A Study of the Creative Problem Solving Process by Architectural Designers: A Perspective of I-Ching BaGua

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Abstract—**I Ching is made up of alternations between conversion, conflict and reconciliation and between problem states of being. A synthesis of I Ching to the eight trigrams (BaGua) is often related to Feng-Shui for architectures in designing a building. In addition to this paradigm, this study observed BaGua as creative problem solving (CPS) approaches while practiced by architectures. The types of problems related to architecture jobs were mainly divided into: administrative, construction engineering, and designing affairs. Data related to the CPS approaches were collected from everyday retrospective recall which encoded by 8 architectures based on the checklist adapted from [5] [6] study. The frequencies of CPS approaches, then counted and subjected to chi-square test. The results revealed that the most frequently used of administrative jobs are Ch'ien trigram (perceived problem occurrence), Kun trigram (consequence evaluation), and Sun trigram (deliberating about ideas). The most frequently used of construction engineering jobs are Ch'ien trigram, Sun trigram, and Li trigram (logical reasoning). The most frequently used of designing affairs are Kun trigram, Sun, and Ch'ien trigrams. This study found not all trigrams were frequently practiced, according to the definition of I Ching, this suggests that the quality of CPS may still be questionable to this particular samples. The findings imply the problem solving process of human may need to be enhanced by training or requested by the top managers based on the elaboration of BaGua.**

Keywords-BaGua; I-Ching; architectural designers; creative problem solving

I. INTRODUCTION

The creative problem solving (CPS) process has been described as the "mutation" of a thought into many variants to generate ideas and the evaluation of these ideas to select the "fittest" or best variant [1]. Most researchers agree that there are four core processes associated with the creative problem solving process [2]. Those four processes are (a) problem identification and construction, (b) identification of relevant information, (c) idea generation, and (d) idea evaluation. If any of these processes are ineffectively performed, idea implementation may be poor. The first three processes are typically viewed as part of the idea generation phase, whereas the latter is considered part of the implementation phase or transforming phase [3]. Most creative problem solving models suggest that the quality of the later processes may depend on the successful application of the earlier processes, which indicates that all of the processes are important [4].

Relevant aspects of the BaGua system consist of dominant entities and processes in modeling. 'Modeling' refers to the development and/or use of models in order to solve some problem, in other words model-based problem-solving. The models discussed here can be categorized as epistemological models, as they share the use of epistemology to represent relevant parts of an objective system and to solve the problem at hand. The models may range from dynamic and continuous knowledge application, to justification and creation to solving problem in research [5] [6].

The fundamental of architectural design is to provide the space that the human needs. Along with the prosperity of technology, architectural designers not only have to obtain the professional knowledge, but also have to acquire the problem solving ability since design is basically a method of problem solving. It is now the era of differentiation architectural design developed by creativity and innovation. Architectural designers discover the problem in the design, promote the creative development in the design to unveil the problem and finally solve the problem with their professional skills. The present study uses these distinctions between potential thoughts and actions and the results of a study by Hong et al. [5] [6], which used the BaGua to generally examine problem solving patterns, to divide architecture design approaches to CPS into five epistemic categories: sensitivity to the problem, mental activation, idea generation, idea transformation, and idea consensus, during which a solution is agreed upon. Each stage of problem solving affects the next stage. To test the frequency of this BaGua CPS, this study confirmed the problem solving patterns observed during a general architecture design.

II. THE ESSENCE OF THE BaGua SYSTEM

I Ching is a philosophy of divination [7]. The BaGua (eight trigrams) are derived from I Ching and propose that the complementary opposites Yin (broken; negative) and Yan (unbroken; positive) are the source of creativity for problem solving [8]. Pham, Liu, and Dimov suggested that each Yao (line) contains Yin and Yan, which form two opposite extremes. [5] [6] describes the Ch'ien trigram as the opening of problems; the Kun trigram represents the effectiveness of the final solution; the Tui trigram is associated with the pleasure associated with the action of reproducing an idea; the Kên trigram is connected with meditation; the Chen trigram is a confrontational force that awakens the revising process; the Sun trigram is the supporting force that helps one penetrate an idea; the Li trigram represents the light of logical thinking that gives all things their brilliance; the Kan trigram signifies passion and mood alteration (see Figure 1).

