

A Differential Study on the Influence of Prior Experience and Visual Stimuli in Idea Generation with Analogy Method

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Contemporary contributions in the literature on design methods mostly favour descriptions of implementation manners, contents, procedures, and advantages or disadvantages; few rely upon actual design tasks to illustrate the strengths and weaknesses of a particular design technique.

Such descriptions often merely verify certain methods without detailing factors that support or hinder applications of methods, which may influence designers' evaluations and understanding.

Consequently, the present study will attempt to explore the merit of analogy method by analysing priming graphic stimuli, field inspection, and subsequent ideas produced. If differences in stimuli and inspection locations play a role in affecting design results, then quantity and quality of ideas generated should reflect such effects. Furthermore, this study will analyse the effects of stimuli and locations on the design process, as well as the relationship between the results and the affected process.

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1. Introduction

One of the purposes of design education is to teach designers to employ their prior knowledge and experience to solve problems encountered in the design process, thus making the process more efficient. Design techniques, however, are to improve on design ability through simple and easy learning rules in design education. This study targets the most challenging phase in the design process, idea generation and modification, by emphasizing association and analogical deduction method.

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Consequently, the present study will attempt to explore the merit of analogy method by analysing priming graphic stimuli, field inspection, and subsequent ideas produced. If differences in stimuli and inspection locations play a role in affecting design results, then quantity and quality of ideas generated should reflect such effects. Furthermore, this study will analyse the effects of stimuli and locations on the design process, as well as the relationship between the results and the affected process.

2. Literature Review

2.1 Design consideration

The 'consideration' in design refers to the internal logic and decision-making processes that designers experience during problem solving.

Throughout courses of design, a four-step mental activity—consideration, choice, planning, and generation—which designers follow helps determine design behaviours that are of concept or imagery thinking basis. Most applications of design approaches concern more with products without indications of unique style; therefore imagery thinking attracts scholarly attention. American psychologist and founder of school of functionality, Dwaey, is one of the researchers who deem consideration a psychological activity. Dwaey maintains that confusing situations cause consideration; that is, when individuals are unable to adapt effectively under difficult circumstances using habits and experience, they are forced to initiate the psychological activity of consideration to attain information and relief through searching, discovering, analysing, and attempting. Problem solving is a type of consideration activity with outward and cognitive behavioural development that has more noticeable procedures. Over the course of development, one looks for a variety of potentially effective reactions to counter problems, and chooses the ideal option to increase the possibility of overcoming problems.

2.2 Analogy Method

In human thinking processes, understanding and problem solving are done with rational thinking logic and past experiences as knowledge background, and memory related analogy deduction methods are used as tools. Analogy deduction process is a temporal psychological consideration activity in which imageries are produced in the brain to form sharp and whole memories.

‘Analogy’ refers to, in its lexical sense, similarities among dissimilar matters. Analogy method is a special consideration or deduction manner by which an object is viewed as another object; such approach is crucial in creative design. Analogy is an important consideration framework; behaviours such as imitation and analogy can serve as raw material in starting thinking processes. ‘Analogy’ refers to deduction by comparing similarities; it is a technique that connects two issues by introducing and contrasting with dissimilarities of a third issue. Analogy methods consist of four fundamental types, which encompass all thoughts and experiences—direct analogy, symbolic analogy, personification analogy, and imagination analogy.

The flow of creative thinking follows a three-step process—design concept, design imagery, and design language; the process is a gradual ‘ambiguous to clear’, ‘abstract to concrete’, and ‘problem to solution’. Liao has proposed an operating framework for analogy deduction, shown in Figure 1.

