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Rethinking the Black Box in Architecture Design Studio

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Abstract

Design as a critical action can be defined as a concrete-utilitarian construction process and a state-related symbolic ritual. The process of design is defined by the abstraction area, which is accompanied by abstract forms of representation for the physical environment in a built environment and the response to problems. Black Box is defined as tool, system, or object that in art and science is evaluated by inputs and outputs and does not include any internal information. The Black Box problem, which is part of the architectural design process, has been reconstructed as a critical stance to the closed and implicit architectural production process, supporting open thought to the end but formally designing houses that remain faithful to this black box. Hence, this article is an example of a physical and semantic representation production with an emphasis on design as a critical action and metaphor. This article, which presents the black box problem through a theoretical perspective and architectural design studio examples, focuses on the semantic and formal representation of all conditions of a cube. This aspect aims to provide a creative cross section from the potential of infinite design.

Keywords

architecture, design studio, design education, black box

Introduction

Design—as a critical action—can be described as a state related to a concrete-symbolic creation process and to an abstract-symbolic ritual. The design process is the production adventure of infinitive representation ways, defined by the field of abstraction and brought along by abstract thinking, through physical conditions in the built environment and with parameters that will respond to problems. This adventure takes place in the design studios where the foundations of architectural education are laid and starts with first-year architectural education.

Architecture is an intellectual field of study and experiment and architectural design and its education are fed by intellectual curiosity and awareness (Cross, 2006; H. Yürekli, 2007). According to Kahvecioğlu (2007), "the main strategy of architectural education can be defined as the provision of the teaching and learning process with a certain accumulation of knowledge" (p. 11). Design studios, which have been used in architectural education for a long time, offer a communication environment associated with the teaching method employed (Boyer & Mitgang, 1996). Design studios are based on a tradition of learning by doing, and the architectural education that started in design studios is enriched by studio executives' comments and criticisms (Schön, 1985; Uluoğlu, 2000). Design studio—a core subject in architectural education—is viewed as an organizational structure, and studio instructors' roles in creating an organizational style in studio education is the subject of investigations into developing creative strategies in design studios (Kahvecioğlu, 2007).

Traditional teaching methods and historical alteration processes in architecture and design, including the one-to-one master–apprentice teaching style, the Beaux-Arts "neoclassical" teaching method, and the Bauhaus "modernist" educational approach, reflect the romantic notion of creativity (Cowdroy & de Graaff, 2005; Kuhn, 2001; Uluoğlu, 1990). The apprentice model of architectural education is founded upon the idea that creativity is a gift and cannot be taught. Meanwhile, the studio model assumes that creativity can be taught, though only by long and direct association with an instructor (Cowdroy & Williams, 2006, p. 107; Williams et al., 2010).

The main aims of design education are to allow different design experiences to be realized and to provide a strong communication-motivation environment (Kahvecioğlu, 2007). The design, which is defined by many experts as a problem-solving method, is a collaborative learning process based on the relationships between the student with their

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instructor and fellow students (Jones, 1980; Sagun et al., 2001; Schön, 1985). In this participatory environment, the process by which the students conceive, make sense of, interpret, and analyze problems has a dynamic structure.

Dutton (1991) stated that the design studio is the heart of architectural education programs and suggested that unlike other disciplines, the existence of a simple, creative, original, and free studio environment is important in architectural education. Their reasoning was that architectural education requires making a beginning that reverses almost all known pre-architectural education and training assumptions (Durmuş, 2015).

Modern architectural education needs to be restructured to facilitate and improve how students learn the curriculum (Sagun et al., 2001). In architecture, the actual intention according to the wording of the curriculum is creating dynamic structures, the limitations of which cannot be precisely defined, that imply seeing and reading developed by workshops, juries, and studio critics. However, if the presence of a curriculum is a topic, it should state that design courses, particularly design studios, constitute the core curriculum. Modern design studios are environments that contain much more than conventional training classes in pedagogical, sociological, ideological, and epistemological terms (Demirbaş & Demirkan, 2003). Design studios that always attach importance to conceptual approaches and mention them extend their study scope through concepts from disciplines such as literature, art, mathematics, and cinema (Hendriks, 2017; Hisarlıgil, 2012). In this context, studios as intellectual environments can be considered platforms where the measures of design problems—limited to a specific period—are discussed, and these limits and measures are deepened in the student–instructor relationship.

Design studios focus on the relationship between creativity and abstraction to make use of their fiction with the aim that students should acquire two- and three-dimensional thinking, expression capabilities, and representation techniques with the aim of acquiring fundamental design skills and basic concepts and techniques for this skill's development. In addition, these techniques are representative types used effectively in conceptualization, solving, and presenting the problems of design.

This article aims to initiate discussion about rethinking the black box approach and how the concept of creativity relates to the architectural design studio. This begins by briefly outlining the architectural design process, concept, and conceptualization. Then, the concept of creativity is discussed in how it relates to design education and, more specifically, architectural design education. There is then a short literature review about the black box theory and approach. The conclusion presents the objective, scope, definition, and method of the problem at the conceptual level using black box examples from the architectural design studio.

Architectural Design: Concept and Process

Students face obscurity and the process of unlearning the curriculum presented in first-year architectural education (Higgott, 1996). In this process, the students engage in efforts to move the conceptual relationship they have established with their surroundings to different levels and convert it to meet their new educational environment needs. Design education allows for how problems are designed—as determined by theoretical and professional concerns—to help some students distinguish themselves (Kvan & Yunyan, 2005).

