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Communication and Participation in Virtual Environments

Towards a parametric participatory urban design decision-making platform

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Abstract: We seek a framework for engaging people in urban design decision-making process by employing virtual tools. We adopt our previously developed parametric tools for design communication as a bridging method between conventional and participatory urban design approaches. We hypothesise that a virtual participatory urban design platform can provide more design associated information for laypeople to participate in design decision-making. The conventional urban design approaches investigate urban form as purely through the lens of urban professionals. In participatory urban design approaches the design decisions remain as general assumptions because of lack of enough associated information. Therefore, we have developed a methodology to produce urban forms by taking advantages of computational tools to engage stakeholders in complex urban design decision-making processes. This paper focuses on designing the charrette tools. We propose a mixed method of virtual and actual to orient people in the design discussion. We investigate our tools for Karori, a neighbourhood in New Zealand. We critically conclude the paper with an overview of our virtual design communication tools which is destined to engage people in a later stage.

Keywords: Informed design methods; decision-making; rules-based system; virtual environment.

1. INTRODUCTION

Urban complexity and dynamics are interrelated and inter-dependent. Designing an urban scenario denotes a process of dealing with complex issues composed of physical and social attributes. The design techniques to deal with such complex issues requires a comprehensive method to configure the design decision-making process. Most of the design methods used by urban professionals as pen-pencil and digital methods are top-down approaches, where the scope of integrating laypeople in the design process is very less. Though such design approach seeks a better urban neighbourhood for its end users, but lack of visual information and tools in the design process doesn't allow the end users to speculate the new design ideas before that has been built. Moreover, sometimes the design processes are cumbersome to address further details related to construction and post-occupancy period. This detailed information also does not help lay people to understand the overall design ideas. On top of that; the design processes have lack of iterations to offer multiple design ideas instead of one. In fact, it is also impossible for urban professionals to address all of the aspects of urban dynamics in a single design process.

The study develops a design discussion platform to produce urban form by employing virtual tools. The quality urban design is that which response sufficiently to social, economic and environmental issues through the physical design. The conventional design approach has not had the tools to visualise urban form during the decision-making stage. Parametric design tools can offer a platform to visualise and analyse urban scenarios for urban designers and planners alongside stakeholders. However, there remains a disconnect between top-down planning processes and the real-life experiences of those who inhabit these neighbourhoods. Our research hypothesises that engaging stakeholders using a virtual design platform can reduce the gap between reality and conceptual design processes leading to a more favourable design outcome. The recent development of computational tools and accepting them in the design process has brought about a significant shift from utopian design approaches to a more systematic design approach. These tools offer a ubiquitous virtual interaction platform to produce and visualise iterative design ideas. We, in our previous work, argued that a computational design process could accommodate maximum urban complexities in a virtual platform for design discussion (Chowdhury and Schnabel, 2017; 2018).

As a case study, we have considered the suburb, Karori in Wellington. In Karori, Wellington City Council (WCC) has run year-long charrettes to understand the community interests and priorities and identify locations for further development (*The*

Karori Project, 2017; Wellington City Council, 2017). To date, the charrette process has generated a map of priorities within the Karori neighbourhood, and the mall area has been signalled as a priority for redevelopment (*The Karori Project*, 2017). Our research includes the mall site of Karori to produce new design ideas in a virtual parametric participatory platform.

