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METAPHORS IN THE DESIGN STUDIO: IMPLICATIONS FOR EDUCATION

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ABSTRACT

Designers frequently use organizing principles derived from metaphors to tackle design problems. Metaphorical thinking enables to understand a design experience in terms of another experience. Despite its importance, little attention was yet devoted to study the use of metaphor as a cognitive device for design education. This research investigated the use of metaphors in the design studio. Its aim was to gain a basic understanding of the way first year design students apply metaphorical thinking to generate solutions during the design process. Reports obtained from students showed that the use of metaphors played a significant role in the definition of a concept, framing a design situation, and specifying goals. However, more knowledge and better skills are needed to improve the mapping and application of structural relationships to the design problem. It is proposed that the use of metaphors in the design studio can be considered as an alternative strategy to traditional design education approaches.

Keywords: metaphor, design problem, design studio, design education

1 DESIGN PROBLEMS AND DESIGN METHODS

Design problems are considered as to be wicked and ill-defined and as such cannot be clearly formulated [1]. A characteristic is that they are unique, complex, and inaccurate and as such cannot be solved exactly like previous similar problems. It is difficult to know what information can be considered as useful until a solution is attempted [2]. Rather than producing optimal solutions, the design process is about finding a solution that may satisfy enough constraints or factors to be acceptable [3]. In the 1960's the so called Design Methods Movement searched to gain a better understanding about the design process [4], [5]. To this aim, scientific theories and methods of design were developed. In the 1970s, and the 1980s it became possible to find studies about design methods and processes applied to the architectural field [6], [7]. The design process was viewed as a series of actions based on problem understanding, gathering information, analyzing information, synthesis, decision making, evaluation, and so on. It was believed that the computer could be used to produce suitable design solutions [8]. However, the Design Methods Movement found difficulties to deal with the complex and ill-defined essence of design problems. As Ulouglu (2000) claimed characteristic of most of these methods was a rationalization of the design process, where personal elements related to the design process were disregarded. In consequence, these methods were not possible to be considered as a true contribution to the education of the individual designer [10].

1.1 The design studio

Traditionally, the design studio has been seen as the most important part of the educational curriculum in schools of architecture. The design studio is the place where students are expected to grasp, present, and defend design ideas, and acquire new techniques and skills [11]. Nowadays it is widely accepted that the method through which students learn is crucial for an educational improvement. Cuff (1991) and Akin (2002) describe the centrality of the design studio in design education in a direct reference to the Ecole des Beaux Arts, the prestigious French design school. A characteristic of this school is the application of a design teaching method based on the transference of experience. In this approach, design instructors' explaining and showing are combined with the students' listening and imitating [13], [14]. While students work on their designs in a trial-error manner, studio instructors criticize their projects in 'one-to-one' sessions. This method, however, has not always proved to be effective for transferring essential design knowledge to students. Variations of this educational design method include showing projects designed by master designers that are similar to the design problem at hand. Being exposed to concrete examples (also called cases or precedents) students are supposed to gain an integrated view of design issues, or concepts that may help them find their own way to the design solution [15]. However, a significant number of studio teachers opposed to this normative approach arguing that novice students are unable to identify and retrieve critical knowledge from the design cases, and transfer it to the problem. Instead, students blindly copy existing projects. This phenomenon is known as design fixation, where students generally experience difficulties to make progress on the design task [16], [17]. A major characteristic of the experience-based and the case-based educational approaches is that they judge the quality of the final design solution, rather than evaluating the knowledge acquired by the student during the design process. Despite the problems derived from these approaches, at the present time they have been extensively adopted as a basis for design studio education in a large number of schools of architecture around the world.

2 METAPHORICAL REASONING

Metaphors enable to understand an experience in terms of another experience [18], [19]. They can be described as cognitive strategies that can aid to comprehend the juxtaposition of concepts that normally are not associated. For example, the metaphor 'Time is Money', reflects the Capitalistic view of maximum production in minimum time. The contemporary theory of metaphor proposed by Lakoff and Johnson (1980), and by Lakoff (1987; 1993) sees metaphor as structuring the human conceptual system. That is, it affects the way people think, what they perceive, and how they categorize experiences in their minds. When a metaphor becomes a part of our conceptual system it may modify it, change our perception of a particular situation, and trigger new insights [22], [23]. A main reason for the selection of a metaphor is the effect that it has in creativity, and in leading to new ideas. As it will be later shown in our study, new ideas or hypotheses emerging from a metaphor are in fact the first stages of a complex process of design development. According to Coyne and Snodgrass (1995) reasoning by metaphor can provide the means by which problems can be defined, restructured, and resolved. The process of metaphorical reasoning can be characterized by the following steps: (1) retrieval and interpretation of a concept from a familiar metaphorical source. Subjects represent the new situation (also called problem target) with respect to a number of features that may hold abstract solution principles [23]; (2) after a concept is

retrieved, it is possible to establish a mapping or projection of concepts or relations from one domain of experience to another [24]. Mapping allows a fresh understanding of the target domain from a new point of view [25]; (3) the metaphorical concept is finally applied to the target in order to develop a design solution.

