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Reflections on Architecture Design Education: The Integrated Design Paradigm

Bashier, Fathi

Department of Architecture, Urban Planning & Development
Faculty of Engineering & Technology, Wollega University, Ethiopia

Email: fatibashier@yahoo.com; fatibashier@gmail.com

Mob: +251 9 368 83917 (Ethiopia), +249 910517774 (Sudan)

Abstract

Studies have recently discussed the failure of traditional design in the studio to develop a rational approach based on systematic methods and objective knowledge. They agree that such an approach is incompatible with the complexity of modern design problems and recognize the need to replace it with a disciplinary approach in order to meet the challenges of modern design. Most critics attribute the failure of the traditional approach to the lack of knowledge. This study, however, argues that the problem is more precisely a problem of the inadequacy of design knowledge conception, and suggests that the development of a discipline-based approach cannot be achieved unless the entire knowledge conception is properly understood and theorized. To achieve this end the study has introduced, in a previous article, the integrated design paradigm as a theoretical framework which describes the knowledge system within the design process. In this article the study reviews the integrated design paradigm and develops a new understanding of design knowledge conception based on systems theory. In the light of this holistic perception, the study proposes *the design process systems approach*, a disciplinary model based on the integrated conception of design knowledge. However, both 'the design process systems model' and 'the (revised)

integrated design paradigm' upon which it is based will have to be empirically verified in a future article.

Key words: process, knowledge, systems theory, knowledge conception, process systems

1. Introduction

This article is the second in the study of the design process by the author entitled "Reflections on architecture design education". The study has been motivated by the failure of the traditional design in the studio to develop a rational approach based on systematic methods and objective knowledge, as has been observed by the author throughout many years as studio instructor. Studies agree that such approach is incompatible with the complexity of modern design and the highly advanced technologies of our time. They recognize the need to replace the intuitive design approach now common in the studio, with a disciplinary approach in order to meet the challenges of modern time design problems.

Most critics attribute the failure of the traditional approach to lack of knowledge. This study argues, however, that the problem is not a matter of lacking knowledge, as in fact there is abundance rather than shortage of knowledge, but is more precisely related to the inadequacy of design knowledge conception as we now know it. The inability of the design knowledge conception to sustain the balance and integration of the rational and the creative activities of design has in the recent years been increasingly commented upon in the studio. The study suggests that the development of a discipline-based approach cannot be achieved unless the entire knowledge conception, the working environment where the development of the design problem and solutions evolves, is properly theorized in a manner that exhibits uniformity and integration. To achieve this end, the integrated design paradigm has been introduced in the first article of the series (Bashier, 2014).

The integrated design paradigm was suggested as a theoretical framework, which describes the system of knowledge within the design process with emphasis on the balanced and integrated relationship of the rational and creative activities. The present article reviews the integrated design paradigm and develops a better understanding of design knowledge conception on basis of which the study proposes the design process systems approach.

In this article the literature review will help the formulation of the working hypothesis of the study. Besides, it is intended to help the development of advanced understanding of the integrated knowledge conception on basis of systems theory. The insight gained from this holistic approach in terms of knowledge interaction, is expected to help understanding how the balanced coexistence of the rational and the creative activities within design process systems is sustained. The concept of

knowledge interaction will be used in describing the mechanism of knowledge produce and use within the integrated knowledge conception, which the co-emergence of the dual activities within design process systems is dependent upon.

Based on the hypothesis outlined above the article draws a preliminary conceptualization of design process systems approach, a disciplinary model based on the integrated conception of design knowledge. However, both ‘the (preliminary) design process systems model’ and the (revised) ‘integrated design paradigm’ upon which it is based will have to be empirically verified in a future article. The present exploratory part of the research relies on observation and on the knowledge, which the author has acquired through many years of experience both in studio teaching and in practice. In addition, the study draws on the international design research and builds on other researchers’ finding. Knowledge from the literature will be used in theorizing about of the empirical observation of design work.

