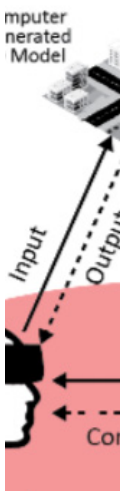
A Framework for Virtual Co-Urban Design



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Abstract

Traditionally, professionals' urban design methods and tools do not allow users to be active in the design process. On the contrary, participatory design processes build the citizen's capacity of traditionally omitted city building procedures. The participants act as individual actors in the participatory design process, and a social hierarchy exists among them. The visual information adheres to the design artefacts used in the process stay in assumptions and leads to an unsolved conclusion with an expense of time. The article argues that immersive virtual reality equipped with producing instantaneous design artefacts and design engagement set-up brings conclusion at the early stage of an urban design process. The design task, the perceptual understanding of the virtual environment and the feeling of affiliation are the catalysts to keep the flow of the conversation. The design experts set design tasks understanding the capacity of the virtual tools and the need for the design problem. The paper presents a conceptual framework to develop a virtual tool based on participatory mindsets and principles experimented with earlier. It discusses how virtual media leverage citizens of a neighbourhood in the design process. In the end, the article puts light on the scope of using collaborative virtual reality tools on a shared understanding of collective design discussion in regenerating and developing urban spaces.

Keywords: Virtual Reality, Urban Design, Co-design, Participatory Design, Civic Engagement

1. Introduction

Decades of studies on urban design are looking into the democratic involvement of stakeholders in a wide range of collaborative and participatory design approaches, as public participation brings accountability to stakeholders (Healey, 1998; Murray et al., 2009). Mostly, participatory design techniques dealing with urban issues have, to date, often used paper-based methods (Al-Kodmany, 2001) and depended on digitally produced images or three-dimensional artefacts (Bannon et al., 2018). However, the lack of ability to understand the implications of different design decisions and tools in the design process hinders non-experts from actively designing the environments they inhabit. Furthermore, conventional urban design processes do not allow laypeople to take part in the design ideation and generation stage easily. So, the research speculates that a Virtual Environment (VE) facilitated instrument enables laypeople to take part actively as designers in the early stage of an urban design process.

Methods like design charrettes and planning workshops already have shown acceptable ways; however, the processes compromise the act of unified design units, where the participants could progress in design discussion as a team, communicate with explicit assumptions and produce meaningful outcomes. The tools and techniques that adhere to the traditional participatory design process primarily allow the participants to act individually. The design ideas also stay hidden in assumption (Chowdhury, 2020). A social hierarchy exists in the discussion process. The lack of perceptual understanding of the design artefacts does not allow those assumptions to visualise in meaningful ways.

So, the need for a conclusive design decision as a unit, we speculate that advanced immersive instrument with the feeling of affiliation of each other activities can bring concrete outcomes in the design decision making process. The flexible nature of virtual artefacts would lose them a bit from the social hierarchy and real-world obligation. This nature of freedom in the design process leverage them to think differently as creative agents. In that line, in this article, we present an already experimented research framework on how to integrate end-users in such a manner that they produce meaningful design outcomes as a team. The framework has been tested in a low-density suburb in Wellington. It shows the robust quality to modify accordingly to any urban design situation.

2. Participatory Goals, Objectives, Tools and Techniques

In the participatory process, it is necessary to identify goals and objectives in planning for participation (Sanoff, 1988). It is also essential to analyse the techniques that are available with the resources they require. Techniques such as surveys, review boards, neighbourhood meetings, conferences, task forces, workshops and interviews, represent a few of the multiple options

of participatory planning. Techniques get purpose with the goals and objectives. The goals and objectives of participation allow the participants to perceive the type of participation. It also depends upon the kinds of issue and people involved in the process. The people interested in participation need the feeling of control in their decision-making process. In that regard, design participation is the only way that can consider their needs and values.

Participatory design approach comes with a varied set of toolboxes (Brandt et al., 2012; Sanoff, 2000). The selection of tools and techniques brings ownership of the participants on the results. Participatory designers pioneered new approaches to designing with users, such as prototyping, future workshops and design games that have become widely accepted and used within the design community at large. In the early year, participation tools and techniques were seen as an essential means to remedy the professional process of systems design. Today the tools and techniques are brought forward the practices of design participation as integral parts of the activities of involved people. However, the design approach gets criticism on mainstream design and technological integration for not accommodating the multiple voices of users.

