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# STUDYING DESIGNERS: AFFECTIVE COMPONENTS OF DESIGN CREATIVITY

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**Abstract:** This paper examines the role of designers' own experience and perception in the process of designing new products, based on an experimental approach with designers. So far, most design studies have investigated the role of visual stimuli and visual modality in the design process. We claim that, designers being humans, other sensory modalities might affect the design process and the design outcomes. We propose an approach to study the practice of designing where both creativity and designers' sensory impressions are investigated jointly.

***Keywords:*** *Creativity, design protocols, designers, emotions, sensory modalities.*

## 1. Introduction: designers, external stimuli and emotional value of products

To remain competitive, companies worldwide strive to design and manufacture distinguishable products that attract consumers. In this paper we focus two major factors of product attractiveness: creativity and emotional value. Recently, there has been a growing number of research investigations aimed at understanding the process of both creativity and creation of emotional value and at enhancing them. Both topics are usually studied independently, while we suggest that there is link between design creativity and emotional value. This paper reviews a selection of studies on design creativity as well as studies on creation of emotional value and tries to build a theoretical framework for experimental studies on the relationship between design creativity and creation of emotional value.

### 1.1 Design creativity and visual stimuli

Several models of general creativity are well-recognized. For instance, Teresa Amabile suggested that creativity is made of three components:

- Expertise: knowledge-technical, procedural and intellectual expertise
- Motivation: intrinsic and extrinsic motivation
- Creative thinking skills: how flexibly and imaginatively people approach problems


**Figure 1.** Three components of creativity (Amabile, 1983)

The « creative thinking skills » can be affected by various parameters including the type of design problem to be solved and the type of external information the designers use along the design process.

Based on this description, several studies have explored how far visual or textual information impact the level of creativity of the design outcomes (Goldschmidt and Smolkov, 2006) but very few investigations have dealt with the emotional processes that underlie the effects of external information.

An investigation described the mental process of analogy reasoning of architects (Leclercq and Heylighen, 2002). Another has shown how designers transform words into mental images then finally into product images, with several moves of abstraction levels (Nagai et al., 2009). Sketching is an important part of design practice and design education and there has been a large amount of research investigations on the sketching activity by designers. As (Schön, 1992) defined it, design can be seen as a reflective conversation based on a generation-visualization loop, made possible by the production of hand-made drawings. Based on observations of the usual practice of sketching, it was confirmed by later studies that sketching would enable to designers to visualize and interpret their ideas and the visualization of their own sketches would give a new twist to their idea flow (Van der Lugt, 2005).

In the design process, visual information are a major support for analogy-making. Two famous examples are "Juicy Salif" lemon squeezer would have been inspired by sci-fi comics byPhilippe Starck as a young boy (Lloyd and Snelders, 2003) and The Dancing Building in Prag, designed by Frank O. Gehry from a movie dancing scene with Fred Astaire and Ginger Rogers (Kacher et al., 2005).

**Figure 2.** « Tancicky Dum », Prag. Frank O. Gehry, based on (Kacher et al., 2005)

Aside these famous examples of visual inspiration, it has been frequently observed by researchers that designers intensively browse images from magazines or websites and used collection of precedents.

To support this common practice among designers, design-dedicated softwares or interfaces have been developed to retrieve images, such as ProductWorld (Pasman et al., 2003), CRAI (Kacher et al., 2005), Cabinet (Keller et al., 2005), TRENDS (Mougenot et al., 2008)

A study with four architectural designers who had to describe verbally their mental path, (Leclercq and Heylighen, 2002) observed that 5.8 analogies/hour were made. Some studies have demonstrated that images have a positive impact onto design creativity. For instance, (Christiaans, 1992) showed that the use of visual stimuli helped designers to produce more outputs; visual stimuli lead to the production of more ideas. Also, (Goldschmidt and Smolkov, 2006) compared the level of creativity of designers' outputs, in two different working environments: with or without visual stimuli surrounding the designers. This study showed that visual stimuli not only help designers to produce more ideas but also they help designer to produce outputs with a higher level of creativity.

### 1.2 Emotional elicitation by external stimuli

As we could observe in previous investigations (Mougenot et al., 2008), designers use external stimuli not only for analogical reasoning but also for emotional elicitation. As mentioned by professional designers in a series of interviews, "searching inspiration" during a design project means trying to find new ideas but also experiencing emotions.

