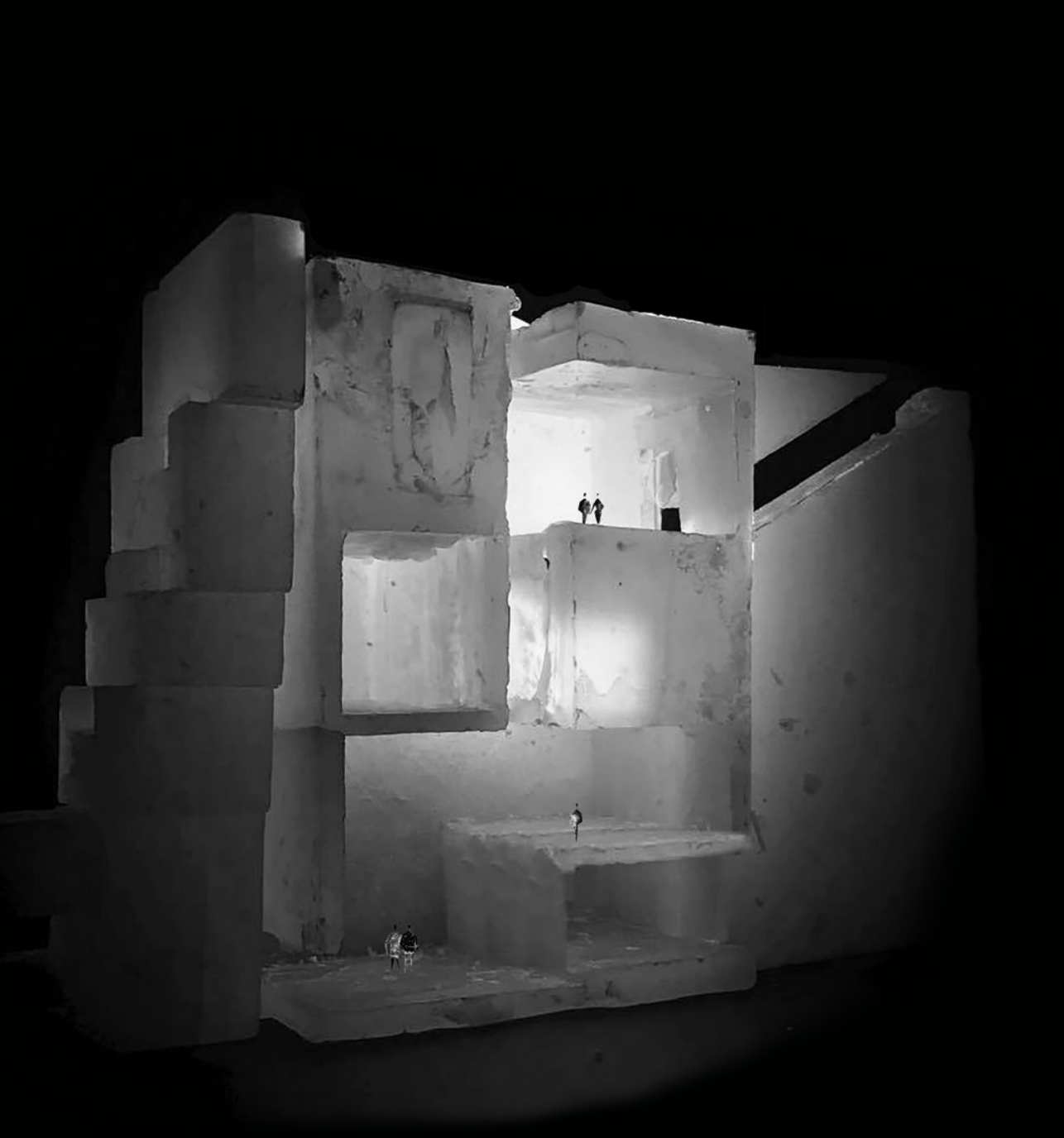


Envisioning Architecture

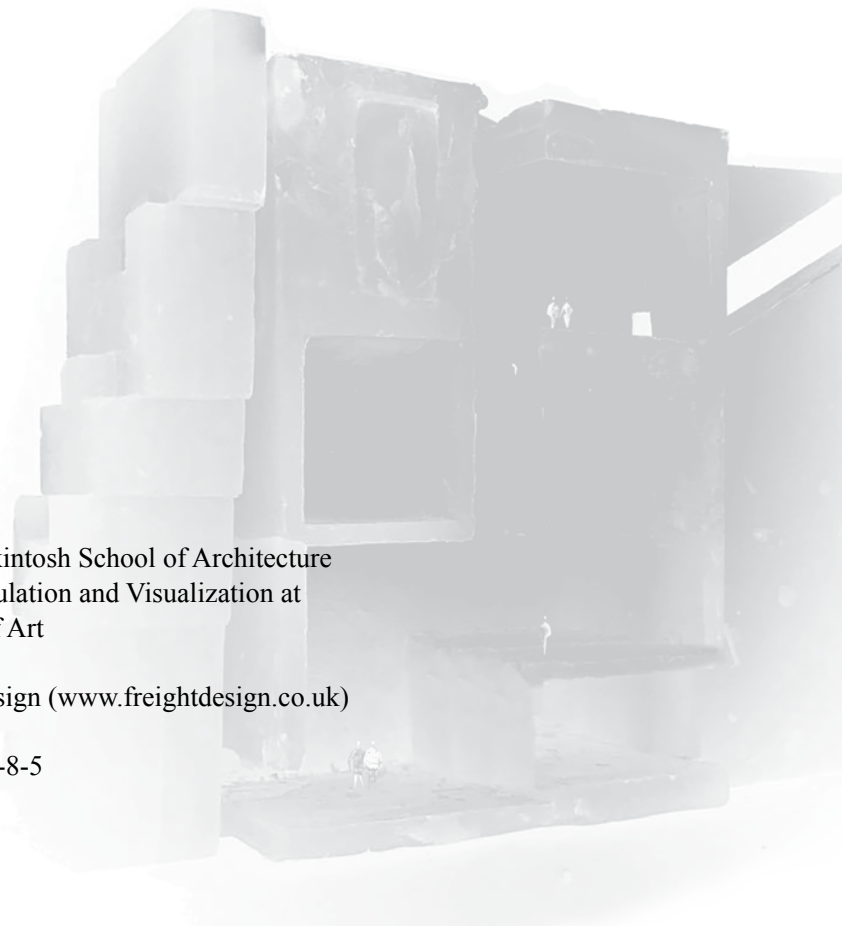
SPACE / TIME / MEANING

ENVISIONING ARCHITECTURE: SPACE / TIME / MEANING

The Proceedings of the 13th Biennial International Conference
of the European Architectural Envisioning Association
at the Glasgow School of Art, 2017

Edited by
Tom Maver, Paul Chapman, Christopher Platt,
Victor Portela and David Eaton

Cover Design by David Eaton (image by Olga Tarasova)



Published by the Mackintosh School of Architecture
and the School of Simulation and Visualization at
the Glasgow School of Art

Typeset by Freight Design (www.freightdesign.co.uk)

ISBN: 978-0-9576660-8-5

Barbara E.A. Piga [a], Eugenio Morello [a], Marco Boffi [b], Nicola Rainisio [b], Giovanni di Liberto [b]
[a] Laboratorio di Simulazione Urbana Fausto Curti, Department of Architecture and Urban Studies, Politecnico di Milano, Milan, Italy, [b] Department of Cultural Heritage and Environment, Università degli Studi di Milano, Milan, Italy

Sharing the experience of urban design schemes through immersive simulation

Introduction: aim and research context

The recent activity of citizens' engagement for communicating the redesign scheme of an urban street using immersive simulation techniques is presented in this paper. The use of multiple tools during events with lay people and local stakeholders was tested in order to investigate the potential use of novel technologies for improving the understanding and the sharing of information in relation to urban transformation processes. In particular, the focus of this paper is about the use of immersive and dynamic experiential simulation in public events. The evaluation of the enabled experience was supported by the direct observation of people reactions to simulations and through dedicated surveys submitted right after the visualizations.

