

Kansei Comparison of Form -ratio between Cubic Model and Refrigerator

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Abstract. Form-ratio means the ratio of Height/Width/Depth in 3-dimensions. The golden ratio or golden section is included as one of the form-ratio. Kansei Engineering System has some basic design databases. Form-ratio and color are basic design elements and they are very important for designing various products in viewpoint of Kansei Engineering. The subjects evaluate the form-ratios of 3-dimensional cubes and virtual products (refrigerator) with SD-scale kansei words (feelings and images). The golden ratio was evaluated as "not beautiful" in refrigerator. We compared with the kansei of cube model and virtual product, and obtained databases of the relationship between the form-ratio and kansei.

1. INTRODUCTION

Kansei Engineering (KE) is a kind of ergonomic technology for translating human feelings ("Kansei" in Japanese) into a new product design. It supports customers and designer constructing a product that is appropriate to his or her kansei. It is very popular as a product development methodology in the world as well as in Japan. (Nagamachi, 1989)

Kansei Engineering System (KES) which is an expert computer system which enables translation from Kansei to product design elements and vice versa. This means that it is able to show the physical product design elements fit to customer feelings (kansei) of product on the basis of Kansei database consisted of the relationships between design elements and their kansei. So far, many kansei databases such as automobile, costume, cosmetic products have been constructed on the basis of kansei experiments and used as main part in KES. We proposed to construct basic kansei design database as well as particular database in KES (Nagamachi et al.; Nishino, 1997).

Form-ratio and color are basic design elements

and are very influential for human feelings to various products (Nagamachi et al., 1996; Ichitsubo et al., 1998; Komatsu et al., 1998). Therefore, the databases of these basic design elements are very important in viewpoint of kansei product design. This means that users who input their Kansei into KES are able to get the basic form-ratio and color design of a target product corresponding to their feelings (Nishino et al., 1998; Nishino et al., 1999).

Accordingly, the purpose of this study is to estimate the construction of form-ratio database for KES. The experiments based on the semantic differential method (SD) were carried out to observe the relationships between kansei and form-ratio, using the form-ratio of cube model and refrigerator created by computer graphics. The data obtained in this way provide us a great deal of information concerning the relationship between form-ratio and kansei through quantification theory type I.

2. EXPERIMENTAL AND ANALYTICAL PROCEDURES

2.1 Measurement of Image Perception

Form-ratio meant the ratio of Height/Width/Depth in 3-dimension. Using the software Lightwave 3D, we constructed the cube model and virtual products with a variety of form-ratio. Figure 1 shows the defined form-ratio Y/X and the virtual product sample which has 2 items and 11 categories. Each objects of cube and refrigerator has 9 form-ratios

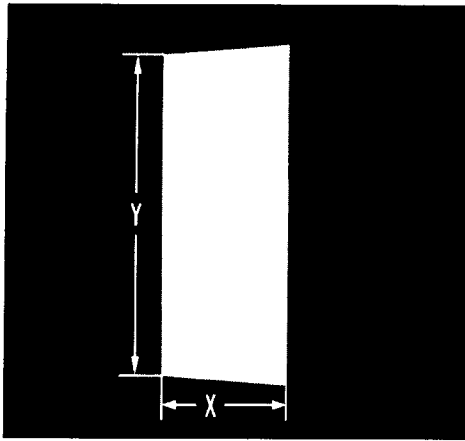


Fig. 1 Virtual Objects and Item/Category used in Experiment

virtual graphics were evaluated by 40 students (20 male and 20 female, age19-22) with SD-scale of each kansei words.

2.2 Statistical Analysis

We obtained the databases of the design elements and the kansei words. We applied the Quantification Theory type I into kansei evaluation of cubic model

Design Item	Category
Form-ratio	1:3.66.
	1:3.33.
	1:3.00.
	1:2.66.
	1:2.33.
	1:2.00.
	1:1.66.
	1:1.33.
	1:1.00.
Color	Gray
	Brawn

from 1:3.66 until 1:1 with two colors. Figure 2 shows the experimental sample. The form-ratio of cubic model and refrigerator is varied in types from 1:1:1 to 1:1:3.66 including the golden ratio 1:1.66.

