

A Study of Cognitive Style on Design Performance

Pei-Shan, Teng * Dengchuan Cai ** Yao-Jen, Fan

* *Graduate school of industrial Design, National Yunlin University of Science and Technology
Yunlin, Taiwan, R. O. C. Email:pst525@ms68.hinet.net*

** *Department of industrial Design, National Yunlin University of Science and Technology
Yunlin, Taiwan, R. O. C.*

Abstract: Designers have the responsibility to understand and care about the users' cognitive habit to distinguish the difference between thinking and performance in different cognitive styles. The purpose of this study is to investigate the relationship between design thinking and design performance in different types of cognition. The Cognitive style index (CSI) would be utilized in this study and it would be classified in "analysis" and "intuition" groups. This research will use experience method and questionnaire method to test two groups with different cognitive style the difference of design process performance in thinking and sketch ability while executing the same mission. In the study, 134 design-majored students (57 male, 77 female, M=21.6 years old) were tested.

The primary result, It would show the conclusions in design process: (1) People in intuition group prefer image thinking and those who in analysis group prefer word thinking. (2) People in intuition group have better performance than those in an alysis group. Finally, the cognitive style can be applied to design education and work, teachers need to respect different users' learning modes and utilize proper ways to gain better learning effect.

Key words: *Cognitive style, Design process, Design think.*

1. Introduction

In cognitive psychology area, the research of cognitive style is an attractive issue. Because of the difference of the development, learning and the environment, there is a large gap between an individual's thinking style and the preference. Although lots of scholars have different definitions of cognitive psychology, the discussions are concentrated in the way of people's information-dealing and their behavior (Mayer and McCaully, 1985; Keefe, 1987; Allinson and Hayes, 1996, 2000; Riding and Watts, 1997; Biggs and Moore, 1993; Jung, 1923; Moore and Kearsley, 1996; Yu, 2006). The preference of cognition behavior, thinking and memory would influence an individual's behavior and activities directly or indirectly. The difference is so-called cognitive style (Keefe, 1987; Allinson and Hayes, 1996; Riding and Watts, 1997; Yu, 2006). Besides, the cognitive style is mainly focused on the behavior of an individual, not the intelligence. The psychologists' research pointed out the characteristics of cognitive style is measurable, stable, polarized. (Allinson & Hayes, 1996; Riding & Watts, 1997) This research is mainly according to the Allinson & Hayes developed Cognitive Style Index (CSI, 1996), and its derivative

simplified version modified by Yu (2006). The CSI developed two dimensions: analysis and intuition, which means the preference of an individual's appearance knowledge and the organized message respectively while facing the information. People with the characteristics of analysis style could deal with language, think abstractly, reason logically, analysis, concentrate on details, prefer solving problem organizationally, and rely on the methodical style; with the intuition, they have sensitive intuition or inspiration, and prefer imagine, metaphor, attitude, emotion, creativity, casual, solving problem at ease, dealing unofficially, planning totally. The application areas of cognitive style most related research are psychology, pedagogy, information management and pre-employment training, and the application is uncommon in design education area. Design is the composite of creativity, thinking and solving ability, especially on the dealing style of word information in design process. Overall, the main issues in this research are to know individual's tendency of cognitive style and the relation between the design process, design cognitive style and the design performance.

2. Research Method

2.1. Cognitive style questionnaire

All participants have to fill in the Cognitive Style Index (SCI) simplified version which is developed by Allinson and Hayes (1996). Yu(2006) modified the CSI as the simple version with 10 questions ($\lambda = .71 \sim .85$, $\geq .71$) ($\alpha .85 \sim .90$). The value of λ is more than 7 confirmed to the experts suggested standard. The index could distinguish the intuition cognitive style and analysis cognitive style, and to be the cognitive style independent variable in this research.

2.2. Design Mission

In controlled time, all participants associate with the topic "HAND". The content could be separated into 3 missions, including words, pictures and scripts of 10 lattices. All participants have to answer on the unlimited amount of A4 papers. The controlled time is distinguished into word idea (20 minutes), picture idea (20 minutes), storyboard including word and pictures (50 minutes), total 90 minutes.

2.3. Consensual assessment techniques

All participants' drawing results would evaluate by 3 experts - 2 are teachers serving in design department; 1 is an incumbent designer. The Likert scale of seven-point would be introduced to judge the intensity in the items. The 3 experts score independently. The standard of evaluation: evaluating the amount of creative words and pictures in participant's association; in storyboard, it is distinguished into 3 items: creativities, analysis, design skills.

2.4 Participants

The participants are including design department students in 2 universities in Taiwan. The amount of recovery questionnaire is 157. After deducting incomplete samples, the effective questionnaire is 134. The sample validity is 85.3%. The amounts of questionnaire are 90. Deducting the incomplete questionnaire, the effective questionnaire is 134. The effectiveness is 85.3%. The background of participants is the junior with basic drawing training at the university. The participants' background information includes 57 males (42.5%), 77 females (57.4%). The age distribution is 20 to 28 years old. The average age is 21.6 years old. The cognitive style

distribution is shown below. The amount of intuition is 72 (45.9%); the analysis is 62 (39.5%). In proportion, the amount of intuition is more than analysis. The result is in keeping with the consequence of cognitive style reference.

