THE EFFECT OF MOOD STATES ON CREATIVITY DURING CONCEPT GENERATION PROCESS IN DESIGN

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ABSTRACT

Design process is a process an engineer goes through in devising a solution of a problem. The process requires both knowledge and creativity. This study focuses on ideation process during concept generation, in which creativity is the most utilized. The aim is to identify how the creative nature of human thought at the beginning stage of design in which the process of ideation is applied, is affected by their mood states. For that purpose, a number of student designers are first induced into several mood states before given a design task. The task applied is on designing a solution for improving the use of a commonly used artefact. The creativity of the idea is evaluated based on the fluency, originality, and expansion. As the result, the 'positive activating mood' is found to be effective for higher level of creativity.

Keywords: Design Process, Creativity, Mood States, Ideation, Concept Generation Process

1.0   INTRODUCTION

In solving an engineering problem, the design process is a process an engineer must go through in devising a solution to the problem. On top of the finite engineering knowledge, the design process requires the infinite element of creativity. The creative nature of human thought has been the focus of a large number of studies in the field of design. Most studies have been discussed within the framework of goal-oriented problem solving. In contrast, a study that has focused on the notion of 'something' which not only underlies the designer's thought deep in the mind but also governs it, has gained attention [1]. This approach is related to the creative nature in design which will be discussed in this paper.

When discussing human thought, individuals are commonly said to have their own peculiar thought; backboned by their background including knowledge, personality, environment, and so on. Numerous studies have reported on individual differences and their variables related to human thought [2], [3]. Likewise, in design, each designer must possess peculiar thought in their design activities. The interest of this study is to understand the peculiar thoughts that may relate to higher level of creativity.

Some researchers in design creativity have suggested that the designer's thought at the early stage of design have the main effect on creativity to design. For example, every design problem begins with an effort to achieve fitness between the form (ultimate solution of design) and its context that defines the design problem [4]. Further, the potential for creating global interpretations for the whole design process is likely to be found mostly at the starting point of the design process, which reflects the designer's state of mind at the outset of the design endeavor [5]. No study have focused on the process of ideation during concept generation process in design, in where the designers start to create ideas, not detailing them.

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Many studies have tested on how the affective states influence the work-related cognition and behavior. Affect has multifaceted influence on both the content (what people think) and the process (how people think) of thought. The term 'affect' denotes a generic or superordinate category of phenomena that encompasses the concepts of mood and emotion [6]. Mood, like emotion, is an affective state. Moods may be of particular importance in organizational behavior because moods are more common, longer lasting, and less noticeable than other kinds of affective states [7].

Based on the above arguments, this study focuses on the mood states in attempt to capture designers' thought at initial stage of design, i.e. at the moment the ideas are created. In addition, this research does not discuss design in the framework of problem solving; a process of ideation is applied in the design task. The creativity of the design outputs is evaluated from the viewpoint of fluency, originality and expansion.

In experiment for examining the effect of mood states on creativity, the subjects are first manipulated into desired mood states. Then, they are required to perform design tasks. Many methods had been performed for inducing the mood of the subjects. The types of Mood Induction Procedure (MIP) are Velten MIP, Imagination MIP, Gift MIP, Social Interaction MIP, Film/Story MIP, Facial Expression MIP, Music MIP, Combined MIP, and Feedback MIP [8].

In this study, the Imagination MIP is preferable since by applying this MIP, words can be collected by asking the subjects to write down their imagination. Further, to increase the effectiveness of the induction of mood, Combination MIP is preferred. Thus, the Combination MIP with the combination of Velten and Imagination MIPs is selected in this study.

2.0   PURPOSE

The purpose of this study is to understand the effect of mood states on designers' creativity in the process of ideation during concept generation process in design.