Design is not a complex, contradictory, or linear process; neither is it an action that can only be carried out with certain skills. On the contrary, it requires reasoning and includes a conceptual level (Rittel, 1985; Uluoğlu, 2000). The problem of conceptualization in the design studio is regarded as a part of a strong cognitive model (Oxman, 2008). Design action is used to define future problems, and designers reveal the definition of nonexistent phenomena as a problem (Jones, 1980; I. Yürekli & Yürekli, 2004). Thus, design is a multidimensional activity involving interpretation, communication, and research; it enables the emergence of intellectual activities and is comprised of creativity and union of mind (Kahvecioğlu, 2007; Oxman, 2006).

Design aims to and necessitates trying to predict the future, define and solve problems, select and interpret knowledge, creation a whole, and abstract thinking. The use of concepts is important and preferential in realizing these goals and requirements. For example, Lakoff and Johnson (1980) suggested using metaphor and analogy, stating that the thought process is a major aspect of a conceptual system and structured metaphorically. Although the concept of metaphors is used to distinguish, experience, and understand something, analogies are defined as conceptual structures that show certain systematic similarities between two types of source as a way of describing conceptual content (Oxman, 2004, p. 69).

Design instructors from international schools of architecture have stated that metaphors have increased the exploration of various design solutions and developed lateral thought processes; however, analogy is a difficult method to apply in the design studio system (Kowaltowski et al., 2010). In architectural design, metaphors in particular are viewed as heuristics that help organize design thinking and tackle ill-defined design problems (Antoniades, 1992; Rowe, 1987). The use of metaphors in developing analysis, synthesis, and conceptual thinking has important effects for design practice and can help promote creativity in architectural design activities (Casakin, 2007, p. 22).

Creativity is effective in both the production of concepts based on abstract thinking and in the completion of the design process in original ways. Creativity, defined as the process of "revealing something new and unusual," is a captivating and stimulating aspect of human thought. Creativity

as the production of useful and noble ideas is often characterized by the "creative leap" that occurs between problems and solution spaces (Amabile, 1996; Casakin, 2007; Hasirci & Demirkan, 2007, p. 259). In early approaches, creativity was seen as an individual thought, process, or outcome that is produced in a short period of time (Amabile, 1991). However, many researchers agree that creativity is an attitude rather than a mysterious gift (Amabile, 1991; Kahvecioğlu, 2007; Sternberg & Lubart, 1999). Creativity is the starting point for learning and knowledge and defined as the capacity to produce numerous ideas with the highest level of originality (Kahvecioğlu, 2007; Lawson, 1997; Portillo, 2002; Weisberg, 2006).

In the context of the design process, creativity is a central concern of many first-year architectural design courses. These processes aim to develop abstract thinking capabilities and support creativity, particularly in design courses and studios. During this process, "thinking processes" and "characteristics" such as following different paths to others, abandoning the mold, not hesitating to dive into the unknown, seeing points that others cannot perceive in the relations between ideas, and being unafraid to try different ways are emphasized (Benami & Jin, 2002; Öncü, 2003). Similarly, Newell and Simon (1972) stated that creativity is a kind of special problem-solving behavior. Creativity encourages students to make speculative and exploratory propositions that can reflect their competence and knowledge in their field (Sternberg & Lubart, 1999). Thus, to enhance students' creativity, instructors use different kinds of principles, tools, and heuristics such as metaphors (Casakin, 2007, p. 21).

Architectural design education is project-based—or problem-based—learning. Although other sciences are concerned with the analysis and description of existing realities, architectural design is about the imagination and synthesis of new realities (Sternberg & Lubart, 1999). As Casakin (2007) explained, "the exploration of unfamiliar and unconventional design solutions requires creative skills" (p. 22). Creativity has often been described as a problem-solving process, but there is more to this process. Creativity and creative processes are related to problem-solving as well as problem definition, and concept generation/conceptualization is a crucial part of these processes (Williams et al., 2010). According to Cowdroy and de Graaff (2005), conceptualization at the highest level of creative ability is the essence of creativity if this is neither taught nor assessed. Therefore, concepts and conceptualization sometimes constitute the beginning and sometimes the whole process.

Although there is no clear consensus within design disciplines as to what creativity really is and exactly what is being taught as creativity remains unclear, architectural design is a set of activities used to organize the decisions needed to change the physical world (Williams et al., 2010). Therefore, the architectural design concept starts with analysis and continues with synthesis. However, design knowledge is a field of knowledge that is difficult to define, classify, or shape (Ayıran, 1995). According to Bayazıt (1994), design is an intellectual project or scheme in which the steps leading up to a result are put forward. According to Archer (1965), it is an objective-oriented problem-solving action. From these definitions, design can be defined as a problem-solving process, trial-and-error method, intellectual and cognitive action, and decision-making ability.

Design researchers' first step is to investigate design processes (Uluoğlu, 2000). Accordingly, various designers (Alexander, 1964; Archer, 1965; Asimov, 1962; Jones, 1980) have developed systematic design methods. These investigations sought to understand how designers think and design (Cross, 2006). According to the creative process designers follow, there are two types of method: the black box approach and glass box approach (Jones, 1980). The black box design process includes an intuitivism that cannot be clearly explained. Although inputs and outputs are clear, there is no information on what goes on in the mind; the process is implicit (Uluoğlu, 2003). The glass box design process has steps that are explainable in mind; the design process is systematic and the inputs, outputs, and progress of the mental process are obvious (Bayazıt, 1994). Jones (1980) described designers using these categories.

According to Aksoy (1987), in the black box design process, relations such as form and function can be established at the level of analogies; the design was ensured to be understandable and controllable in accordance with the systematic approach. However, the architectural design process does not take place entirely as either a black box or glass box. The focus of interest in this study is the dynamics of creativity, particularly in architectural design studio instruction and organization, through the theory of black box. In the field of architectural education, it is also argued that creativity is a basic constituent of the black box approach.