We selected 31 adjective pairs of kansei monitoring virtual form-ratio model from kansei word database which has approximately 1,800 Japanese adjective based on three layer kansei structure model that is consisted of physical, impression and value kansei. Each form-ratio and

and refrigerator to find out the correlation between the form-ratio and kansei words.

3. RESULTS OF THE ANALYSIS

3.1 Kansei Analysis of Form-ratio in Cubic Model

Multiple correlation coefficient was very higher to estimate the Kansei from form-ratio. Fig 3 shows the relationship bar graphs by the category score

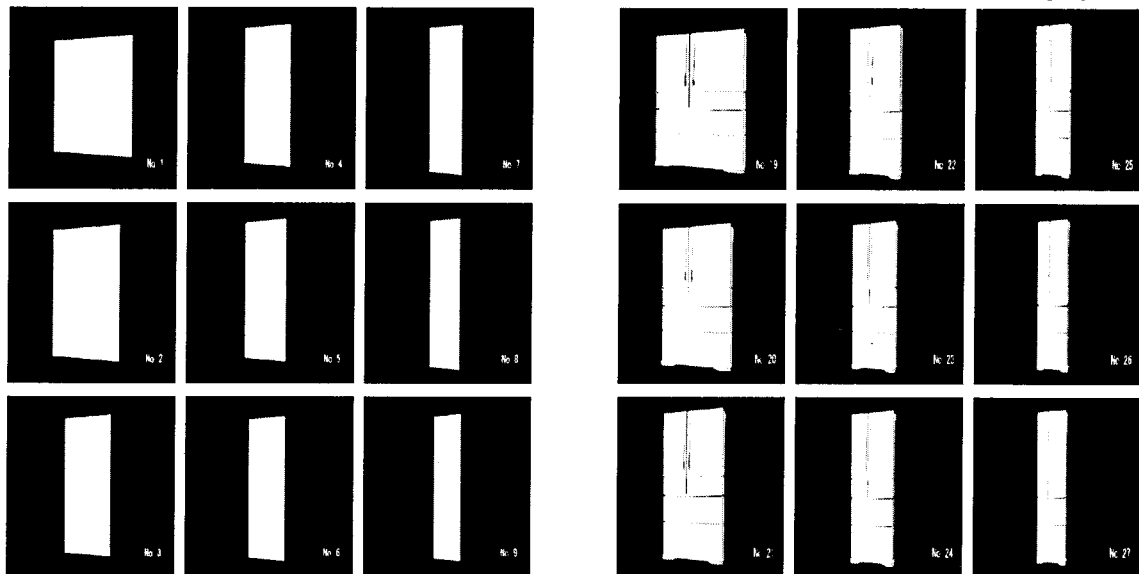


Fig.2 Experimental Sample

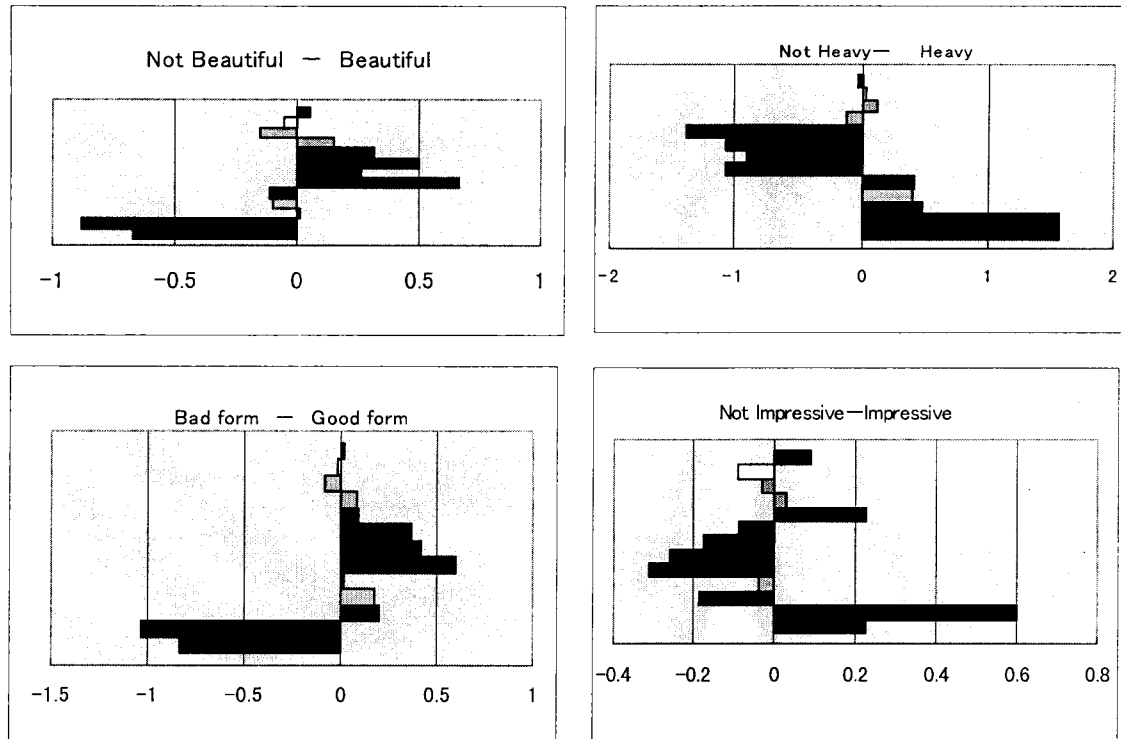


Fig.3 Category Score Pattern of Cubic Model

between form-ratio and kansei. Each bar indicates gender (female, male), color(gray, brown) and form-ratio(1:3.66-1:1) from upper side respectively. For example, Fig.3 indicates that gender and color items are indifferent to the kansei "Not beautiful-Beautiful", and that the form-ratio 1:1.33 will give the kansei "Not beautiful", but the form-ratio 1:2.66 will give "Beautiful". Golden ratio 1:1.66 shows neutral in "beautiful" kansei. The kansei "Not Heavy-Heavy" graph shows the larger the form-ratio, the more "Not Heavy". These two graphs shows linear relationship between form-ratio and kansei.