3.0   METHOD

This study attempts to understand the effect of mood state to the creativity level of a designer. For this purpose, the subjects are first induced into different mood states before given a design task. Further, the creativity level of the ideas is evaluated. Finally, correlation between mood states and the creativity score is tested. Figure 1 shows the methodology of the research and will be discussed in detail in Section 4.0.
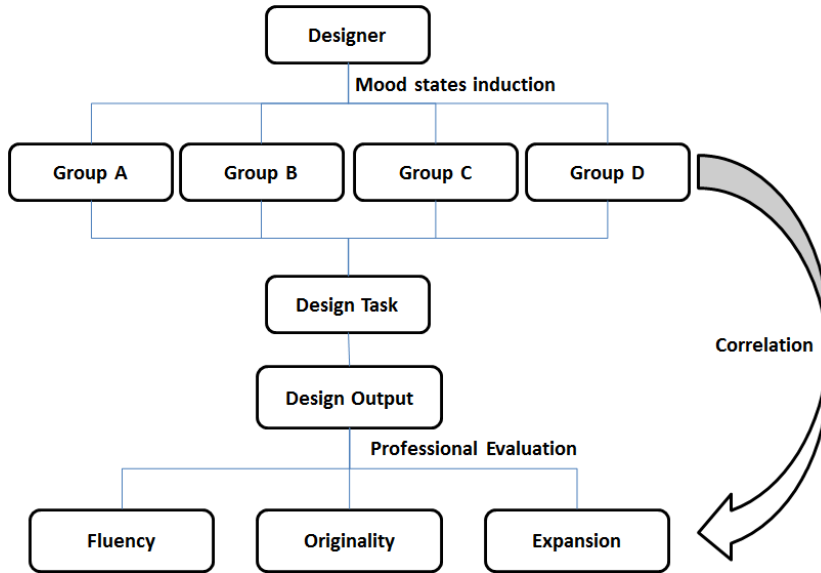
Figure 1 Methodology of research

4.0   EXPERIMENT

In order to classify the original Velten statements into four mood groups to be used in the main experiment, a preparatory experiment is initially conducted. The four groups are as follows:

- Group A: Positive activating mood state
- Group B: Positive deactivating mood state
- Group C: Negative activating mood state
- Group D: Negative deactivating mood state

The main experiment is conducted to obtain the explicit 'mood words' and design outputs. The experiment is conducted in two stages: Stage A (Biographical Memory Task), and Stage B (Design Task).

In Stage A, subjects were randomly manipulated into four groups of mood states as stated above.

After been manipulated into particular mood state, subjects were required to perform a design task (Stage B). In this task, subjects were required to think about possible ways to design a better umbrella.

4.1   PREPARATORY EXPERIMENT

Preparatory experiment is conducted for classifying the Velten statements into four mood groups to be used in Stage A of the main experiment. Velten MIP is by far the most widely used technique for the induction of positive and negative mood states. The original Velten list consists of statements describing each positive, negative, and natural self-evaluations or somatic states [9]. Only positive and negative statements were used in this experiment. The purpose of this preparatory experiment is:

- To reduce the number of statements (originally 116 statements in total), and
- To classify the positive and negative statements into four groups of mood states required for the main experiment.

4.1.1   PROCEDURE OF PREPARATORY EXPERIMENT

University students and adults (N=30; 40% men, 60% women; 73% Malay, 17% Chinese, 3% Indian, 7% other races) aged 20-40 participated in this experiment. In a questionnaire, the original positive and negative Velten lists (116 statements in total) were presented. First, using the original method in Velten induction procedure, the subjects were asked to feel the mood described by the statements. Then, they were instructed to answer a number of questions such as 'How do you feel after reading the statement?' The choice of answers are 'Strongly deactivated', 'Deactivated', 'Neither activated nor deactivated', 'Activated', and 'Strongly activated'. Explanations on the terms 'activated' and 'deactivated' are given beforehand.

4.1.2   RESULTS OF PREPARATORY EXPERIMENT

Factor analysis was conducted. Initial factor analysis revealed a 17-factor and 15-factor solutions for positive and negative statements respectively. To reduce the number of items and increase reliability of the classification, items with factor loading below than 0.6 and had high cross-loadings with other factors were removed from the list. Factor analysis with the remaining items revealed that a two-factor solution for positive statements (Table 1) and three-factor solution for negative statements (Table 2). From the results, statements P29, P52, P53, and P58 for Group A, P4, P45, P48, P55, and P58 for Group B. in the negative statements, N18, N19, and N24 for Group C, and N30, N34, N35, N52, N54, and N58 for Group D are selected.