Thus, what is inside the black box? This is a novel approach to decision-making that indicates a way out of the stagnant dialectic in recent years (Simon, 2004). The processes are dedicated to input or output functions, and hidden units are internal to the network. The black box approach represents the independent specialized processes in the design (Hodjat et al., 1998). The object solution is represented by a black box transformation and its input and output place interfaces. After the requirements have been built, the black box transformations and black box places can be decomposed into more refined results (Dawis et al., 2001, p. 1556).

Finally, the black box discussion in Reyner Banham's critical text, "A Black Box: The Secret Profession of Architecture" warrants mentioning. He claimed that "architects draw to 'think architecture'" and argues there is an absolute distinction between "architecture" and "building," and between architecture and what he prefers to call, "good design" (Banham, 1996; Dodds, 2017, p. 2). Architectural education is a closed system that turns students into architects and is described rather cynically as "a black box" with rather elusive inner workings (Banham, 1996).



Figure 1. Black box model (prepared by author).

In brief, the concept and process in architectural design are parts of the overall relationships that are interconnected and interrelated; these serve a design action and allow design to be realized. In this context, this study, which puts forward both the concept and black box design process as a design studio problem in first-year architecture education, offers a representative example as a critical stance against the idea that the architectural production process is closed and implicit.

Objective and Scope

This study's main purpose—considering the black box approach in the architectural design process—is to reconsider the design studio and reveal the originality of the teaching methodology. In this context, studio design, which deals with the black box problem that is an important theoretical approach in the design process with different intellectual and semantic dimensions, aims to create a representative example in which the design process is discussed uniquely and critically.

The studio study conducted with first-year students of Karadeniz Technical University (KTU) Department of Architecture in the spring term of 2016 (the second term), was carried out with 13 lecturers and seven research assistants. The studio theme was a fictional house project that supports open thinking all the way while keeping the originality of black box formalistically as an objection to designers who claim that the architectural production process should be black box (Durmuş, 2016). Thus, it aimed to produce a physical and semantic house representation emphasizing that design is a critical act.

Black box theory, which is a part of the design process, aims to analyze system inputs and outputs, regardless of the system's content. This situation in the design process is called this because the designer cannot exactly imagine the process for this action. This study, conducted through examples of architectural design studio and from a theoretical perspective, deals with the representation of all conditions/cases of a box/cube in terms of meaning and form. From this aspect, it offers an original section consisting of an infinite number of design possibilities that can be proposed to readers.

Definition of the Problem and Method

In science, engineering, art, and architecture, a black box is defined as a device, system, or object evaluated by an input and output that does not contain any internal knowledge (Figure 1). Open system theory is an aspect of black box theory. Both have input and output flows and represent intermutation with their environments. As an aspect of the architectural design process, the "black box" problem means to design all conditions that fulfill this state, of which a "cube" was designed in the context of the term project of designing the cube's environment.

In this context, students' expectations were divided into two categories. The first, "cube design," contains information about the black box each student will create:

- The designers will design a 12 × 12 m cube that will include the house function.
- The cube has to make use of any kind of semantic initiative associated with the black box.
- The cube should be perceived as a whole.
- The cube is a condition to be designed. This condition can be interpreted as follows:
  - Out to In: The cube's existence is essential. Voids and subtractions can be made in the given volume.
  - In to Out: The cube's absence is essential. Fillings and additions can be made keeping the given volume limits.
- The use of any kind of structural fiction, plane, surface, layer, level is free while creating both of the cube's conditions.
- The volume defined by the cube allows for a 576 m^3 usage area. The area to be used as a house can be 100 to 200 m^2.
- The remaining volume should be created in consideration of the concepts of flexibility and expandability so that it can respond to the functions beyond the housing needs program.

The second category of what is expected from students is the "environment design" that contains basic decisions underlying designs for the basic area in which each group will be involved:

- The location of the cube will be redesigned with the group decision within the given area.
- The floor space in which the design will be located is 48 × 48 m. This is a grid area divided horizontally and vertically by 12-m axles.
- The initiative of using a level in the grid area was given to the designers.

The method of this study, which investigates the problem from a historical perspective by referring to a black box and glass box approach within the scope of the above-described problem, simultaneously refers to the doubleness of analytical creativity, which is an indicator that we will never question the depth of the mind of a candidate architect. This situation that

