Research on Product and Preference by *Kansei* information

-Analysis of *Kansei* data responding to visual information on Chair-

Nam-Gyu Kang* and Toshimasa-Yamanaka**

* *University of Tsukuba, Graduate school of Human Comprehensive Sciences Japan,*
rainkng1@kansei.tsukuba.ac.jp
** *University of Tsukuba, Institute of Art and Design Japan,*
tyam@geijutsu.tsukuba.ac.jp.

Abstract: When purchasing a multifunctional product, the choice is based not only on visual information but also on its performance or functionality, whereas products such as chairs are selected mainly regarding visual information. It means that the visual information of chairs strongly influences the purchase.

This research, as part of the 21st Century COE Program, sponsored by the MEXT, aims at considering the relevance of product visual information in order to understand the differences between two kinds of groups: people who have a certain experience of design, and inexperienced people. Moreover, the purpose of this research is to analyze the relation between the preferences and the delightfulness feeling of each subject.

While watching images of chairs on a big screen, each subject was asked to evaluate comprehensively each chair considering five levels (like very much, like, neither like nor dislike, dislike, completely dislike), and more precisely five visual information criteria (‘style’, ‘material quality’, ‘structure’, ‘color’, and ‘comfortable feeling of a form’). The chair images were shot from the height of people's eyes in four views (front, side, back and semi-side directions). Simultaneously, brain waves were measured (α-wave) at the frontal lobe as a physiology index. Then, the subject checked liked and disliked details on each chair, based on the four images viewed. Finally the subject was asked to select the chair he/she would prefer to buy.

Consequently, it was pointed out that the ‘style’, the ‘structure’ and the ‘color’ scores were different. Concerning the selection of the preferred chair to buy, scores also differed. Concerning the ‘inexperienced’ group, the ‘color’ criteria obtained a very high score, ‘style’ criteria being the other one to exceed ‘comfortable feeling of a form’. Concerning the ‘experienced’ group, the four criteria ‘style’, ‘structure’, ‘color’, and ‘comfortable feeling of a form’ were identically high. The opposition of the scores between both groups concerning the ‘structure’ criteria was also analyzed. The result of brain-waves analysis showed that there was no correlation between preferences and the delightfulness feeling.

To conclude, the authors suggest that *Kansei* approach should be more involved in the field of design. The authors aim at structuring a design approach based on the user's preference satisfaction

evaluation method, as introduced in this paper, preferred to an approach depending on designer's intuition.

Key words: Kansei-evaluation, preference, visual information, brain wave (α-wave), chair

1. Introduction

The Users still choose products in many cases, looking at products directly in market. However, users of today are very busy, so there are not few users who wish a method which doesn't require time and comparing various products immediately is possible. The following three examples are the method. It is to acquire the information of products from a catalog or publishing like a magazine, and to acquire information from public-media like a TV or newspaper, and to acquire information from searching goods on the Internet. This method is not to acquire information from actual products, but is a way of performing a judgment, as the decision making process, only depending on the visual-information of product, and selecting some product.

When a user buys some product or some products, the user chooses products by a certain personal standard. Then, when users select some products only depending on the visual-information, what is the visual-information which affects a user's preference most? And, what kind of relation does the tendency of one's preference to the product have with the selection for buying it? Moreover, what kind of feature will be shown as the comfortable feeling at the time the user meets and sees his/her favorite goods? Also in the design field, the research on user's *Kansei*-feature over the product is becoming more important.

2. Purpose of Research

The purpose of this research is divided into the following three purposes. The first purpose is to examine what is the design element which had an influence on users' preference most, and to consider the result, dividing it into the 2 fields (provide design (=the person who has a design experience) and the field which chooses design (=the person who doesn't have a design experience)). The 2nd purpose is to search for the characteristic of the relation between the preference of user and the position of the product. The impression of product differs by the view-position. The last purpose is to analyze the change of the brain waves while users see the product which he/she likes, and to examine concerning the preference and the feeling of pleasantness.

I would like to make a data base to support a product design by analyzing the characteristic of the users' preference in the case which a choice is done only by the visual information of the product. And then, to close the gap between the side of providing a new product (designer) and the side of selecting the product (user). This is the purpose of the last part of the this research

3. Method

In this research, the experiment which considers the characteristic of the users' preference in to each chair was done on dividing into the following two situations. The first, 4 chairs were chosen from 12 chairs by the pilot experiment which it was to evaluate a preference in to chairs. All of the 12 chairs were placed in the University of Tsukuba. (Fig.1)

The evaluation of the preference which was used for this experiment was two kinds. The two evaluation methods were the way of evaluating at once, being intuitive while seeing one product and the way of evaluating while comparing two products.