**Figure 3.** During experiment: a designer is selecting and commenting "useful" images


**Figure 4.** Selected images are annotated with explanations about their "usefulness"

Also, when looking at pictures of which designers had to evaluate the utility value in a given design task, all designers commented the pictures in term of emotional impact they experienced. They selected these pictures because they can feel an impression of "freshness", "coolness", "simplicity" and so on. In this case, the visual stimuli caught designers' eyes because they helped to experience a feeling or an emotion.

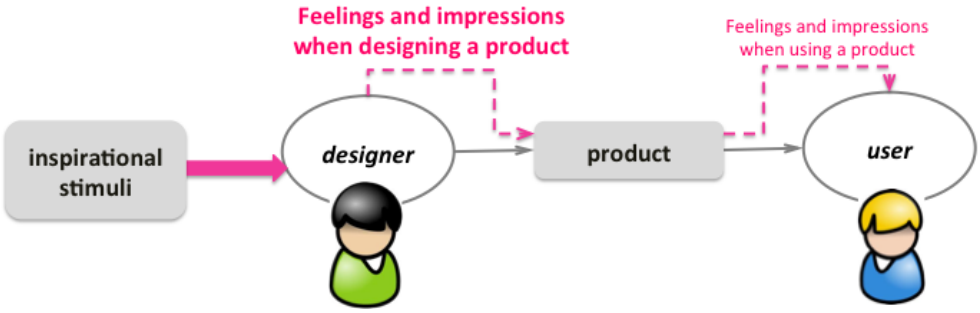


**Figure 5.** Studying feelings and impressions when designing

## 2. Research question

Much effort was put on understanding how stimuli could support design creativity and analogical reasoning. However, how to support the creation of emotional value was not much investigated.


**Figure 6.** Emotions as the fourth component of creativity?

As we saw earlier, the visual modality has been largely studied because designers are known to intensely use visual sources of inspiration (magazines, pictures, mood boards…). Other sensory modalities have remained outside the scope of design investigations so far. Yet, designers are human beings with their own impressions and emotions which are affected by all sensory modalities and we believe that designers' experience, including emotional, influence the whole design process and the quality of the design outputs. Thus, in our investigations, the focus is set on the designers' themselves and our goal is to understand how external information affects the designers' emotional processes and level of creativity.

Our research hypotheses are the following:

H1 : Sensory stimulation boosts designers' creativity.

H2 : Stimulation of memory recall boost designers' creativity.

## 3. Experiment 1: Stimulation with sound-symbolic words

### 3.1. Motivation

In this experiment, we aimed at exploring the role of onomatopoeias, a special type of word in Japanese language, in creativity and creation of emotional value.

In Japanese language, onomatopoeias allow people (and designers) to evoke several aspects related to products, like physical properties, emotional properties and impressions. Since they are learned in early childhood, they are used very spontaneously and they are considerably more effective than usual words in conveying feelings and moods or in describing states, motions, and transformations. Their meaning is complex and thus very useful in daily conversation among adults and even in formal written language. They are an intuitive way to express emotions and abstract concepts.

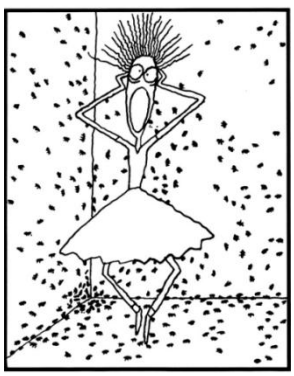

**Figure 7.** Illustration of "uja-uja". Describes many small things gathered together and moving, such as swarm of insects or a crowd of people seen from a distance. (Gomi, 2004)

In this experiment, we tried to identify the effect of onomatopoeias, when used as language stimulation, on designers' creativity. Since onomatopoeias convey many useful aspects in the context of design, they might positively influence the level of design creativity compared to non-onomatopoeias words.

### 3.2. Experiment Design

The experiment was conducted with 52 participants, design students in 1st and 2nd year of college at Tokyo Design Academy. The participants were divided into two groups. Each participant has to sketch four concepts of products (clock, chair, glasses, mobile phone), in the order that was indicated in the form, to globally balance any order effect. Each product concept was associated with a describing word, either an onomatopoeia or a regular adjective with a close meaning.