"Bad Form-Good Form" and "Not Impressive-Impressive" graphs show the curve relationship between form-ratio and the kansei. A peak form-ratio of "good form" was 1:2.66 and a peak form-ratio of "impressive" was 1:1.33. In each kansei graph, golden ratio shows neutral in "Beautiful", a little "Heavy", a little "Good form", and a little "Not Impressive".

3.2 Kansei Analysis of Form-ratio in Refrigerator

Multiple correlation coefficient was very higher in each Kansei word. Fig. 4 shows the category score

in each kansei. The kansei "Not Beautiful-Beautiful" graph shows that form-ratio 1:3.0 gives us feel the most "Beautiful" and the most "Impressive", but the form-ratio 1:1 gives us feel "Not beautiful". Golden ratio also gives us feel "Not Beautiful". Form-ratio 1:30 is typical one used in the existing refrigerator design. Form-ratio 1:1 gives us feel "Heavy", "Bad form", neutral in "Impressive". The form-ratio 1: 3.33 gives us feel "a little Beautiful", "Not heavy", "Bad form", neutral in "Impressive". Golden ratio gives us feel "Not Beautiful", "Heavy", "Bad form", "Not Impressive". In similar way, we obtained better form-ratio in 31 kansei words.

4. KANSEI COMPARISON BETWEEN CUBIC MODEL AND REFRIGERATOR

We compared with the kansei pattern between form-ratio of cube model and refrigerator. It seems that the kansei evaluation of real equipment is similar to the simple cubic model, but It is different from cubic model in some kansei evaluations which are mostly influenced by personal value and prototype model. For example, in "Not impressive-Impressive" kansei, the most impressive form-ratio

