AN INVESTIGATION OF METAPHOR USE AND LEARNING STYLE IN DESIGN PROBLEM SOLVING

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ABSTRACT

Metaphor plays a key role in design practice. By framing problems in a particular way, they impose structure on a design situation and determine interpretations made and approaches taken. With experience, students learn to exploit the analytic power of metaphor throughout the design process, yet how experiences develop this skill is little understood. It is argued that the reflective nature of design makes it sympathetic to analysis using Kolb's Experiential Learning Theory. An investigation of learning and student metaphor use is, therefore, described. Findings are to be used to identify aspect of learning that can help develop successful metaphorical thinking in students.

Keywords: Metaphor, Reflective Practice, Framing, Experiential Learning Theory

1 INTRODUCTION

Metaphors are integral to architectural and product design [1]. They are used by designers to structure their approach to a given problem – setting the boundaries and the potential relationships to be made [2]. In the educational design studio, however, the use of metaphors in design problem solving is not well understood. Except for a few empirical investigations [3], [4], [5] the use of metaphors by design students has deceived further study.

Different learning styles have also been shown to have an impact on design problem solving. Dermibas et al [6] used Kolb's Experiential Learning Theory [7] to study the effects of learning styles preferences on student performance during the design process. Statistically significant differences were found between the performance scores of students with diverse learning styles at various stages of the design process. It was also seen that scores of students with different learning styles increased at the end of the design process. In another study (also using Kolb's model) Kwan and Junyan's [8] investigation of architectural students in China found a statistically significant correlation between learning styles and academic performance that led them to suggest that studio based programs can disadvantage students with particular learning styles.

Except for the above however, few other studies have focused on the effect of learning styles in the design studio. Moreover, no study has considered the relationship between learning styles and the use of metaphors in the design studio. As both of these elements are essential to design, and empirical study is proposed of architectural design students and the way they use metaphor. Kolb's Experiential Learning Theory offers a basis for this study.

2 METAPHORICAL THINKING

A metaphor can be considered as a juxtaposition of two things which share certain characteristics in common but differ in others. Metaphors allow us to understand and reflect on a problem in terms of another problem that is not directly associated to it [9], [10]. To think metaphorically involves relating two elements by the preposition 'as' or the verb 'is' – e.g., *a house is a city*; or *a square as a temple of joy*. Metaphors are, however, not only to decorate language – they also structure and organise our thoughts [11]. Coyne and Snodgrass [2] claimed that metaphors are part of the study of rhetoric, concerned with how we argue, understand, and solve a problem. Indeed, the use of metaphors in problem solving has been shown to be pivotal, helping to define and elaborate the problem from fresh viewpoints [12].

At first glance a metaphor seems to lack sense, but a second view can bring to mind new ways of considerations. Seeing one problem in terms of another exposes aspects that would otherwise be missed. Essentially then, metaphors enable the transfer of concepts and ideas from remote domains to the problem at hand. According to Coyne and Snodgrass [2] "this metaphorical view of problem setting temporarily removes the question of whether problems exist independently of our understanding of a domain – in other words, whether an 'objective' problem statement exists."

2.1 Metaphor and Design

Many design problems are vague, ill-structured, and non-routine. It is, therefore, not possible to apply algorithms to obtain solutions for particular problems. Metaphor has, however, proven to be an ideal means to deal with design problems. Consideration of metaphors as an approach in design studio proposes an alternative to objectivists concepts of thought and understanding, fostered by the Design Methods Movement in the 1970s [13]. Metaphors contribute to the redefinition and reframing of a design situation, thus allowing the designer to perceive the design from different viewpoints during the interaction with the situation [14]. This establishes a reflective dialogue with the design situation [15] – by re-interpreting a problem it is possible to explore a large number of innovative metaphors, identify a suitable metaphor, and apply it to a specific problem situation. In this way, conventional knowledge is extended to new frontiers, and novel problem definitions and creative means of generating design action emerge [13].