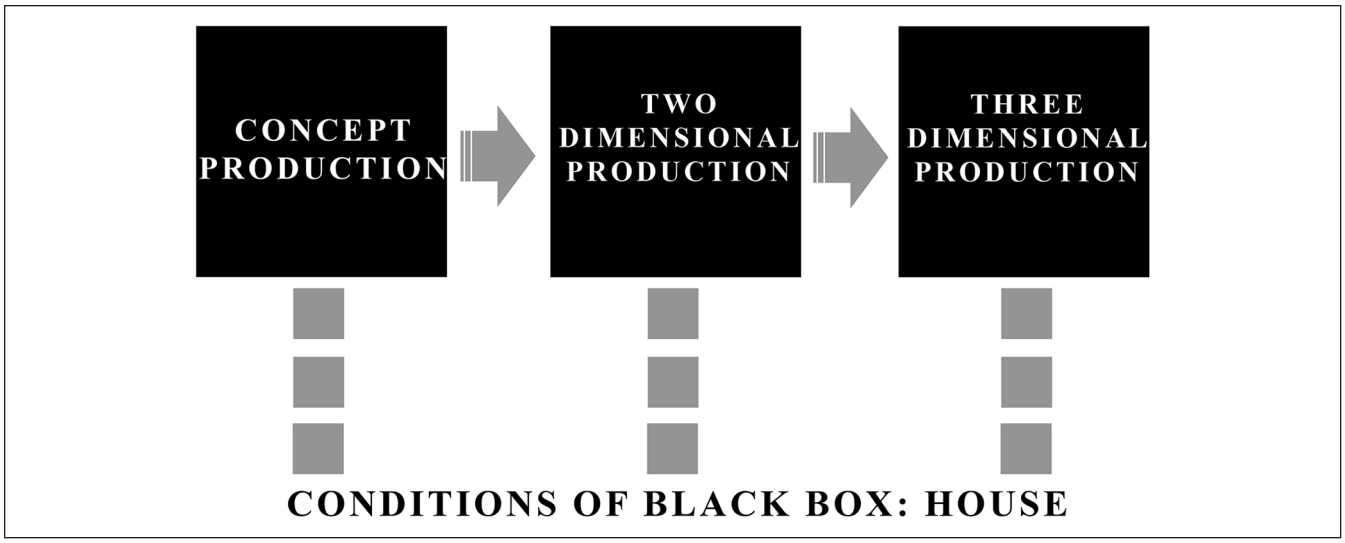

Figure 2. Three-stage methodological scheme seen in cube and environment designs (prepared by author).

makes use of thought and practice together validated a three-stage method of debating the ambiguous attitude of the black box over a problem (Figure 2). These three stages were determined by discussion separately in the context of cube design and environment design categories. Although individual decisions are at the forefront in cube design, group decisions predominate in environment design. In the first stage, "concept production," intellectual initiatives comprising analysis, scenarios, and needs are produced. In the second stage, "two-dimensional representation production," the produced concept is questioned, abstracted, and two-dimensional diagrams are produced. In the third stage, "three-dimensional representation production," produced two-dimensional representations are expanded into the third dimension and mass formation is formed depending on the concept.

In summary, this study's purpose and method is to exemplify reconsidering and discussing architectural design studio—an important and preferential course of architectural education—through a new perspective. Accordingly, the article containing original examples in which the presented methodological scheme is evaluated over both the "Conditions of Black Box: House" theme and students' works.

Conditions of the Black Box: House

The "Conditions of Black Box: House" theme exemplified from projects by eight students who were guided by this article's writer were discussed in two categories: "cube design" and "environment design." The discussions that started with the concept and place relation as in regular studio work, continued with the category of "environment design" and necessitated starting with a choice of place and concept that suits the theme. The production of alternatives for the environment design also necessitated selecting concepts concerned with cube design. In this context, a three-stage methodological scheme was used for each category concerning "cube" and "environment" designs.

Environment Design

The environment, which consists of a floor space of size 48 $\times$ 48 m, is a grid area divided horizontally and vertically by 12-m axles. The environment design consists of pedestrian and carriageways, connections, green spaces, and houses (cube settlements). The road-connection-green relationship, which is considered in detail near the housing area, was discussed on the theoretical level in terms of its positive and negative effects on the concept production of environment design.

According to these discussions, the concept of environment design was defined as "rotation." This concept—defined as having proceeded since the very start—and the process changes required to achieve the result were deepened with the concepts of codes, passwords, entities, essences, and so on. In addition, we confronted the concept of rotation in the expansion of a box/cube, and a cube is formed by gathering the surfaces that are actually displaced. Here, rotation was described as "the movement of ideas and finding space for itself," rather than as physical displacement.

The conceptual approach based on movement/displacement of cubes placed at four corners in the floor space set forth two separate representations located at the center or periphery after a large number of generated alternatives (Figure 3). According to the representation given in the center, eight cubes were placed in such a manner that four were at the bottom, and the others were at the top. In this rotation, symmetry, dominance, and a closed-in layout are at the forefront. Although the existence of two facades for each cube to

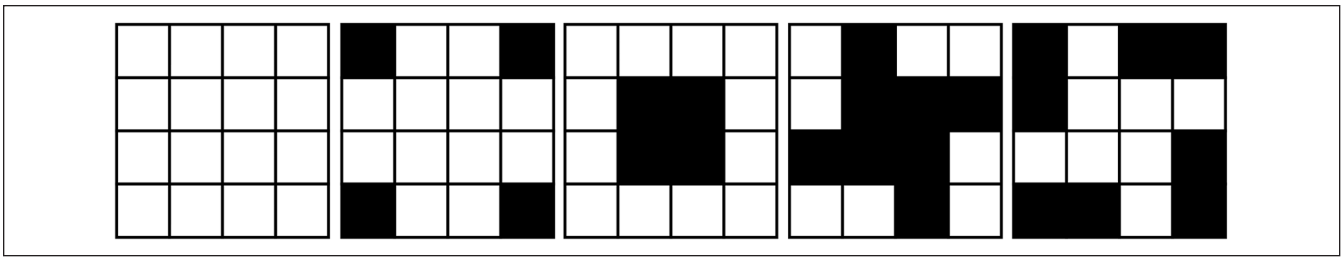

Figure 3. Layout scheme of the rotation concept belonging to environment design (prepared by the author).

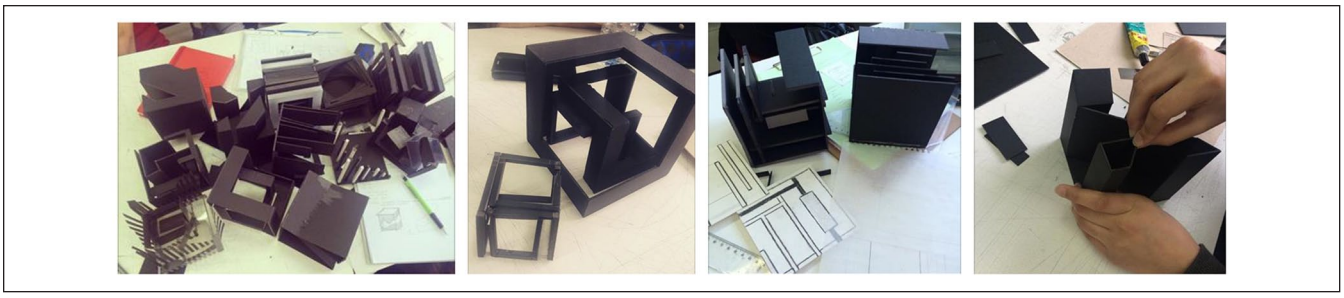

Figure 4. Examples of three-dimensional cube design representations (photos by author, 2016).

