

Iterative Visualization Processes in Architectural Design

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Abstract

In recent times information and communication have become key features in any technological advancement. The situation is similar with the construction industry, where information and communication between designers, professionals and management team is important to the design outcome. It is obvious that designers' use some form of visualization techniques to communicate their design to parties involve in managing the design processes and construction activities. Therefore, as the construction industry is involves with the construction of all sort of structures thus communication between designers and other parties in the industry is vital. The design is the blueprint of construction activities and the requirement for a construction site which is produced by the designer thus a design have to facilitate the ease in communicating the information to other professionals involve in the construction processes. In this case study about how designers use conventional methods to communicate their idea to other parties in the construction industry is paramount for understanding construction projects. Consequently this paper tries to look at the simplest visualization methods designers' use to communicate design information in the construction industry. Sketches are designers' tool for generation, production, and evaluation of the design idea in a similar vein designers use sketch as a tool to clarify ambiguous information contain in construction document thus sketch help in communication and documentation of design information. This study focuses on iteration in designers methods of visualization as manifested through conventional methods of representation like those found in sketches and production drawings. Iteration was chosen because according to the results of this study it was manifested that iteration in designers sketching activities enhance the accuracy and clarity of the design. During the preliminary stage of architectural design, sketch is use as a tool for idea development and adaptation. The character and behavior of sketches make it a medium for communication and documentation in design process. Sketch is worthy of study because it is a vital tool in design process. Finally, the aim of this research is to identify iteration in designers sketching using a standard method of representing iterative process. The timeline method of representing iteration was chosen and used in this study where by the iteration happen at the final embodiment of the design. Future research can determine whether iteration has a positive or negative role in designers sketching process.

Keywords

Design, Visualization, Iteration, Sketches

1.0 Introduction

A good design is a gift to the present generation and the generation yet unborn. Therefore it is the responsibility of the designer to deal with their design in a way that it can help the client and the environment. It is against this background that this research conceived the idea to produce this paper about iterative visualization processes in architectural design. The paper is limited to designers' conventional method of representation. One may ask about the importance of the study of sketching because it could be possible that technological advancement could scrub down traditional and conventional tools for design problem solving. Designers' use sketches as a tool to represent their ideas into descriptive drawings, as a result of this the study of sketching could merit the enrichment of knowledge in the field of architecture and engineering by understanding designers' method of sketching which then give the opportunity to propose some modification to the existing method of sketching for the benefit of the future generation of designers'. The study on sketching can also contribute to design knowledge and offer opportunity for new areas of research. Findings and results in this study can assist in improving the sketching methods of different classes of designers' from professional, experienced, and student designers'.

During the design process, various types of sketches and models are produced, with varying levels of concreteness and completeness. The nature of the sketch and the passion of the sketching activity in general depend on the designers' approach.

Sketches are drawings expressing the initial design concept and also show how the designer arrives at the final concept of a design. Sketches are vital to design concept because they provide the designer with an opportunity to visualize mental ideas consequently to manipulate those ideas into forms and shapes to serve as functional space in an architectural piece. Sketch is an important tool in the construction industry because it helps the designer to work on the initial idea of the design. Improving the clarity of the idea quality of the design is one of the functions of sketches which make it one of the most important communication tools in the construction industry.

The clarity of the construction drawing is important for presentation and other construction operations consequently the sketches clarify design information for other professionals and staff of the industry to be able to communicate with the design idea. It is the duty of the designer to use sketch as a tool to remove ambiguity in their design for clarity and understanding.

2.0 Visualization methods in the construction industry

The visual representation of a product and the role of visualization have recently become a central issue in design research because much of the design is concerned with concrete qualities of the design elements in custody. Designers represent their designs and other associated information using symbolic and physical artifacts, with the use of visualization as a technique to represent information about their design. These techniques include;

- i. Mental imagery
- ii. Sketch
- iii. Model Making
- iv. Computer technology

Imagery is a method of idea generation and development at the conceptual stage of the design. A designer can use Imagery to manipulate shapes and forms and recombine them in a meaningful and even

more creative way; this is an activity that is more relevant to brainstorming. Manual sketching and model making are also forms of visualization designers use to represent their design. Computer technology is a computerized method of design representation, where designers' use computer aided design software to produce, document and communicate their design successfully.

4.0 The Importance of Iteration in Sketching

Designers employ sketches as a tool for their designs, but for understanding the important of iteration in sketching it is significant to comprehend iteration in relation to sketching.

Iteration occurs during idea development in sketching therefore iteration is significant to cognitive activities in the conceptual stage of sketching process. Conceptual sketch have less or no meaning, only the author of the sketch can have an insight of what is happening in the sketch. Sometimes even the author may not fully understand the sketch but with iteration the required clarity of the sketch will be achieved. Sketches are useful for designers because it leads to more creative result. Therefore sketch is an important tool for designers and the construction industry because it assists in the ideation process and design communication.