Pham et al. [8] explained that the CPS represented the five stages fundamental behavior: (1) sensing that a problem has occurred or will occur, (2) generating and gathering ideas, (3) decreasing conflict and increasing consensus, (4) transforming ideas, and (5) implementing the idea to solve the problem. In this process, elements of combination, segmentation, replacement of logical thinking and mood arousal are adapted. These stages correspond to the categories of CPS and can be arranged in an octagonal format with four axes. According to Hong et al., applying the binary system from I Ching, the 'A axis' (see Figure 2) represents the problem-solving process; the Ch'ien trigram represents "beginning" in the universe and can be represented as the problem of an individual's openness to the world; the K'un trigram represents "ending," which can be interpreted as the effectiveness of the solution. Using the extended explanation provided by Pham et al., Hong et al. assign the generating and gathering ideas process to the Tui trigram and the Kên trigram. In the CPS process, finding a solution to a problem involves three basic interactions with data, devices and people through reading, observing and discussing. This interaction is represented by the Tui trigram (see Figure 1). The Kên trigram, however, represents a period of mental "stillness", or "self-contemplation," which is used to refine and master ideas. Bring BaGua to CPS process, an idea should be examined from various perspectives using different approaches to raise support for the idea at the Sun trigram or conflict over the idea at the Chên trigram; at this stage, consensus is increased. Finally, the refined idea should be scrutinized using consequence-based rationalization to ensure that the idea is the most feasible and effective.
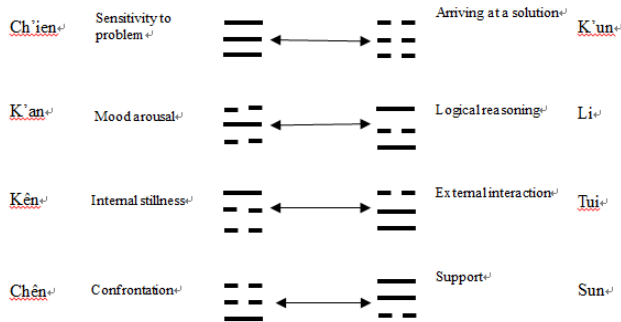

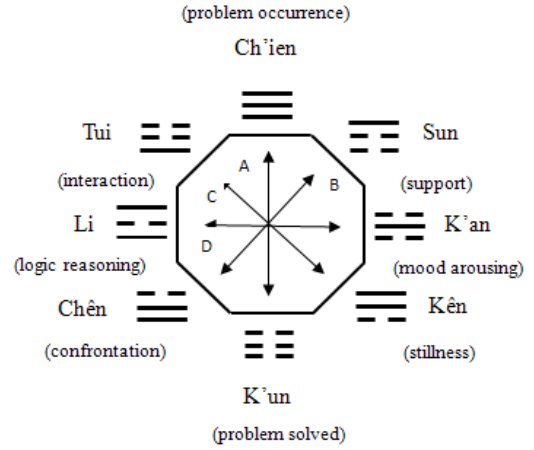FIGURE I. THE BAGUA (EIGHT-TRIGRAM) MODEL OF CREATIVE PROBLEM SOLVING

FIGURE II. THE BAGUA AND CREATIVE PROBLEM SOLVING

Moreover, during both the Tui and Kên trigrams and the Sun and Chên trigrams, the one's thought process will be triggered by a logical thinking process at the Li trigram, and one's emotions will be aroused from a grounded state to an excited state. This results in mental concentration at the K'an trigram, enhancing problem solving. Essentially, the transformation stage includes two stages: refining solutions and building acceptance. If there are only a few promising options, the challenge may be to refine, strengthen, or develop each one to make it as strong as possible [3]. The building acceptance stage involves searching for potential sources of resistance and identifying possible factors that may influence the successful implementation of potential solutions (Figure 3).
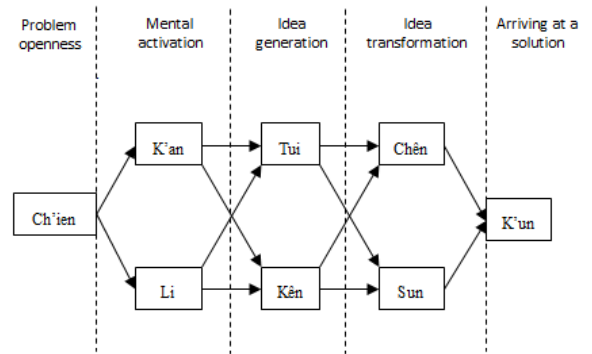