The research domain of this activity is experiential simulation. Recent ICT development enables today to develop impressive tools for enhancing the quality of multi-sensory simulations: firstly, the quality and speed of image production has tremendously accelerated through fast-rendering techniques that will lead in the near future to trial-and-error processes whereby almost real-time alternative design solutions will be tested in co-design activities (responsive loops); secondly, novel visualization modalities through immersive reality, completely change the fruition of simulations from static and distant objects to fully engaging tools (experiential simulation).

The proposed exploration is based on the use of novel envisioning tools, in particular immersive reality, transferred to the communication of urban design transformation. In particular, as a long-term research objective, we want to investigate how the use of these tools – and in general architectural simulation – in design and co-design domains can impact the evaluation of design schemes and the overall progress of the design process.

Only few examples of similar applications are available and have been

exhaustively documented[1]. We argue that the experience is still unripe because of the following reasons: firstly, technologies are under continuous refinement, and the rapid evolution of the tools did not allow to root these tools in the practice with a reasonable level of maturity in the urban design domain; secondly, the rapid evolution was not well documented by scholars operating in the domain of visualization of architecture and the design of participatory design processes[2]; thirdly, people are simply not trained and used to visualize virtual environments through immersive technologies, and this affects – or even alters – their evaluation of displayed scenarios. For instance, the 'surprise effect' resulting from the use of immersive viewers for the first time can distract from the evaluation of the content, i.e. the design scheme represented by the visualization.

The case-study application

The regeneration project called "Ripensiamo insieme via Celoria!" (Let's imagine via Celoria together!) was launched as part of the sustainable campus initiative running on our district between the two major universities, namely the Politecnico di Milano and the Università degli Studi di Milano. The project proposes the redesign of a public road that represents the *trait d'union* between the two universities. Potentially, the street could represent the core of the district and it is also located at the very centre of the campus. In short, it could become the university walk crossed every day more than 20.000 students. Nevertheless, today the street is a neglected space, and its major function is to host the cars of the university commuters. Recent sustainable mobility policies, declining trends of car ownership, and resilient water management solutions of public open spaces, are only few of the topics that legitimate the civic willing to give back this space to people for hosting social activities and eco-systemic services.

The design exploration started in 2014 with the production of three schematic transformation scenarios, with the idea of opening a debate with public stakeholders and people. For instance, the idea was not to influence people with an established solution (which, indeed, we did not have at that time), but to initiate an engagement process and listen to people issues. This first part of the process is summarized in a previous paper by the authors in 2015[3].

After the first phase of listening to community needs and meeting with public stakeholders in 2015, a design scheme collecting all the inputs was produced with the idea of giving it back to people evaluation and gather reactions. The new design scheme mainly proposes the removal of most of the car parking lots that cover most of the horizontal surfaces today, the introduction of traffic calming solutions and the substitution of pavements and furniture.

According to our design approach, a photorealistic representation of the future

[1] On the use of digital visualizations for participatory planning for landscape design and urban design: Appleton & Lovett, 2005; Bates-Brkljac, 2007; MacFarlane at al., 2005; Wergles & Muhar, 2009.

[2] One solid reference to our research is represented by the work of Eckart Lange at the University of Sheffield, UK (Lange, 2005; Bishop & Lange, 2005).