2. The Research Problem

2.1 The Failure of Design Knowledge Development in the Studio

It is possible to identify three components of design knowledge: (1) The design problem: need and values are identified as goals, which are interpreted into space arrangement to accommodate activities (2) Basic principles component is the knowledge from past experience, from which design theory is developed. (3) Technical knowledge transferred from other fields mainly engineering such as structural, mechanical, electrical, acoustics and sanitary engineering...etc. The three components of design knowledge initially derive from different sources. Contrary to what has been suggested that architecture, as an applied field, is dependent in knowledge on other fields of study (Griffiths, 2004), architecture doesn’t rely only on the knowledge that is developed in other disciplines but ideally uses knowledge that is developed within the field of architecture itself.

Architecture students are supposed to investigate the design problem and to explore past design experience in order to provide a factual knowledge base for design including design criteria and design theory. However, this is not always the case. The lack of enquiry based knowledge in students work has been repeatedly raised in the final year external examiners` report as witnessed by the author in some architecture schools over the years. They have invariably complained about the students` failure to provide objectively developed knowledge to support decision-making in design.

In addition to the knowledge developed within the field of architecture itself, architecture design uses other types of knowledge gained from different fields such as: structural, mechanical, and electrical engineering as well as ergonomics, environmental sciences, economics, science of materials. In addition to the social sciences, anthropology, information technology etc. However, it has been noted in the recent

years that the transfer of knowledge into architecture design generally and technical knowledge in particular has not been adequate.

Benkari (2013) for example, complained about the slowness of architecture education institutions in the United Arab Emirates (UAE) in updating their curriculum to suit technology advances. Although sustainability has become a major concern of city planning and development policy in the UAE there is a wide gap between the country's political decisions and commitments for sustainability and the content of architecture education curricula. In spite of the bold political decisions and governmental projects undertaken in UAE in favor of a sustainable future for its cities, as Benkari noted in her research of the Sustainability Paradigm in Architectural Education in UAE, architecture education programs were quite late in responding to these new challenges. She reports a gap that exists in UAE between the political decisions and governmental strategies on one side and the content of the academic programs designed for the professional preparation of future architects on the other.

The inadequate transfer of technical knowledge in the studio is echoing in design practice too and causing concern. Although technological sciences constitute a fundamental part of the curriculum in every school of architecture, Tzonis (2014) finds that the technical failures of architecture projects indicate that architects often fail in practice to employ technical knowledge in design.

In another context O'Cathain (2003) has referred to a number of studies which reveal "a widespread apparent lack of concern among the architectural profession for the stated requirements of their clients". According to him the Strategic Study of the Profession carried out for the Royal Institute of British Architects, RIBA (1992- 1994), revealed a large gap has opened up between the expectations of the architects and those of their clients. A similar result was arrived at by a study conducted by the same writer which has involved a number of architectural firms. The study shows that "none of the architects delivered precisely what was required of them even though all had the same carefully-worded written contract with specified deliverables".

The failure of knowledge development in the studio and in practice indicates that design as a discipline still is not developed or perhaps, as Owen (1998) describes it, is a slow learner. As a result the use of creative skill in the studio with little support of factual knowledge has increasingly been criticized in the recent years. It has been pointed out that the use of creative skill has been limited to the production of drawings instead of being used in the objective creation of design concepts. Lawson (2005) calls this a design by drawing approach, in which students design the drawings instead of drawing the design. Learning architecture design in the studio has become a sort of neo-apprenticeship, where students learn by doing not by applying disciplinary methods. Design drawings in the studio have become like manufacturers' product

catalogues, relaying on copy-past with little support of objective knowledge or rational decision-making.

2.2 The Conventional Design Knowledge Conception

It is clear from the above discussions that there is no shortage of knowledge. The problem then is likely related to the conventional knowledge processing system and more precisely the inadequacy of the knowledge conception, which is often hampered by its own inability to foster the interaction between the rational and the creative components of design and to maintain balance and integration of the two.

Trying to find out what hinders the capacity of knowledge conception as mentioned above it is possible to point out two key features of the traditional studio, which are closely linked with this deficiency. The first is the knowledge divide in architecture education. The source of design knowledge in the curriculum of architecture education is traditionally divided between the studio in the core and the classroom-model taught courses (Phillippou, 2001). Although the development of design knowledge has been a major concern of design research since the 1980s, there is a gap in the literature with respect of the separation between the two channels of knowledge in architecture design curricula, the studio and the classroom, and the impact this has on knowledge development. It is noted that the separation between the sources of knowledge makes a barrier between the basic principles knowledge developed within architecture and the technical knowledge transferred from other fields. This barrier impacts not only the integration between these types of knowledge but also the balance between rationality and creativity in the design process.