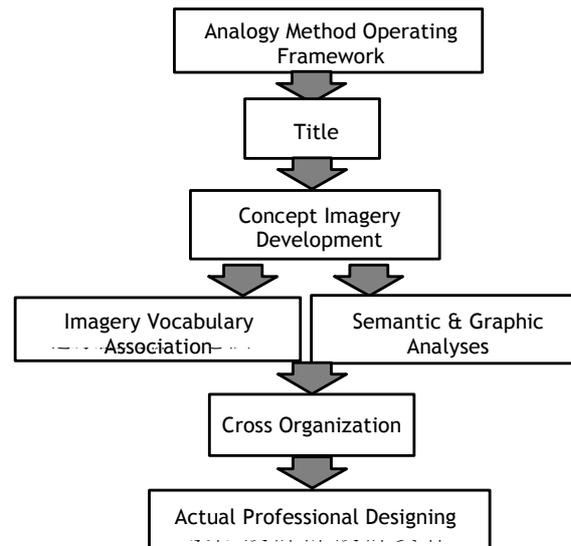


Figure 1. Operating Framework for Design Consideration and Analogy Application

Discussions on design techniques have emphasized applications of them in a design situation, while effects of prior experience and visual stimuli on design processes and design outcomes have eluded research interests. If advantages of applying design approaches described in the literature cannot be obtained or if design results cannot be objectively evaluated, then with the absence of an evaluation standard, design results can be readily expected. As a result, it can be seen that literature on analogy methods mainly focuses on their implementation, strengths, and weaknesses, without a systematic debate, which entails perceptive differences in usage, uncertainty of analogy methods, and efficiency in applications.

This study, therefore, stresses the importance of preparation; that is, the effects of how prior experience and visual stimuli are administered, as opposed to how methods are used or what applications of methods yield. To investigate those issues for purposes of elevating understanding of design preparation, this study was of an experiment nature with idea exploration done by three research students in a department of design. Group A was not administered any priming material before analogy method, while the other two groups were permitted graphic material or on-site inspection. Analyses on idea evaluation standard were done with four criteria, namely, creativity, feasibility, expandability, and relevance. Comparison analyses were completed on the quantity and quality of ideas generated in order to seek the most proper priming material.

3. Method

3.1 Experiment content

There were three groups, differing in priming items. Group A designed under analogy method without primers; Group B was primed with pertinent books and magazines; the primer for Group C was a field trip to IKEA.

3.1.1 Participants.

It was assumed that more experienced designers would outperform less experienced counterparts. Therefore, three graduate designer students with sufficient background and experience from Chang Gung University were sought; each of them should have received over four years of formal training in design. Since the title of design in the experiment was 'How to sit with comfort', criteria for objective and errorless participants selection included experience in furniture design with abstract nature. The first of the final three participants had about one year of research experience in public space and seats; the second had about two years of actual experience in exhibition hall design; the third had designed furniture and competed in over three public space and furniture design contests. They were randomly assigned to each of the three groups.

Design investigation, which was the priming preparation, divided the groups into one experimental group and two control groups. Usually designers look for information or inspiration from the Internet, books, television programs, or movies; this study attempted to explore the distinctions in quantity and quality in idea generation after different information searching.

3.1.2 Design title.

The title 'How to sit with comfort' was chosen to facilitate the application of analogy method and actual design time spent in real life. The furniture-related conceptual title allowed participants to draw on personal experience or common sense to excite innovative and inspirational selves within.

Prior to the official experiment, a pilot experiment revealed that participants needed the first 5-10 minutes to practice with analogy method, peaked in numbers of ideas and concepts produced in the following 15-20 minutes, and slowed down afterward. Participants were told to stop reading and talking after the experiment started; they were unable to continue searching for concepts by reading, touching, and listening, which in turn could help restrict experiment variables. The length of experiment time was then set to 30 minutes.

This study would count numbers of concepts generated after design toward the quantity of results. The step of definition design concept was a probable solution to the design subject; it could be a vague concept or simple imagery expression that characterized the initial developmental stage of ideas proposed.

3.1.3 Recording material.

During the experiment, participants did not simply speak out about what they thought; they often drew or acted out their ideas. Thus, to capture every movement, there was one video camera, one scanner, and one recording pen. The camera was to record behaviours, reactions, and voicing; the scanner was to supplement the camera by recording graphics and written language.

