The Real Virtual or the Real Real: Entering Mixed Reality

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Abstract: As part of the international discourse on the revival of the Mixed Reality hype, the main goal of this paper is to present an exploration of combining application fields of human interaction with large-scale environmental data flow in the realms of Virtual Reality (VR) and Augmented Reality (AR). The multidisciplinary research project, Landscape in Transformation, at Aalto University in Finland aims at developing an innovative platform in VR/AR to enable the designer and the future users of landscape architecture and urban design and planning projects to actively understand and interact with the hidden layers (datasets) of the site. The perception, imagination and engagement with abstract data aims to open up new possibilities for revealing the relevance of datasets in relation to design.

Keywords: Mixed reality, participatory design, data mapping, data-driven communication and design strategies, storytelling

1 Introduction

In order for the profession of landscape architecture to assert itself in multidisciplinary cooperation in an era marked by profound ecological change and progressive digitalization, a new trajectory needs to be established in design and planning (CANTRELL & HOLZMAN 2016). Global urban tendencies, such as urban sprawl and the rapid growth of cities, require strategies that can integrate datasets with geographical, ecological, sociological and infrastructural factors into planning and design.

Landscape architects have to be able to handle a high level of complexity in their designs when dealing with dynamic forces, such as water, tidal activity, wind, and changes of season, and their influence on geology and vegetation over time (WALLIS 2016). Therefore, landscape architects are currently challenged to generate a new computational workflow by creating multiple platforms to communicate and exchange data information (AMOROSO 2012) and design strategies. Unconventional thinking is often the first step towards innovation. Pioneering experimental computational approaches are particularly needed in the increasingly complex field of landscape architecture and urbanism (FRICKER 2015).

If one takes a look at the mixed reality pioneers of the 60`s, it is interesting to observe, that they were having a clear vision for the integration of the technology. The technological aspect was not merely in the forefront rather the innovative usage. Relating the virtual with the field of architecture and landscape architecture (GRAU 2003), there is a strong connection recognisable. Designing is deeply tight to expressing and experimenting in the virtual, projecting the near future or a fictive vision of the future (ZUMTHOR 1999). The space created in reality has as well a parallel dimension in the imaginary virtual, influencing and inspiring the user. By simply using the current VR/AR technology for imitating the real in the virtual, we are loosing a huge potential of the technology.

This situation has led to the foundation of a multidisciplinary research platform in 2017 at Aalto University consisting of architects, landscape architects, VR artists and specialists from

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the fields of data-capturing and data-mining. Under the leadership of Pia Fricker, a new Chair for Computational Methodologies in Landscape Architecture and Urbanism constitutes the interface between the Departments of Architecture, Film, Television and Scenography, Media, and the Built Environment.

The goal of the research platform is to close the current gap between visual representation (AMOROSO & SECHTER 2013) and the analysis of data in the design process. In order to do so, the research examines possibilities enabling a direct handling of data in the design process for perception and storytelling purposes within VR/AR (DOURISH 2001). The development of a methodological framework and tools that should enhance the potential of landscape architecture by focussing on computational design methodologies within the realm of VR/AR (DANAHY 2012) is the focus of the exploration. The designer should be given the ability to influence and steer the output with direct feedback in order to achieve an iterative design process (Figure 1). Currently, the representation of datasets can easily be, often inadvertently, incorrectly interpreted or purposefully used to influence the design process (KLANTEN et al. 2012). Therefore, the exploration of immersive interaction technologies opens up a new field for interacting and reinterpreting the flow of data in order to create audio-visual interaction spaces that will open a variety of tools to help understand the changes in our living environment.

Fig. 1: Experimental approach towards VR/AR technology: Through a series of intensive workshops with developers from the game industry, students of the Mixed Reality Studio 2017, were encouraged to formulate their own critical opinion towards the potential of the integration of mixed reality. Left: Students are testing the integration of the augmented reality App Arilyn for telling a story (GIANNACHI & KAYE 2001) within a regular environment (http://arilyn.fi). Right top: Exploring AR tools together with immersive technology specialist (http://teatimeresearch.com/). Right bottom: Understanding the perception and testing the navigation in pointclould models in VR. Source: Courtesy of Pia Fricker, Aalto University.