Participatory design refers to a coherent set of organising principles and general guidelines for carrying out a design process from start to finish (Bratteteig et al., 2012). The guideline must be carefully selected, adapted and appropriated to the specific project and situation at hand. Techniques may be used independently to plan the design project (Bødker et al., 2009). In this sense, prototyping may be the technique that Sanders and Stappers (2008) suggested as 'make tools' with a participatory mindset. According to Brandt et al., this way of conceiving tools and techniques is slightly deceptive as they can be applied irrespectively to a specific project's purpose and values. What is essential is that tools and techniques are appropriated in a design practice while concerning the problem. It means that choosing tools and adopting participatory mindsets is less one of doing things right and more a question of being aware of what can be accomplished by those particular tools and techniques as parts of the design process.

3. The Framework

A series of surveys and experiments were set up to investigate stakeholder's active design ideation, generation, and collaboration. The framework incorporates a preliminary questionnaire survey to define the design task, development of the instrument, design experiment, and expert evaluation (figure 1). Steps like feedback survey and protocol analysis had been reported in (Chowdhury, 2020; Chowdhury & Schnabel, 2019).

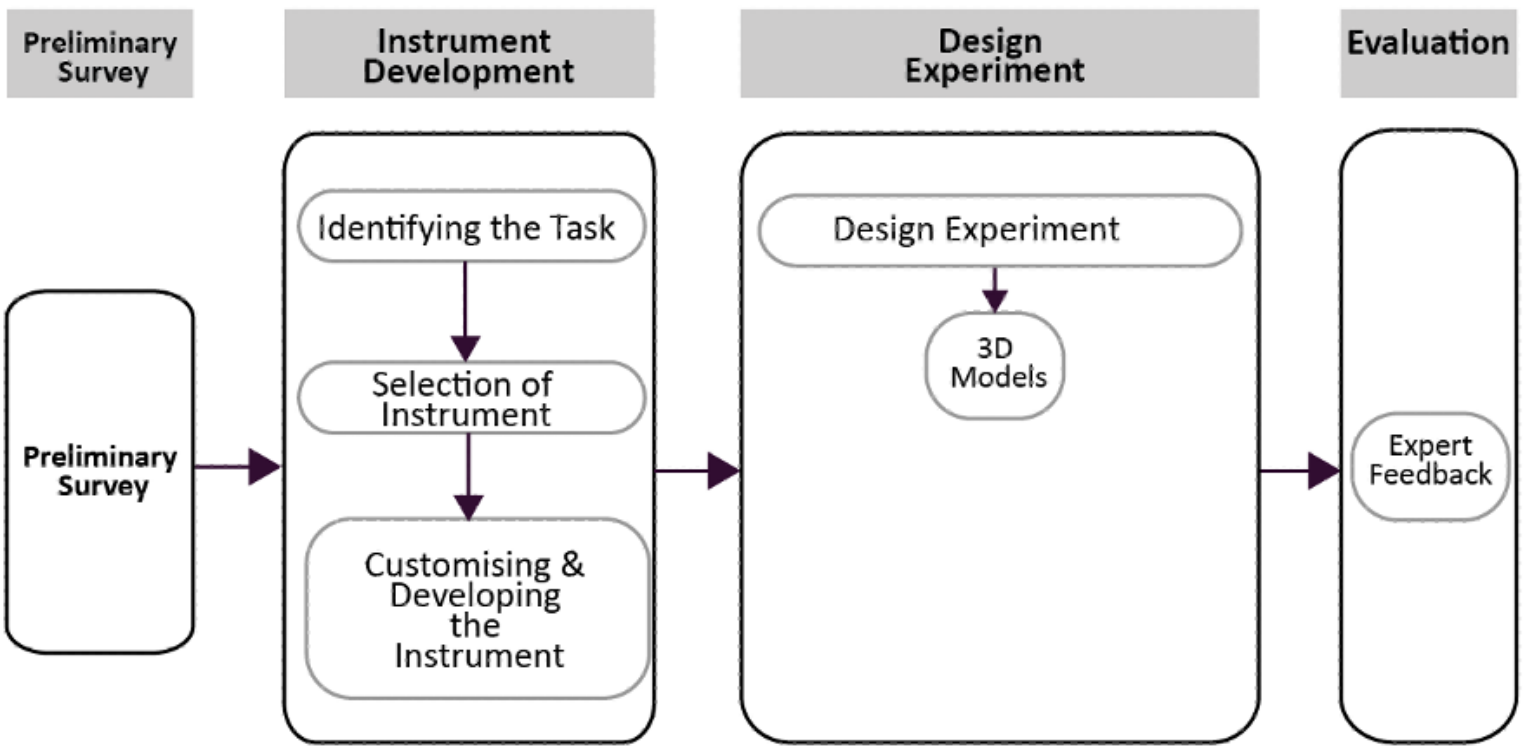

Figure 1. The Framework

3.1 Preliminary Survey and Design Task

At the beginning of the process, a questionnaire can help to define the design task. After understanding the design task, the experts develop the virtual instrument and design the experiment set-up. The essential part of virtual instrument development is identifying the quality of the instrument's perceptual affordance and customising the instrument with the design task. The design task can be developed according to the interest of the users. In that case, the expert has to speculate what kind of design task can involve the participants in the design discussion.