2.1 The use of metaphor in design

During design problem solving, designers use basic ideas, organizing principles, and heuristics in order to narrow down the search space, where a design solution can be found. These provide them with 'primary generators' or starting points to tackle ill-defined designs, and enhance their understanding about the problem [8]. As an alternative to organizing principles and heuristics, metaphors can be considered as cognitive strategies used to deal with design problems [26]. Metaphorical reasoning is part of a conceptual system that can contribute to structure design thinking. Although designers are not always conscious of the role played by metaphors in design, they frequently use them. In fact, designers are fluent in bringing metaphoric projections to bear on a problem situation. Metaphors provide insights into the design process that contribute to guide and structure design thinking. Shifting from one metaphorical concept to another permits to explore new design ideas that were not seen before. By associating designs with new metaphors it is possible to redefine and characterize designs in new terms. For example, Coyne (1995) argued that when playing with geometry, the process is never entirely geometrical. Shapes are not only shapes but also rays, leaves, clouds, tokens, symbols, etc. The power of a metaphor lies in its ambiguity, because not being one thing in particular it can be many at the same time. Under the architectural design viewpoint, this ambiguity is what makes the differences between a literal use of a metaphor (e.g. an identical copy of a historical style), and using a metaphor as a tool for restructuring a design situation (e.g. a metaphor based on a concept derived from a past architectural style). Different type of metaphors has dominance within different design communities. For example, an architect may perceive spaces as having the characteristics of a fluid. This metaphor opens up possibilities for designing spaces with a high level of flow (e.g., The Villas of architect Le Corbusier). Rowe (1987) claimed that normative positions can endow metaphors the power to stress certain design approaches over others. An example is the metaphor proposed by the Modern Movement 'form follows function' which opposed the possibility of using historical precedents while dealing with design problems. The physical outcome of the design was the result of the relationships established between its functions and its structural and environmental systems. Despite the important role played by metaphors in design, no empirical study has been carried out in order to understand how these could be used as a tool for design education.

3 EMPIRICAL RESEARCH

3.1 Objectives

The goal of this study is to gain an insight in the use of metaphors in the design studio as an alternative to traditional education. We will verify in which way metaphors can be of major assistance to novice designers, while solving architectural design problems. Metaphorical reasoning will be analyzed in the different stages of the design process. In particular, we will be interested in studying the effect of using metaphors to: define the aspects that characterize the design concept, identify constraints related to the design

problem, transfer and apply the design concept to the problem at hand, and to develop the design solution.

3.2 Participants

Fifty five designers participated in the task carried out in this study. Subjects were first year architectural design students, who had been involved in a limited number of design projects as part of their undergraduate work. All the students were volunteers who received neither payment nor course credit for their participation.

3.3 Design Task

All participants were provided with a brief that called for the design of a 200 meter public walkway in an urban context. Subjects were requested to develop their project in a mixed-use neighborhood located in a real city. They were asked to define the itinerary of the walkway, and focus on the relationship between public and private urban spaces. The design problem was thought to be tractable enough to be tackled by designers with very few design experience.

3.4 Procedure

The design task was carried out in a design studio during a total of sixteen sessions, which were divided into two sessions per week, for the period of eight weeks. Each session lasted four hours, which represents a total of sixty four hours dedicated to the design task. The first four sessions were devoted to select a metaphor, and define the aspects of the metaphor that students would like to focus to deal with the design situation. They were asked to construct an abstract mock-up (without scale, function, or geographical context) depicting their interpretation of the selected metaphor. In the second six meetings, students were requested to clarify their design goals, and define problem constraints. In addition, they were asked to establish relationships between the selected metaphor, and the specific design problem in order to explore alternative design solutions. Subjects were then requested to design the itinerary of a walkway located in a mixed-use neighborhood, and construct a 1:200 mock-up. In the last six meetings, students were asked to use the metaphorical concept to develop the design solution into a more fine grain of detail. A representative part of their design proposal was selected, and developed through a 1:100 mock-up. During the different stages of the design process, students received feedback from a team of five teachers.

