

Looking for city 4.0. Two work in progress experiences in Zaragoza

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Abstract

This study presents the current status of two work-in-progress experiments of citizen's participation in the design and self-definition of the resilient city developed in the Open Urban Lab of eTOPIA art and technology centre and in the Harinera communitarian art centre in Zaragoza (Spain). Both pilot projects are part of a main framework of research about the potential role of Informatics and communication technologies, citizen science experiment, self-fabrication and maker's tools in the citizen's participation to the resilient city. The goal of the investigation is to define a method of co-create and bottom up environmental analysis for a self determination of a resilient urban productive landscape.

Moving from a definition of City 4.0 the investigation will focus on is on citizen's role in the bottom up revolution from smart city to resilient city. Finally it will be presented how the use of open technologies and co-design techniques are going to be involved in two pilot projects: La Milla Productiva mapping of the Digital Mile Park for a resilient landscape design; and Guerrilla Energética an artistic, low tech actions to transform wasted urban areas by means of workshops of self-defined energy productive landscapes.

Keywords

Citizen Science, resilience, co-design, urban space

1 Introduction: Looking for city 4.0

To imagine the City 4.0 form, as the image of the city of the future, more than a sci-fi exercise is attempt to predict how next industrial revolution will affect the way in which the people will live together, based in the study of their landscape footprint.

First of all it is necessary to clarify the revolutionary aspect of the current industrial stage of evolution. Nowadays, the so called third industrial revolution is subject of debate by scientific community. A generally accepted definition of third industrial revolution is the digitalization of fabrication and the consequent evolution of goods production to "mass customization" (The economist, 2012). As well of fourth industrial revolution is defined by:

"[...] Emerging technologies breakthroughs, artificial intelligence, robotics, internet of thing. (Annual meeting World Economic Forum, 2016)"

This ambiguity in the definition of terms, caused by divulgation mass media, generates a first lack of reciprocity between industry 4.0 (in reference of a fourth industrial revolution) and a missing correspondent industry 3.0.

In order to find a coherent definition of City4.0 is necessary to disconnect the univocal relation between city evolution and goods production technologies, towards a more complex model that involves "social technologies".

Charles Landry (2017) offers a definition of City 4.0 moving from the intrinsic urban evolution:

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“The full impact of digitalize world and its disruptions, the blending of physical and virtual and the rise of artificial intelligence that is yet to come”

Starting from the historical city as City 0.0, Landry presents an urban form evolution based on telecommunication technology evolution that ends in a software driven nomad society based on Uber, Air BnB, or Facebook model. This image of the City 4.0 as an interactive reflection of the physical city is aligned with the human evolution toward abstraction theorized by Bolter and Grusin (2002) through the “Re-mediation” of one media by a new media mechanism. In their point of view, the cyberspace re-mediate electrical telecommunications as social space re-mediate some historical places of the cities.

Moving from mass production scale to the diffuse fabrication perspective, offered by personal fabrication technologies (Gershefeld 2007), it could be possible to obtain a paradoxical fragmented scenario of sprawling productive realities, resulting into a grey mix. In that landscape Information and Communication Technology (ICT), Augmented Reality and Web 4.0 would assume the role of essential tools to “see colors”, or in other words understanding and interacting with the city.

Studying the manner in which new media have modified social behaviour is possible to recognize a common trend related to the evolution of the relations between persons and space, which come from the evolution of relations between persons and person. On one hand emerging mobile technologies define a tendency of mutation from communities based on relations of nearness type “door to door” to decontextualized communities type “person to person” (Wellman, 2001). On the other hand the growth of urban population, that is presumed to get to the 70% of worldwide population in 2050, evidences that this shadow of decontextualization of relations isn’t affecting the urban space as predicted. Individual are not invariable respect the territory, and the death of the city (Castells, 2008) is not happening.

The re-mediation of the public space made by the cyberspace, looks came back to fill the historical city places using mobiles technology itself. The Smart phones as “place” of closer relationship, with parents and friends, brought into the public space that semi private space of nearness relationship.

Can we imagine a similar leapfrog into the diffuse production scenario? Manuel Castells (2008) considers that space dynamics in the Information Age creates a contradiction between “*the space of flows and the space of places*” in the megalopolis growth. These mega-nodes, where the people and power are concentrated, are the most characteristic expression of globalization urbanism:

“[...], few people in the world (actually 13 per cent according to the World Values Survey) identify with the global, cosmopolitan culture that populates the global networks and is worshipped by the mega nodes’ elites. In contrast, 47 per cent of people feel a strong regional or local identity.”

