

AESTHETICS BASED ON “SYNESTHETIC KANSEI”

SEARCHING FOR THE MECHANISM OF “EMBODIMENT” AS THE FOUNDATION OF DESIGNING

Makito OHTSUBO^a, Hiroya IGARASHI^b and Daichi MISAKI^b

^a Nagoya City University Graduate School of Design and Architecture, Japan

^b University of Tsukuba Graduate School of Comprehensive Human Science, Japan

ABSTRACT

In “design world”, there are two kinds of people. They are designers and users. From when designing began, they were communicating each other, some how. As an example, they communicate by sharing “cognition of beauty”. But we don’t know exactly how does it possible. In this paper, we tried to find the foundation of communication between designers and users through simple experiments regarding “cognition of beauty”. In those experiments, we let the subjects divide a line at their will. And as a result, we find some tendencies even in that simple action, which we regard as a very primitive act of design. We are going to call embodied abilities behind act of design “Synesthetic KANSEI”.

Keywords: *Synesthetic KANSEI, embodiment, cognition of beauty, rules of beauty.*

1. INTRODUCTION

1.1. Designing

R. Buckminster Fuller divided all of humanity’s tools into two main groups. One is “the craft tools” and the other is “the industrial tools” [1]. His criterion of this classification was that the tool “could be invented by one man starting all alone” or not. So that means, he said, the first industrial tool was the spoken word that needed two persons at least. Applying this hypothesis into product design, we can notice the fact that minimally two persons are always needed.

^aMakito OHTSUBO: 2-1-10 Kita-Chikusa, Chikusa-ku, Nagoya-shi, Aichi, 464-0083, Japan, ohtsubo@sda.nagoya-cu.ac.jp.

There are two types of people related to designing. Designer and user are those types. And also we can divide action of designing into two types. One is the action that designing product, and the other is the action that using product [Figure.1].

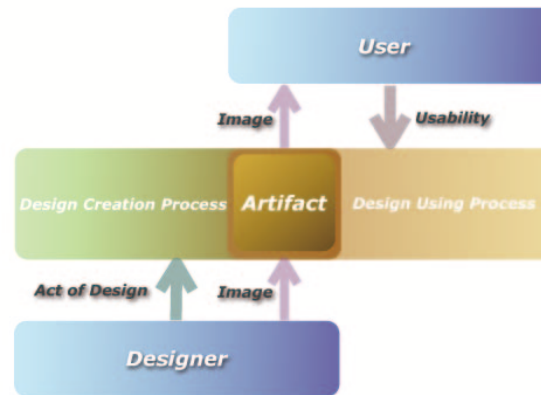


Figure 1: Two types of designing

Our casts of design theater are product itself, designers and users. These three casts establish “design world” we call.

Some strange phenomenon occurs in this design world. Fundamentally, dis-communication lies between every relationship (the designer and the product, the product and the user). Every experience in this world is subjective. There seems to be no foundation that ensures communication between designers and users. But still design history tells us the success of our designing.

We are interested in this phenomenon. We think there is some design theory needed to solve this dis-communication problem. Such as it is the same meaning as objective-subjective cognition of design. We suppose phenomenological tradition in philosophy may be one of the good references [2].

1.2. Enactive interface

We discussed around the enigma above for several years [3, 4]. We picked the word “embodiment” up through discussion. When one mastered the way of using some artifact completely and could use it without being aware, we call this condition “embodiment”. At this point, we argue that the artifact equips “Enactive Interface”. The word “enactive” expresses a condition when action and cognition occur at the very same time [5]. We treat “Enactive Interface” as an ideal status of artifacts’ user interface.

And also, natural but very important point is that designer and users both have bodies. This is one of the reasons why we choose such keyword as “embodiment” and settle it as a foundation of our research project. Design always starts from one stroke of line on a paper drawn by a body of a designer.