2. THE BIG RESEARCH

In our previous paper (Chowdhury and Schnabel, 2018), we have developed a computational neighbourhood design framework (figure 2). The framework comprises four steps. It starts with developing the urban parameter, then instrument development, the engagement and ends with an evaluation. The output of every step feeds into the next step. We have considered the report of the WCC for Karori redevelopment and sought out the locations where the community wants to redevelop. From the consultation report of WCC on Medium Density Residential Area (MDRA), Karori community is looking for a thriving city centre surrounded by the Karori Mall, Karori Library and Karori Community Hall (Wellington.govt.nz, 2018). Also, re-conceptualising the Karori Mall is one of the prime concern for the community. Therefore, our framework seeks the physical aspects of designing urban form. We also have taken into consideration of building design guidelines prescribed by WCC. We have developed the urban parameters related to designing urban centres, such as land division, size of the courtyard, mixed-used functional area and their arrangement, energy consumption and annual revenue. The second step develops the rules of how these parameters are computed in an algorithmic process. Finally, we test our process through charrettes by engaging lay people. This research mainly focuses on the methods of engagement. The engagement happens with mini charrettes in virtual environments. We employ VR tools to initiate collaborative design discussion. Here, we plot the steps of charrettes and tools of the charrettes. Our paper seeks further ways of the charrettes. The paper develops the detail steps and tools for engaging people in virtual design discussion process.

