A TOOLKIT FOR COLLABORATIVE DESIGN: ENVISIONING AND SHARING THE IDENTITY OF PLACE THROUGH TRADITIONAL AND EMERGENT TECHNIQUES OF SIMULATION

Barbara E.A. Piga [a], Eugenio Morello [b], Galia Shokry [c], Rossella Salerno [d]

[a b c] *Laboratorio di Simulazione Urbana 'Fausto Curti', Department of Architecture and Urban Studies, Politecnico di Milano, Milan, Italy*

[b] *Lab'Urba, Ecole d'Urbanisme de Paris, Université Paris Est Créteil, France*

Introduction

Objective

The aim of this study is to develop a novel toolkit for co-design that is heavily based on the use of digital simulations during the process. The occasion for setting up a novel co-design methodology and testing different work modalities was possible because of a real case-study application: a collaborative collaborative design experience launched with community stakeholders within the sustainable campus initiative at our university. The methodology was implemented according to a 'learning by doing' approach, i.e. during the co-design process, and focused in particular on how and when to use visual simulations during the different types of activities and in relation to the different stakeholders.

The research context: traditional and emerging tools and place-making

The toolkit is composed of a variety of tools, ranging from traditional representations of design projects (hand-drawn sketches and perspective views, top and front views, plans, orthophotos and pictures) and digital simulations (both photo-realistic and more artistic interpretations of places).

Moreover, we wanted to study new opportunities offered by the employment of emergent technologies[1], traditionally applied in disciplines outside the domain of architecture and urban design. Techniques taken from the movie industry, the gaming industry or even the military sector have been incrementally adopted in architectural practice over the years. Some outcomes of this shift have had a positive

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[1] Danahy, John W. "Technology for dynamic viewing and peripheral vision in landscape visualization". Landscape and Urban Planning, No. 54. 2001, pp. 127-138.

influence in public involvement processes, since the architectural representations have become more readable by the lay public[2]. We argue that the same tools, especially interactive ones, can be efficiently applied to enabling citizen engagement and supporting place-making processes. In particular, outdoor Augmented Reality (AR) represents a powerful medium for engaging people in co-design activities, because it enables a sense of immersivity and immediate understanding of design schemes in place.

The case-study application: a car oriented and inhospitable street

The occasion for testing a co-design process and simulation techniques was the redesign of a shared public space, an initiative promoted by the project 'Città Studi Campus Sostenibile', a sustainable campus program supported by the Politecnico di Milano and the Università degli Studi di Milano[3]. In particular, the ongoing object of redesign is via Celoria in Milan, a street that lies in-between two universities at the heart of the university district of Città Studi[4]. This street represents a symbolic place for the entire city, but it was neglected over time. In fact, when the university area was built, at the beginning of the 20th century, the street had its own sound identity. Despite the fact that at that time, this was a location at the margins of the town, the street was designed as a tree-lined boulevard, with a dignified section, and green parterres. With the coming and increasingly extensive use of cars, the street suffered the consequences of traffic and parking: from a pleasant street for people it became a jungle of disordered cars parked everywhere, where students struggle to safely reach the university.

Methodology

The reasons for a collaborative design approach for re-thinking a public space

The urgent challenge to turn the street into a safe path for pedestrians was a good occasion for re-thinking the entire street design and offered a tremendous opportunity for studying and applying new ways for an effective collaborative design based on a wide use of visuals and digital simulations of future transformations. In particular, we wanted to understand the modalities and the timing for applying