Participants were given pieces of A3 blank paper, pens, ballpoint pens, and pertinent materials on public space and furniture usage.

3.2 Design procedures

The experimental procedures were as follows:

1. Design title was given at the testing site
2. Priming activities
3. Participants relaxed
4. Analogy method experiment
5. Idea development
6. Experiment ended; interviews on design ideas
7. Experiment materials retrieved

3.2.1 Pilot experiment preparation.

In order to ensure experimental accuracy and discover rare problems, two participants in the pilot experiment helped clarify issues such as the positioning and clarity of the camera, lighting, and paper texture. Before the experiment, the principal researcher ascertained the proper setting and materials, and participants were given opportunities to understand experimental requests and process.

3.2.2 Title explanation and warm-up.

The first part of this stage used examples in the book "Product design and development". Participants were given a title which had been tried with analogy method and resulted in some ideas; participants were encouraged to practice with analogy method.

3.2.3 Official experiment.

Other than the difference in priming materials, participants were all allowed 10 minutes to relax, and those in the third group moved to the location of the official experiment. Attention of participants was distracted in those 10

minutes to spread out deviations of continual design consideration. The official experiment ended after idea development.

Participants were invited for some snack and tea after the experiment, and were interviewed for approximately 10-20 minutes on the use of analogy method, effects of prior stimuli, usual design consideration process, sources of ideas, and opinions about strengths and weaknesses of the experiment.

4. Analyses Techniques

Data obtained in the experiment were in the formats of visual, sound, and written; the video camera showed differences in consideration process and behaviour of participants in two groups, and the written data showed ideas produced in the three groups that included written language, graphics, idea proposals, and remarks. The recording pen offered opportunities to return to different parts of the experiment to supplement observation.

The analyses consisted of two parts: the evaluation of ideas generated and analyses of design consideration process. The former included evaluations of quality and quantity; creativity, feasibility, expandability, and relevance were the four criteria for quality evaluation standard. Creativity referred to the uniqueness of ideas; feasibility referred to the affordability of present technology; expandability concerned with the continuity of ideas; relevance referred to the pertinence with the title.

In the design consideration process, this study used the most common way to analyse: timing and idea source; it was expected to elevate objectivity and accuracy. Analyses for spoken language were also utilised to look at spoken data; however, the concept of timeline analyses were the main tool for understanding idea production, relationships among ideas, and idea interaction with participants.

5. Results

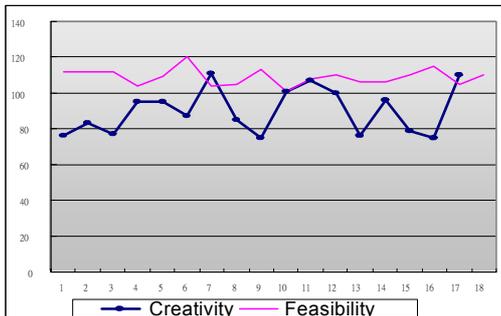
5.1 Analyses on quality of ideas

Ideas generated in this study were evaluated, regardless of groups, online by 30 industrial design professionals based on the four criteria abovementioned; results are shown in Figure 2. The evaluation differences can be seen clearly, and from the results obtained, effects of prior experience on analogy method were not significant in feasibility, expandability, and relevance.

Table 1. Idea Evaluation and Mean

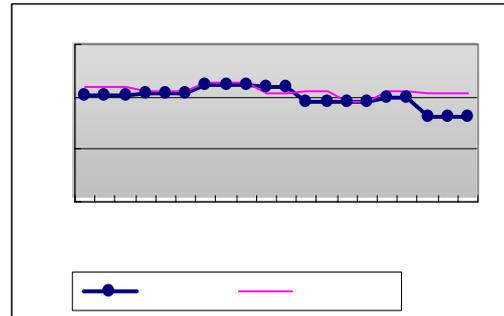
	Direct Experimental Group	Graphic Experimental Group	Field Inspection Group
Creativity	3.10	3.43	3.29
Feasibility	3.76	3.66	3.36
Expandability	3.49	3.56	3.30
Relevance	3.65	3.5	3.27

In terms of quantity of ideas, direct experimental group had 17 ideas, graphic experimental group had 20 ideas, and field experimental group had 16 ideas; the scores assigned to each group were second, first, and third, respectively. There was no significance. Individual evaluative analyses were also done on creativity and feasibility.



