

Architectural Design Process: Relating Designer Iterative-Behavior and Design
Quality Measurements

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I wish to dedicate this thesis to my beloved mother Hajia Amina Mallam Adamu and my late father Alhaji Idi Danfulani (May his soul rest in peace, Amin.)
Mom, Dad I 'am so proud of you

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ABSTRACT

This study examined designers' behavior in the architectural design process. Among the various types of designer behaviors, iterative-behaviors are specifically considered in this research. Iterative-behaviors are regarded to be a goal directed component of a particular process. Therefore this study aims to investigate its implication on the architectural design process. The main objective of the study is to identify and analyze these behaviors within the context of the architectural design process. Physical actions, eye movement, and sign language are some of the typical iterative-behaviors in the design process. Among the methods used to study such behaviors include field observation and verbal protocol analysis of design problem solving activities. These were the two methods used to capture observed data of a group of final year architecture students performing given design tasks within a closed environment at the Faculty of Built Environment (FAB) in UTM. Sketches were the medium of design representation accepted as observable data in this study. The study also used qualitative and quantitative methods of analysis in acquiring the general findings of the research. In the first instance, Pearson correlation coefficient analysis and graphical presentation provided statistical evidence of linear relationships between designers' behaviors and scores. Further methods of analysis included theoretical computation between duration, scores, actions and activities during the design session. The results of data analysis indicate that designers' iterative-behaviors did not influence the score of the resulting design, but some positive outcomes were established like those pertaining to the relationship between designers' sketching fluency and the score of a resulting design. Finally the research also postulates the possibility of repeating this study on other parts of the world, thereby establishing whether designer behaviour and design output could be linked to cultural and psychological differentiations.

ABSTRAK

Kajian ini mengkaji tingkah laku pereka dalam proses rekabentuk senibina. Diantara pelbagai jenis tingkah laku pereka, tingkah laku 'iteratif' merupakan aspek khusus dalam penyelidikan ini. Tingkah laku 'iteratif' ini disifatkan sebagai komponen bermatlamat terarah dalam proses tertentu. Oleh itu kajian ini bertujuan untuk menyiasat implikasinya terhadap proses rekabentuk senibina. Objektif utama kajian adalah untuk mengenal pasti dan menganalisis tingkah laku ini dalam konteks proses rekabentuk seni bina. Tindakan fizikal, pergerakan mata, dan bahasa isyarat adalah beberapa ciri tingkah laku 'iteratif' yang berlaku dalam proses rekabentuk. Diantara kaedah yang digunakan dalam mengkaji tingkah laku ini adalah pemerhatian di medan dan aplikasi analisis protokol lisan terhadap aktiviti-aktiviti penyelesaian masalah melalui pendekatan rekabentuk. Ini adalah dua kaedah yang digunakan bagi memperolehi data cerapan hasil daripada pemerhatian terhadap sekumpulan pelajar tahun akhir senibina dalam melaksanakan tugas rekabentuk yang telah diberikan melalui persekitaran yang tertutup di Fakulti Alam Bina (FAB) di Universiti Teknologi Malaysia. Lakaran yang terhasil daripada aktiviti-aktiviti tersebut di terima pakai sebagai perwakilan hasil rekabentuk dalam kajian ini. Kajian ini turut menggunakan kaedah analisis kualitatif dan kuantitatif bagi mencapai penemuan penyelidikan yang dikehendaki. Kaedah analisis korelasi Pearson dan persembahan grafik telah menyumbangkan bukti statistik tentang wujudnya hubungan linear antara tingkah laku pereka dan skor yang mereka telah hasilkan. Kaedah analisis lanjut turut merangkumi pengiraan teori antara tempoh, skor, tindakan dan aktiviti-aktiviti semasa sesi reka bentuk. Hasil analisis tersebut menunjukkan bahawa tingkah laku 'iteratif' tidak mempengaruhi skor rekabentuk yang terhasil. Namun, beberapa hasil positif yang lain telah dapat dikenalpasti, khususnya yang berkaitan hubungan diantara kelancaran lakaran pereka dan skor rekabentuk yang terhasil. Penyelidikan ini turut mencadangkan kemungkinan kajian ini diulangi di kawasan-kawasan lain di dunia bagi membuktikan sama ada tingkah laku pereka dan hasil reka bentuk tersebut dapat dibezakan pula berasaskan faktor-faktor budaya dan psikologi.

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CHAPTER 1

INTRODUCTION

1.1 Background Introduction

In recent times information and communication have become key features in any technological advance. The situation is similar with architectural design domains, where information and communication between designers, professionals and management teams are important to the design outcome. Architectural design in the 21st century is involved with various methods of visualization ranging from, model making, sketching together with manual and Computer Aided Drafting. These methods contribute to designers' ability to communicate their design to parties involved in managing design and construction processes. The implementation of these methods in the design process is carried out by designers and other technical support staff in design education and practice.

The use of sketch as a medium for communication began with early civilization and has continued up to the present digital era where designers use sketches for design ideation with different mediums of representation ranging from conventional pencil and paper to digital tablets and computers. In the early civilization, artists, historians and scientists use sketches as a medium for representation and documentation of ideologies, beliefs, and events. Leonardo da Vinci produced some of the most prominent sketches in the 15th century such as the flying machine, the water flow, and the organ sketch (Brockwell 2010). These pieces of sketches show how Leonardo use sketching as a medium for externalization and documentation of mental ideas.

In developing their design, modern designers' use sketching as a tool to generate and communicate the conceptual idea of the design. They also use sketch to clarify ambiguous information in their design; thus, sketches assists in the process of development, communication and documentation of the design idea.