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[2] Kwartler, Michael, & Longo, Gianni. Visioning and visualization: people, pixels, and plans. Lincoln Institute of Land Policy. 2008; Bishop, Ian D., Lange, Eckart. Visualization in Landscape and Environmental Planning: Technology and Applications. London, New York: Taylor & Francis. 2005.
[3] Morello, Eugenio, Piga, Barbara E.A. "Envisioning the sustainable campus: the urban model as the hub that supports the transformation", in: Morello, Eugenio; Piga, Barbara E.A. (eds.), Envisioning Architecture: Design, Evaluation, Communication. Milan: EAEA. 2013, p. V–XI.
[4] Piga, Barbara E.A., Morello, Eugenio, Signorelli, Valerio. "The Combined Use of Urban Models to Support a Collaborative Approach to Design Towards the Sustainable University Campus: Participation, Design, Transformation", in: Saleh M. Uddin; Chis Welty (eds.), Design & Graphic Palimpsest: Dialogue, Discourse, Discussion. Atlanta (Georgia –USA): Design Communication Conference. 2014, pp. 53-58.

different collaborative design tools. Once the project is concluded, a co-design toolkit will be proposed by the authors in order to replicate the experience in other projects.

Not only the physical and utilitarian transformation has to be taken into account, but also a radical change of identity for a public space that should be able to promote social integration. People are simultaneously part of the environment and perceivers that interpret and give value to it: the sense of belonging (identity) and the atmosphere of places are the outcomes of the interaction between people and space. This is the reason why collaborative design is necessary to promote the environmental and social quality of places.

The challenge: the temporal dimensions of co-creation and design techniques

In order to promote an effective co-design process, the temporal dimension of the activities and the reference to specific design tools and products has to be carefully considered. We argue that a detailed programming of a calendar of activities and deliverables to guide the process is not possible at the beginning of a bottom-up collaborative design process, because the steps are defined over time and highly dependent on informal unexpected events that can stop or accelerate the planned activities. In particular, our research interest lies in the understanding of the use of design visualizations and simulations (mainly drawings, digital representations and physical models) throughout the process. In fact, the crucial questions we face while we develop the activities refer to the legitimacy of using representations for envisioning future scenarios. Visuals can be used in several ways, but can highly manipulate the process if not properly used. In fact, representations can serve as media for interacting with the actors of the process (citizens and public officers), in particular for: (i) informing them, (ii) helping them select and create their own suggestions and ideas about possible future conditions, (iii) convincing them to sustain a specific design solution or on the contrary to discard bad options. In short, the use of images is very powerful, especially when we deal with digital photo-realistic simulations, which are easily readable by laypeople.

Setting up a process for enabling co-creation: the application

The process has developed over a series of events, and is still ongoing. There are five main steps listed below and summarized in Table 1. Initially, the work was carried out by the urban simulation laboratory (*Laboratorio di Simulazione Urbana 'Fausto Curti'*) in collaboration with student interns and the Laboratorio Modelli, and later with the contributions of the students of the architectural and urban simulation course[5].

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[5] POLIMI – Architecture M.Sc. class named *Architectural and Urban Simulation*, main instructors R., Salerno & B., Piga. Politecnico di Milano, Social web-page: www.facebook.com/IcArchitecturalAndUrbanSimulation.

Table 1. The collaborative design process and the types of design supports used

		EVENT 1	EVENT 2	EVENT 3	EVENT 4	EVENT 5
TYPE OF EVENT	FORM OF PARTICIPATION	STAND AT PUBLIC EVENT	STAND AT PUBLIC EVENT	MEETING	RESEARCH SEMINAR	WORKSHOP
	FOR WHOM	CITIZENS, STUDENTS	STUDENTS	PUBLIC OFFICERS	RESEARCHERS, STUDENTS	CITIZENS
	SCOPE	COMMUNCATION AND COLLECTION OF OBSERVATIONS	COMMUNICATION AND COLLECTION OF OBSERVATIONS	COMMUNICATION, COLLECTION OF OBSERVATIONS, ORGANIZATION OF ACTIVITIES	TESTING OF AR TOOLS IN OUTDOOR SPACES	COMMUNICATION, COLLECTION OF OBSERVATIONS AND CO-DESIGN
TYPES OF DESIGN SUPPORTS	FACILITATORS (STUDENTS AND RESEARCHERS)	NO	YES	YES	NO	YES
	TOP VIEWS AND MAPS	YES	YES	YES	NO	YES
	PICTURES OF THE PLACE	YES	YES	YES	NO	YES
	PHYSICAL MAQUETTE	YES	YES	YES	NO	YES
	DIAGRAMMATIC TRANSFORMATION SCENARIOS	YES, THREE	YES, THREE	YES, THREE	NO	YES
	SITE ANALYSIS INTERPRETATIONS	NO	YES	YES	NO	YES
	PROJECT SCHEMES	NO	NO	YES, MULTIPLE	NO	YES, MULTIPLE
	RENDERS (SUBJECTIVE VIEW)	NO	YES	YES	NO	YES
	IMMERSIVE SIMULATIONS (AR)	NO	NO	NO	YES	YES
	INTERACTIVE SIMULATIONS	NO	NO	NO	NO	YES