**Table 1.** Experimental design (O: onomatopoeia, R: regular word)

| | **Group A N=26** | **Group B N=26** |
|---|---|---|
| **Product to be sketched** | Type of word in brief | Type of word in brief |
| Happy + Glasses | R | O |
| Masculine + Chair | O | R |
| Hot + Clock | R | O |
| Mellow + Phone | O | R |

Examples of design concept are shown in the following figures. Figure 8 shows an example of a "mellow phone", the shape and texture of which change with the ON / OFF use status.

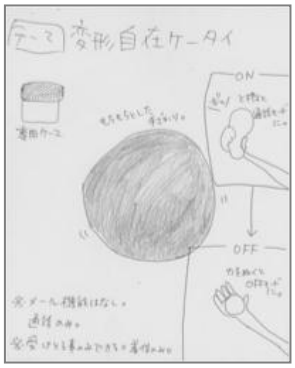


**Figure 8.** Example of [Mellow + Phone] concept

As a result, we observed that sound-symbolic word used as inspirational stimuli tended to support the design of products with a higher user-friendliness and emotional value when used as language stimulation.

## 4. Experiment 2: auditory stimulation vs. visual stimulation

### 4.1. Motivation

The study of design practice should not concentrate on the sole visual modality. Sound for instance is a powerful emotion-trigger. This experiment tries to answer the following question: Can design creativity be enhanced by auditory stimulation?

We expect that auditory stimuli will support design creativity as much as visual stimuli do but also we expect that the type of creativity supported by auditory stimuli will be different from design creativity stimulated by visual stimuli.

### 4.2. Experiment design

25 participants had to sketch a new concept of chair, either after having looked at a picture (n=13) or having listened to a sound (n=12), both representing the same situation or product (e.g: picture of a fireworks in the visual condition and sound of a fireworks in the auditory condition). Four different types of stimuli were given: crying baby, waterfall, hair-dryer, and fireworks.

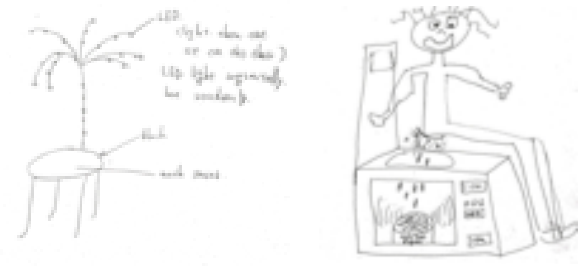

**Figure 9.** Examples of sketches produced by participants. Left: visual condition / Right: auditory condition (Stimulus: "Fireworks")

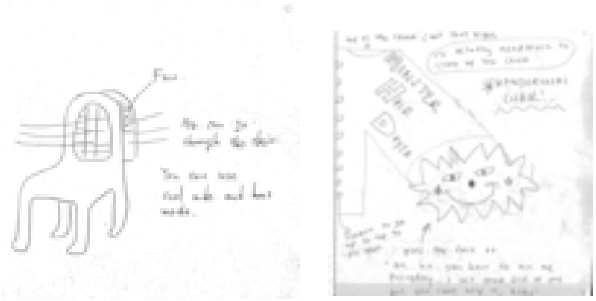

**Figure 10.** Examples of sketches produced by participants. Left: visual condition / Right: auditory condition (Stimulus: "Hair-dryer")

The novelty of each concept was assessed by two external judges (experienced designers). The assessment was based on a guideline we designed with the idea that design creativity should be reflected in artifacts with high emotional value and novel modes of usage and user-interaction.

**Table 2.** Guideline for assessing the originality of the concepts sketched by the participants

| **Low-level features** (look, shape, color, texture) | **High-level features** (use, interaction, experience) | |
|---|---|---|
| not novel | not novel | → 0 |
| novel | not novel | → 1 |
| novel / not novel | slightly novel | → 2 |
| novel / not novel | highly novel | → 3 |

As an example, a chair concept that had a novel shape but no originality in its usage received a "1". The results show that auditory stimuli, as compared to visual stimuli, tended to support the production of more original design concepts.