Another feature of the traditional design approach, which has significant impact on knowledge conception, is its implicit nature. The major disability of the implicit design approach is the absence of a clearly defined knowledge conception, the fact that is limiting the ability of producing knowledge and diminishing the chances of rational decision-making, testing and modifying designs. It has been noted that the case where design approach is implicit and consequently an adequate knowledge conception is lacking has always been associated with the tendency to give more attention to the formal end product than to problem solving. This is the case where the inadequacy of the design knowledge conception because of the implicit nature of traditional design, often leads to the lack of balance and integration between the rational and the creative components of design.

2.3 The Integrated Design Knowledge Conception

Theorists have, since the early days of the design movement in the 1950s, realized the need to balance creativity and rationality in the design process. Jones (1970) aimed to re-conceptualize the design process so that intuition and rationality could co-exist instead of having one exclude the other. Since the 1960s, many writers

have recognized the importance of the relationship between creativity and rationality in the design process. With innovation requiring both creativity and rationality, these concepts are known to be mutually interdependent and should not be considered as separate (Kroes, 2010; Casakin, 2008; Wankat and Oreovicz, 1993). However, no theory has developed that could bring the rational and the creative aspects of design together within an integrated conceptualization.

At present there is no design theory exists that describes in a coherent way the knowledge conception within the design process (Bashier, 2014). This poses difficulty for designers regarding the dual nature of design activity especially in terms of how the essential co-emergence of the rationally and the skill-based can be developed in a balanced and integrated manner. This indicates the importance, as evident in the failure of the traditional design to develop knowledge, of some form of design theory that could explicitly articulates the design knowledge conception to emerge. Therefore, the study recognizes the need to revise the integrated design paradigm, with emphasis on defining the function of design knowledge conception and how knowledge is produced and used within the design process.

3. Research Plan

The previous discussion leads to the formulation of the study problem. There are two closely related problems in traditional design: the lack of a coherent design theory and, the consequent inadequacy of the design knowledge conception. In the first article in this series the study has suggested the integrated design paradigm as a theoretical framework, which describes the system of knowledge within the design process. In the following section, the literature review has two objectives a) to enable revising ‘the integrated design paradigm’ and to develop a more advanced understanding of design knowledge conception based on systems theory, b) to formulate the research working hypothesis, which presents a preliminary theorization of ‘the design research systems model’.

4. The Literature Review

The integrated design paradigm, as already mentioned, considers the design process from the perspective of general systems theory as a system of knowledge in interaction within the wider knowledge environment. General systems theory was originally proposed by biologist Bertalanffy (1928). He postulates a new discipline called *General System Theory*. Bertalanffy proposed a system could be broken down into its individual components that a system is characterized by the interactions of its components and the nonlinearity of those interactions. Systems theory provides an internally consistent framework for classifying and evaluating the world (Walonick, 1993).

The subject matter *General System Theory* is the formulation and derivation of those principles which are valid for 'systems' in general. Thus, a basic problem posed to modern science is a general theory of organization. General system theory is, in principle, capable of giving exact definitions for such concepts and, in suitable cases, of putting them to quantitative analysis.

While in the past, science tried to explain observable phenomena by reducing them to an interplay of elementary units investigable independently of each other, conceptions appear in contemporary science that are concerned with what is somewhat vaguely termed 'wholeness', i.e. problems of organization, phenomena not resolvable into local events, dynamic interactions manifest in difference of behavior of parts when isolated or in a higher configuration, etc.; in short, 'systems' of various order not understandable by investigation of their respective parts in isolation. General System Theory, therefore, is a general science of 'wholeness'. There is a general tendency towards integration in the various sciences, natural and social. Such integration seems to be centered in a general theory of systems (Bertalanffy, 1968).

This theorization helps understanding and conceptualizing the design process as a system of knowledge with emphasis on the interaction of knowledge within the system as well as between the system and the wider knowledge environment. The study uses systems theory to explore knowledge processing and to explain the mechanism of knowledge interaction within the integrated framework of knowledge conception.