FIGURE III. BAGUA IN CREATIVE PROBLEM SOLVING PROCESSES

III. RESEARCH METHOD

The present study mainly focused on the difference between eight trigram model and every trigram of architectural designers on administration, engineering profession, design profession and creative problem solving. The study adopted a chi-square analysis for the questionnaires collected in order to conduct a persuasive assumption. Purposive sampling was incorporated and 153 valid questionnaires were collected. Among them, 31 were administration, 41 were engineering profession and 81 were design profession.

IV. RESEARCH FINDINGS

The conclusions based on the research purpose and result are proposed as follows:

A. *There was a significant difference between every trigram in administration.*

In Chien trigram (sense of problem occurrence), every item had a significant difference, but Chen trigram only had one item with a significant difference. Every other trigram had at least 3 items with a significant difference. The 4 of the most applied items were Kun trigram, Kun trigram, Li trigram, Sun trigram in descending order. In descending order, the 5 of the most applied items were: 1. Kun trigram (strategy-verification): When I am trying to solve a problem, I judge the usefulness of knowledge about it. 2. Sun trigram (supporting): I make corrections to my idea if it is different from the supported data". Chien trigram (sense to problem occurrence): "I am sensitive to changes in others' opinions when solving a problem, I am sensitive to changes in the function and material of an object when I am solving a problem. 3. Li trigram (logic reasoning): When I am faced with a problem, I can understand why this method is effective in solving the problem. 4. Chien trigram: I am sensitive to changes in human emotions when I am solving a problem. 5. Li trigram: When I am faced with a problem, I can understand the relationship between items A, B and C. Li trigram: When I am faced with a problem, I can understand the similarities and differences between event A and event B. Sun trigram: I supply additional information if I find more supporting ideas for my new thought. Kan trigram (emotional arising) : I feel complete concentration when I am solving a problem. Kun trigram: When I am solving a problem, I reduce the chances for the same kind of problem to happen again.

B. *There was a significant difference between every trigram in the engineering profession.*

In Chien trigram and Li trigram, every item had a significant difference, and Chen trigram (confrontation reducing) only had 2 items with a significant difference. Every other trigram had at least 3 items with a significant difference. In descending order, the 4 of the most applied items were: Chien trigram, Sun trigram, Li trigram and Kun trigram. In descending order, the 5 of the most applied items were : 1.Chien trigram: I am sensitive to changes in others' opinions when solving a problem. 2. Chien trigram: I am sensitive to changes in the element (people, places and things) of an event when I am solving a problem, Kun trigram: When I am trying to solve a problem, I judge the usefulness of knowledge about it. 3. Chien trigram: I am sensitive to changes in human emotions when I am solving a problem. 4. Sun trigram: I supply additional information if I find more supporting ideas for my new thought. I continue to find necessary information to make my new ideas deliberated. 5. Li Trigram: When I am faced with a problem, I can understand what causes idea A to become idea B. Chen trigram: In the process of problem-solving, I would find more evidence in proving my idea if someone is opposing it. Kan Trigram: I feel complete concentration when I am solving a problem.

C. *There was a significant difference between every trigram in the design profession.*

In Chien trigram, every item had a significant difference, and Kên trigram, Sun trigram, and Chen trigram only had 3

items with a significant difference. Every other trigram had at least 3 items with a significant difference. In descending order, the 5 of the most applied items were: 1. Kun trigram: When I am trying to solve a problem, I judge the usefulness of knowledge about it. 2. Sun trigram: I supply additional information if I find more supporting ideas for my new thought. 3. Kun trigram: When I am solving a problem, I reduce the chances for the same kind of problem to happen again. 4. Tui trigram: Encountering a problem during problem-solving, I get a new idea when I call my friend for help. 5. Sun trigram: I continue to find necessary information to make my new ideas deliberated, in descending order. Kan Trigram: I feel complete concentration when I am solving a problem.

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