1.3. Image and interface

As shown on Figure 1, designing shared by designer and user in two ways. They are “image” which expresses identity of the product and “interface” which expresses direction for

use. Mainly, the concept “embodiment” concerns with “interface”. On the other hand, it is believed that “image” relates to aesthetic issue, or “cognition of beauty”. When Maturana and Varela proposed the concept “Autopoiesis”, they invoke some paired concepts like “Autopoiesis and Cognition” [6].

Despite the explanation above, we also think that “image (cognition of beauty)” and “embodiment (interface)” are related. For example, there is a notable research done by Kurosu and Kashimura [7] (Once D. A. Norman mentioned about this research in his book [8]). Their conclusion was that apparent beauty might affirmatively affect the evaluation of user interface.

1.4. KANSEI towards beauty

There may be some tendency that all the human beings shares in cognition of beauty. There are some experienced designers who constantly provide products that impress and satisfy users. We never think that the designers take a decision on a hit-or-miss basis. They usually design with confidence that is on some sort of basis of universality.

Experienced designers may be trained in the use of KANSEI, which is shared potentially by all the people. In this paper, we named the main concept “Synesthetic KANSEI” by way of experiment. By using this term, we are trying to represent a part of KANSEI, which embodied and used by human beings through some sort of synesthetic mechanism.

2. PURPOSE

The purpose is to investigate the tendency of human being’s cognition of beauty through simple experiments. Result may lead us to find the trigger to define “beauty” by designer, and to evaluate “beauty” by user.

Our whole project’s goal is to understand the mechanism of “embodiment” as the foundation of designing. In this paper, the topic is limited to aesthetic issue, but this point of view will form a part of the whole project, we believe.

3. SYNESTHETIC KANSEI

3.1. Synesthetic KANSEI

We are trying to search what we call “Synesthetic Kansei” which can be shared by people and can be a basis of design practices. “Synesthesia” is a neurologically based phenomenon in which stimulation of one sensory or cognitive pathway leads to automatic, involuntary experiences in a second sensory or cognitive pathway. On the other hand, “Synesthetic Kansei” is defined as a sense that is equipped implicitly by people based on some common ground (ex. we are grown on the earth with no exceptions). For instance, we use such expression as “warm colour” in everyday life. But in this case, “warm” means a sensation we percept through our skin (or nerves that detect changes in temperature), meanwhile “colour” is a stimulus we percept through our eyes (or optic organ). This kind of intersensory process is seen often around our everyday activities. We conceived of the idea of the term “Synesthetic KANSEI” based on those kinds of human ability.

Besides, we keep in mind of the concept “common sense” which is broadly introduced by a Japanese philosopher Yujiro Nakamura following the philosophical tradition from Aristotelian era [9]. He criticized dominance of visual sense in science literature, such as experimental psychology for example. And he advocated the importance of “common sense” as a function that integrates all the sensation in humane way.

3.2. The Golden Ratio and other rules of beauty

The Golden Ratio not only pulls mathematician’s concern but also is applied in art and design as a criterion for visual aesthetics since when it was discovered in ancient Greece.

And also, there are many rules of beauty, such as “symmetry”, “Fibonacci sequence”, “rules of thirds”, and so on.

Designers have been using these rules consciously or unconsciously in their activities. And they sometimes succeed, and sometimes not. Important point is that we are still not sure why those rules bring us aesthetic feelings.

3.3. Fechner’s work

History of psychological research on the Golden Ratio dates back to Fechner’s work in 19th century. He proposed three ways of research. They are as follows:

1. The method of choice - subjects choose, from among a number of alternatives, the item that they like (or dislike) the most.
2. The method of production - subjects are asked to draw, or otherwise create, an object of a certain kind that has features or proportions they find most agreeable (or disagreeable).
3. The method of use - the experimenter examines pre-existing objects of the kind being studied, and determines whether they conform to certain hypotheses about the determination of aesthetic pleasure.

Since the Fechner's time, many researchers followed and refrain experimental researches, but still there is no consensus about the mechanism of the Golden Ratio [10].