2.2 Metaphors in the Design Studio

Several empirical studies examine metaphor in design. Coyne and Snodgrass [13] tested whether the study of metaphor can inform design studio practice and found a close relationship between design and metaphor. This provided insights to improve design education. Application of different metaphors was favoured over others by virtue of a series of factors such as our historical context, the norms of our practice as professionals, the conventions of the design studio, and the personal interests of the teachers.

In an empirical study dealing with the use of metaphors in the design studio, Casakin [16] found that metaphors help identify and retrieve design concepts, and define goals and requirements. In another investigation Casakin [3] empirically studied the use of metaphors by novice design students. The aid provided by metaphors was explored in the different phases of the design activity. It was found that metaphors were more useful in early design stages than in the final stages of the process. In a further study that

focused on the development of skills however, Casakin [17] found that when students acquire more knowledge and experience, the application of metaphors proved to be successful in the final stages as well. The analytic power of metaphors on design problems has also been shown to have a unique contribution to design innovation [18].

3 METAPHOR AND LEARNING STYLE

Metaphor is a useful analytic tool as it acts as a 'mental model' [19] of the problem. Interestingly, it has been suggested that an individual's capacity to acquire and develop effective mental models is primarily influenced by their particular 'learning style' [20].

3.1 Learning Styles

The concept of 'learning style' is, however, not well understood – indeed, there is no one definition in the literature. It is known variously as 'thinking styles', 'cognitive styles' and 'learning modalities' [21]. Unsurprising, then, there is similarly no one universally accepted theory. It is thus possible to find different studies of learning styles in the literature, from those with a basis in behaviourist, Gestalt or Jungian psychology, to others that emphasise sensory stimulation or that have evolved from popular notions of neurology or brain structure [22]. It was, however, insights into the role played by experience that stimulated development of Kolb's experiential learning theory – a theory that proposes a different perspective on learning from traditional, behavioural theories that emphasise the acquisition, manipulation and recall of abstract symbols [7].

3.2 Experiential Learning

Kolb argues that learning styles are not determined by inherited characteristics, but develop through experience [21]. He suggests that it is the combination of how people perceive and how they process information that forms the uniqueness of their own learning style, and proposes a learning model comprised of two continuums (*Figure 1*).

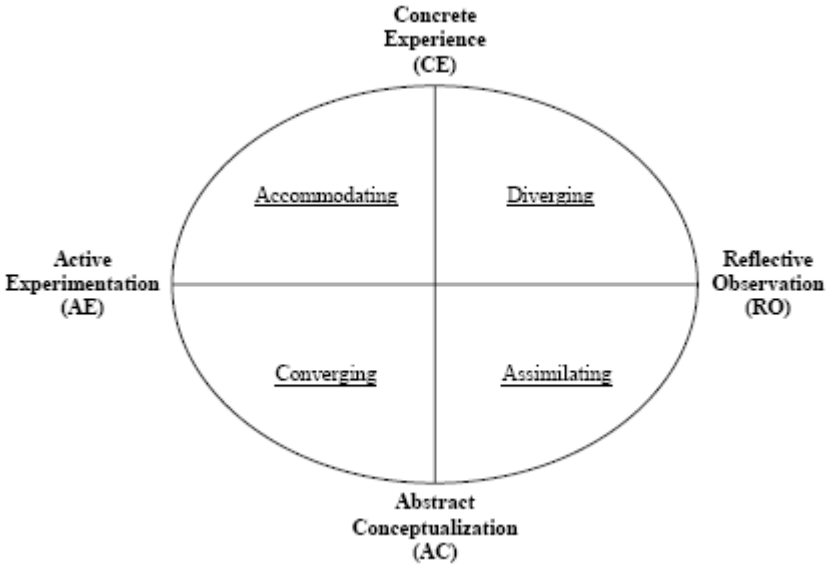

Figure 1 Kolb's Experiential Learning Model (from [7]).

The concrete-abstract continuum is concerned with the way we *perceive* new information – some people preferring to feel their way through (concrete experience) while others prefer to consider it (abstract conceptualisation) [20]. The active-reflective continuum is concerned with how we *process* new information – whether we are inclined to jump in and try things (active experimentation) or process new information by reflecting on it (reflective observation) [20].

