditional design principles, as embedded web-based technologies get cheaper and allow real-time data exchange and communication with intuitive gestures.

According to the study by Wellman (2001), the individual becomes both an economic and a symbolic capital and since 1990s, with person-to-person communities, the person has become the portal, being connected even while on the move.

We need to transfer this potential to future vehicles, connecting the user/driver with the surrounding spaces and with other vehicles, thus creating an efficient and **interactive network**. In this vision, experts tend to focus on making transportation more intelligent by creating a networked infrastructure in which cars and other vehicles can exchange information in an ad-hoc mode. To this end, customers need to know and share as much information as possible; but delivering useless data may gradually become 'noise'. It is therefore crucial to find a balance between individual requests and community-oriented design, using context-aware applications, participatory sensing, user-generated content and social networking applications. As suggested by Büscher et al. (2009), acting this way, it is possible to optimize services and get suggestions for the improvement of informed travel systems, capable to drive customers towards smart decisions.

Several concepts every year show technological improvement about connecting equipment for cars. As a matter of fact, technology companies like Android and Apple, are working hard to refine technologies to provide systems for in-car connectivity systems capable to 'mirror' and expand users' digital life and connectivity potentials. The resulting cleverer vehicle, capable to communicate with other cars and to provide a wide set of directions about trips and surrounding places, is just one of the possible demonstrations of how web-based smart technologies can connect individuals and create responsive and collaborative networks.

Self-driving

Furthermore, an increasing amount of studies is pushing the boundaries to provide in the next future more intelligent and autonomous vehicles, less relying on human involvement or even not needing a driver at all (Buehler, Lagnemma and Singh, 2009). This is a really exciting opportunity entailing big consequences on future vehicles perception, as well as debates about limits and potentials related to their use. They may in fact turn into a sort of 'mobile spaces' in which ICT may support communication and interaction with other vehicles and surrounding spaces, allowing users to work and relax while on the move, instead of simply drive.

Future cars for personal mobility may come to be dwelt within very differently in the next decades, with almost untold consequences on urban life and consequently on the relationship between individual and community. Car manufacturers are constantly at work on various micro-cars capable to provide innovative answers to commuting needs. Urry (2006) underlines how 'the evolution towards smaller, lighter, smarter, information-rich, communication-enhanced vehicles better integrated into the public transport systems and public spaces' will not include telecommuting as a key feature to transforming urban life, since current trends 'suggest that many people want to engage in communication simultaneously with locomotion'. It is therefore increasingly crucial to provide vehicles capable to improve the actual urban situation merging a private and a public dimension. This is an essential step in the way we conceive infrastructures and services, towards a revolution in urban mobility, influencing the way we perceive technologies and products, as well as our lifestyle and sense of community (Argante, 2010).

8. Conclusion

Technologies are becoming more and more pervasive in the urban environment, creating responsive spaces labelled as 'smart' cities in which feedback loops enable connections between the environment, people, products and administrations. Municipalities are called to take actions to provide citizens better and more sustainable spaces but, as technologies are becoming more and more pervasive in the urban environment, it is also mandatory to have ultimate technologies and efficient connections to allow citizens to interact, communicate and exchange information. To this end, Web-enabled networks are gaining a growing relevance in the contemporary society and several studies tend to underline the crucial role of collaborative patterns, capable to exploit ICT as supportive equipment and to involve citizens in the value-generation process, towards striking solutions capable to improve the quality of urban life. These may range from web-based platforms to online applications for mobile devices. However, when people are called to share the same urban spaces, possible conflicts may arise, because of the discrepancy between individual interests and collective needs.

Social life becomes therefore a sort of deal, according to which the individual tendency to stand out and the collective needs towards social equality try to find a balance Simmel (1904). This is particularly evident in the field of urban transport that represents a knotty problem for crowded cities, requiring a total commitment to find effective solutions.

Even if it is too early to define with certainty the future of urban transportation design, it is possible to understand how pervasive ICT together with flexible and shared solutions, meant to provide answers to the individual desire of personal transport, will have to coexist with more 'traditional' public transport. Striking solutions for citizens' everyday commutes may be individually used, owned, rented or shared, optimizing space and power consumption, minimizing their environmental impacts and integrating pervasive technologies, thanks to which users can actively participate as 'sensors' (Büscher et al., 2009).

The future car industry will have to be coherent with his own past, but also carefully concerned with users' and brand's requirements, like safety and customization issues, as well as environmental constraints, like clean energy use and integration with other forms of mobility. The result will be a wide range of vehicles supporting more sustainable behaviours and reconciling personal mobility demand with collective requirements in an integrated intermodal mobility for our future metropolitan areas.

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