In this paper, it is not a main purpose to find the mechanism of the Golden Ratio, but we agree that the Golden Ratio can be refereed as the standard of beauty. As reported as follows, we conducted three experiments. These experiments look like following type 2 of Fechner's experiments as a result. In experiment 1, the Golden Ratio was used as criteria of results. And it was unnecessary constraint for the purpose of this paper. In experiment 2, implicitly aesthetics was considered, but main purpose was about diversity of expression. In experiment 3, to investigate the reason for the embodied cognition of beauty, we considered the scheme of experiment.

4. EXPERIMENT 1

Regarding the Golden Ratio phenomena, we conducted a simple experiment to find if it is based on universality (instinct) or mere ability that needs training.

Subjects were 49 healthy male and female from 19 years to 22 years old (major: design 49). First, they were shown approximately 130.9 mm line segment. Second, they were directed to

divide the line segment into beautiful ratio (except dividing equally) at their sense. Third, they were directed to measure shorter part of the line segment.

When the shorter part is 50 mm, the line segment is divided in golden ratio as a result.

4.1. Result of experiment 1

7 subjects (16%) made 50 ± 1 mm shorter part. 27 subjects (55%, including the former) made 50 ± 5 mm shorter part.

According to the nature of the school that they belong, subjects were not well trained in art skill before they entered the school. But still half of them left good result.

4.2. Discussion of experiment 1

Actually speaking, this experiment was held as an introduction of a lecture about beauty of form, to let the students feel a sense of good proportion. Because of these situations of the experiment, we would say that the control of the experiment was not enough (prohibition of equal division, for example). So we would better wait for further argument until strict data will be gathered.

5. EXPERIMENT 2

We conducted another experiment to find the tendency when people divide a line with their sense of values. Subjects were 42 male, and 38 female (80 total) from 18 years to 26 years old (college students, major: design 30, medicine 30, others 20). The stimuli were two types of line segment; a: 70mm segment line divided into 7 equal by 1mm mark [Figure 2], b: 70mm segment line divided into 8 equal by 1mm mark [Figure 3]. Instruction was "Please divide the following segment line with one line." Considering order effects, 40 subjects were tested by a-b order, other 40 subjects were tested by b-a order.



Figure 2: 7 divided line



Figure 3: 8 divided line

5.1. Result of experiment 2

On the whole, a dividing point tends to be shifted to left from the center of segment line ($p < .05$). Compared with majors (design and non-design), there was a significant difference on the value of variance in dividing points distribution ($p < .05$).

5.2. Statistics on a basis (analyzed by JMP 6.0.3)

These are the data that analyzed using t-test for each divided into 7 and 8. The results are as follows:

Whole samples

N	160 (80*2)
Average	-0.0519
Df	159
S.D.	0.2659
Average test (H0=0)	
	t-test
Statistic	-2.4691
p (Prob > t)	0.0146

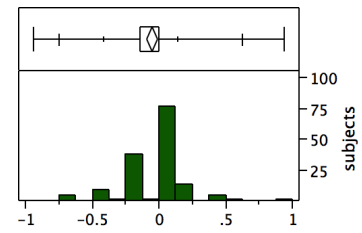


Figure 4: Distribution of dividing points (Whole samples)

Comparing number of divide (“Divided into 7” with “Divided into 8”)

“Divided into 7”		
N	80	
Average	-0.0461	
df	79	
S.D.	0.26464	
Average test (H0=0)		
	t-test	Wilcoxon signed-rank test
Statistic	-1.5595	-262.500
p (Prob > t)	0.1229	0.0166

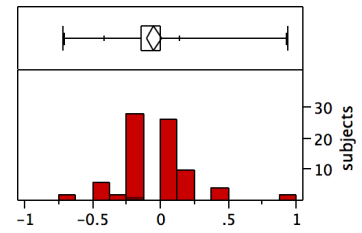


Figure 5: Distribution of dividing points (Divided into 7)