For our recent experiment, we set the design tasks after addressing the future development plan of the Wellington City Council and the interest of the local community (Chowdhury & Schnabel, 2020; Chowdhury & Schnabel, 2019). The design task was to generate ideas of urban form on an empty lot in the neighbourhood centre.

3.2 Instrument Development

Involving non-experts and their responses to the design task require an intuitive, immersive instrument with a low threshold interface and minimum training requirement. The instrument's perceptual affordance supports the flow of generating design ideas during the collaboration. Sanders (2002) mentions that "Make Tools" are becoming a new language for co-design, which serve as a common ground for connecting the thoughts and ideas of people from different disciplines and perspectives. At first, we explored

instruments like 'Fuzor,' 'Grasshopper3D,' 'VR sketch,' 'Unity3D,' and 'Hyve3D', which have features that require expert knowledge to operate. Thus, we had to develop a customized interface responding to the design task and can easily involve laypeople in the design process.

3.3 VE Design Experiment

The recruitment procedure of the design participants happens by invitation through social media, circulating posters, and personal soliciting in public spaces. An introduction to the design task and training starts at the beginning of every session. For the Wellington case, we organised our experiment in the local community.

3.4 Design Experiment Set up and Design Task

The design experiment starts after an introduction to the virtual instrument. The experiment follows by giving the task to the designers and requesting them to explicitly convey their opinions through verbal conversations.

In our tested framework, an immersive experiment set-up developed to leverage non-experts designers to participate together in an urban design discussion with the help of the representation of 3D artefacts (Chowdhury & Schnabel, 2019). Designer A sees the VE immersed through a Head-Mounted Display (HMD) and as a first-person point of view, he interacts with the 3D artefacts via a controlling device to generate, delete and alter the Design. Designer B sees the 3D artefacts through an 80-inch display screen and as a third-person point of view, he interacts with the artefacts through instructing Designer A to execute his design vision. The experiment set-up brings the generated ideas of Designer A to Designer B. Figure 2 shows a diagram of a design unit. The diagram is triadic as they are closely related entities and depending on each other actions. They follow a conversation protocol during their design sessions. Designer A generates design action and seeks verbal feedback from Designer B. The IVE instrument and design task can establish communication between Designer A and Designer B. The process follows a sequence of actions from Designer A to Designer B through the representation of 3D artefacts in the display screen.