Table 1 Factor solution and loadings for positive statements

	Factor	
	1	2
P55. This is great – I really do feel good.	.900	
P57. This is just one of those days when I'm ready to go!	.860	
P45. I can find the good in almost everything.	.842	
P4. This might turn out to have been one of my good days	.645	
P48. My thinking is clear and rapid.	.581	
P29. I'm able to do things accurately and efficiently.		.585
P58. God, I feel great!		.669
P53. Life is firmly in my control.		.653
P52. I feel industrious as heck – I want something to do!		.606

Table 2 Factor solution and loadings for negative statements

	Factor		
	1	2	3
N54. Everything seems utterly futile and empty	.750		
N35. The way I feel now, the future looks boring and hopeless.	.744		
N58. I want to go to sleep and never wake up.	.712		
N30. I've noticed that no one seems to really understand or care when I complain or feel unhappy	.709		
N34. Things are worse now than when I was younger.	.677		
N52. I don't concentrate or move	.673		
N7. It has occurred to me more than once that study is basically useless, because you forget almost everything you learn		.866	
N8. People annoy me; I wish I could be by myself.		.866	
N19. I'm getting tired out		.703	

N18. Just to stand up would take a big effort.		.845
N24. I can't make up my mind; it's so hard to make simple decisions.		.621

4.2   MAIN EXPERIMENT

The main experiment was conducted in two stages: Stage A (Memory Task), and Stage B (Design Task). The purpose of Stage A is to randomly manipulate and assign the subjects into four discrete groups of mood states. The purpose of Stage B is to test the effect of mood states to creativity level.

4.2.1   PROCEDURE

The experiment took approximately 1 hour. Subjects were undergraduate students (N=79; 73% men, 26% women; 65% Malay, 32% Chinese, 3% other races) aged 20-24 at Faculty of Mechanical Engineering, Universiti Teknologi Malaysia.

Four types of booklets were prepared for the Stage A; each one for each discrete mood state. Equal number of sets from all four types was distributed to the subjects, who were not informed that there are different types of booklets.

Stage A consists of two parts. In the first part, subjects were instructed to read some statements (obtained from the preparatory experiment) and try to feel the mood described by the statements. Then in the second part, they were instructed to imagine an event that happened in their life that evoked any of the mood items from a list given, and write down a free composition about the event [9]. They were asked to imagine the event vividly and try to experience the original perceptions, sensations, and reactions. The lists of mood items are different according to discrete mood states [10]. The mood items are:

- ・Group A (positive activating)   : happy, elated, excited,
- ・Group B (positive deactivating)   : calm, relaxed, at ease,
- ・Group C (negative activating)   : disgusted, fearful, ashamed, disdainful, worried,   afraid, guilty, angry, upset,
- ・Group D (negative deactivating)   : drained, lifeless, fatigued, depressed, discouraged, failed, sad.

Stage B was conducted immediately after Stage A. In this stage, all subjects were instructed to think about possible ways to design a better umbrella [11]. They were noted that they are NOT required to design a new umbrella, but to suggest any possible way (as many as possible) to improve the design of a current commonly used umbrella. They also noted that they can list up any unsound ideas and it is not necessary to think about detail mechanism, efficiency, or practicality.

Figure 2 shows examples of the sketches.