“Divided into 8”		
N	80	
Average	-0.0577	
df	79	
S.D.	0.26869	
Average test (H0=0)		
	t-test	Wilcoxon signed-rank test
Statistic	-1.9195	-94.5000
p (Prob > t)	0.0585	0.0376

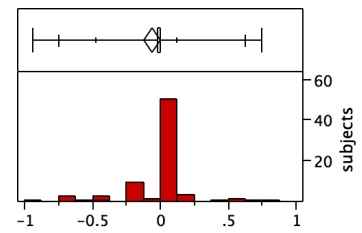


Figure 6: Distribution of dividing points (Divided into 8)

Comparing majors (“design” with “non - design”)

“Design”		
H0	116	
Average	-0.0456	
df	115	
S.D.	0.29647	
Average test (H0=0)		
	t-test	Wilcoxon signed-rank test
Statistic	-1.6553	-339.000
p (Prob > t)	0.1006	0.0208

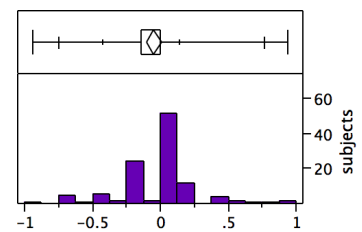


Figure 7: Distribution of dividing points (Design)

“Non - design”

N	44	
Average	-0.0686	
df	43	
S.D.	0.16113	
Average test (H0=0)		
	t-test	Wilcoxon signed-rank test
Statistic	-2.8247	-66.0000
p (Prob > t)	0.0071	0.0044

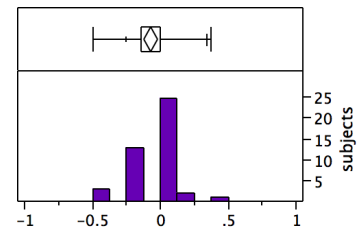


Figure 8: Distribution of dividing points (Non - design)

All values of average are minus (A dividing point tends to be shifted to left from the center of segment line).

Compared with Design and Non-design, it suggests that there was a difference on S.D.

5.3. Discussion of experiment 2

It is interesting that a dividing point tends to be shifted to left from the center of segment line. It seems to the tendency of human kinds. The reason is not certain, but there is one possibility of reason that most of the subjects are right-handed (75/80). Almost right-handed people uses right hand when drawing line. When drawing line, their right hand cover right side of line. We think that is the one reason to shift left. We think the asymmetry of our body function cause the asymmetry of dividing points. We can expect the relation between aesthetics and “Embodiment”.

It is also interesting that there was a significant difference on the S.D. in dividing points distribution when it compared with majors; design and non-design [Table 1, Figure 9]. From this result, subjects in design group have more diverse senses of value than non-design group. Or subjects in design group have synesthetic sense, and they may represent with using the divergence from that sense.

6. EXPERIMENT 3

Two experiments reported before were hold simultaneously but at the different places. And also the purpose of experiments was a bit vague. By examining these results, we conducted next experiment.

Subjects were 67 healthy male and female from 19 years to 22 years old (major: design 63, non-design 3). First, they were shown approximately 130.9 mm line segment. Second, they were directed to divide the line segment into beautiful ratio at their sense. This time, we did not prohibit equal division. Instead, we let them try the same task twice, so that various results were expected. Third, we asked them to write down comments on the reason why they thought each proportion of segments was beautiful.

When the shorter part is 50 mm, the line segment is divided in golden ratio as a result. This is same as the experiment 1. And there is no “tick mark” on the line segment like in experiment 2.

6.1. Result of experiment 3

Among 134 trials (67 subjects x 2 trials), equal division appeared 50 times (37%). On the other hand, close to exact golden ratio appeared only twice (1%). Even when we include 50 ± 5 mm shorter part division, the number of appearance was 18 (13%).

Following the finding in experiment 2, we calculated the average of length of divided point from left edge. The value was 56.7 mm, which indicates a tendency of divided point to shift to left from the center of segment line. 59 subjects were right-handed.