be designed were considered an important disadvantage, that it is located at the center of the floor space was considered advantageous in terms of representing the concept's essence. According to the representation on the periphery, eight cubes—located doubly in the corners of the floor space—define the area. The cubes that define each other with cross symmetry in terms of site plan have equivalent opportunities in the use of the environment area (vehicle, pedestrian, green space, connections, etc.). Each cube couple, coming side-by-side, gives a reference to a movement cycle through successive angles, called rotation. In the representation on the periphery, the cubes only contact each other on one surface. Thus, since each house will have an equal number of closed and open fronts, this was considered a fairer distribution. Besides, the appearance of the designed environment is the same in every direction such that three cubes are ahead and one is behind. With all of these equivalent opportunities and advantages, it has been decided that the state of settlement to the periphery is a more accurate choice in a two-dimensional representation of the concept of rotation.

The clarified two-dimensional representation was revived at the third dimension, and the volumetric relationship between the cubes was postponed until the next stage to be discussed individually in the cube design.

Cube Design

The cube design, which is another category of the black box problem, was carried out through three stages including the concept production, two-dimensional representation production, and three-dimensional representation production similar to the environment design category. The cube concepts that were created by considering subextensions of the rotation concept decided in the environment design were carefully selected in terms of both creating the scenario about the house user and selecting the cube in the place that is appropriate to the concept.

In the layout scheme in which each cube couple was placed at a corner point, the cubes underwent rotation upon the movement of the corner points. In this context, each concept was gathered in pairs such that they point to a corner associated with rotation. These concepts were listed as "Isolation, Contrast, Illusion, Metamorphosis, Symptom, Expression, Labyrinth, and Dilemma." Two-dimensional representations of each concept were produced, and transformation to three-dimensional representations was carried out that mainly kept the final selected two-dimensional representations (Figure 4). Thus, the formation of the cubes and their relationships to each other were fictionalized such that they were somewhat more limited by common walls locations in one way but that served the concept.

Representations of Black Box: Examples

The eight students' responses to the black box problem are presented here together with concept explanations for each and three-dimensional representations. In addition to the problem of individual black boxes, the dual cube conditions in the environment design were debated in terms of form and concept during the studio term.

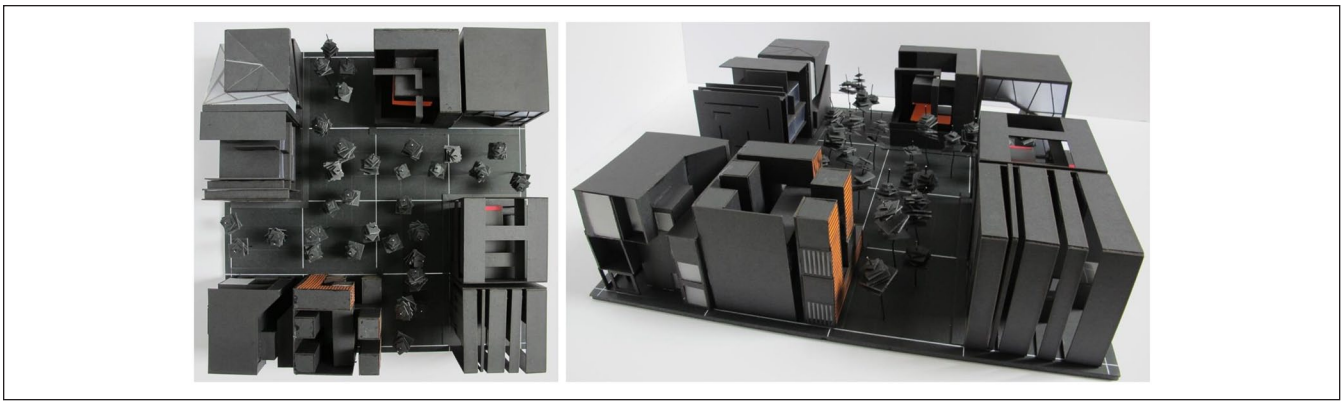

Figure 5. Concept phrases and cube formations in the environment designs of cubes (photos by author, 2016).

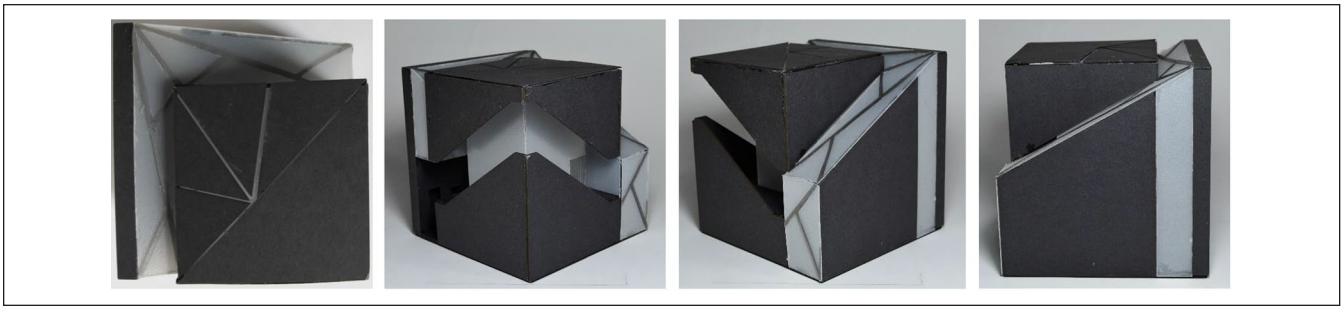

Figure 6. Condition of a black box that represents the isolation concept (photos by author, 2016).