[3] Piga et al, 2015

scheme based on dynamic and immersive simulation was the proper modality towards the twofold aim of engaging (more) people with a trustful anticipation of future spaces and at the same time communicating the sense of experience as close as possible to future reality, in order to collect informed reactions to the future atmosphere of the envisioned place. Figure 1 represents a snapshot of an immersive tour of the road, which was depicted before and after the proposed transformation. The engagement phase activated through the use of immersive simulation is the object of this paper and is presented in the next section.

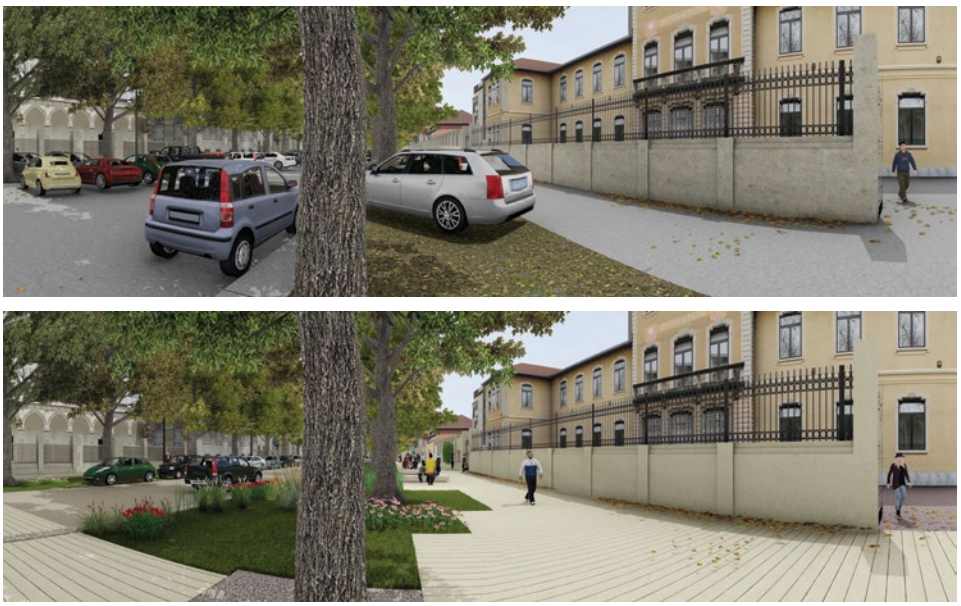


Fig. 01. The simulated urban environment: above, the digital representation of the current street landscape and below, the proposed design scheme.

The application: using immersive simulation in public events

Three public events provided the testbed for our methodology. The first occasion was an evening meeting organized at the municipal hall totally dedicated to the exploration of the redesign project. On the opposite, the second and the third events were outdoor activities (one happening directly on the street interested by the redesign process), which were not directly related to our exploration, because one was the Spring Party organized by the students and the second was a day dedicated to outdoor sport activities. This remark is important because not all the people we engaged during the events had a precise idea about the street redesign project, hence totally free of any prejudice about the transformation.

Our first scope was to achieve the engagement of people during the public events. Literally, we had to catch their attention and invite them to test our simulation and join our debate about the proposed urban transformation with different products: the use of immersive simulation with Head-Mounted Displays (HMD), i.e. visors and cardboards equipped with smartphones, a selfie-wall, i.e. a big printed poster

depicting the envisioned future environment, and a physical model of the street in scale 1:200 (Fig. 02). Moreover, the digital advertisement and engagement happened through social media[4] along the whole process, and it is indeed a powerful tool for continuously and a-synchronically engaging people in the discussion and provide a repository of our work.