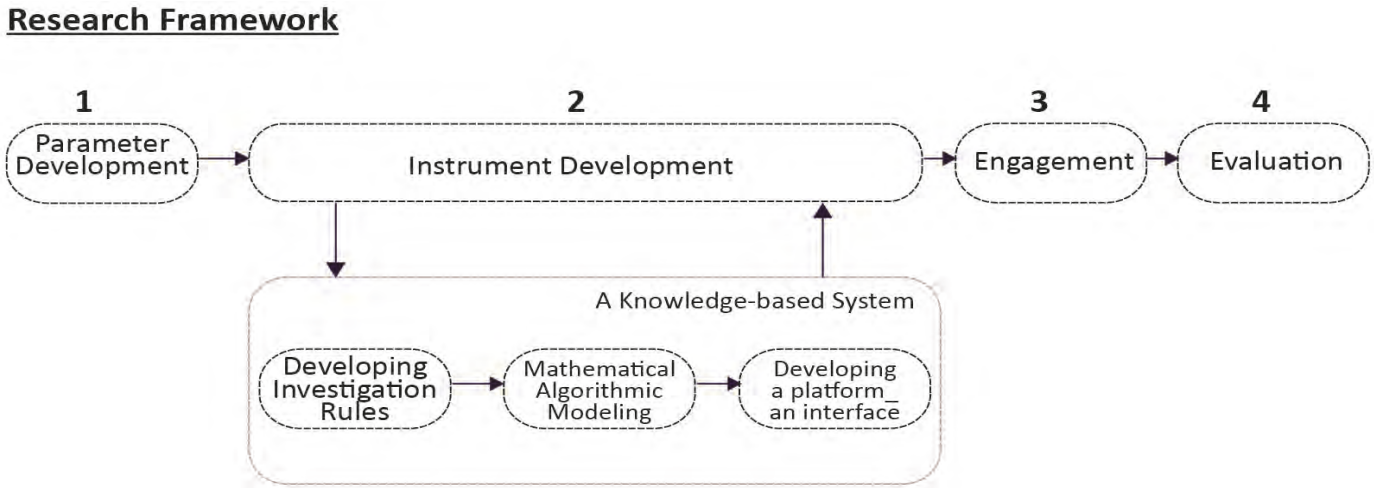

Figure 1 The big research framework

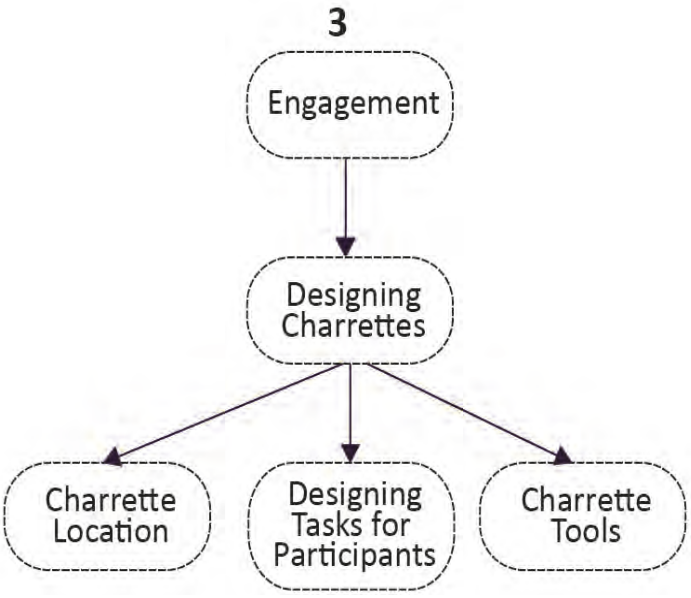

Figure 2 Research Steps in Engagement

3. COMMUNICATION AND PARTICIPATION IN DESIGN PROCESSES

Communication is a sense-making process between virtual and actual. For Deleuze (1990) sense follows the logic of virtual events, as it brings into existence that which expresses. Sense is purely virtual which constantly actualized through communication (Luhmann, 2004). Between nineteen-sixties and early nineteen-seventies, there was a scholarly debate on the question of how a process of systematisation in a design methodology could be made accessible to laypeople. Till (2005) criticises the approach of the design methods movement, as he sees a fundamental contradiction between seemingly authoritarian aesthetics and high economic and technical expense on the one hand, and the social reality on the other. On that note, Hofmann (2014) argues that the transparent design process alone was not enough to enable laypeople or users to participate since the drawings and technical information are only comprehensible to the experts. Again, regarding communication in urban design process, Steinø and Veirum (2005) have pointed out that the process is time and resource consuming. It also faces the barrier of differences in thinking and language between professionals and laypeople. Moreover, lack of detailing in the early design phase, does not allow lay people to understand the design while ironically, as the level of detailing increases, and makes it easier to understand which can no longer be changed without considerable expenses in terms of time and resources (Steinø and Veirum, 2005; Steinø *et al.*, 2013).

The conventional participatory planning process is based on pen and pencil, paper maps, photographs and physical models (Al-Kodmany, 2001). Such visualisation techniques still provide specific visual consequences of governing the design of data representation (Tufte and Robins, 1997). Visualization in urban context offers a method to see the unseen which enriches the process of scientific discovery and fosters profound and unexpected insights. Participatory design processes are based on these visualisation techniques. The participatory urban design process has brought the idea of the bottom-up approach. Healey (1997) points out the demands of public participation in decision-making for more accountability on the parts of stakeholders. It brings the shift from a top-down to bottom-up strategies in urban planning practices (Murray *et al.*, 2009). Bottom-up, participatory urban design approach encourages direct communication in urban design. Participation, concerning design processes, can be defined as information exchange (Sanoff, 2000). Walters (2007) argues about the importance of visualizing three-dimensional information in urban design process for ordinary people to see what their ideas look like. In the past few years, researchers have taken full advantages of computers in participatory design processes by producing three-dimensional graphics, virtual reality and web, at least at the stage of prototypes if not in planning practices. Arguments and counter-arguments are there for these explorations by raising the questions whether this kind of tools is best for communicating spatial ideas to encourage discussion and decision-making process with the public or not.

An individual user in a design participation process becomes a member of the design team (Dulgeroglu, 1977). It provides the participants with the opportunity to influence both the design process and the design product. Participation in design process does not necessarily mean user harmony, but that achieved the influence of the user in the design process. User participation denotes power interchange so that decision can be examined from the points of view of interested groups. Therefore, the user should help the designer in making decisions on conflicting issues of design to avoid the involvement of too many design participants.