There are six perspectives of an iterative process these perspectives include evolution, converge, refine, reworking, negotiation, and repetition (David et al. 2007). Sketching process was regarded as a process that involves thinking, regrouping, interpretation, and reorganization (Robbins 1994, Schon 1983, and Goldschmidt 1994). Therefore, this study is intended to determine some of these perspectives of iteration that could be possibly found in designers sketching activities.

In order to identify iteration in sketching it is important to study about what is sketching and iteration. Sketching is a process of generation, revision, refinement, consolidation, and development of a design (Gero et al. 2001). Sketching was also referred to as a tool for ideation process (Suwa and Tversky 1997). Iteration simply means involving repetition. Iteration was also defined as the repetition of activities to improve an evolving design (Eppinger et al 1997). Different concepts and definitions associate iteration with repetition such as modification, rework, and redesign. This study tries to investigate where iteration happens in designers' sketching activity. Future research can investigate the role of iteration in sketching.

5.0 Methodology

The aim of this research is to investigate iteration in a designer sketching activity. Therefore this research investigates iterative-behaviors in designer sketching activities through

1. Designer visitation and reworking while sketching (table 1)
2. Information contained in the produced drawings (figure B, E, F, A).

Several methods of data collection have been employed from content analysis, close group discussion, and the experiment.

Experimental research on observing design activity are in form of straight observation, interviews, questionnaires, protocol analysis which take place after design activity with records of the verbal and real design activity taking place (Stauffer and Ullman 1991, Ericsson and Simon 1993). "Method to measure iteration in engineering design include by character, computer software, assimilation and feedback time line, episodic and identity pattern. This method of analysis the design task has to be identified and the tools for data collection and analysis must be provided. The data are to be classified based on physical action and looking action. A coding scheme has to be developing to record the number of actions of the designer during sketching activity" (Safoutin 2003). For the purpose of this study actions

represent designer visitation between drawing sheet and reworking on previous drawn sketch to modify them.

6.0 Experimental Design & Data Collection

A design task was issued to a Master of Architecture student (male) from Architecture department, faculty of the built environment, university teknologi Malaysia. The design task contains information about the design of an internet café on a chosen site. The purpose of the study is to be able to observe designer looking actions between drawing sheets throughout the exercise. The experiment was conducted by the observer and designer only in a private computer room. The designer was allowed to work freely until the time he feels the job is done. A table of 1.2m x 2.4m was provided where by the designer face one 1.2m end and the observer face the other 1.2m end (Figure 1).

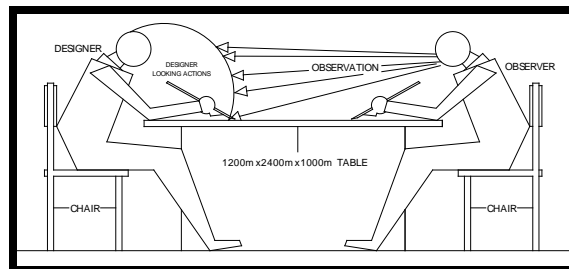


Figure 1: Research Situation

During the process of the experiment the designer is restricted to work with the drawing instrument provided by the researcher for their sketch. These instruments include pen and pencils, eraser, and drawing sheets (A, C, E, B, & F) while conducting the experiment.

During the exercise the designer uses the following sheets for the drawings.

- i. Sheet A (Design Brief)
- ii. Sheet C (Perspective Drawing)
- iii. Sheet E (Second Floor Plan)
- iv. Sheet B (Third Floor Plan)
- v. Sheet F (Ground Floor Plan)

The designer start with the sketch of the third floor plan (figure 2) then move to the second floor plan and the ground floor (figure 2 and figure 5) subsequently move to the final sketch which is the perspective drawing (figure 4)

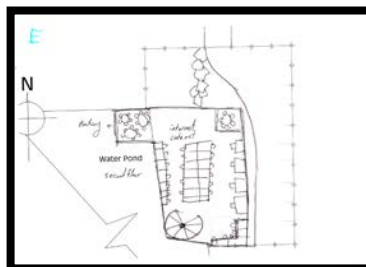


Figure 2: Sheet B Third Floor Plan



Figure 3: Sheet E Second Floor Plan

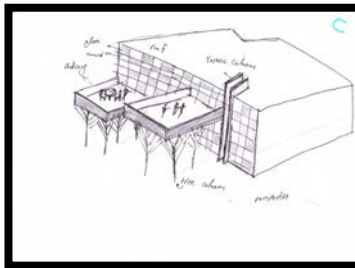


Figure 4: Sheet C Perspective



Figure 5: Sheet F Ground Floor Plan

While working on sheet B (figure 2) designer visit sheet A (design brief) twice at the same time as working on sheet E (figure 3) designer visit sheet A (design brief) once and three times for sheet B (figure 2) and finally all other sheets are visited (figure B,E,F,A) in the production of sheet C (figure 4).