Source: elaboration by the authors.

In order to reflect the complexity of the current condition of the street, a number of products were proposed and aimed at: (i) representing the ambiance of the place (ii) communicating alternative scenarios of transformation with the intention of opening the discussion without presenting design solutions. The representations developed by students[6], together with interactive simulations, a physical model and other technical representations constituted the basic materials for involving the local community in the co-design process. The types of representations increased in terms of quantity and complexity over time. In fact, we started using the physical model and a simple map of the street, then we added subjective images and representations, and in the near future, we will move to more immersive and interactive simulations.

Four public events took place, and one is planned as the natural progression of the process. In parallel, we opened a webpage on a social media site aiming to keep actors updated about the ongoing process[7].

The first public launch of the initiative (Fig. 1) happened during the seminar *Giornate della Sostenibilità: Focus Ambiente*. Two big posters, a physical model and a questionnaire with three different car-accessibility scenarios compose the

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[6] Eight students' works were displayed, three of which were photo-based, two were sketches of which one included an abstract watercolor interpretation of the street; last, was a work that included maps and sections of the street.

[7] Social web-page: www.facebook.com/pages/Via-Celoria-Milano-Città-Studi-Campus-Sostenibile/433083053490339

package of materials presented to citizens. No design proposals were produced in this phase, only three diagrammatic scenarios displaying one with the most relevant topic, i.e. car accessibility. The simple schemes explain the possibilities at hand. The scenarios are described with attention to the specific changes each option proposes: (1) removing all street parking, (2) creating a 30km zone to slow traffic, or (3) fully pedestrianizing. People were asked to indicate their preferred scenario, and to share their comments and ideas. The next step was to reach a shared vision and the new identity of the area that will inform the final design solution. In fact, we argue that by comparing the current situation to a number of alternative solutions, the audience has the elements to start a dialogue on the basis of different visions. People were asked to indicate their preferred scenario, and to share their comments and ideas. Actually, the initial activities were not intended to define design solutions, but to help people to envision the change. We assume that architects are able to coherently interpret and address emergent explicit and implicit needs.

After, the same materials have been presented to an audience composed mainly by students but opened to the public, at a popular university event, known as the Spring festival or the *Festa della Primavera* (Fig. 2). The main difference with the previous event was the presence of students as facilitators to introduce the concept and ask students for contributions (via questionnaires and annotations on maps). On this day, nearly 100 votes were collected.

The first occasion to meet with local representatives happened a few months later and could benefit from the outcomes of students' place interpretations and design schemes produced during the teaching activities (Fig. 3a). Students' works helped reveal new topics and enlarge the number of points of view and interpretations of the street condition. Moreover, the projects served as suggestions to orient the discussion on relevant points (accessibility, activities, safety, green connectivity). Discussing eight different design solutions enabled a balanced conversation because no influence by way of any single project was possible.