2 Tracing Mixed Reality

The desire to put yourself into an immersive parallel identity goes back to the nineteenth century and the creation of the panoramic image (360-degree murals or panoramic paintings) and its representation in spatial installations. Panoramic paintings resented the first visual mass media in Europe.

Driven by the rapid developments in electromechanics and computer technology, the Sensorama Machine, created by Morton Heilig in 1950, enabled the breakthrough of VR technology. If one considers the relevance of this technology for architecture, then the presentation by Ivan Sutherland and Bob Sproull of their first VR/AR head-mounted display, HMD (Sword of Damocles) in 1968 at MIT's Lincoln Laboratory certainly serves as a milestone. Ivan Sutherland had already described his vision for the future of virtual reality in 1965 at a computer conference when he said that you shouldn't think of a computer screen as a way to display information, but rather "as a window into a virtual world that could eventually look real, sound real, move real, interact real, and feel real". This was a time of massive innovation in responsive and immersive technologies (SUTHERLAND 1968).

Over the last twenty years, the game industry has been the main market outlet for this technology. In 2010, Palmer Luckey designed the first prototype VR goggles, Oculus Rift, which came on the market in 2014 as a test version. Since then, more than 200 similar products have been developed in the area of HMD and VR goggles (mobile VR viewers). These latest tools are equipped with room-scale tracking and gesture input devices and open up many application fields within architecture and landscape architecture.

3 Application Potential for the Field of Landscape Architecture

Brian Barth's article: "Virtual Reality Is Making a Leap; Will Landscape Architects Be Ready?" appeared in the December 2015 issue of *Landscape Architecture Magazine,* and described the on-going discussion of possible implementation areas of VR and AR technology in landscape architecture. Barth quotes John Danahy, founder of the Centre for Landscape Research at the University of Toronto: "VR is more than just a fun design tool, it is also a tool that can change the way the environment is perceived by both the public and the practitioners. VR technology will serve a broader social purpose to the extent that it is used "as a prosthesis for design thinking…. and to educate a group of people to think for themselves [by] teaching them a language for seeing the landscape."

The technology is available where the innovative areas of application can coexist within the large-scale planning and design activities, however, the question remains: How can the themes of Big Data and VR/AR capture new possibilities for the profession of landscape architecture? The opportunities extend far beyond creative communication concepts (GIANNACHI et al. 2008) and natural and realistic images of the surroundings, they would allow spectators to investigate themes and topics in their own individual actions.

VR and AR technologies allow people from all backgrounds and abilities to engage and interact with digital environments intuitively – the same way we all engage with our natural surroundings (GIANNACHI 2011). It can also help us to create faster and more efficient prototyping and iterations of design variations. Within the foreseeable future, the use of VR

devices and different kinds of online real-time apps will be part of daily life. As part of a participatory process, the outcomes could automatically feed back into the decision- and design processes.

4 Test Case: Landscapes > Talkscapes

Contemporary Virtual, Augmented and Mixed Reality interfaces (VR, AR & MR) give incredibly intuitive access to digital environments (HALE et al. 2009). Our transdisciplinary research hub created a set of tools and workflows that combine highly detailed geometrical data of a site with 3D models and point clouds of a future design, as well as site-specific environmental datasets, such as rainfall, wind or ambient noise data.

Fig. 2: Immersive storytelling with high-resolution pointcloud data model. Student project by: Eeva-Maija Ekman and Heidi Seesto. Series of atmospheric screenshots, modelled with Rhino, Cinema 4D and Unreal Engine. Within VR, the students focused on telling the atmospheric story of their design through superimposition of environmental data sources, represented in an artistic way, which enhances the perception of space. Source: Courtesy of Aalto University.

The results of this first step are will be combined and designed into an interactive environment and presented as part of an innovative platform for VR/AR systems, where both designers and prospective users of a landscape architecture project will be guided through these datasets with a combination of narrative tools and contemporary game mechanics (TIERNEY 2007). This will allow the various participants to actively understand and interact with the hidden layers of a physical location and finally giving them a deep understanding of and connection to a specific environment. The resulting cutting-edge spatial perception space aims to open up new kinds of simulation and participatory processes in environmental design and urban development in order to shape the future and give sustainable answers to societal and environmental challenges.