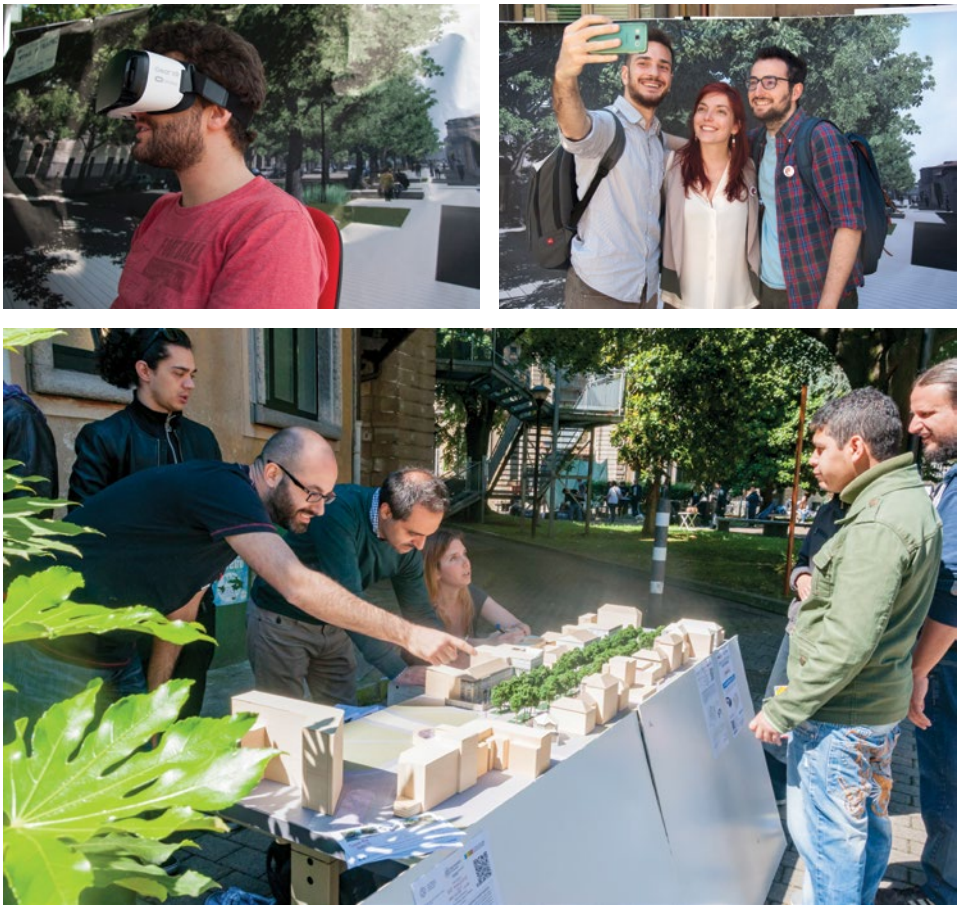


Fig. 02. Used tools: Head-Mounted displays; selfie-wall and physical model.

Moreover, social offer now the possibility to add panoramic images that people can navigate by scrolling the mouse.

The experiment

The experiment consisted in the testing of the immersive spherical panorama of the envisioned transformation of the street with people during the events. The transformation was shown as a 3-D photorealistic virtual model of the street, depicting an ordinary day, including also some noise features like dust and leaves on

[4] A Facebook page was created (https://www.facebook.com/Via-Celoria-Milano-Citt%C3%A0-Studi-Campus-Sostenibile-433083053490339)

the pavements. Three were the spots on the street offered to the users, which were able to navigate through the scenes simply pressing a button on the visor. The introduction of noise and small features that help in giving back the atmosphere of a place into a rendered image, is a crucial aspect in order to increase the sense of legibility and recognition of an environment, thus eliminating the feeling of distance that sometimes digital representation generates to the observer[5].

After the immersive experience with the visors which lasted few minutes, the observer was asked to fill a survey aiming at evaluating the reaction to the digital immersive environment. The final goal of this inquiry was to support our future research in the production of more engaging and reliable images.