Under these premises, the scenarios of the evolution of City 4.0 are far to be clear. For these reasons in this work is proposed a perspective shift. Instead of try to analyze how the “4.0 technologies” are globally affecting the urban space by different people use, this study investigates how people empowered by “4.0 technologies” can act on their local environment.

The method includes field research by using citizen’s science tools, in co-created activity involving citizens in participatory process of resilient landscape design.

2 Citizen Science as a new tool in participatory design of the resilient city

Smart City models are devoted to the study of the relations between city and technology. It is evident that the technology deployment that is creating the Smart Cities where we live, it is making emerge a plethora of ethic, social and politic question about urban and information sciences (Kitchin 2016).

Since cities started to include every kind of digital infrastructure, network, sensor, and actuator in their infrastructures, the amount of data produced has grown exceptionally, providing flows of information about cities and citizens (Kitchin 2013). The real time city, as data central control from institutions, is a reality in Rio de Janeiro and London, where movement of cars and people are monitored in every moment, as well as in Dublin or Santander where these data are open and can be used by citizens. These smart city models had been generating an image of panoptical city that has been cooling the enthusiasm about new media. Moreover, these smart cities have been generally boosted as result of the inversion of

multinational societies of technology. Those smart cities, far from be developed with sustainability as final goal, seems to be a joint association of tech multinationals and cities to fight the 2008 crisis (Rossi 2015).

For these reasons a lack of trust in these models generate fears related to the crash and paralyzation of infrastructures, due to cyber attacks or bugs born in the same system (Kitchin 2012). Those fears are clear manifestation of the inquietude respect a corporative attitude on Smart City that was not leaving space for citizen's manifestation (Hollands 2008). Hence, Kitchin suggest a radical change of attitude, as well as a reshape of the entire urban science. First of all coming back to the city complexity in contrast to simplifications generate by machine learning. Secondly, coming back to the main principle which assumes that urban science cannot be neutral, as well as raw data don't exist. Finally, coming back to the basic ethics on sharing data as voluntary act of responsible citizen, instead of an external opaque data gathering.

Some proposals in that line are coming from the Aalto Institute in order to define the role of citizen in the definition of the city by means of the use of ICT. The use of mobile apps and soft GIS tools allow to reach the parts of population that were excluded from classical mechanism of citizen's participation, for lifestyle, age or, simple lack of engagement.

"Previously, planners and professionals were the producers and users of urban information. Currently, the users are also co-producers of urban information. The talent and the mass of user groups create the value of digital applications (Horelli et al. 2010)"

New technologies applied to planning assessment software make possible subjective and emotional data mapping, which automatically flow through the web to be involved in the city plan definition. This could be a perfect example of how citizens using ICT technologies as tool and web 3.0 as medium can help (in a non-direct way) to define their environment.

The goal of this investigation is try to help in the technologies 4.0 model definition. On one hand, generating direct feedback between cyber space and digital space by people participation and using web tools. On the other hand in reference to digital fabrication tools of mass customization, focused on a Do It Yourself perspective.

In order to investigate the potential of DIY culture into the self-definition of the resilient city it has planned to a series of community field activities by using Citizens Science tools. The goal of this first cycle of social experiences is to define limits and issues of citizen's active engagement in scientific experiences focused on landscape holistic interpretation.

3 Two pilot projects in Zaragoza

3.1 Social Art and Citizen Science as tools of participation

The two projects presented in this paper were created from the necessity of a direct experimentation of the citizens' science tools in order to better understand the problems associated to different approaches in social experiments. Albeit the limitations (reduced sample size, personnel involved and material resources) that reduce the quantitative value of these experiments, these experiences allow to obtain a very interesting overview of complementary aspects on the citizen science.

On one hand the Milla Productiva (Productive Mile) project comes from a lack of identification of inhabitants in the surroundings of the Milla Digital (Digital Mile) park detected by the Smart City department of Zaragoza's Municipality. This misalignment actually reflects the problem of communication between the same institution that has its headquarter in the entrance of the Park (the Open Urban Lab, in the eTOPIA, Art and technology Center) and his closer neighborhood. The Milla Productiva Project has been promoted by the authorities as a call for active citizens with a Top-Down approach, in order to try to involve the most direct users and stakeholder of the area. At the same time it takes form thanks to the collaboration of Cesar Laboratories of citizen science (owned by University of Zaragoza and placed in eTOPIA) and my voluntary work has mediator and researcher. So these projects arise as a multidisciplinary collaboration between scientists, investigators and administration in a contemporary art environment to solve a common problem by involving citizens.