Later, we held a seminar on the role of ICT for design[8], where we briefly tested AR solutions[9] (Fig. 3b) with a small number of users. AR on a tablet enables people to experience the design solution freely in a more immediate and natural way, i.e. in a partially immersive way and in motion. This solution is apparently very effective for the communication of design schemes, even if some technical problems do not yet allow for fluid observation; AR solutions will be further tested during the next co-design events.

Finally, the planning of a workshop with citizens of the local community, hosted and organized by the local municipality, will constitute the next step to be held soon. On that occasion the same materials will be introduced as the basis for discussion.

[8] International Research Seminar: Walk-scape: ongoing research on Augmented Reality solutions for the built environment (10.3.2015) https://plus.google.com/photos/108828272419148333503/albums/6140200860534177649

[9] The AR tool was develop by Chiara Calabrese, an engineer student of POLIMI, under the supervision of prof. Luciano Baresi (DEIB) and co-supervisor Luca Lamorte, with the support of the Laboratorio di Simulazione Urbana 'Fausto Curti' (Calabrese, 2015).
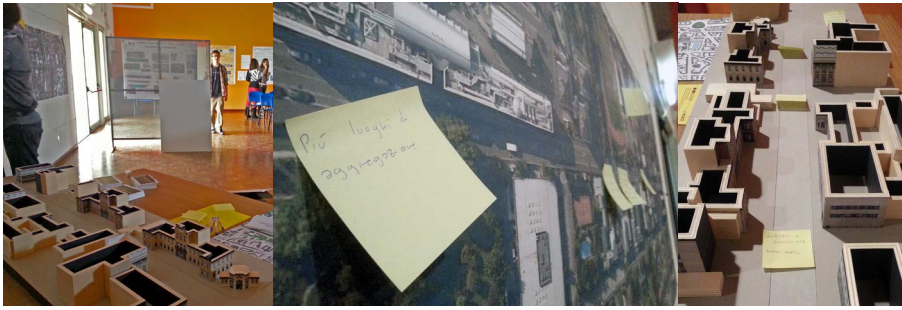
Fig. 1. Pictures taken during the first public event to launch the co-design process: the physical model and a questionnaire we proposed to participants, the board with participants comments, the physical model with participants comments
Source: pictures taken by the authors.

Fig. 2. Pictures of the second public event aimed at involving the student community in the process: the physical model, the questionnaire, the boards and the visuals by students
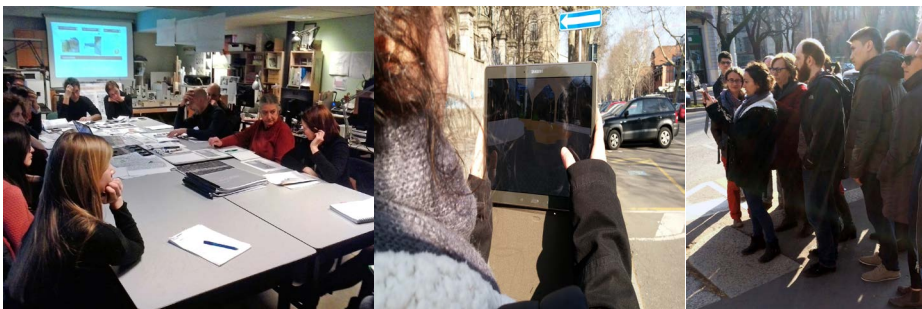*Source: picture taken by the authors.*

Fig. 3. (a) Pictures of the third public event aimed at involving the student community in the process. (b) Testing of outdoor AR techniques to validate design schemes on site
Source: pictures taken by the authors.

Design activities carried out by students to support the co-design process

The work carried out by students was developed in parallel and was used to provide additional material in support of the co-design activities. It is important to note that the site analysis interpretations and final design schemes are not the product of co-design activities but originated from students' team work.