According to the theory, the extremes of each continuum are mutually exclusive. If we try to perceive new information, for example, by concrete experience *and* by abstract conceptualisation, a conflict occurs [20]. The conflict is resolved when each individual makes a choice – in this way, each individual develops a preference, that is, a learning style to perceive and process new information [7].

It is important to recognise that Kolb considers this to be a learning cycle, with the extremes being steps in a learning process. Indeed, the idea of a continual process and the conflict resolution described above are characteristic of experiential learning in general. Many other are sympathetic to, and recognisable in, design. This is scarcely odd when experiential learning theory has influenced studies of design practice.

3.3 Experiential Learning Theory and Design

Consider the notion of learning occurring from the tension between expectation and experience. Work in architectural design [23] suggests that unexpected discoveries and 'situated-inventions' are pivotal to creative practice while studies of sketching, and its unintended consequences, further support this idea [24] as well as the experiential proposition that 'learning involves transaction between the person and the world' [7].

Dewey's concept of the 'reflective-arc', or how new experience constantly reforms memories, has also been applied to design [25]. Most notable in this area is the work of Schon [1] who emphasises the dialectical nature of design work – the reflective dialogue (mentioned above) between designer and design situation. With respect to the resolution of conflicts, of particular interest is Schon's process of *naming-framing-moving-reflecting*: where designers attend to a design situation to form a problem (naming and framing), develop a solution (moving) and evaluate the outcome (reflecting) [26].

Similarly, in his work, Kolb discusses the concept of *praxis*. A primary process of this concept involves 'naming the world'. This is both active – as naming something transforms it – and reflective – as our choice of words gives meaning to the world around us [7]. The way in which we frame the world, however, imposes an order on a situation that constrains our interpretations, inferences and, of course, our choice of names. There thus appears to be some relationship between the concepts of *action* and *reflection* in learning, and *naming* and *framing* in design.

3.4 Metaphors and Experiential Learning in Design

There are issues raised by experiential learning for design. The notion of frame, for example, is not at all formally presented [26]. It is proposed here, however, that mental models, specifically metaphor, are one way of conceiving of frames – they impose an order on a situation, allowing us to explore and solve a problem – and, with the influence of learning styles on mental models having already been identified [20], it is the aim of this work to establish the nature of the relationship between learning styles and metaphor, and how this influences student performance in design.

By asking students to develop their own metaphors, it is suggested that architectural design straddles both the active-reflective and the concrete-abstract continuum – with the intrinsically reflective nature of design making it difficult to delineate problem solving into the two continuums. It may, however, be instructive to identify general learning styles of students comfortable with metaphor use in order to learn from their approaches, and support other students. Such a study will also help to raise students' awareness of their own learning styles in order that they may consider their approach, develop their skills and learn how to learn.

4 IMPLICATIONS FOR EDUCATION

What could be the implications of the above said for design education? Training students in the use of metaphors in the design studio is by itself a valuable accomplishment. Reflecting about design problems by the use of metaphors may provide arguments to view the problem from unconventional perspectives. Students, who may come to a situation with consolidated preconceptions, are encouraged to assume a reflective attitude towards the problem, and engage in a dialogue through which suitable metaphorical ideas emerge.

However, success in teaching design through the use of metaphors might be strongly related to learning styles characteristic of each individual student. In order to test this, an empirical investigation is currently under development. In the first stage of the research, we provided students with a design task and asked them to solve it by the explicit application of metaphorical thinking. In the second stage, we provided students with the Learning Style Inventory developed by Kolb. Through the use of this survey, and experiential learning theory generally, we aim to determine the learning style of each individual student.

5 CONCLUSION

At present, we are investigating possible relationships between the level of success of each individual student in the use of metaphors, and their learning style. The goal is to gain insight from the characteristics and practices of students with learning styles conducive to successful use of metaphors so that the practices of other students may be improved. It is believed that, with metaphors being such a powerful tool in design, any insights gained in this investigation will allow for the development of design studio teaching programs that improve problem solving skills, and lead to innovative designs for the future.

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