4. PARAMETRIC URBAN DESIGN SYSTEM

The current phase of parametric design tools has become an integral part not only of the manual design process but also of the cognitive design process. Such software tools are not only allowing designers to analyse and evaluate, but also generating and exploring alternative design proposals. These tools have already set free designers from 'design fixation' and the limitations of conventional wisdom and thereby allowing to explore a huge number of possible proposals for a design problem (Bentley, 1999). A generative design process leads to the possible proposals of designs. Criticism on generating design process comes from two different perspectives. Firstly, regarding the relationship with the contextual built form, such design process offers an unnecessarily wide range of proposals which most often inappropriate for the context. Secondly, the range of the proposals must not be unduly wide and at the same time must not be restrictively narrow. Thus, the scope must be considered before the development of the generative proposals (Janssen *et al.*, 2000). Janssen *et al.* (2000) argue that the generative process must be considered the designer's personal style. The intrinsic nature of an architectural design approach is to reveal the hidden knowledge which is familiar with the aspects of the design of the buildings. This approach is indicated by the domain-specific knowledge-based design system which aims to challenge the designer. Similarly, Schnabel (2007) also argues that the architects do not prescribe a fixed gestalt, but on a set of rules and instructions which can inform and generate the desired outcome. It allows a reaction on a variety of site-specific variables that can be modified according to the need. Parametric design techniques suggest controllable and adaptable solutions at an earlier stage of the process that reacts to the given situations and the outcomes. Our paper admits with the need for the scope to derive the design knowledge for a generative system and seeks the scopes from the design rules relevant to urban parameters.

To 'parametrize' the quality of public space, it is necessary to understand the relationship between the physical properties of urban spaces and the human activities which are likely to engage within those spaces (Van Ameijde and Song, 2018). The famous sociologist William H. Whyte has prescribed many possible rule-sets for creating successful public spaces, including guidelines for visibility, accessibility, seating, greenery and environmental conditions (Whyte, 1980). Similar, Jacobs supports the conservation of organically grown neighbourhood qualities against large-scale renewal schemes. Jan Gehl's

'New Urbanism' movement also seeks friendly urban networks by creating walkable neighbourhoods containing a mixture of housing types and workspaces. Our research relies on these urban theories to produce enclaves for quality urban spaces. We believe physical spatial dimensions of an urban space influence public behaviour. Therefore, we seek the urban parameters which influence the spatial connectivity between urban spaces. Our developed rules between urban parameters produce multiple physical properties of urban spaces. And our developed interface helps the end users to visualise alternative design ideas.

5. COMMUNICATION IN VIRTUAL ENVIRONMENTS (VE)

Easy availability of affordable equipment and software for Virtual Environments (VE) already has transformed the architecture practices. VE has propelled the level of communications between designers and clients. Still, various issues are improving rapidly regarding communication and collaboration, technology overhead and potential contribution to design outcomes (Schnabel and Kvan, 2002). VE is leveraging the designers with a greater potentiality to perceive 3D understanding of space and volumes. Extension of VE to Immersive-VE (IVE) offers the user an active and real-time interaction with the design and therefore to some extent ensures a real sense of presence (Schnabel and Kvan, 2003). Schnabel and Kvan (2003) argue that as IVE plays a significant role in design and form-finding of architectural creations, so the virtuality becomes, in that sense reality. Such immersive virtual environments help to perceive some volumetric qualities of a building or space which were hard to depict in 2D drawings.

Virtual Reality (VR) is a marketing terms of virtual environment. VR acts as a medium of human communication through the means of sharing information and experiences among people (Sherman and Craig, 2003). It represents a technology to imitate certain aspects of reality. In a more profound sense, VR concedes with Jean Baudrillard (1981)'hyperreality' as an operational condition of a thing or idea which is defined by what it does rather than what it represents. He used the word "simulation" to describe the working concept of hyperreality. The word "simulation" denotes an experience that "feels real" produced by artificial means, usually (but not necessarily) digital. In the process of simulation, the user implicitly agrees to overlook the obvious fact that it is produced by radically different means of experience which it evokes (Scheer, 2016). At the end of the process, only the experience matters not the way, how it was produced. According to Scheer (2016), the main characteristic of hyperreal visibility is the pervasive elimination of the differences between image and reality. It is a deterministic approach not to experience images as realistic. Such fidelity to the pervasive nature put a value on the attributes of visual representation. The differences between reality and digitally produced images do not pass unnoticed but pervasive nature of fidelity convince to accept the experience. It explains hyperreality manifest the aspects of vision. Vision is accepted as primary sense through which people receive information about their world. The phenomenon of vision in the simulated virtual world provides more informative visual information to the users. Computation tools can facilitate simulation. We employ contemporary Virtual-Reality (VR) tools to produce hyperreal vision of urban scenarios for community people. We provide multiple design alternatives in the immersive virtual environment to perceive a broader concept of the new design ideas.