On the other and the Guerrilla Energetica (Energetic Guerrilla) project was born as a place of informal investigation. The environment is once more a Center of art, promoted by Zaragoza Cultural, the municipal agency of culture impulse, but oriented as a social experiment of self-managing assessed by authority. In Harinera Center of Communitarian Art, the Guerrilla Energetica project that I designed had been accepted as a project resident to be developed between citizens and other residents. The completely horizontal managing environment makes possible to assume the project as a Bottom-Up experience. In that experiment Art thinking is a guideline of creative development of scientific experiments and DIY fabrication of small scale devices for the implementation of renewable energy in the district. In both case the “art” factor is present with different degrees of latency from as a tool more of people engagement to key of data interpretation. Science and art change their roles several times.

3.2 La Milla Productiva: a TopDown Citizen-Scientific approach to urban landscape design.

3.2.1 Social retrofit of a futuristic landscape.

If Milla Productiva project born from a “serendipity” collision between cultural actuators and stakeholders, it is very important to remark that all the Milla Digital Campus (including the park, eTOPIA and CIEM, Milla Digital Business Incubation Center) was born as a workshop of technological symbioses between urban landscape and citizens as “*a new public space for the city of the digital age*”.

“Milla Digital is an initiative of Zaragoza City council to convert over a million square meter in the city center , formally used for railways into a center of innovation and creativity [...] developed in close collaboration with the public corporation Zaragoza Alta Velocidad 2002”. Its masterplan counted with the collaboration of University of Zaragoza, Massachusetts institute of technology, Fraunhofer Gesellschaft and an international Committee “inspired by Manuel Castells including William J. Mitchel its chairman, Saskia Sassen and Peter Hall among other.”

The Milla Digital Campus is the linear park that connecting the ex-central train station of Zaragoza “el Portillo” to the new high-speed train station of “Delicias” and the Expo 2008 site. It acts as connecting column of the future “Open Source district”. Starting and ending with a Mediateque and a Centre of Art and Technology the Campus in 2006 was object of international Tender of design won by Colmer Dumont, Angence Ter, BRL and Procam team, of a prototype of smart bus shelter by Sensable city Laboratory, a pavilion by Carlo Ratti and several prototyping project as David Cuarteller’s Gohan Project in 2007. Until in 2009 as well as other similar strategic plans in Europe the realization had a radical break.

Now, almost 10 years after, the Park is currently called “el descampado” (the waste ground). The WIFI infrastructure is going to be dismissed for obsolescent by Zaragoza city council because the cheap and faster mobile data economy creates a leapfrog effect. The interactive fountain system is mostly unknown and far from characterizes that route as a walking green axe connecting to the city center.

Following the line of an Open Source environment highly customizable by users, this project pretends to make a step forward in the retrofitting process of this paleo-futuristic landscape. The complete process is based in the citizen’s participation and it starts from the emerging citizen science approach to understand fail and potential of previous experimentation with the final aim of to develop a co-creation tool to fabricate a new kind of resilient landscape.

3.2.2 Design with complexity

The Milla Productiva Project has been planned in response to the principles of Resilient Thinking (Folke et al. 2010). It includes trying as much as possible to reflect all the complexity of relation of a Socio-Ecological-Systems (SES), with long time variables and short feedback. Moving from the Carpenter’s definition:

“Resilience has multiple levels of meaning: as a metaphor related to sustainability, as a property of dynamic models, and as a measurable quantity that can be assessed in field studies of SES.” (Carpenter Walker, 2001)

One goal of Milla Productiva is to define new variables by involving people as Citizens Scientist in a co – creation process. In order to increase gradually that complexity, the project consist in a cycle of modular citizens’ science workshops to focus a new variable in each one starting from general theme as: WATER, FOOD, ENERGY, IDENTITY and COMFORT.

3.2.3 Dynamic modularity

The modular approach ensure every step of the adaptive management. Adaptive management is understood in Holling's 1978 definition as active field test where scientist and managers adapt and learn by each other, in a panarchic dynamic equilibrium thought exploitation conservation release and reorganization stages (Djalante et al., 2011).

In order to pursue the resilience of all the process, each topic will be developed as an independent module that in a panarchic approach will afford all the stages of: co-design, develop, analysis and re-design through fore loop and back loop.

Each co-design workshop will start with a brainstorming session that we call "looking for new questions". In that stage will emerge the particular issues that participants really care, and which are focus to the main themes (water, food, energy, identity and comfort). In that stage is crucial not to involve technical tools in order to avoid the fears caused by technical inadequacy. The second stage is the "variable definition" where a common unit of measure is defined by all the participants. The technical planning of the activity can be developed by the organization or in common depending from the participant profile. In that stage technological education, as well as ecological education, has been emerging as an important tool of engagement, especially working with young people and non technical profiles.