One of the observation made during this experiment was the activities that happen when the designer iterate back to previous sketches is to rework and modify the exiting sketch. Example of this rework iteration occured in-between sheet F (figure 5) and sheet C (figure 4) that is upon finished working on sheet F the designer iterate back and work on sheet E for a period of two minutes before proceeding to the final sheet which is sheet C.

7.0 Data Analysis and Results

The data for this experiment was analyzed by observing the sketching activity to collect the useful data and finally employ qualitative method of data analysis (table 1). Also qualitative methods of data analysis such as close group discussion, and literature review wear used to compare between rework and revisit iterations. In order to represent this rework iteration the study would adopt the timeline method of representing iterative process (Safoutin 2003). In this method the graph was produce base on vertical and horizontal axis where the process is on the vertical domain against the time which is on the horizontal domain (figure 8) timeline representation on rework iteration which happens between 24th and 26th minutes (table 1).

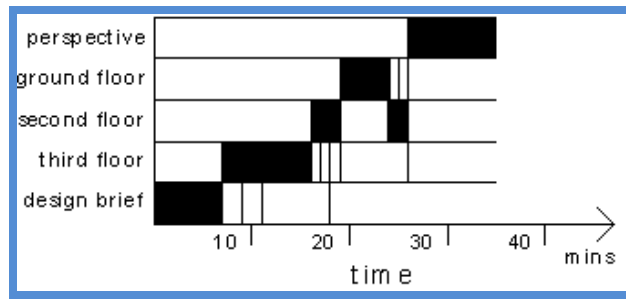


Figure 8: timeline representation of designer visitation between drawings in sketching activity

The table below contains the analysis of the sketching process base on time, duration, task, visitation and rework.

Table 1 analysis of designer iteration in sketching exercise base on visual and rework actions.

S/No.	Time (mins)	Duration (mins)	Drawing working on	Visual visitation	Rework
1	1	01 -07	A		
2	2		“		
3	3		“		
4	4		“		
5	5		“		
6	6		“		
7	7	07 - 16	B		
8	8		“		
9	9		“	*	
10	10		“	*	
11	11		“		
12	12		“		
13	13		“		
14	14		“		
15	15		“		
16	16	16 - 19	E		
17	17		“	*	
18	18		“	**	
19	19	19 - 24	F	**	
20	20		“		
21	21		“		
22	22		“		
23	23		“		
24	24	24 – 26	E		*
25	25		“	*	*
26	26	26 – 35	C	***	*
27	27		“		
28	28		“		
29	29		“		
30	30		“		
31	31		“		
32	32		“		
33	33		“		
34	34		“		
35	35	“			

* The star represent the occurrences of visual visitation (looking actions) that is when designer look back at previous drawn sketches to solicit for information in order to develop new sketches and the other is when the designer rework on previous sketch that is to make some corrections on existing sketch.

Below is a brief clarification of information contain in each column of the table

1. Time: time indicate the duration of the sketching exercise (35mins table 1 second column) starting from the first minute to the last minute of the sketching process.
2. Duration: duration indicates the time designer spent working on each sheet (table 1 third column).
3. Current task: current task indicates drawing sheets designer was working on (figure 2,3,4,5 and table 1)
4. Visual visitation; visual visitation indicates designer visit and revisit in between drawing sheets (figure 2,3,4,5 and table 1)
5. Rework: rework indicates designer act of correction on drawing sheets (figure 2,3,4,5 and table 1)

The results indicates that the reason why the designer iterate back was to was to clarify previous drawn sketch this was visible when the designer return and worked for about two minutes on the second floor plan (figure 3) before proceeding with the perspective drawing (figure 4). This iteration indicates that revisit and rework actions in designer sketching activities are very important because it gives room to accuracy, modification and clarity of the design.

8.0 Conclusion

Designer behavior was the main target data for the research. This aspect will be studied by analyzing the records of the observation. The coding scheme is used to extract the data during the experiment. The result shows that designer exhibit a lot of iterative-behavior while sketching and also indicate that the designer iterate more than once during the sketching exercise.

The observer focuses on designer physical and looking actions during sketching activity and uses the timeline method of representing iterative process to represent where the iteration happen during the sketching process. The results of this study help to understand the relationship between designer actions in sketching process. After the data collection and analysis it was shown that the designer visits previous sketches in order to develop new ones or improve the visited sketch. Furthermore, the aim of this research is to identify iteration in designer sketching. But future research can determine whether this iteration has any positive or negative role on the sketch.

This study was conducted so that it could be part of new areas of research in the construction industry. Research in building construction in the near future is expected to cover different field of study ranging from social science, engineering, medical sciences, business studies, and arts. It is the hope of stake holders in the construction industry that researches in the field of construction can be adopted and collaborated with the highly advance modern construction techniques.

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