The survey was based on the seminal work in the discipline of environmental psychology consolidated in the late 80ies, whereby a number of scholars investigated the relationship between man and the (built) environment, in order to extract clues about affordances, quality and well-being generated and offered by the built environment[6]. This wide dataset was able to provide a varied and holistic picture of how the chosen location could be perceived once designed and built. In particular, the dispensed survey covered four main areas, whose items were pre-tested during the first event and then adapted for the final version during the second and third ones. Firstly, taking inspiration from the *preference matrix*[7] four variables of environmental preference have been investigated trough appropriate items: coherence, legibility, complexity and mystery. Secondly, the perception of other immaterial features linked with psychological well-being has been analysed referring to *flow*, a construct described by Csikszentmihalyi (1975/2000) that defines a condition of engagement and enjoyment lived by people while performing challenging tasks; it allows to characterize the kind of interaction with the environment experienced by people. The third part has been designed including the ITC-SOPI developed by Lessiter and colleagues (2001), to measure the sense of presence elicited by the tools used by participants to explore the digital environment. Finally, we have included a fourth part with free adjectives to be associated to the environment, to capture spontaneous feedbacks on place perception; this last part has investigated also the local affordances in terms of possible actions to be performed there. This wide dataset was able to provide a holistic picture of how the chosen location could be perceived once built and about the psychological well-being that it might elicit.

Evaluation of the design proposals

Concerning the evaluation of our work and the overall activity about the use of immersive simulation, we mainly refer to two modalities: the sound recording of the direct feedback by people during the events, and a more scientific modality consisting in a survey submitted right after the experience of the immersive simulation.

The collection of suggestions occurred in different modalities: talking to people,

[5] This topic is well documented by Kepczynska-Walczak & Walczak (2013)

[6] The main references refer to the well-known research work by Kaplan & Kaplan (1982, 1987) and Gibson (1979)

[7] Kaplan & Kaplan, 1982

taking notes, audio and video recording and taking pictures of people during and right after the experience of immersive simulation. This part of evaluation did not follow a scientific protocol and refers more to a qualitative assessment about both the content of the visualization and the usability and appreciation of the technology. We did not notice any significant obstacle in using the technology considering the age of the users: both young and old people completed the experiment without major hinders or complains.

During the three events we collected 203 surveys in total, as reported in Table 01. The filling out of the questionnaire and the interpretation of the data is still ongoing and will be the subject of a future paper.

Table 01. Facts about the questionnaires collected during the event

Event	**Filled questionnaires**
Presentation at the Municipality 3 Hall, 18.04.2016	29
Spring Party, 20.05.2016	122
Sport Day, 28.05.2016	52

Considerations and future work

During the activities carried out in 2016 we collected numerous reactions that will inform the refinement of the design solution by including the final observations that are pertinent with the development of the design scheme.

Afterwards, we will present again the refined design scheme to local representatives of the public municipality, and the redesign of the street will be included in the larger envisioning scenario for the whole university district that is currently in progress, after the decision of the State University to relocate the scientific schools to another campus, thus opening completely new scenarios of occupation for large portions of the district. Of course, this new and unexpected scenario will completely change the center of attention of the public discussion. Nevertheless, the improvement of the environmental quality of the public space in the district becomes even more relevant in a process of temporary abandonment and new inhabitation of large portions of the district.

Concerning the use of immersive simulation in public events, our experience shows that the proposed modality for engagement and co-design is very powerful and at the same time very delicate. In fact, on one side, it can improve the understanding of the future built environment, on the other it can manipulate the evaluation of proposed design solutions, because people tend instead to evaluate the device and the immersivity of the experience. In fact, the “wow effect” of immersive reality can distract the observer from the main scope of her/his task, but the novelty of the experience will be reduced in the future once HMDs will be widely diffused. Moreover, the content of the displayed image has to be coherent with the expected outcome in place according to ‘ecological validity’ principles.

Finally, the use of immersive simulation was used in this work for sharing information and communicating the photorealistic representation of a design scheme.

Future work will extend the application to co-design processes in a continuous refinement of design solutions together with citizens and stakeholders. If this task seems to be too expensive and time-consuming under current conditions, it will be less and less the case in the future with the improvement of fast rendering techniques.