6. CHARRETTE STEPS AND TOOLS

The engagement step includes charrettes. In general 'Charrette' is a method to devote people in a concerted effort to solve a problem. The number of participants varies with the type of charrettes and with the focus of the charrettes. We consider three people at a time in a single charrette event. Every charrette comprises four steps. Three participants will assign three different tasks. The first participant decides on urban forms and connectivity. The participant produces new building forms for Karori Mall, and it's precinct by manipulating the information of land division, building height, functional arrangements, the size of the courtyard and spatial connectivity. The produced urban forms shared to the second participant to experience in immersive VR. Here, the second participant provides feedback on the decision of the first participant. Concurrently, the third participant keeps an eye on the change of the indicators of annual revenue, energy consumption and floor area. The third participant provides feedback to other two participants on their decisions on urban forms. The whole process let the participants negotiate between themselves to come with desired urban scenarios. Finally, we do a questionnaire survey to report how such virtual design decision-making platform can help participants to visualise new neighbourhood.

6.1 Charrette Information

Charrette steps and duration

1. The first participant produces the urban form in the parametric tool – 10 mins.
2. The second participant provides feedback on that urban form in immersive VR – 10 mins.
3. The third participant provides feedback on the information on energy and revenue – 10 mins.
4. Questionaire survey – 10 mins.

Participants

- People of Karori.

Tools

- A printed Google map of Karori to orient participants in the design discussion.
- Desktop pcs / laptops to let the participants produce different design ideas.
- VR-headsets to let the participants to virtually immersed in a newly designed environment.

Charrette Locations

- Karori Community Center.