3.2.4 Engagement low-tech

In order to avoid to fall in the citizen-scientific stereotypical profile of participant, and to reach the engagement of different kind of citizens and stakeholders along the entire cycle, each activity is developed with a focus group and subsequently open to all interested people.

Depending from the activity design the activity development can involve just members of the focus group or more citizens. In case of target group is formed by very young or old people, the focus group has included tutors or mediators to save the gaming/discover character of the activity and involve more people in the activity development.

3.2.5 Data driven maps reviews

Final goal of all the process is to produce a series of data-driven maps which represent a holistic image of the Digital Miles area, representing each one a metabolism variable of this part of urban landscape.

The use of quantitative data (even if they are no statistically representative) in citizen science allows to objectify the voluntary act of sharing data, helping avoid the commonplaces and involving all the stakeholders.

3.3 First experiment between identity and art "OrientARTE en la Milla"

The first activity developed in the Milla Productiva framework was focused on *IDENTITY* theme by mean of Public Art as a tool of identity definition in public space. The activity was structured as an orienteering race with adolescents, to define a map of representative landscape, involving the art and monuments as land mark in the city and graffiti and street art as manifestation of self-determination and appropriation of spaces.

3.3.1 Method

For the specific theme involving art and identity, the working group of interest was formed by teenagers. Participant were between 14 and 17 years old students of high School in Zaragoza .

The activity was co-designed by a multidisciplinary focus group including the author of this paper as mediator and art consultant, a representative of Smart city department of Zaragoza, and Teachers of technology and physical education in the academic program. In the comparison meeting were emerged the problems of engagement working with teenagers, the fear to face abstract themes, insecurity about teachers technical skills to develop the data gathering stage at the school, and the necessity to involve the activity in a gaming scheme.

In response of all the question opened it was chosen to use a technological tool already known by students: the mobile app GPS Orienteering (HippsoApp). The activity was structured as a familiar sport for the students, an orienteering race with the implementation of specific tasks to support the data interpretation stage.

The race was a 3500m approximately, to develop along a free score race scheme based on 13 control points located on all the principal places of access at the park and 6 points of special interest, easily recognizable, located in its interior. During the race the students were invited to take photographs of these elements that help their orientation, and can be used for comparison purposes.

To avoid influences and repetition, participant were divided in 3 groups with different starting and ending points starting the race every 5 minutes. Along the route two shopping carts where left as bonus element. Participants finding the cart has the task of bring it to the next control point. All the time spent carrying the shopping cart have to be subtract to the total race time.

After the race all the students were invited to share their best pictures and to submit a survey of data interpretation support with 10 qualitative questions like:

- Did you get lost? Where?
- Have you found something unexpected?
- In your opinion, which was your best time point?
- Where would you like to have a break?

3.3.2 Data interpretation

Students used their owned mobile phone. This choice produces some problems in the data collection because there are discrepancies in GPS data detection. Some mobile phones were not detecting the start point data localization being too close to the Etopia building.

Most of the students choose to run in couple reducing at 50% the sample size. The 50% of the participants shared complete information (tracking data, photos and survey) and an additional 20% shared incomplete data. Thus it was possible to generated 5 sample paths with the available information. The experiment has been considered useful to test the computational model of data analysis and to understand the problems of this field campaign, despite of the small amount of experiments to do a rigorous statistical analysis.