### 4.3. Results and discussion

The ratings given to the sketches of each group, in the four cases and throughout the whole experiment where examined (figure 11). The average scores for the group with visual stimuli vary between 0.77 and 1.08, with an overall average of 0.88. Given their low scores, the sketches of this group seem to be original in term of low-level features only, like shape, pattern or texture. The average scores for the group with auditory stimuli vary between 0.83 and 1.89, with an overall average of 1.42. This group generated more novel concepts, with a tendency towards original high-level features, like new modes of using the product or interacting with it.

A two-tailed t test was performed. In all cases, the inter-judge agreement (Cronbach's alpha) was higher than 0.7, which we consider acceptable in this context.

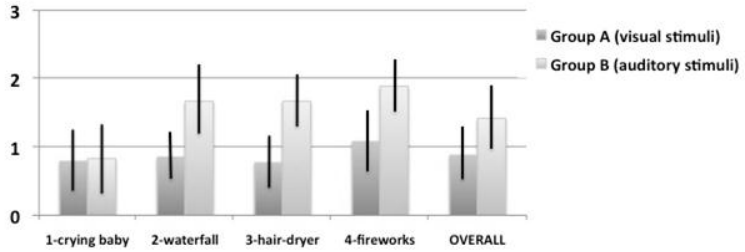


**Figure 11.** Average originality scores

In the case of stimuli #1 and #2, there was no statistically significant difference between the groups. As of stimuli #3 and #4, and also throughout the whole experiment, the sketches produced with auditory stimuli received higher scores than the sketches produced with visual stimuli and this difference between groups was statistically significant.

**Table 3.** Comparison of group A (visual condition) and group B (auditory condition)

| **Stimulus** | **Inter-judge agreement (Cronbach's alpha)** | **Group A / Group B comparison (Two-tailed t test )** |
|---|---|---|
| 1: crying baby | 0.743 | t (19) = 0.101; NS |
| 2: waterfall | 0.787 | t (23) = 0.92; NS |
| 3: hair-dryer | 0.8 | t (21) = 2.74; p = 0.012 |
| 4: fireworks | 0.866 | t (23) = 2.36; p = 0.027 |
| overall | | t (91) = 2.93; p = 0.004 |

The examples in figure 5 and figure 6 illustrate how the participants who received auditory stimuli generally tended to imagine new stories based on their personal experiences and to create products that embodied these stories.

In the "hair-dryer" condition, the auditory condition made the participant remind of her/his personal daily experience of drying hair, which she/he judged boring; thus, the proposed concept aims at giving the product user the same experience: the user has to climb up a ladder to eventually be able to sit on the chair after a big "boring" effort.

In the "fireworks" condition, the product concept developed in the auditory condition made the user experience, through the haptic sense, the same impressions as the participant when listening to the sound of fireworks. Besides, a new way of interacting with a chair was proposed to the user.

## 5. Discussion and conclusion

The experiments showed that with auditory stimuli, the participants tended to create original experiences and new ways of interacting with the designed product; they also tended to address a wider range of senses and to create products that arouse deeper impressions and emotions among users. The analysis of the sketches annotations shows that the most original concepts were produced after a recall of personal experiences and memories which where elicited in higher number in the auditory condition. Sounds have the potential to help designing products with unique affective properties because they may afford more freedom for sketching, unlike pictures, which might tend to prime designers toward irrelevant low-level image properties like shape or color. Our experimental results support the idea that auditory stimulation boosts designers' creativity. Thus, we think it would be useful for designers to use sounds, not only images, as creative stimulation in the design workplace.

In our paper, we proposed a research approach where creativity and designers' experience are both taken into account in the study of design protocols. Through an experimental approach reproducing usual creative process of designers, we could observe that designers' creativity was enhanced by an auditory stimulation, as compared to a visual one (Experiment 1). It was also observed that the stimulation by sound-symbolic words (in Japanese language), as compared to regular words, elicited higher emotional arousal and led to the generation of design concepts with higher affective value (Experiment 2).

Overall, our study helped to get a better understanding of the role of designers' impressions in the design process and shows that it is necessary to stimulate designers' own affect in order to enhance design creativity. These results lead to practical recommendations for design practice, like using a large variety of stimuli from various types, visual stimuli but also auditory stimuli.

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