The cubes' concepts, starting from the upper left corner and continuing in a clockwise manner, ending in the lower left corner in the floor space, are "Isolation–Contrast," "Illusion–Metamorphosis," "Symptom–Expression," and "Labyrinth–Dilemma" (Figure 5).

The concept of *isolation* involves getting away from everything and blocking sensations, which mean being kept separate, separation, and abstraction. Isolation, including leaving things out and leaving someone alone, emerges as a representation of the user's inner world and is produced in the scenario. Isolation, which includes reclusiveness in this case, was interpreted positively as being a user preference. In spite of the transparent part used in one part of the cube, complete isolation was provided with the use of a cube-in-cube design where a more closed spatial resolution could be provided (Figure 6).

The concept of *contrast* exhibits negative calls with meanings of contradiction, opposition, and inconsistency. Users living alone in the residence led to the creation of a spatial organization in which the closeness effect dominates. The cubic condition formed by the planes was represented by surfaces formed in orthogonal directions to each other (horizontal and vertical) (Figure 7). The linear voids that are located on the cube's exposed surfaces and contrast with each other were used effectively to create a mystical effect in the interior space.

The illusion concept, which includes false notions and delusions, is also a condition that can be extended to define outstanding and ironic states. From the black box definition, the black box problem itself becomes an illusion when considering that it is both recorded and under risk. Even so, the black box becomes defined as an illusion that can only be understood as much as it allows. For the user scenario in which two brothers live, two separate spatial analyses were created in the cube. The formal volume consisting two telescopic cube frames was designed such that it could satisfy the scenario and is consistent in both its own constitution and in the whole (Figure 8).

The *metamorphosis* concept describes a change of condition that means alteration, transfiguration, undergoing a change, and developing. As an example of an alteration, a black box is a metamorphosis that has to exhibit different appearances in terms of both the interior space arrangement and mass formation. According to the scenario produced, a house for a three-person family is interpreted as an example of metamorphosis with the ambitious use of a public space. While the cube designed for this context is massive and a full square, it comes to the forefront with its transparent, vacuolar, and stable geometric attitude (Figure 9).

The concept of *symptom* refers to signs, clues, and traces. This concept traces information kept in a black box to reach real results and puts forward the breaks and distortions



Figure 7. The black box representing the contrast concept (photos by author, 2016).



Figure 8. The black box representing the illusion concept (photos by author, 2016).



Figure 9. The black box representing the metamorphosis concept (photos by author, 2016).

experienced in this journey. Therefore, the concept of symptom was used as a schizophrenic attitude and was represented by formal distortion. According to the produced scenario, a house designed for a schizophrenic couple and their children can transform into a volume where the integrity of the cube's massive conception does not get distorted and various spatial distortions take place through placed planes and surfaces (Figure 10).

The concept of *expression* means to externalize spiritual events and inner truths with clear expressions and is a condition in which reality search is questioned. The concept that points to putting forward situations of subconscious and feeling in addition to existing reality contains obscurity just like the black box concept. This scenario is fictionalized as a house in which three university students live and represents the spaces of young people trying to define themselves. The cube has the same formal character in the plan and frontal view and points to the reality of a black box cut into slices (Figure 11). However, this is not a response to either the black box or sought reality; in contrast, it is the expression of all these uncertainties.

The concept of *labyrinth* refers to a situation that is very hard or impossible to leave; a puzzle that is hard to solve. This concept, which refers to the implicit process of a black box, emphasizes the confusing effect of the procedure that is required to arrive at a solution. In this context—as required by the scenario produced—flexible space analyses were developed for different usage areas of a crowded family. The cube is formed of rectangular prisms that evoke the labyrinth effect on the facades in three directions, and the location plan



Figure 10. The black box representing the symptom concept (photos by author, 2016).



Figure 11. The black box representing the expression concept (photos by author, 2016).

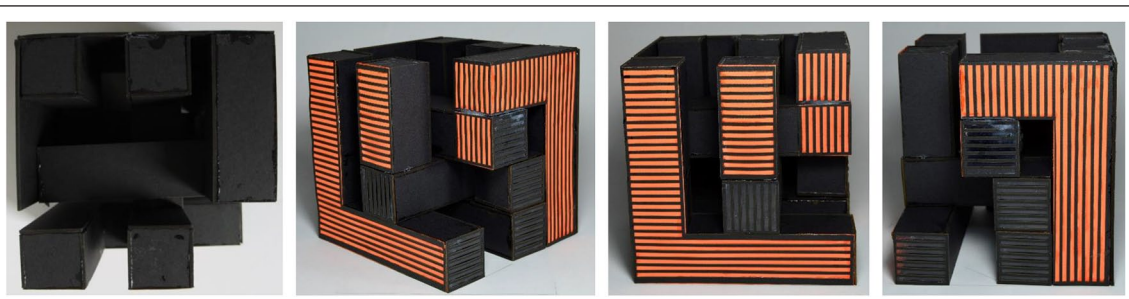

Figure 12. The black box representing the labyrinth concept (photos by author, 2016).

is an indication that a situation that seems impossible can be overcome through spatial analyses, assuming that the integrity is maintained (Figure 12).