3.5 Survey

At the end of the design task, subjects were presented a short survey, and were requested to assess the use of metaphors according to an ordinal scale from 1 point (did not help), to 5 points (helped a lot). The survey dealt with the following statements:

- The use of metaphors helped me to define a concept and frame the general design situation under a new point of view.
- The use of metaphors helped me to define design goals, and to constraint the problem.
- The use of metaphors helped me to establish a system of new relationships between a design concept and the design problem at hand.
- The use of metaphors helped me to apply a general concept to the design problem at hand, and to develop an unconventional design solution.

3.6 Statistical analysis methods

The response provided by the participants was submitted to Spearman Correlation Test, and T-Test statistical analyses. See Table 1, and Table 2.

3.7 Example of a successful use of metaphors in the design studio

In this section we illustrate the use of metaphors through the different stages of the design process. We present a report based on a debrief session carried out with a design student after the design task.

At the outset, the student claimed to have thought about a number of metaphors to tackle the design problem, and finally selected a metaphor about 'a walkway as a meandering experience'. He claimed to have used this metaphorical source to frame the design situation anew. The subject said:

"After I choose the metaphor I started to think in those aspects related to the design of a roundabout walkway. This helped me to define my design concept in a totally unconventional manner, characterized by the idea of a circuitous route. The goal was to design a walkway that instead of being characterized by a straight forward and repetitive itinerary, it should embrace mystery and surprise."

The designer claimed that constraints in the design problem included a series of turning points along the walkway intended to define unexpected relationships between the public and private spaces. He commented:

"I imagined that the meandering experience should allow visitors to walk around like if they have no exact destination to reach, and without prior notice meet local people in 'hidden' and 'fuzzy' spaces that need to be deciphered."

While the subject started to design the walkway in the assigned site, he established a mapping of relationships with the selected metaphor. This allowed him to transfer the metaphorical concept to the design problem.

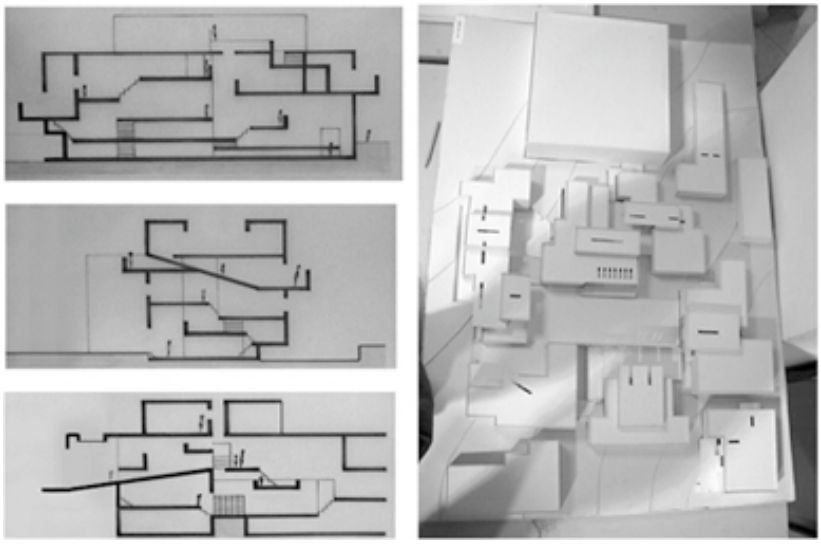

Figure 1. Example of a design solution produced by a student. Metaphorical source: the walkway as a meandering experience.

"When I considered the idea of a roundabout experience in the site, I realized that a non-linear organization of the buildings could be proposed. So I tried to generate a system of closed spaces that might allow for controlled views along the pathway."
In the final stage of the process, the student developed the design idea and arrived to a successful solution characterized by a series of vertical and horizontal twisting routes full of mystery. See Figure 1.

4 RESULTS

A significant correlation was found in a comparison between the use of metaphors as a help to define a concept and frame the design situation (Q1), and as an aid to specify goals and constraint the design problem at hand (Q2), (Correlation coefficient = .386; Sig. 2 tailed = .003; N = 57). Results showed that those subjects, who succeeded in elaborating a design concept and framing the design situation, were also able to define design problem goals and requirements. However, the use of metaphors was significantly more helpful in Q1 than in Q2 (Sig. 2 tailed = .022; df = 55; t = 2.360).
In another comparison, a significant correlation was observed between the use of metaphors as a help to define a concept and frame the design situation (Q 1), and as an assistance to map a design concept to the design problem (Q 3) (Correlation coefficient = .320; Sig. 2 tailed = .017; N = 55). Findings revealed that those subjects, who claimed to succeed in defining a concept and framing the design situation, were able to transfer the design concept to the particular design. However, additional results demonstrated that metaphorical reasoning was significantly more useful in Q1 than in Q3 (Sig. 2 tailed = .007; df =54; t = 2.811).