Walonick, 1993 defines three general approaches for evaluating subsystems. A *holist* approach is to examine the system as a complete functioning unit. A *reductionist* approach looks downward and examines the subsystems within the system. The *functionalist* approach looks upward from the system to examine the role it plays in the larger system. All three approaches recognize the existence of subsystems operating within a larger system (Walonick, 1993). The study finds that both the holist and the functionalist approaches taken together may constitute a suitable approach for design process systems.

Markus (1972) presented a useful systems model describing their content and how they work. Based on Markus the study identifies the design process as having objectives and goals to reach those objectives. It is useful at the point to distinguish between the objectives and goals of the design process. It is understood that need represents the primary objective of the design process, whereas the specific physical environments required for the need to be fulfilled can be classified as goals.

It is obvious that satisfying human need is the main objective of the design process. The design process achieves its objective by a number of goals, they are: (1) human activities: design objectives generate activities; (2) the (physical) environment: activities must have appropriate spaces in order to function properly; (3) Knowledge: the study regards the design process as a system of knowledge in which the interaction

between the different types of knowledge involved take place through the channels of producing knowledge (problem formulation and theory development) and using knowledge (concept creation).

Owens (2005) divides creative people in two groups, the finders and the makers. In similar way the architect is a finder and a discoverer, whose design work is a combination of discovery and invention. Architects play two roles in making designs: producing knowledge (discovery) and using knowledge (invention). Discovery is concerned with theorizing about the design goals. It is analytic activity in which the architect explores, analyses and objectively produces knowledge including: the formulation of the problem which is the study of needs and activities and the development of design theory which is concerned with studying past experience and discovering the norms in space design.

In his role as inventor, the architect uses the rationally developed knowledge already produced by discovery and creative skill to create new designs. It is the activity concerned with the accomplishment of design objectives through the interaction of goals (knowledge). The interaction between need as represented in the formulation of the problem and space as represented by design theory is necessary for the generation of design concepts. Fusing past experience (design theory) and new conditions (design criteria) give rise to new concepts. The architect uses design theory based on the study of past experience and his own creative skill to generate new ideas for new conditions.

System thought has been influential in architecture theory in the recent years. The design process, as seen from the perspective of the integrated design paradigm, is an open system within the broader environment context. Walonick (1993) calls this a bilateral relationship that exists between the environment and the components of the different systems operating within the environment. The design process, as seen from systems theory, can be considered a controlled open system. Based on Walonick, the basic characteristics of the design process as an open system is the dynamic interaction of its components with the environment. It receives input (knowledge) from the environment and releases output (knowledge) to the environment (Walonick, 1993).

The communication of knowledge between the design process and the environment can be conceived as a permanent cyclic pattern in which as Schon (1983) describes “Researchers are supposed to provide the basic and applied science from which to derive techniques for diagnosing and solving the problems of practice. Practitioners are supposed to furnish researchers with problems for study and with tests of the utility of research results”.

Jaskiewicz (2007) draws an interesting analogy between what he calls complex systems and living organisms. A lot can be learned from nature, he suggests. Most important characteristic of their similarity is that the design process, just as in organisms, doesn't end when the design is complete or a building is materialized. What

concerns us most in this study is the notion that buildings after being materialized they keep interacting with the environment as they are continuously being studied by other designers and commented upon by critics. As Jaskiewicz noted “Even though an architect may not be involved in them anymore, buildings keep on mutating and re-adapting to their environment...” (Jaskiewicz, 2007). This thinking opens the way for design process systems to develop in a systematic way like in natural organisms, which transcends the occasional production of designs to the permanent production of knowledge.

4. The Design Process Systems Approach: A Preliminary Conceptualization

The literature review, as already stated, has focused on providing insight into two issues: the first is reviewing the integrated design paradigm, which has led to a more advanced understanding of design knowledge conception based on systems theory. The other issue which the literature review has achieved is guiding the study to the formulation of the research hypothesis.

In the light of the new understanding of design knowledge conception, which has been acquired on basis of systems theory the study proposes *the design process systems approach*. This proposal stands at this stage as a hypothesis, which needs to be empirically verified in a future article. In the present article, the study draws out a preliminary theorization of the design process systems approach.