6.2. Discussion of experiment 3

Multitude of equal divisions and diversity of the other values were expected results. We took the results as a matter of course. But “left shift tendency” was found again in this experiment. It might be able to be said that the phenomenon is general.

Although we do not know still why, we might be able to add “discussion in cognitive linguistics” to the hypothesis such as “effect of right-handed” or “effect of mathematics education”. Cognitive linguistics was first proposed by George Lakoff and Mark Johnson [11]. One of their arguments is that metaphor is both embodied and situated in a specific environment. The term “image scheme” represents their theoretical stance. For instance, there are many artifacts that express passage of time by using rotation. It is believed that there is “cycle scheme”, which had been embodied by human being through experiencing natural phenomena such as cycles of day and night. In a similar way, there may be “embodied significance” buried in the position of a from-left-to-right line segment.

Another interesting findings were in subjects’ comments. Although examples are not many, several subjects mentioned about artifacts used by their hand such as sword, spear and ice-lolly, in their answers why they thought each proportion of segments was beautiful. They might have imagined those artifacts as mere visual image. However, in their imagination, they might have grabbed those artifacts and have used kinetic sense to evaluate the beauty of line segmentation. If so, there might be “Synesthetic KANSEI” in their decision of action, since they used kinetic sense to evaluate visual beauty.

7. CONCLUSION

As a statistical result, we can only say that there is a tendency of divided point to shift to left from the center of segment line. Although we need further investigation to find the reason, the tendency is very curious for understanding embodiment in designing.

Values of division ended up with diversified results. However, we found some clue to imply the existence of “Synesthetic KANSEI” in subjects’ comments. Semantic investigation might be effective.

From now on, we will try to clarify how it is shared through further experiments. And then, we want to find the foundation of “Synesthetic KANSEI” which can be utilized by designers.

8. FUTURE VIEW

The series of experiments were done by using horizontal line segment only. At the next experiment, we would better use another condition also, vertical line segment for example, so that the reason may be cleared why dividing points tend to be shifted to left from the center of the line segments.

Regarding semantic investigation, we can try to extract keywords from comments we gathered to utilize in some method like semantic differential method.

We believe that further research will bring us deeper insight about relation between embodiment and cognition of beauty and act of design.

REFERENCES

1. Fuller, R. B., *Operating Manual for Spaceship Earth*, Lars Müller Publishers, Baden, p. 122, 1969.
2. Merleau-Ponty, M., *Phenomenology of Perception*, Routledge Classics, 2002.
3. Ohtsubo, M., Igarashi, H., Uemura, T., Embodiment Background of Enactive Interface (*In Japanese*), *In the 8th conference proceeding of Japan society of Kansei engineering*, Tokyo, 2006.
4. Igarashi, H., Ohtsubo, M., Design system based on embodiment, *In the proceeding of Design Symposium 2008*, Tokyo, 2008.
5. Varela, F. J., Thompson, E., Rosch, E., *The Embodied Mind*, *The MIT Press*, 1991.
6. Maturana, H. R., Varela, F. J., *Autopoiesis and Cognition – The Realization of the Living*, D. Reidel Publishing Company, 1980.
7. Kurosu, M., Kashimura, K., Apparent Usability vs. Inherent Usability – Experimental analysis on the determinants of apparent usability, *In the CHI Companion 95*, Denver, Colorado, pp. 292-293, 1995.
8. Norman D. A., *Emotional Design – Why We Love (or Hate) Everyday Things*, Basic Books, p. 17, 2004.
9. Nakamura, Y., *Kyōtsu Kankaku Ron (Common Sense Theory) (In Japanese)*, Iwanami Shoten, Tokyo, 1979
10. Green C. D., All that glitters: a review of psychological research on the aesthetics of the golden section, *Perception*, 24(8), pp. 937-968, 1995.
11. Lakoff, G., Johnson, M., *Metaphors We Live By*, University Of Chicago Press, 1980.