The concept of *dilemma* is defined as a decision between two propositions that have the same judgment and results. This concept points out that there are many ways to come through in the black box process but also includes the dilemma that these ways do not always help get the desired result, calls the restriction a situation that forces its users to make a choice. This design offers spatial solutions in which two sisters do not interfere each other's areas according to the produced scenario; one is married and has a child and the other is single, thus these are treated as two lives separate from each other except for common areas (kitchen, WC, etc.). The cube formed in this context was put forward as a volume where this discrete state comes to the forefront formalistically and the separation becomes clear with the nested boxes (Figure 13).

This study supports many conceptual studies in the literature. Its outcomes suggest several reflections about rethinking architecture design studio through a black box concept. The study also shows that the relationship between concept and geometry as seen in Figure 14 can be interpreted in two- and three-dimensional representations. Each design came into existence in three dimensions based on their own concept and two-dimensional representation. However, they clearly demonstrate that the relationships established between the concepts and scenarios positively affect the formal approaches to the cubes and that responsibility must be felt against the other cube.

As a result, both cubes are positioned together, and the concepts are considered interrelated but requiring different

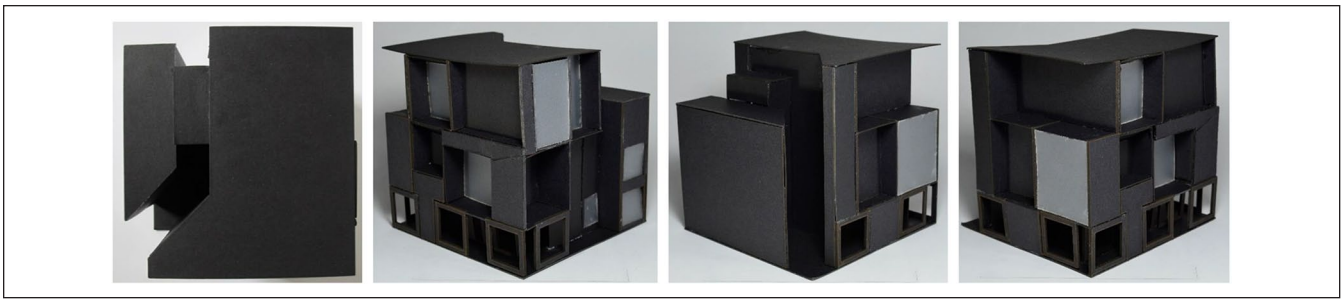

Figure 13. The black box representing the dilemma concept (photos by author, 2016).

scenario productions. For example, both *Isolation* and *Contrast* represent a situation, become withdrawn and isolated as required by the meaning that they give the reference and produced scenario. Meanwhile, *Illusion* and *Metamorphosis* represent a black box through formalistic gaps; they consist of house examples for family use as required by their scenarios. *Symptom* and *Expression* reveal the obscurity of a black box by tracing and expression. Finally, *Labyrinth* and *Dilemma* allow for independent and flexible space analyses based on the ideas of restriction and separation.

Conclusion

Based on the association between studio instructor and student, architectural studios are an aspect of traditional architecture education. However, studio fictions that allow for different theoretical perspectives need and encourage rethinking in modern architectural education. In this article, the "Conditions of Black Box: House" studio that exemplifies the work of a group reveals architectural experiences during which the design process is critically questioned and represented formalistically with black boxes.

Instead of re-using familiar solutions, implementations of concepts and metaphors in a design studio can contribute to unconventional thinking and to rethinking architecture design education. In the black box approach, one method in the creative process that designers follow is conceptual abstractions coming from references that create bridges between mental and physical activities and are the basis for deeper explorations of theoretical concepts (Akin & Akin, 1998; Kowaltowski et al., 2010). Therefore, we can say that the conceptual thinking and use metaphors in design problem-solving have crucial implications for generating creativity and design activities.

This article discusses "creativity within first-year architectural design education" which is analyzed through black boxes. An architectural design studio education has multiple inputs that affect and form its creative value, and first-year architectural design education can be taken as a starting point for learning and knowledge creation. The results show that the black box architecture design studio has made great achievements in both design studios and creativity to create an atmosphere in which students can enhance their creative skills.

Considering all architectural works and designs as a Cartesian geometric box problem, rethinking the idea of the box produced interesting results. The "black box" metaphor precisely references the architecture design process. In other words, the design process remains untouched and thus locked in the black box (Hustinx & Denk, 2009). Therefore, why think inside or outside the box when you can create? The box problem is a special area in the architectural scale; it encourages us to consider the idea of being inside or outside a box. In architecture, a black box is both reassuring and provocative (Sanya, 2013). Although a well-defined box indicates order and continuity, it also requires being related at different scales such as form, space, and public spaces. Both the defined and undefined versions of the box enable endless diversity because the box itself offers a defined volume and a free thinking-expression area.

The black box studio setup that sees all facts, topics, concepts, approaches, and even the design process itself as a black box has important pedagogical outputs. One positive pedagogical output is that the studio's student-centered attitude enables instructors to encourage to a guide level, thus allowing area for free thought. In this context, the group work carried out together in the part of the period became instructive in that students should architecturally respect their own and each other's projects. Meanwhile, it has been instructive as they should design by adhering to the context of environment design. Thus, opportunities to encounter the context problem have arisen at the abstract level in the early period.