During the M.Sc. course, we asked students to develop urban design projects on the basis of an experiential design approach[10]. This was mainly anchored on the following arguments: the interpretation of the place has to be grounded on experience, with specific reference to multi-sensory perception; the subjective perspective of the designer is crucial to guaranteeing the environmental and aesthetic quality of places as deeply investigated by traditional urban design scholars; hence, immersivity, in space and time, is here considered as a key component to take into account for developing the urban design project.

The first design task was the interpretation of the place as it currently appears. Students were asked to visit the project site and to describe their feelings concerning the first urban encounter (Fig. 4). No information was given in order to let them freely perceive, interpret and depict the design area. Although the cultural and educational background of the students was various, coming from architectural, planning and social studies, some common trends in the personal experience of the place were recognizable: a sort of collective feeling emerged. For instance, the road was perceived as a merely functional space, serving in particular as an extensive parking lot and a distribution corridor of students' flows to reach the campus pavilions. In order to describe their personal sensory and emotional geographies of the place, students could use different types of media to communicate their experience, according to their sensitivity and technical skills.

Fig. 4. Interpretations of the current condition of the street by students of A&US
Source: elaboration by students. Courtesy of (a) Prap Chaiwattana (b) Julia Gocalek.

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[10] Rasmussen, Steen E. Experiencing Architecture. Cambridge MA: MIT Press. 1964 (originally published in 1959).

Interpreting the present, sharing the scenarios and simulating design solutions

So far, the process has worked as a strong attractor of attention, as a way for foreseeing possibilities, as an activator of dialogue among different place users, and, we hope, as a catalyst for a real transformation. We can state definitively that today the process has triggered collaboration among the stakeholders. In fact, the local public authority and the two involved universities are cooperating for improving the quality of the city and its inhabitants.

Understanding the role of the different types of representations and simulations was a crucial operation to properly involve people, and create a common ground for an effective and fruitful dialogue towards the new identity of the street. Moreover, the parallel dissemination of the process and the products on social media were great amplifiers for keeping attention on the topic between one event and the next. All these tools, each one with its own peculiarity, supported the dialogue across a diverse audience. Below, some detailed comments on the experience of using these multiple means during the process are listed.

The *physical model* was the first strong attractor during the public events and a good support for the debate. It also proved useful in orienting participants to the location potential interventions and as a reference when answering questions about how they moved through campus and which areas of the street they used most.

The *display board* with the scenarios was probably the most referenced item in order to give a visual overview of the project possibilities. In fact, it represents the item that asks for interaction.

Representations of the experience of via Celoria developed by students stimulated ideas and invited more interpretive comments (Fig. 4). In fact, the interpretations of the place emerging from a multiplicity of personal visions offered by the students helped bring focus to the intangible effects of the current condition. This approach made it possible to share a common idea of the identity of the current condition, while launching a mechanism that looks into the future.

The *photo-based renderings* were most useful to refer to when describing the scenarios and seemed to more clearly communicate the issues that the schematic scenarios were attempting to address. Some participants reacted to the photos, recognizing their own experience in the visualizations.

Experiential interactive simulations based on outdoor Augmented Reality are essential to virtually place lay-people into the possible future scenarios.

In short, subjective views of the existing condition proved useful to keep in mind the visual perception from specific points of view. On the contrary, physical models and technical drawings, such as top- frontal views and sections, were useful for getting the overall picture of the physical layout of the street. The real-time combination of these different media enabled the observers to correlate experience and city structure, from a more interpretative to a more flat and technical perspective.

Conclusions

The paper has introduced the ongoing experience of a co-design process about the re-design of a public street and has aimed at providing new critical insights on the use of novel digital visual simulations along the path. The experience demonstrates that images are powerful and at the same time that visual materials can highly impact the process both in a positive sense (i.e. improving understanding of future environments, speeding up discussions) and in a negative one (i.e. manipulating audience opinion and affecting decision-making). Moreover, different media present different peculiarities and opportunities. The emerging considerations will be used to implement a dedicated toolkit for co-design with simulations.

Acknowledgments