4.2.2   RESULTS

The creativity of the design outputs is evaluated by three creativity indicators as follows:

- Fluency
  Measures how smooth the subjects' thought in generating ideas. In this study, it is determined by counting the number of ideas
- Originality
  Refers to the uncommonness of the ideas. This is determined by counting the number of idea that does not overlap with other ideas.
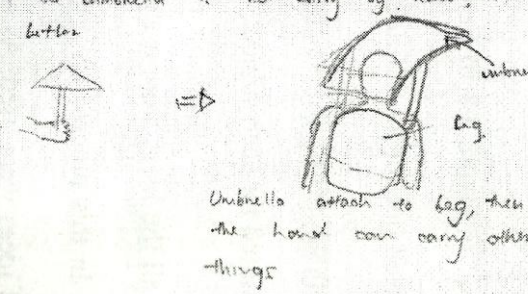
- Expansion
  Refers to the number of categories been considered in the idea generation. This is judged by observing in what category the idea is.

The process for determining the value of the indicators above was carried out by three undergraduate mechanical engineering students. To ensure the validity of the evaluation, the students initially evaluate the ideas separately, before they sit together to come out with one agreed classification for each idea. The process was carried out for all design outputs (ideas) randomly, without knowing the mood group of the designers. In other words, all ideas collected from all sets of design outputs were gathered and managed uniformly.

The categorization of ideas is shown in Table 3.

(a)　　　　　　　　　　　　(b)　　　　　　　　　　　　(c)

Figure 2 Examples of design outputs produced by three different subjects; (a) is where the ideas are listed in words. (b) is where ideas are listed in words and some are explained by sketches, and (c) is where an idea is presented by sketches with some notes on the sketches.

Table 3 Categories of the ideas

'What the idea is about?'	Category
An idea concerning the physical structure, including partial structure of the umbrella.	Structure
An idea concerning the material, including material of parts of the umbrella.	Material
An idea concerning about how the umbrella is used.	Usage
An idea about putting sub function to the umbrella, on top of the main function, to protect a user against extreme weather.	Additional function
An idea concerning about how strong and how durable the umbrella in protecting a user against extreme weather.	Strength & Durability
An idea concerning about how to store the umbrella.	Storage
An idea concerning the look, beauty and art.	Aesthetic
An idea concerning about protecting a user against any harm while using the umbrella.	Safety & Health
An idea concerning environmental matter	Environment
An idea that do not fall under any of the above categories.	Others

5.0   RESULTS

A one–way ANOVA was conducted to compare the effect of mood states on fluency, originality, and expansion. There was a significant effect of mood states at $p<.01$ level for fluency $(F (3, 53) = 5.038)$, and $p<.05$ for expansion $(F (3, 53) =3.231)$.

  Further, post hoc comparisons using the Tukey HSD test were conducted. For fluency (Figure 3), the test indicated that the mean score for Group A (M=6.47, SD=2.183) was significantly higher than the other groups (Group B: M=4.43, SD=1.950; Group C: M=4.33, SD=2.188; Group D: M=3.69, SD=2.136). Group B, C, and D did not significantly different among each other. For expansion (Figure 4), the test indicated that the mean score for Group A (M=1.71, SD=1.359) was significantly higher than Group D (M=1.39, SD=1.123). The difference from Group B and C was not significant; however, lower tendency was detected. For originality (Figure 5), no significant difference was detected. However, different from other indicators, the lowest score was observed in Group B.
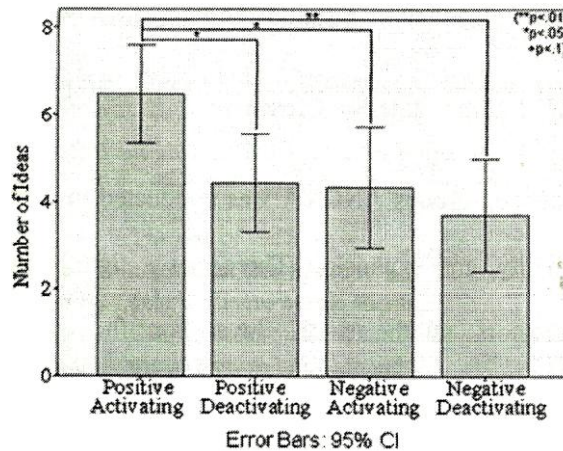