Another pedagogical output is gaining mental practice of producing concepts, making sense of a concept, questioning and representing a concept, and supporting creativity through established metaphorical relationships. This is exemplified in how two-dimensional representations of a concept can successfully reference three-dimensional representations. A box is more than just an object. Here is a sample of different box shapes and geometries with different concepts and metaphors for a black box architecture design studio. At the end of the term, the projects were exhibited together with their environment designs, in which all groups were involved, to

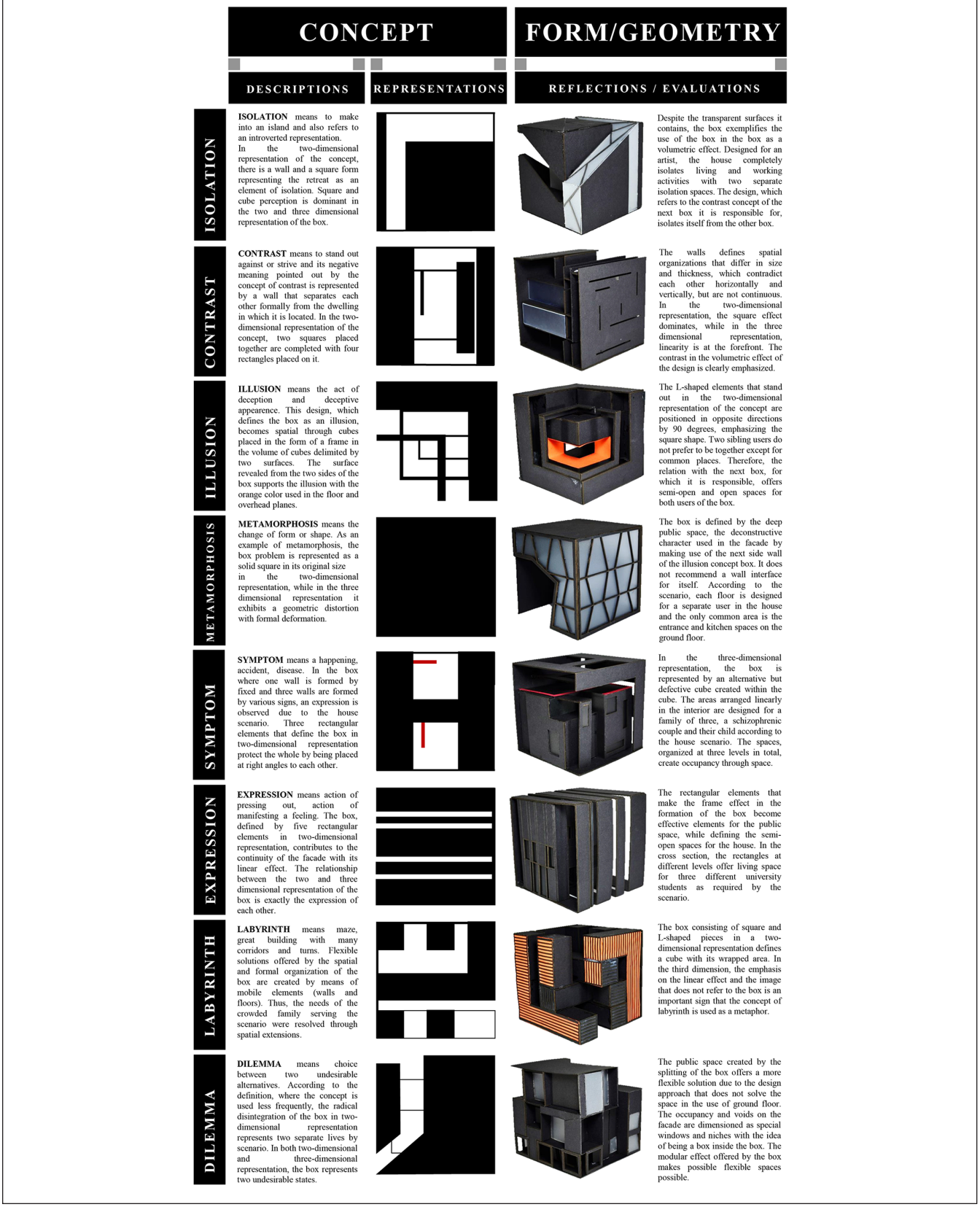

Figure 14. The connections between the concept and form/geometry of the black boxes.

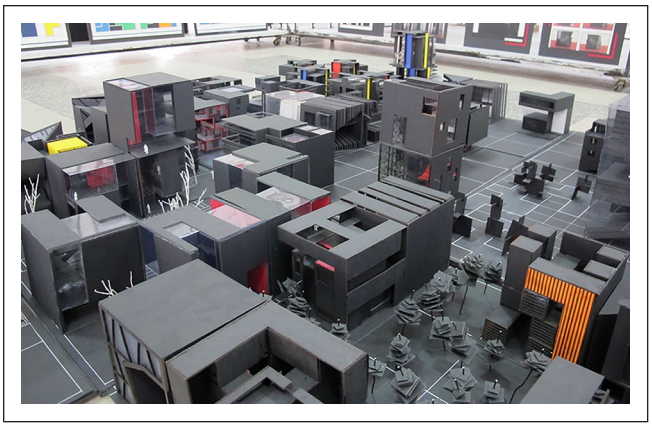

Figure 15. Conditions of a black box: House, end-of-term exhibition (photos by author, 2016).



Figure 16. Conditions of a black box: House, cube alternatives (photos by author, 2016).

show that there were about 110 different outcomes for a problem (Figures 15 and 16). Gathering the environment designs together defines the urban puzzle as possessing an infinite number of alternatives.

In conclusion, when discussing a studio experience as an example of representation and debating the eight sample projects mentioned here, which were evaluated critically and theoretically; we can say that this first-year project discussed a theme that points to the correct gains in architectural education. The studio, set forth with keywords such as concept, scenario, metaphor, criticism, representation, creativity, and black box, achieved its objective through its unique products. It has touched upon buildings as boxes, environments in boxes, and boxing and black box theories in architectural design process. The scope of this study is limited to how first-year architecture students can use metaphors to enhance creativity in their designs through a black box. In the future, I hope to extend this research to explore reflections of metaphors and design creativity through a black box with fourth-year architecture students and compare their results.

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