Basically one of the common sketching techniques is the conventional pencil and paper sketching (Figure 1.1). In this method designer pattern of behavior such as physical actions, Eye movement, and sign language form part of the sketching activities. These behaviors are implemented again and again in a pattern of iterative-behavior until a final goal is achieved. These Iterative-behaviors could be an important part of Architectural Design Sketching because iterative-behavior was **proof to be important in the aspect of accuracy and clarity of a design (Safoutin 2003)**, but yet the importance of iterative-behaviors in Architectural Design Sketching is neglected. Hence, the lack of study of iterative-behavior in architectural design sketching is an issue for concern.



Fig 1.1 Conventional Pencil and Paper Sketching

Among the benefit of this study could be a propose design of a computer application and a mechanical device that could assist designers in managing design behaviors.

1.2 Importance of the study

One may ask whether it is worthwhile to study the behavior of designer in architectural design sketching, as it could be possible that technological advances that we have could displace manual and traditional methods of solving design problems. But, since sketch is a common visual thinking tool for all classes of designers, the study of designer behavior from the perspective of sketching potentially forms an important issue of research in architectural design process. To identify the significance of designer behavior in relation to designer tool also makes the research an important case in architectural design process. The study also merits the enrichment of knowledge through the structuring of literature and pointing out new areas of research in the field of design and science, it can also help studio masters in monitoring design studio projects and in understanding the behavior of designers. Finding and result of this kind of study can assist stakeholders in design domains to improve on existing manual and traditional methods of design problem solving. The study is finally target to reach to the audience of all classes of designers from novice to expert. It is also the hope of the author that the study should add-up to existing knowledge in design domains.

1.3 Problem Statement

The statement of the problem is the focal point of the reach. This is normally one to two sentences long but explicitly explains the focal point of the research.

The statement of the problem of this research is explained as;

Iterative-behavior is the act of repetitive behavior, usually with the aim of achieving a desired goal, yet the occurrence of iterative-behavior in architectural design is neglected.

The Architects are trained professionals charged with the responsibilities of solving Architectural design problems and managing the building processes. The behavior of these professionals could provide insight into their problem solving

processes; therefore lacking in this knowledge constitutes a significant research gap in the study of Architectural design process.

1.4 Research Aim and Objectives

The aim of this study is to identify and determine the importance of iterative-behavior in architectural design sketching.

The objectives of the research include:

- i. To identify iterative-behavior in Architectural design process
- ii. To investigate the role of iterative-behavior in Architectural design process

1.5 Research Question

- i. Are there iterative-behaviors in Architectural design process?
- ii. Is there a significant role of iterative-behavior in Architectural design process?

1.6 Scope of Study

Some of the terms and methods use in this research could be new to the field of architectural design process. These include terms like iterative-behavior, progression, skills, copy, concretization, abstraction and clarity. The researcher thinks the introduction of these terms and methods will add to knowledge and also possibly provide new area for future study in the field of design and science. It is very important to consider the following technical/observation parameters.

- i. Subjects involved in this research will be five final year Undergraduate student of Architecture in the Department of Architecture, Faculty of Built Environment Universiti Teknologi Malaysia, Skudai, Johor, Malaysia.

- ii. Four experienced design Academicians from the same faculty to facilitate the design quality measurement.
- iii. The audio/visual lab from the same faculty will be used as the research environment, allowing for easy access to research equipments and facilities.
- iv. The research instrument includes three sets of video cameras, one digital photo camera, computer film editing facilities, timer/stop watch, bell/ringer, voice recorder, set of drawing instruments, and design task.
- v. Iterative-behavior has many definitions and concepts, but in regard to this study some of the definition and concepts which relate/considered iterative-behavior with a repetitive pattern are emphasis.

1.7 Chapters Review

Chapter 2 introduces and explains the component of the research literature such as design process, visualization, iteration and iterative-behaviors. Some of the explanations indicate that visualization is a medium through which designers/authors represents their ideas with detailed explanations on the content of the representational artifact. These mediums include mental imagery as a technique to generating and developing design idea in the preliminary stage of an architectural design process, followed by manual sketching and physical models as another form of visualization techniques use in architectural design process. Finally, computer technology was also identified as a method of visualization in architectural design process.

Other literature considered Iterative-behavior as the act of repetitive behavior, usually with the aim of achieving a desired goal where the adjective iterative describe any repetitive process which is often applied to any heuristic planning and development process. Each repetition in the behavior is referred to as iterative-behavior.

Chapter 3 describes the methodology used in observing design activities. These range from relatively informal methods, such as direct observation, to retrospective methods that take place after design activity meticulously record of the design activity as it takes place. The iterative feature of sketching behavior is identified and subsequently measured with the supports of empirical methods. In the current study a design task was developed together with specific method of data collection and analytical methods. The data is classified into two iterative-behaviors and design quality measures through the use of coding scheme that identify/classify designer iterative-behavior in sketching activity. Three different methods of data collection are use to satisfy the aim and objectives of the research. The first source includes discussions with a supervisor and colleagues. The second source should include the use of literature review as well as the World Wide Web (WWW). The last data source will be an experimental research.

Chapter 4 presents the method of analysis used. The research employs both qualitative and quantitative methods of data analysis. Qualitative methods include comparing the relationship between variables while quantitative methods include identifying the linear relationships between variables using correlation methods of statistical analysis.

Chapter 5 explains the research findings and conclusion. The findings are the results of the analysis while the conclusion includes suggestions and recommendations.