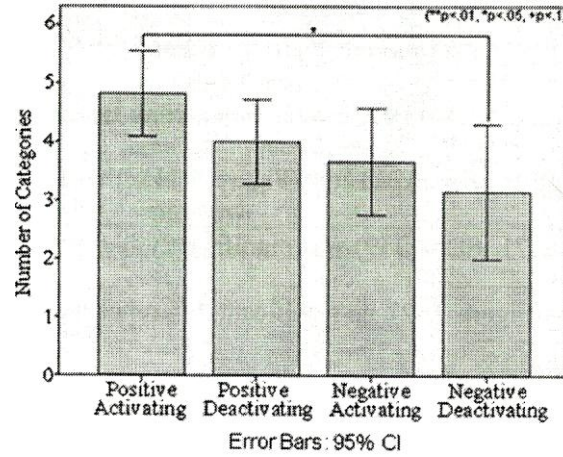Figure 3 Means of the number of ideas (fluency)

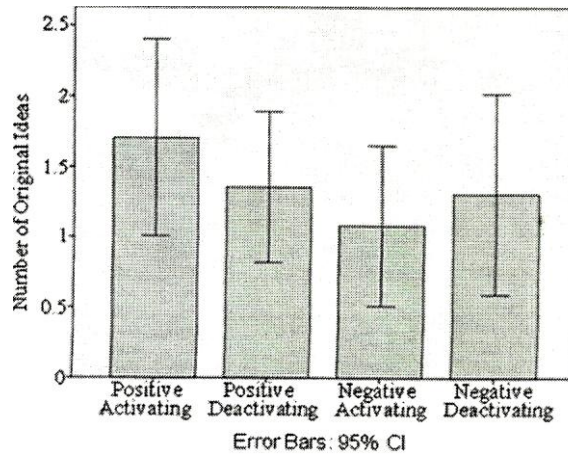Figure 4 Means of the number of categories (expansion)

Figure 5 Means of the number of original ideas (originality)

6.0   DISCUSSION

This study tested whether the different mood states affect the creativity of design outputs. Two stages of experiments were conducted. In the first stage, four groups of different mood states we formed. The formation was by randomly inducing the subjects into different mood states based on the combination of Velten and Imagination Mood Induction Procedure.

In the second stage, the subjects were required to complete a task of ideation. The created ideas were then evaluated based on fluency, originality and expansion.

The results show that positive activating mood state has significant effect to the fluency. This indicates that in positive activating mood, subjects are able to think smoothly and create many ideas. The other mood states are significantly not contributing to the ability; being in comfort or worry or sad does not contributing to the good output of producing ideas or brainstorming.

Secondly, the positive activating mood state has significant effect to the expansion. On top of being fluent in generating ideas, the ideas are also expanded in categories. The expansion of ideas, which is proven to be related to the level of creativity, is detected in the higher number of categories the ideas were categorized in. The negative deactivating mood is significantly not contributing to

the expansion, while positive deactivating and negative activating mood states found to have lower tendency in contributing to the expansion.

Positive activating mood state has significant effect to the originality. The subjects were able to create uncommon ideas in this mood state significantly, as compares to the positive deactivating, in where the subjects were probably in comfort and the mind is not challenged. The ability in the two negative mood states was also low.

The results supports the previous findings that people in positive mood will evaluate a stimulus more positively [12] and seriousness affect the effort exerted on creative activity [13]. In addition, the results also coherent with the findings that creativity is enhanced by moods that are associated with approach motivation (activating) rather than avoidance motivation (deactivating) [9].

Finally, the results also suggest that the differences in the subjects' thoughts (focusing on mood states) at the starting point of design process have effect on the performance of the design process.

7.0   CONCLUSION

In order to capture the nature of thought at the beginning stage of design process, this study focused on mood states of the designer, and attempted to identify how the mood states of a designer can reflect his/her ideation performance. The effect of discrete mood states on creativity of the design outputs was confirmed. The results suggested that positive activating mood has significant effect of creativity. This finding could be a proven guideline to be applied at schools in where pupils need to be trained of creative thinking skills, and companies in where creativity is required in solving problems. In addition, the findings also could give hints in improving design education.

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