CREATIVITY AND VR USE

A case study

WAEL A. ABDELHAMEED
University of Bahrain, Manama, Kingdom of Bahrain
wael.abdelhameed@gmail.com, wabdelhameed@uob.edu.bh

Abstract. Creativity with its various processes is involved in all design actions. Creativity used in architectural design is different than creativity in other domains. However, creativity in general with its related cognition processes has no general theory. This research proposes certain activities of initial architectural design phases in which the role of activity is important. The research proceeds to present a case study of two architectural design studios in which a VR environment is employed in order to investigate the effect of VR use on the creativity in those initial design phases. The research applies a methodology of qualitative and quantitative analysis. Various architectural design factors are neutralized to overcome the influence generated from human factors variation and design thinking prejudice on architectural designing and the associated creativities.

Keywords. Virtual Reality; Creativity; Architectural Design; Design Studio.

1. Introduction

Designing deals with problem solving cases which are ill-defined and wick-ed. As such, there are no clearly defined design goals (Goel, 1995; Simon, 1973), systematically applied strategies to attain design objectives, routine procedures for design problem solving (Gero, 2000), or ideal design solutions (Rowe, 1987). It is evident that design solutions are open-ended; any design solution can be further developed by applying further design actions.

Understanding the nature of thinking utilized to reach a solution of a design problem can reveal the characters of design thinking and the tasks performed. The bounded rationality that is a characteristic of design, refers to the concept that designers are rarely in a position to identify all possible so-
olutions to a given problem; rather, they settle for what seems to relate to the required properties designers see at the time (Simon, 1973; Rowe, 1987). Generally, problem solvers make decisions that might be seen as satisfactory; according to Simon (1979) this process is called "satisficing".

As a corollary to the foregoing characteristics, architectural design problems are problems with continually possible reformulation. The strategies of solution generation and the overall organization of search through a design-problem space, is an area in which no general theory seems to exist (Rowe, 1987). The cognition activities related to the design processes do not have clear details or specific order designers perform. Some maintain that ambiguity can be a resource for design (Gaver, Beaver and Benford, 2003).

2. Design and creativity

The study investigates only the role and the effect of creativity in design activities, rather than the creativity itself and its related cognition processes. Many researchers such as (Gero and Sosa, 2005; Maher, 2010) investigated the creativity in design and its related processes. Maher (2010) stated that creativity support tools are recognition, perception, and diversity.

Creativity with its various processes such as emotion, intuition and innovation, is involved in all design actions (Crosss et al., 1994). The final product of design domain should have such as functions, usefulness and values among others that are not required in products of other domains, or even can be achieved (Christiaans, 2002). Consequentially, creativity in design is different from creativity in other domains.

Designing tasks need a representational medium to be performed in. Designers utilize representational environments to explore what is in mind and to develop design ideas. In other words, media the representation environments assist in design definition and in design evaluation at different stages of designing. Each medium, a representation environment, has its own praxes that another medium cannot provide the designer with.

3. Creativity in architectural design activities

Creativity does not have general theory to be used in describing the cognition activities and other processes related to it (Rowe, 1987). Architectural design with its different influential factors generated from various areas such as, human needs, functionality, environment, structure, economy and aesthetics, has a nature that is unique. In decision making processes of designing, architects use logical decision-making process such as, analysis and evaluation in a subjective way to reach satisfactory solutions.
The architectural design process has main areas that form its main phases. The researcher selects certain design activities based on the theme and scope of the two design studios in which the quantitative investigation is conducted. Those activities simultaneously highlight the creativity role in the cognition actions of designing, namely: problem definition, constructing concepts, forming new design ideas, exploring design ideas, form propositions, form compositions, and form exploring.

The study investigates those design activities to indicate how the architecture students benefit from the VR use and to highlight the relationship between creativity and VR use, if any.

### 3.1. VIRTUAL REALITY USE IN DESIGNING

The most common use of Virtual Reality in architecture has been to enhance the experience of walking inside or around a structure that does not exist. VR researchers have worked toward making VR an effective tool for design creation and design exploration. Recently, VR has been extensively used in designing to visualise different design solutions for one main reason that it is much easier and cheaper to evaluate the form and design in a virtual environment instead of building or modifying a physical model. VR has been used as a design support environment, providing creative and innovative potentials (Achten and Van Leeuwen, 1999).

The study employs a VR environment, the VR Studio program, in design studio to investigate how creativity of architecture students may be affected by designing in a virtual reality environment. The VR Studio is a VR program, developed by Forum8 Company. The researcher uses the micro-simulation function of the VR Studio to help student in designing activities (Abdelhameed, 2012).

### 3.2. ARCHITECTURAL DESIGN STUDIO

Being conducted into two design studios, the study focuses on the initial design phases through which concepts are constructed and forms are proposed and composed. Those design phases cover the previously selected areas and activities to investigate creativity effect. The two design projects have the same design complexity (Abdelhameed, 2013).

The research focus was explained to the students to understand the procedures being applied during their design work. Students were asked to identify and record the VR effect, if any, during design development in the VR environment. Questions related to conceptual designing, virtual reality use and visual design thinking were discussed in the design studio for example, what is the deference between any digital medium and VR environment,
with what design ideas students should start the VR use, at what design situation VR use is more effective and beneficial, etc.

In the primary phase, the design tasks were directed to define the design problem and to develop and construct students’ design ideas into architectural propositions and compositions. The students were asked to provide self-records of each explicit stages, actions and reasoning. Those explicit sequences’ records, with the supplementation of students’ textual explanations, were used in presentation and criticism the students’ designs. The presentation of conceptual designing steps that are prejudice and individual from one design case to another, this presentation was highly beneficial to the students through the exposure to different uses of the same medium, and to different design solutions.