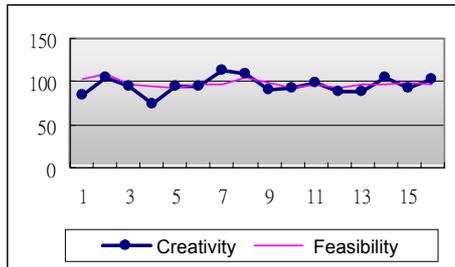
blue: Creativity pink: Feasibility

Figure 2. Direct Experimental Group

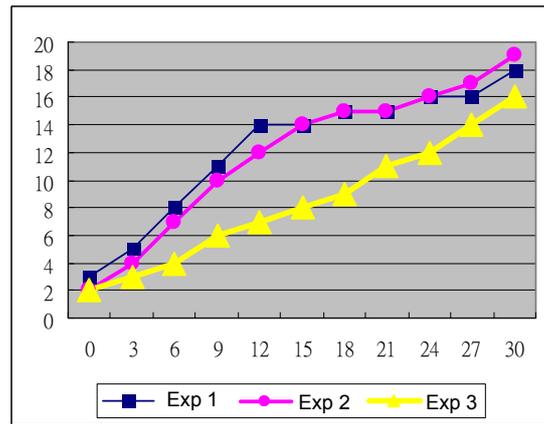


blue: Creativity pink: Feasibility

Figure 3. Graphic Experimental Group



blue: Creativity pink: Feasibility
 Figure 4. Field Inspection Group



blue: Experiment 1 pink: Experiment 2
 yellow: Experiment 3
 Figure 5. Timeline and Quantity Produced

5.2 Analyses on process

From the camera, there were some differences in concept generation in the three experimental groups. The group without prior graphic materials or data expressed in written form, whereas the graphic group and the field group drew pictures in addition to writing. It is suggested that the latter two groups were pre-stimulated, and had better understandings of concepts. It is interesting to notice that, the field group often drew first before jotting down remarks; this could be due to their excessive exposure to visual and touching stimuli. The graphic group also had pictures, but was not as assertive as the field group. The differences in expression in these two groups can be readily observed from the concept generation process.

6. Discussion and Recommendations

From this study, it can be said that even though differences were not great between graphic and field groups, the latter received higher evaluations on several concepts, which can be attributed to sharp stimulation in the field. Moreover, creativity in these two groups was higher than the direct group. It is suggested that association in analogy method is facilitated through external stimuli, hence the higher creativity; while common sense must be used if no priming items are offered, but practicality would be higher. In addition, the number of concepts generated in field group was big, due to more complete perception of concepts and more time-consuming to express. From the data in the video, it is clear that direct group used traditional technique of deduction

and association, whereas field group could not jot down ideas fast enough, because ideas kept jumping out; this is a phenomenon in using analogy method. Analogy method expects designers to produce more valuable, more cutting-edge designs, therefore field inspection is quite important and influential to designing with analogy method.

It is concluded that field inspection does not differ greatly from graphic observation, but designers often produce unexpected results after on-site observation. It is certainly helpful to field inspect prior to using analogy method; some ideas may be impractical, but all are advanced. Designers thus have a clearer grasp of shapes of products and written descriptions, and completeness, practicality, and efficiency increase. It is recommended that in design education in the future, graphic and field inspection can be implemented prior to using analogy method, allowing designers to create more effectively with complete and practical ideas.

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