3. Result and discussion

3.1. Cognitive style cluster analysis

Via non hierarchical cluster procedures, cognitive style scale would be inducted as 2 groups: intuition and analysis. In addition, besides 10th questions of Cognitive Style Index (CSI), others have high significance. It reveals that the cognitive styles are different in thinking process.

No.	Test questions	T	Intuition	Analysis
01	I like to do a lot of thinking.	8.23*	4.29	3.13
02	I will not reject thinking deeply.	5.51*	3.97	3.26
03	I prefer complex issues than simple ones.	7.90*	3.39	2.19
04	I like to do something that could challenge my thinking.	8.54*	4.03	2.76
05	I like to waste long time to think something.	8.17*	3.89	2.60
06	I believe my intuition.	6.19*	4.11	3.16
07	I totally believe my presage.	4.37*	3.58	2.89
08	My first impression is usually correct.	4.95	3.56	2.84
09	I usually believe my intuition to decide if I trust someone.	2.38*	3.68	3.27
10	I could judge someone doing things right or not by intuition.	3.98*	3.78	3.16

TABLE 3. The results of cluster analysis.

3.2. The comparison of cognitive styles design process

Thinking method in design process in cognitive style is not apparent significantly. The design task results are shown in Table 4 & Table 5. Compared with the amount of word ideas and creative words, people with analysis style were more than with intuition style. And compared with the amount of images and creative image ideas, people with intuition style were more than with analysis style. Compared with scores in creativity, analysis and design skills in scripts, people with intuition style got higher than with analysis style.

Therefore, in design thinking, the cognitive styles are indeed different. People with an analysis style have better performance in word expression and description; people with intuition have better performance in image expression and comprehensive performance.

Items	Cognitive style*	M	SD
Word	I	8.36	5.18
	A 8.67		4.64
	I	3.30	1.60
	A 3.44		1.41
Image	I 5.14		3.09
	A 5.17		3.12
	I	2.26	1.41
	A 2.00		1.09
Storyboard Creativity	I	5.21	2.97
	A 5.28		3.30
Analysis I	I	5.16	2.88
	A 5.02		2.90
Design skills	I	5.36	3.03
	A 5.15		2.92

*I= intuition. A= analysis.

TABLE 4. The results of design process in cognitive styles.

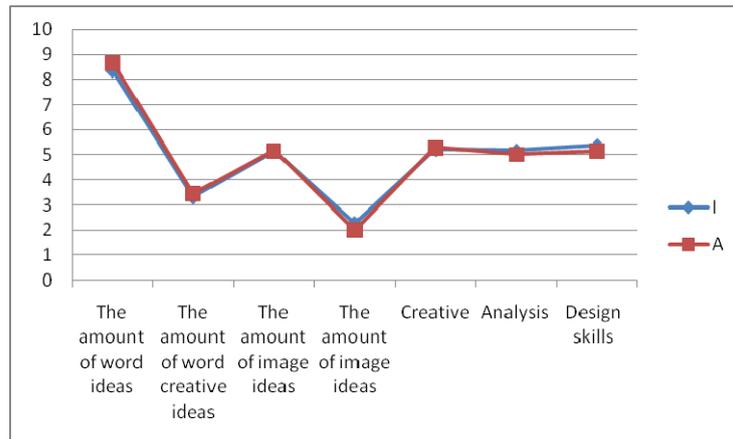


TABLE 5. The change of design process in Intuition and Analysis.

4. Conclusion

The conclusion was arranged as below:

1. In the choice of the information classification (word & image) in the design process, the cognitive styles are certainly different. The students with intuition style preferred thinking by image, and in the sketch drawing and amount response, they had better performance than students with analysis style.
2. The students with analysis style preferred thinking by words, and have better performance in description and adjective-applying. Therefore, there are different thinking models and dealing ways between 2 groups in cognitive style, so is the design performance.
3. In scripts (words & images), the students with intuition style have better design performance than with analysis style in 3 items (creativity, analysis, design skills). People with intuition style could think comprehensively, and the total performance in scripts is surely better.
4. The relative analysis between each variable in design performance reveals that the word thinking and image thinking would influence the final design performance. The reason is that all single elements, words and images, are the thinking resources of creativity, analysis and design skills. Therefore, handling better association of words and images would have better performance in final design performance.

Compared with the cognitive style relative research samples, this research couldn't get reveal differences in each cognitive style. This research paid attention to an individual's performance in design process, and using more time to design missions. Otherwise, considering experts should evaluate each questionnaire by several items, such as words, images and scripts, if they waste too much time to judge, the evaluation standard would be influenced. The suggestion would be simplified the design missions in future cognitive style research to reflect the conspicuous differences in a large amount of samples in references.

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