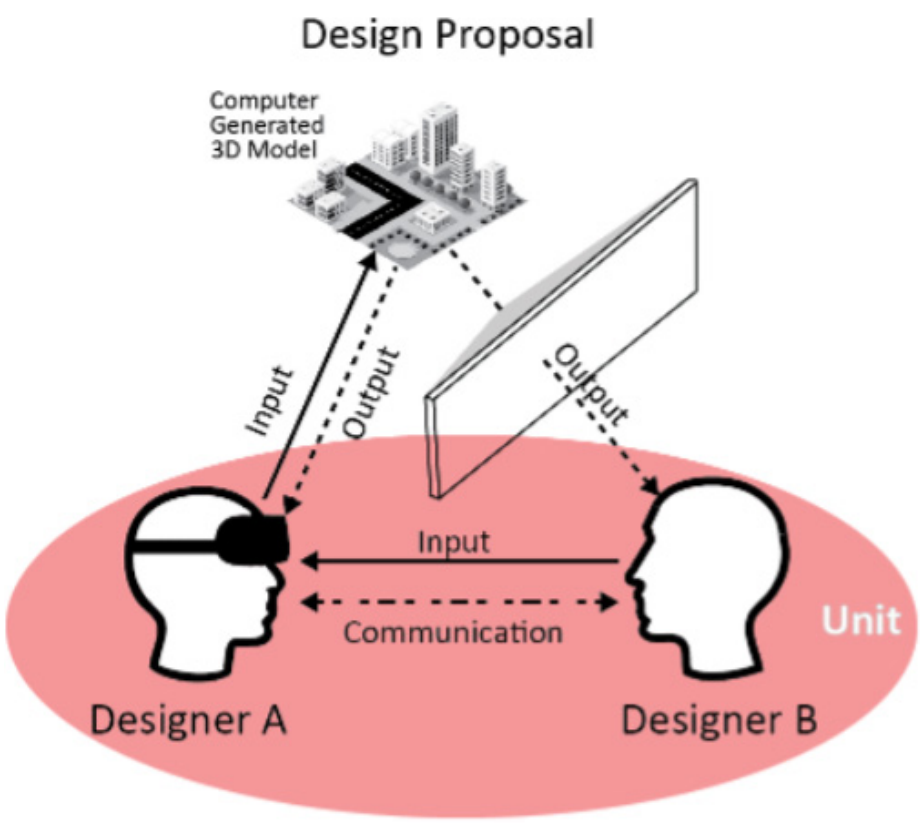

Figure 2. One unit of 'Enhanced Communication"

The 3D artefacts are communicated through the HMD, and the display screen, where Designer A is immersed in VE and Designer B is partially immersed through the large screen, a screen-based immersed. As the 3D artefacts are generated in a virtual urban environment, they represent an urban form in the environment. The perceptual quality of VE facilitates such an abstract understanding of the urban form. Designer A generates 3D artefacts as a representation of urban form as input in VE and the output from VE goes to Designer B. Designer B can be a group of persons. The experiment set-up can bring a feeling of affiliation with each other activities during the design sessions. The communication process may let the designers Design together as a team rather than acting as individual actors. The collected data from the design experiments can reflect on design collaboration.

3.5 3D Models & Evaluation

The generated 3D models are saved for expert evaluations and record the proposed functions on the case site. Experts assessed the design communication by evaluating the meaning of design proposals—a detailed report published in Chowdhury (2020).

4. Discussion & Conclusion

The results from the design experiment in Wellington showed us that the community people proposed different design alternatives for the same lot (Chowdhury, 2020; Chowdhury & Schnabel, 2020). Designing with virtual instrument offers new opportunities for them to engage in the urban design discussion. They acted as design units, rather than individual actors in the participatory process. The perceptual awareness of the instrument encourages laypeople to engage in design communication and collaboration. The employed media acts as an extension of perception, which allows pre-conceived design ideas to be visualised fully. The collaboration activities happen in various design stages through verbal communication, presence, and co-presence with the generation of 3D artefacts. The value of affording non-experts contributes to an authentic urban design collaboration that generates bottom-up information for stakeholders.

Like civic engagement, the conceptual models deal with the issues of rational ignorance, which help the laypeople come to a consensus in a short period. The experimental set-up enables the citizen to immerse and involve themselves in design situations to the point of "being there", bringing the sense of walking in the neighbourhood. The framework demonstrates that integrating a suitable virtual instrument minimises the distance between the non-experts' collective design imagination and its representation during the initial stage of urban design. The straightforward nature of design

creation, communication, and collaboration offers an opportunity for experts and non-experts to collaborate in the early stage of urban design. Therefore, it re-establishes a new direction to include stakeholders in the design process. The intuitive design communication empowers non-experts to participate in a spatial discussion on designing future neighbourhoods.

Biography

Shuva Chowdhury is a PhD scholar in Architecture at Victoria University of Wellington (VUW), New Zealand and a Lecturer of Architecture at Southern Institute of Technology (SIT) Invercargill, New Zealand. His work focuses on spatial innovation in architecture and urban design, and computer-aided design collaboration and generation. He is a member of the American Institute of Architects (AIA), Architectural Designer New Zealand (ADNZ) and the Institute of Architects Bangladesh (IAB). He is a collaborative research member in Digital Architecture Research Alliance (DARA). Prior to his study at VUW, Shuva has practised architecture in Bangladesh and taught at American International University-Bangladesh (AIUB). He holds a professional degree in architecture from the Bangladesh University of Engineering and Technology (BUET), an M. Arch in Digital Design Pathway from Mackintosh School of Architecture (GSA), Glasgow, UK, and a post-professional degree in architectural design from Barcelona Institute of Architecture (affiliated by UPC and UPF), Barcelona, Spain.

Professor Marc Aurel Schnabel is the Dean of the Wellington Faculty of Architecture and Design Innovation, Victoria University of Wellington, New Zealand. Trained as an Architect, he is leading research in architectural technology. He has taught and worked in Germany, Australia, and Hong Kong for thirty years. He is recognised for his research in computational design, virtual reality, digital heritage, parametric design learning and intelligent cities. He has been the President

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