Table 1. Correlations for questions Question 1: Framing and restructuring of the general problem. Question 2: Definition of goals and constraints. Question 3: Mapping relations between concept and the problem at hand. Question 4: Developing the solution

		Question 4	Question 3	Question 2
	Corr. Coef.	.174	.320	.386
Question 1	Sig. (2-tailed)	.200	.017	.003
	N. Subjects	56	55	56
	Corr. Coef.	.221	.491	
Question 2	Sig. (2-tailed)	.099	.001	
	N. Subjects	57	56	
	Corr. Coef.	.294		
Question 3	Sig. (2-tailed)	.028		
	N. Subjects	56		

Table 2. Means, standard deviations, and standard error means obtained from student's reports

	Mean	Std. Deviation	Std. Error Mean
Question 1	3.701	1.161	.155
Question 2	3.31	1.088	.144
Question 3	3.26	.9044	.120
Question 4	2.38	1.145	.151

A significant correlation was also verified in a comparison between the use of metaphors as an aid to constraint the design problem (Q2), and metaphors used to map a general design concept to the design problem (Q3) - (Correlation coefficient = .491; Sig. 2 tailed = .001; N = 56). It was found that those subjects, who claimed to succeed in mapping, were able to define design goals and requirements.

In addition, a significant correlation was observed while comparing the mapping (Q3) and application of a metaphorical concept to the particular design problem (Q4) (Correlation coefficient = .294; Sig. 2 tailed = .028; N = 56). Results showed that those subjects, who were able to establish relationships between the metaphorical source and the design problem, did well while applying the metaphorical concept to the design target, and developing a design solution. Nevertheless, additional findings indicated that the use of metaphors was significantly more helpful in Q3 than in Q4 (Sig. 2 tailed = .001; df = 55; t = 5.104).

In contrast to these findings, no significant correlations were observed in the comparison between the use of metaphors as an aid to frame the design situation (Q1), and as an aid to apply the design concept to the particular design problem (Q4). (Correlation coefficient .174; Sig. 2 tailed .200; N= 56). Furthermore, no significant correlations were found in the assistance provided by metaphors to constraint the design problem (Q2), and as an aid to apply a general concept to the design problem (Q4) (Correlation coefficient .221; Sig. 2 tailed .099; N= 56).

5 DISCUSSION AND CONCLUSIONS: IMPLICATIONS FOR DESIGN EDUCATION

From results obtained in this study we found that students have the cognitive capability to use metaphors in design problem solving. Novice designers claimed that using metaphors to define a concept and frame a design situation anew, helped them to specify problem goals and constraints. Restructuring the design situation according to a new point of view was a critical step to define goals and requirements, and map structural relationships with the target. A correlation was also found between mapping, and applying a concept to the design problem. Establishing structural relationships between the metaphorical source and the design target was vital to develop the design solution. However, no correlations were found when using metaphors to frame and to constraint the design situation, as compared to the process when the concept was applied to the design problem. Framing, constraining or defining design goals not always guarantee a successful application of a metaphorical concept to the design target.

It is important to note that most novice students claimed that metaphors were significantly more helpful to frame the design problem anew than to establish mappings between the metaphorical source and the problem. Students were required to use metaphors as a design aid, and were instructed to use them at each stage of the design process. However, this did not automatically imply high correlations between metaphors and benefits at every stage of the design process. In fact, findings showed that metaphorical reasoning was more successful in mapping concepts than in applying them to the design problem.

Generally speaking, it can be said that the use of metaphors played a more significant role in the definition of a concept, framing a design situation, or specifying goals. These processes are characteristic in the early stages of the design process, known as conceptual design. Although the use of metaphors also played an important role in mapping and application of structural relationships to the design target, it was not as significant as in the processes described before. Developing a solution through the

application of metaphors demands a certain level of expertise that novice students not always have. It is suggested that more knowledge and better skills are needed to establish abstract relationships with the problem, and gradually transform them to a concrete design solution. Training novice designers in the use of metaphors in the design studio, particularly in the mapping and application of abstract relationships, will contribute to: enhance design thinking capabilities, gain a better understanding of the design process, enhance design critic abilities, and will reduce design fixation problems. As an alternative to traditional design education approaches, the use of this strategy in the design studio will increase student's possibilities to find their personal way to the design solution without being influenced by the instructor's experience, or by normative approaches such as case-based learning.

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