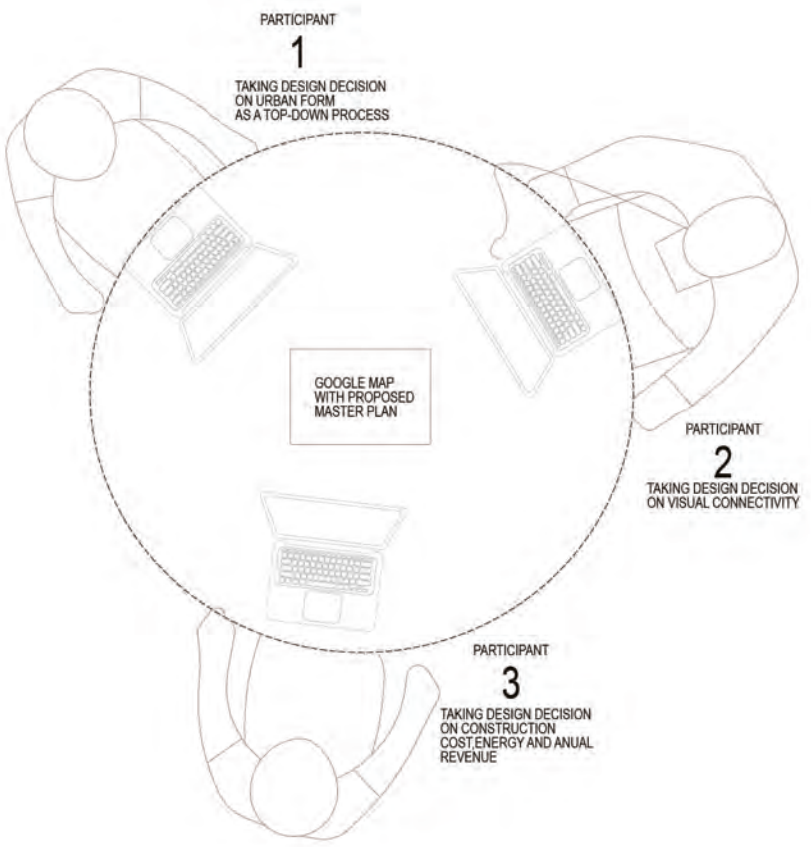

Figure 3 Charrette Diagram

6.2 Charrette Interfaces

Three participants act in three different interfaces. These interfaces are linked to each other (figure 4). The first participant takes design decision on the urban form in an interface developed in Grasshopper3D. Here, the participant operates the relative numbers of physical aspects of building form. This interface allows the participant to take design decision on different urban parameters as a top-down approach. The parameters are land division, building height, size of the courtyard and urban connectivity. The second interface is a Sketchup VR interface. The second participant experiences the new urban form designed by the first participant in the immersive virtual environment. Concurrently, the second participant can provide feedback on visual connectivity in urban space. The third interface is an Excel diagram sheet. It indicates the new changes in construction cost, energy consumption and annual revenue. The third participant follows the real-time changes in the sheet and informs other participants to manipulate. Thus, three participants engage in collaborative design process.