Bibliography

Appleton, Katy; Lovett, Andrew. „GIS-based visualisation of development proposals: reactions from planning and related professionals. *Computers, Environment and Urban Systems*. vol 29:3. 2005. p. 321-339.

Bates-Brkljac, Nada. "Investigating perceptual responses and shared understanding of architectural design ideas when communicated through different forms of visual representations". In: Banissi, Ebad; Burkhard, Remo Aslak; Grinstein, Georges; Cvek, Urska; Trutschl, Marjan; Stuart, Liz; Wyeld, Theodor G; Andrienko, Gennady; Dykes, Jason; Jern, Mikael; Groth, Dennis; Ursyn, (eds.), *Proceedings of the 11th International Conference on Information Visualisation*. Zurich: IEEE. 2007. p. 348-353.

Bishop, Ian D.; Lange, Eckart. *Visualization in Landscape and Environmental Planning: Technology and Applications*. London, New York: Taylor & Francis. 2005.

Csikszentmihalyi, Mihaly. *Beyond boredom and anxiety*. 1975/2000. San Francisco: Jossey-Bass.

Gibson, James J. *The ecological approach to human perception*. 1979. Boston, MA: Houghton Mifflin

Kaplan, Stephen. Aesthetics, affect, and cognition—Environmental preference from an evolutionary perspective. Environment and Behavior. vol. 19:1. 1987. p. 3-32.

Kaplan, Stephen, & Kaplan, Rachel (eds.). *Cognition and environment—Functioning in an uncertain world*. 1982. New York, NY: Praeger.

Kepczynska-Walczak, Anetta; Walczak Bartosz M. "Visualising «genius loci» of built heritage". In: Morello, Eugenio & Piga, Barbara (eds.), *Envisioning Architecture: Design, Evaluation, Communication, Proceedings of the 11th conference of the European Architectural Envisioning Association*, Rome: Edizioni Nuova Cultura. 2013. p. 451-457.

Lange, Eckart. "Issues and Questions for Research in Communicating with the Public through Visualizations". In: Buhmann, Erich; Paar, Philip; Bishop, Ian David; Lange, Eckart, *Trends in Real-Time Landscape Visualization and Participation*. Anhalt (Germany): 6th International Conference on Information Technologies in Landscape Architecture. 2005. p. 1-11.

Lessiter, Jane; Freeman, Jonathan; Keogh, Edmund; Davidoff, Jules. "A cross-media presence questionnaire: The ITC sense of presence inventory". *Presence: Teleoperators, and Virtual Environments*. vol. 10. 2001. p. 282-297.

MacFarlane, Robert; Stagg, Harry; Turner, Keith; Lievesley, Matthew. "Peering through the smoke? Tensions in landscape visualization". *Computers,*

Environment and Urban Systems. vol 29: 3. 2005. P. 341359.

Matsuoka, Rodney H.; Kaplan, Rachel. "People needs in the urban landscape: Analysis of Landscape And Urban Planning contributions". *Landscape and Urban Planning*. vol. 84:1. 2008. P. 7-19.

Piga, Barbara E.A.; Morello, Eugenio; Shokry, Gaia; Salerno, Rossella. "A toolkit for collaborative design: envisioning and sharing the identity of place through traditional and emergent techniques of simulation". In: Kepczynska-Walczak, Anetta (ed.), *Envisioning Architecture: Image, Perception and Communication of Heritage, 12th International Conference of the European Architectural Envisioning Association Conference*, Lodz: Lodz University of Technology. 2015. p. 418-426.

Wergles, Nathalie; Muhar, Andreas. "The role of computer visualization in the communication of urban design: A comparison of viewer responses to visualizations versus on-site visits". *Landscape and Urban Planning*. Vol 91:4. 2009. P. 171-182.

Website:

https://www.facebook.com/Via-Celoria-Milano-Citt%C3%A0-Studi-Campus-Sostenibile-433083053490339 (accessed 24.04.2017).