Starting by discussing the goal, objectives and procedures, the design studio continued with various presentations in order to highlight how the students record their design steps and how to benefit from this process.

Constructing concepts and design ideas were the initial design activities, in which students transferred their design ideas into the VR program as earlier as they could. Students/subjects were advised to apply back-forth movement between the VR use and their representational sketches or computer modelling programs in case of finding VR use not effective in changing or exploring new ideas or concepts. This last procedure was to overcome that many students/subjects used the VR environment for the first time. They stated that it takes time to get familiar with the environment and its functions and potentials, although their CAD use can be evaluated between the range of excellent to good level. All students prefer to use CAD programs in designing after the conceptualization phase.

4. Methodology

The research proposes a simple methodology to investigate creativity in design, through identifying certain design tasks and activities in which the creativity effect appears. Applying quantitative and qualitative analysis to achieve the research objectives, the researcher recorded and classified developments and modifications of student designs. Concurrently, they record their own design activities to easily track and evaluate transformational steps of decision-making rationale and reasoning.

Analyzing textual records of the students and observations of the instructor/researcher provides a wide stream for qualitative investigation. On the other hand, conducting a questionnaire in the two design studios furnishes with a basis for quantitative investigation. The total number of stu-
dents/respondents is thirty nine; one design studio has twenty students while the other has nineteen.

5. Analysis and results
Quantitative data generated from the student responses were analysed in figures. Qualitative observations and analysis were necessary to explain both trends and remarks appeared in the quantitative results. The questionnaire analysis and research results and discussion are in the following part, classified into the four following question groups.

5.1. PROBLEM DEFINITION
Around fifty seven percent of the students find that the VR use has between weak effect to average effect on their creativity preformed in the design tasks of problem definition, Figure 1. The rest of the responses are divided between above average and strong effect. The main response was the average effect with about thirty six percent.

It can be stated that sketching has an important role as a cognitive process to explore and construct what is in mind. While, the VR use needs specific formal properties and form precision as well as specific dimensions which usually are not completely defined or achieved in the initial phases of problem definition.

Some students performed the major design activities of this area in manual media before transferring their designs to the VR program. Other students benefit from the VR use by exploring conditions and limitations of the site, Figure 2. Of those who used the VR program, some explored environmental factors related to climate and typology while others located some abstract forms and masses in the site.

5.2. CONSTRUCTING CONCEPTS AND FORMING NEW DESIGN IDEAS
Approximately thirty six percent of the responses record that the VR use in the tasks of constructing concept has weak effect and below average effect on their creativity performed in the respective design activities. On the other tasks of forming new design ideas, around forty percent of the subjects find that the VR use has above average effect and strong effect on their creativity preformed in the design activities of idea generation, Figure 3.
In the tasks of constructing concepts, around forty four percent of the students find that the effect is average, while in the tasks of forming new design ideas forty six percent were recorded that the effect is average.

Design activities performed in the tasks of constructing concepts required to start without a specific idea. Many students preferred to use sketching and manual media instead of VR in this area, Figure 4. Although forming design ideas has the same characteristic, the activities here include exploring certain ideas, in which the VR use is more beneficial.

5.3. EXPLORING DESIGN IDEAS AND FORM PROPOSITIONS

Around fifty four percent of the students find that the effect in the area of exploring design ideas is above average and strong. In the area of form propositions, approximately sixty four percent record the same effect, above average and strong. The trends in the two areas have the same direction; however, in the area of form propositions no weak or below average effect was recorded, Figure 5.
Staring from activities of these two areas, the majority of students had tentative forms in an abstract level in most cases, Figure 6. Those students transferred their designs into the VR program, which helps their creativity effectively in terms of exploring their designs and later proposing and modifying their forms. It was stated in the textual records of those students that the VR environment is a more creative medium for exploration and proposing specific design ideas and forms.
5.4. FORM COMPOSITIONS AND FORM EXPLORING

In the area of form compositions, around fifty nine percent of the students record that the effect is above average and strong. In the area of form exploring, around sixty seven percent of the respondents find the effect above average and strong. In both areas, thirty three percent of the responses were recorded the average effect, Figure 7. No weak or below average effect was recorded in form exploring activities and tasks.

The students in these two phases have specific forms with more details. The nature of design activities used in composing forms and building up certain formal complexity, is more related to digital media generally, and the VR use particularly. Although students were using the VR for the first time in designing, fifty nine to sixty seven percent find it effective in form composition, and more effective in form exploring. However, after having their designs and forms finalized, students transferred their designs to other computer modelling programs which they are more familiar with, Figure 8.

Figure 6. Two images of a student design in exploring design ideas and form propositions.

Figure 7. VR use effect on creativity in form compositions and form exploring.
6. Discussion

Different levels of virtual reality use and visual design thinking were evident in the instructor observations. However, both the simple methodology applied and the various design factors neutralized, overcome the effect generated from human variation and design thinking prejudice.

From the instructor observations, some students highlighted a link between their creativity and the perception provided within the VR use. There was more and high awareness of forms and shapes that students work with and their spaces and relationships.

Figure 9 shows the diversity and variety resulted from student responses. The main observation is that the strong effect steadily increases from the initial design phases to the later design phases. The more recorded response is the average effect.
7. Conclusion

This research paper presents the results of a case study of two architectural design studios in which a VR environment was employed in the initial design phases in order to investigate its effect on the creativity used in those initial phases.

The study has confirmed that the VR use is beneficial in the later phases of designing, rather than the initial phases of designing. Virtual Reality not only helps in evaluating design ideas and design concepts but also assists in constructing and forming these ideas and concepts.

The research highlights the need for more functions in the VR environment to be directed to enable designers to start without specific or certain design idea. More investigations and researches should be directed to this research area.

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References

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