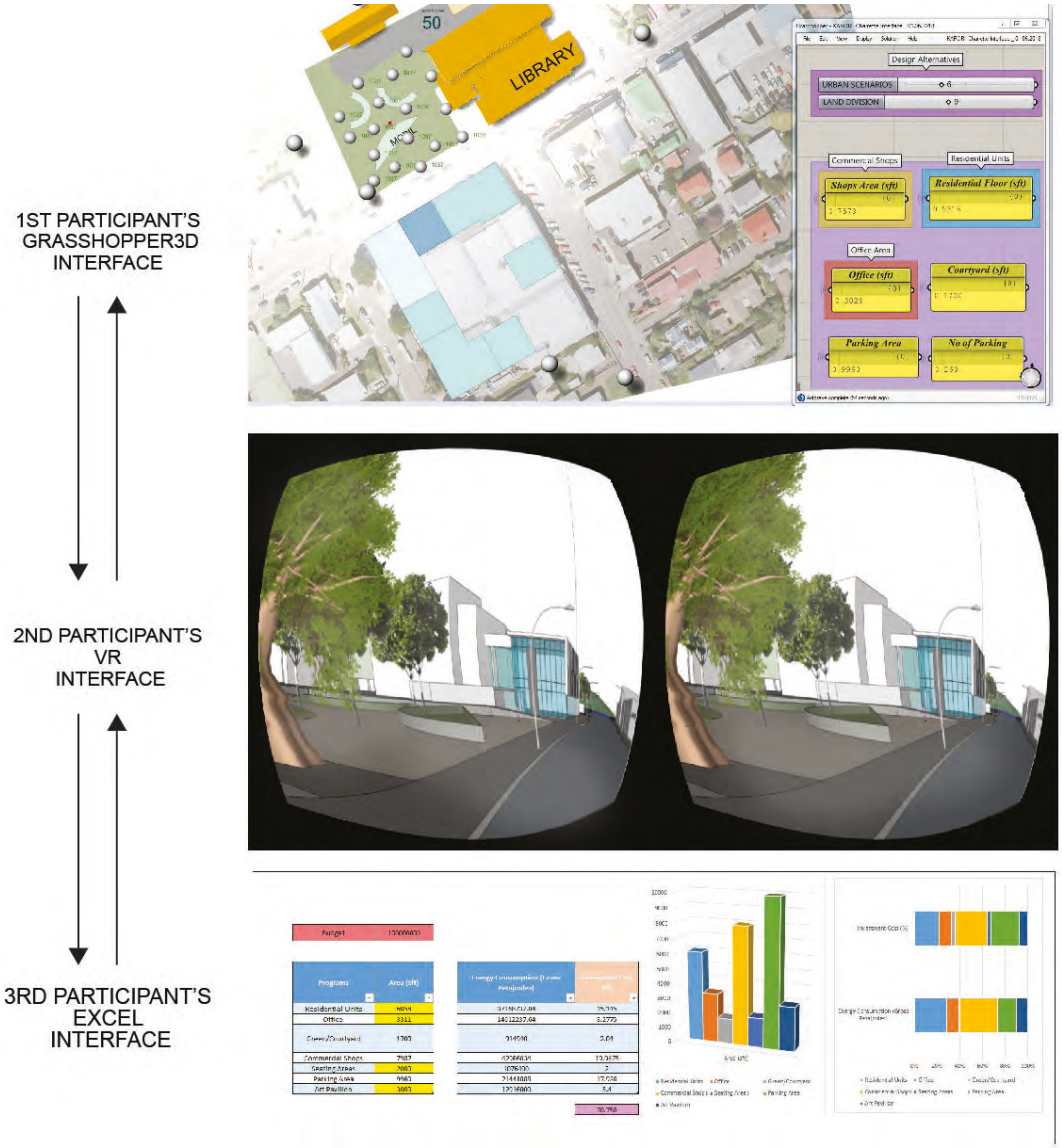

Figure 4 The three interfaces

7. DISCUSSION AND CONCLUSION

We would like to discuss our work from two different perspectives. One is from the perspective of a community designer, and another is from the perspective of the digital turn in architecture practices. Designing a community bandies everybody from politicians to planner and urban designers to developers to members of communities themselves. The idea of community development represents the shares values between the individual and society. The conventional British and American urban planning and design practices have been criticised on the relationship between physical urban form and the social activities and attitudes of citizens (Walters, 2007). In this regard, the role of public participation in planning and urban design is crucial. Our research is also developing a parametric framework for public participation to design a community centre by employing form-based codes. We acknowledge that there would be debates between policymakers, professionals and public to set priorities on urban growth or development, open space, traffic, schools, parks, affordable housing and other urban issues. That's why we synchronised the charrette decision making steps between the participators. Our research reduces the flexibility of decisions by setting different tasks for different participants.

Throughout the nineteenth century, most architects either ignored or reacted against the new technologies of industrial mass production. As Le Corbusier and others began to claim in the early twenties, mechanisation was changing the world, and architecture had to rise to the challenge. Architects should invent new architectural forms, made to measure for the new tools of mechanical mass production and town planners should invent new urban forms, made to measure for the new tools of mechanical mass transportation. For the rest of the twentieth century, many architects and urbanists did just that. Oddly, many architects and urbanists are still doing that right now, as they ignore, or deny, that today's machines are no longer those that Le Corbusier and his friends celebrated and sublimated almost a century ago (Carpo, 2011). Digital technologies are continually evolving to accommodate dialectic nature with reality which promotes innovative ways to interact with end

users. A problematic issue for parametric design approach, in general, is that it never resolves all the parameters which are necessary for design. Urban professionals still need to elaborate most parts of the design in their mind. Another problem of parametric programs that they have been designed and attached with conventional workflow in alignment with process thinking not intuition. Hence, the operators of these systems have to anticipate the project directions beforehand to create geometry and to build the inter-relationships. The criticism on VR technology is that it limits the number of the participants as the headset types allow one participant per computer. Again, with VR there is a distinct lack of face-to-face involvement with other participants.

Despite having limitation, our research illustrates a possible integration of end-users of a community in neighbourhood design discussion. We speculate that the low threshold based virtual interfaces can bridge the gap between top-down and bottom-up urban design processes. Neighbourhood design is a complex amalgamation of design decisions where the procedure lacks to integrate laypeople into the design process. In that context, our research presents a novel design decision–making method in neighbourhood design. In the end, the paper sets a possible direction to include laypeople in a virtual design charrette to design new urban alternatives for their neighbourhood.

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