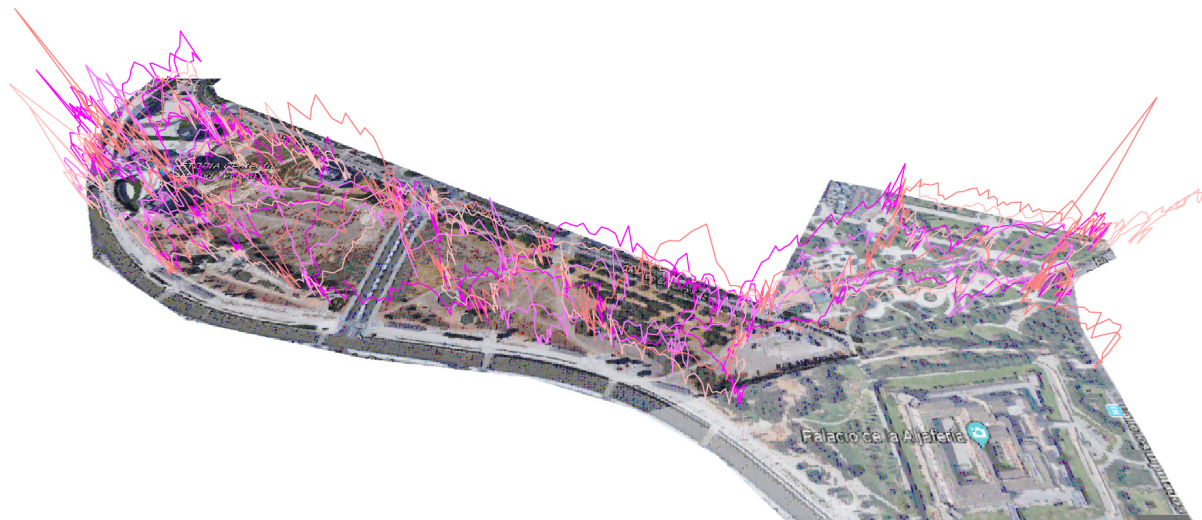


Figure 1: Data paths.

Each path is defined by a series of GPS coordinates, collected approximately each 2 seconds. Local speed has been defined as an attribute of the point in the space and it has been directly calculated by time differences in the position of subsequent points. The range of local speed has been normalized to avoid alteration due to participant physicals entrainment. All the paths are represented in a geo-localized map having local speed as third dimension.

Speed data has been filtered out of a maximum and minimum threshold to a reduced number of most significant points. These points had been used as attractive points in a qualitative vector field representation of the Milla Digital Park.

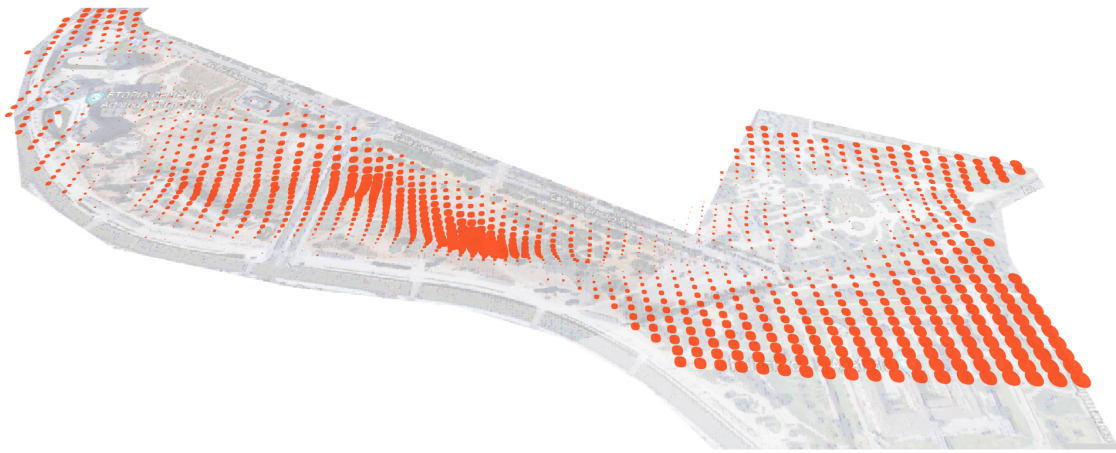


Figure 2: Representation as gravitational field of Identity variable in to the landscape orientation.

The geometrical interpretation as vectorial field of the data collected results coherent with the qualitative data expressed by questions and pictures. The area results polarized by two zones of high density of architecture and vegetation where orientation is easier. In the middle of the park emerge a lack of identification that coincide to be the place where most of participant get lost.

3.4 Guerrilla Energética

Guerrilla Energética (energetic guerrilla) is a didactic project whose purpose is education and sensitization about renewable energies, inspired by Guerrilla gardening experience of urban re-development by bottom up action of re-greening and appropriation of urban wasted areas.

The integrated productive landscape subject in that project is entirely focused on energy production in a low tech and high “fab-able” perspective. The 3 stages that form one guerrilla action are: “Stage 1=Build your own weapons” a cycle of learning by discovering activity about basic energy tools. “Stage 2=co-design strategies” a long time co-design workshop in which participants are purposing and co design a site specific action in public space. “Stage 3= Energetic guerrilla in action” intensive workshop of communitarian fabrication action in public space. During the process participants are empowered by learning technologies, made conscious by working together and pro-actively involved in hacking the public space by design and fabricating artistic accretions that make visible the hidden power potential of the environment. This physical hacking action comes in claim of more responsible politics of renewable energy.

This project based on Art thinking models comes as counterpoint to the citizens’ science activity to investigate more informal ways to involve citizens in the fabrication of a future possible city, in a 4.0 perspective that see ICT technologies and planning assessment models as tool of a low tech bottom up smart city.

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