4.1 Design Knowledge within the Revised Integrated Design Paradigm

The design process as seen from the integrated design paradigm is a system of knowledge in interaction with the wider knowledge environment. There are different types of *design knowledge* used in the design process. These can be grouped under two broad categories: the first is the type of knowledge produced from within the discipline including the design problem and the design theory. The other is mainly technical knowledge which is transferred from other engineering or technological fields. These two types of design knowledge can be referred to as working design knowledge to distinguish them as specific forms of design knowledge.

Design knowledge in general according to Cross (2007b) is found in published design information, in buildings and in people. Design knowledge as such is largely found in a developed form, which cannot be used directly in the design process, as working knowledge, unless transformed into data first. Data is then processed, as will be elaborated later, through the knowledge producing and knowledge using channels of the design process system to develop the following three components:

1. The design problem refers to the need and the values of the owner, the users and the community. These are interpreted into functional activities and the spaces required for accommodating such activities.

2. The design theory or the basic principles of design consist of the knowledge, which derives from past experience and constitute the basis of new designs.
3. Technical knowledge of design including the technical knowledge used in the construction of the building and the provision of all kinds of mechanical and electronic services.

4.2 Design Knowledge Conception

Design knowledge conception defines the mechanism of knowledge interaction, which monitors knowledge producing and using within design process systems. Design knowledge is produced and used through two processing channels, discovery and creation. *Knowledge produce* is an act of discovery which involves exploring, analyzing data and producing objective knowledge including: (a) defining the design problem which is the study of the need, activities and space requirements; and (b) formulating the design theory which is concerned with studying past experience and discovering the norms governing functional space arrangements. While defining the design problem is about exploring the need and interpreting need activities into functional spaces, design theory is concerned with discovering how spaces in similar buildings were in the past experience organized in order to satisfy the need efficiently. *Knowledge use* in turn is an act of creativity which involves using objectively produced knowledge and creative skill to generate more knowledge or concepts and to create designs.

4.3 Design Process Systems: A Preliminary Conceptualization

The design process system can be defined as an open system in which the central idea revolves around constantly evolving knowledge: knowledge discovery and knowledge creation are constantly evolving in a produce-use-produce cyclic pattern within the integrated conception.

Understanding the knowledge mechanism in design process systems, the design knowledge conception, helps modeling the knowledge structure on basis of the interaction within the system and between the system and the broad knowledge environment. Such dynamic structure is characterized by a cyclic movement in which, similar to ‘the knowledge building and using model’ suggested by Owen (2005), knowledge is used to develop designs then designs are evaluated to generate further knowledge. In such sustainable mode of knowledge development, explored knowledge is used in producing specific forms of design knowledge (the design problem and design theory). Design theory is then used to build up new concepts, which will be evaluated and further knowledge generated and so on (Table: 1).

item	Channel	Action	Knowledge
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1	Discovery	Analytic/interpretive	Produce knowledge	Problem Definition
2	Discovery	Analytic/interpretive	Produce knowledge	Theory formulation
3	Creation	Interactive	Use & produce knowledge	Concept generation
3	Creation	Interactive	Use knowledge	Design creation
4	Evaluation	Analytic	Produce knowledge	Theory Formulation

Table (1): The design process system model

Source: the author

5. Conclusions

The integrated design paradigm has developed an advanced theorization of design knowledge conception based on systems approach. It has become common for systemic models such as design processes, as Markus (1972) noted, to be reasonably useful in terms of representing and interpreting the real world in way which has some predictive power. This development has a significant implication for exploring the potential of knowledge interaction both within and across the boundaries of the design process systems. Understanding the design process system's knowledge interaction enables the replacement of the traditional linear design process model with a constantly expanding knowledge producing model. This development opens the way for the design process systems to be digitized. Digital design process systems would benefit from the current digital revolution including huge sources of open data and highly advanced software.

Design process systems approach can be used in a variety of fields especially planning the built environment. As open systems sensitive and responsive to societal change, digital design systems can be employed efficiently to influence change in the role of design in all aspects of modern life and society development.

The study proposes *the design process systems approach*, a disciplinary model based on the integrated conception of design knowledge. In this article, it has presented a preliminary theorization of the *design process systems approach*, however, a full conceptualization needs to be properly carried out in a future article in which the study hypothesis will be tested and empirically verified.

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