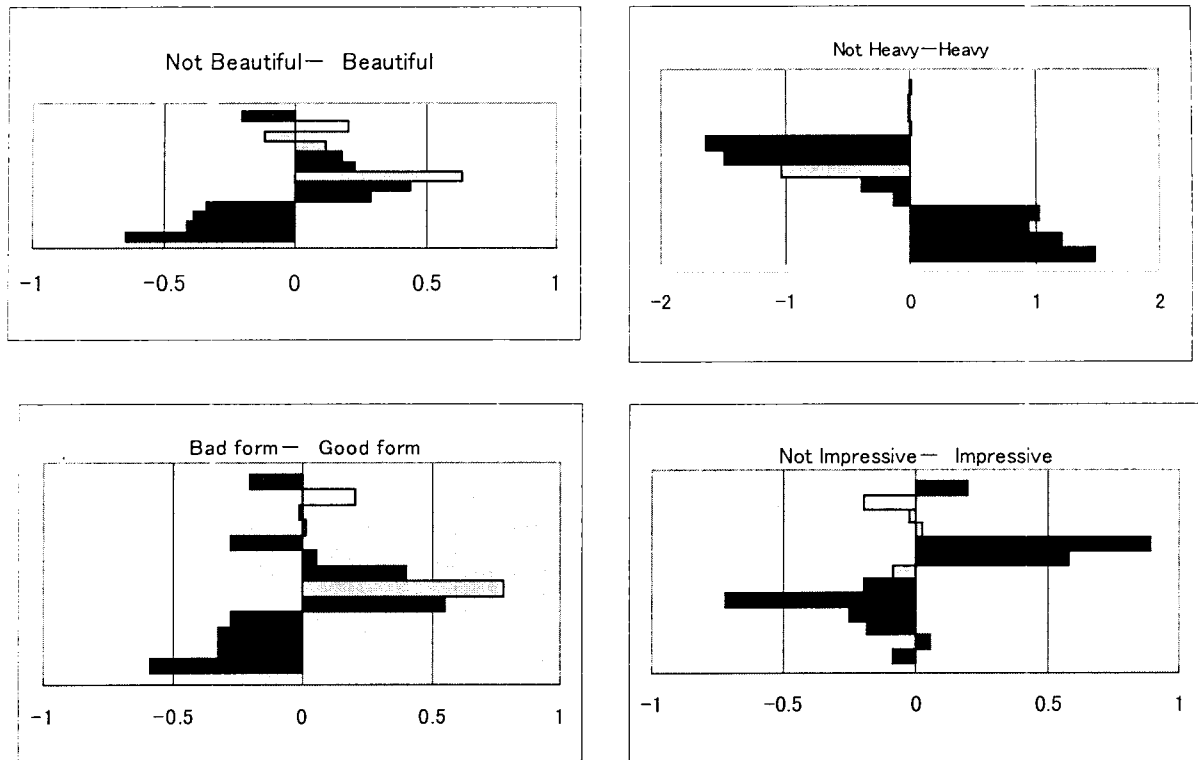


Fig.4 Category Score Pattern of Refrigerator

is 1:1.13 in cubic model, but It is 1:3.33 in refrigerator. We found out the similarity and difference of kansei evaluation between cubic model and refrigerator.

Similar kansei between cubic model and refrigerator are the feeling concerning the physical properties such as " Heavy", "Good shape", "Balanced", but different kansei between them are the feeling concerning the personal value and prototype image such as " Impressive", " Like". This means that we should classify and consider the kind of kansei such as physical kansei, image kansei, value kansei in Kansei engineering methodology.

Golden ratio should be also considered in this kansei semantic space. The golden ratio of cubic model was evaluated as " not beautiful", " good shape ", and " well balanced". On the other hand, the golden ratio of refrigerator was evaluated as " not beautiful", "not good shape", neutral in " well balanced". Golden ratio was not always " beautiful", " impressive" in cubic model and refrigerator. Rather, It was shown that Golden ratio is " Not Impressive", "Heavy", " Bad form".

5. CONCLUSION

Conclusion was summarized as follows within the scope of the experimental work. Kansei(human feeling and image) was closely related to the form-ratio. It was found that the form-ratio strongly effected on kansei through semantic space and prototype image , and the kansei evaluation of cubic model and real equipment is similar in physical kansei evaluation, but image or value kansei evaluation is different.

Further, It was found that golden-ratio was not always "Impressive" and " Beautiful". This suggests that we should consider the relationship between the form-ratio and kansei evaluation. We attempted to construct a database model as the basic designing database in Kansei Engineering System. It would be useful in designing the form-ratio of various products by Kansei engineering methodology.

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