5 Pilot Teaching Project: Entering Mixed Reality

As part of the new Professorship for Computational Methodologies in Landscape Architecture and Urbanism, the experimental VR lab at the Department of Architecture was hosting its first teaching experiment in autumn semester 2017. The overall goal of the pilot prototype studio was to investigate the potential of integrating VR/AR technology to achieve a new reading of the Big Data topic within the field of a complex, large-scale landscape design topic (FRICKER 2016).

The studio, "New Approaches to Reality through Integration of Immersive VR Experiences", is geared towards Master's students or advanced students in the fields of landscape architecture, architecture, media, film and engineering. As the incorporation of VR into the workflow of landscape architects, architects and designers is already standard in many offices throughout the world, the studio approaches the field from a methodological, design-supportive point of view.

The following questions were addressed:

- How can we explore this new workflow in order to re-imagine the given possibilities within mixed reality?
- How can we achieve a new way of participatory or collaborative systems by integrating VR in order to understand the complexity and potential of the future task, i. e. integrating the challenges of climate change, national and international societal challenges, etc.?
- How do these interrelated questions on datasets offer new vantage points on the landscape architectural ramifications of climate change, extending and amplifying our understanding of ideas such as resiliency, sustainability, and eco-technology?

The focus of the explorative studio lies on entering the next level of VR and Mixed Reality, going beyond a pure representation of an existing or future design. Intensive studio sessions on theoretical questions, software learning (mainly Revit, Rhino and Unreal Engine) and elements of storytelling will enable the students to formulate their personal position for integrating VR into their future career. The studio is supplemented by intensive workshops and a lecture series with guest specialised in mixed reality. The use of programming is integrated in order to be able to create individualized tools on an open-source platform that are to integrate various databases, e. g. geodata and dynamic data, such as large-scale data flow and small-scale human behaviour directly into the design process.

Special focus is set on the integration of VR from the very beginning of the design phase. Therefore the VR lab was designed to support the team experience, as well as the interaction with the audience. The different methods of VR usage were collected through several questionnaires and feedback rounds. Especially the understanding of scale, as well as the possibility to directly design and draw in VR was regarded as extremely helpful in the early design stages.

Fig. 3: Final project by Elina Renkonen and Salla Salovaara. The project is based on integrating wind data into the model. The data is translated into an interactive light design and responsive vegetation – which respond to the movement in VR. Issues of teleporting, degree of freedom of a virtual visitor, as well as level of abstraction were tested in order to translate local data into an immersive VR experience. Source: Courtesy of Aalto University.

Being able to add a personal level of abstraction to the aesthetic representation of the space enabled the students to enter the metalevel of their design. Within extensive VR sessions, students discussed their perception and developed their own set of tools to design in VR, as well as to express their story in VR. Integration of abstract or local sound sources, seasons, elements of game design helped to understand the immersive experience.

6 Conclusion and Outlook

The possibilities of VR/AR open up new intuitive way of interacting with environmental data streams in order to integrate them in an interactive process throughout all design phases. The contribution of this visionary research platform to the field of landscape architecture, urban design, geoinformatics, and the application fields of VR and AR is very substantial and significant, as the developed workflows will close the current gap between pure data visualization and participatory and perception tools to encourage future users of a site to contribute to the process (LAUREL 2014). It combines cutting-edge knowledge and new ideas and concepts, rather than a mere refinement of existing ones (MASLOW 1966). The innovative team constellation opens unexplored areas of investigation and new directions for joint research. The methods developed during the first teaching experiment will be integrated and further developed in the newly founded Urban Studies and Planning Master's Programme, a cooperation between the University of Helsinki and Aalto University. The results did draw the attention by city municipalities, as the need for meaningful participatory VR tools is on very high demand in Finland.

Further interdisciplinary case studies involving international academic and professional partners will contribute to the development of a deeper methodological integration of immersive technology to enhance the academic and societal impact.

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