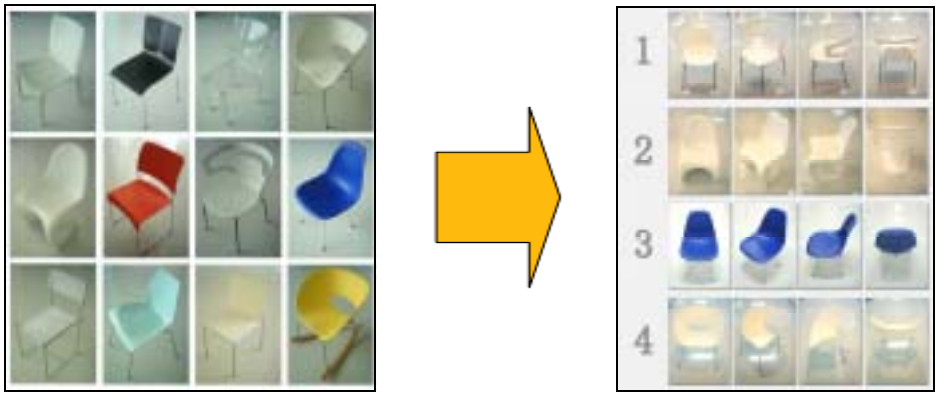


Fig.1 the cahiers were used this research

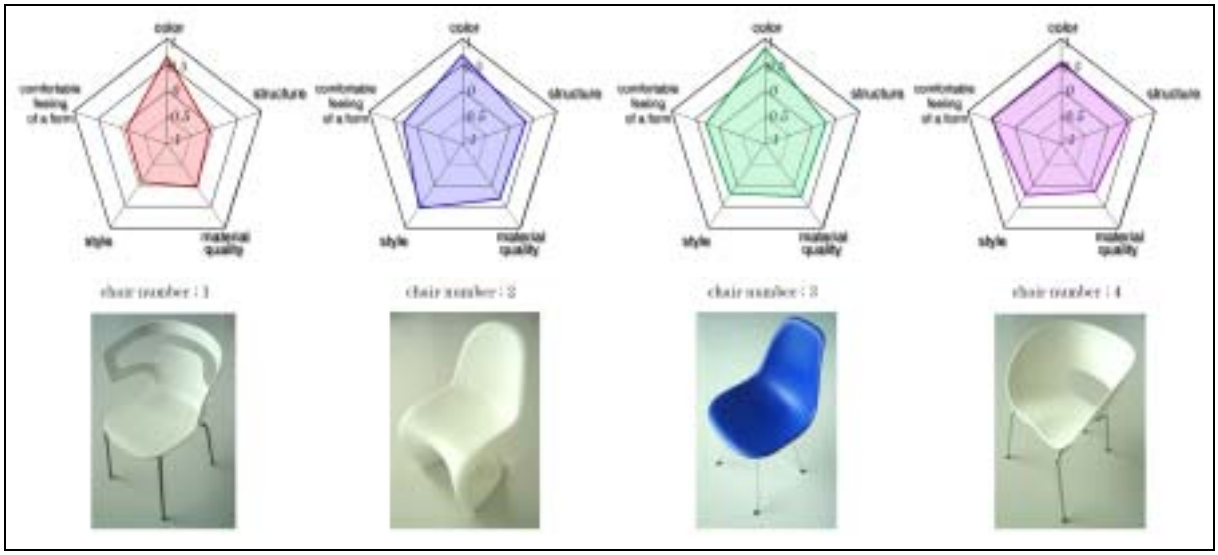
The following subjects evaluated the five visual-information criteria (‘style’, ‘Material quality’, ‘structure’, ‘color’, and ‘comfortable feeling of a form’) while seeing 4 kinds of chair images. The chair images were shot from the height of people's eyes in four views (front, side, back and semi-side directions). And then, subjects evaluated their preference to each chair. The subjects were 40 people, the persons who have a design experience were 21 people, and the persons who don't have a design experience were 19 people. The data was considered through the multivariate analysis from divided into 2 groups. Another experiment was done with the brain-wave measuring device to compare the relation of the preference and the comfortable - feeling. This experiment was to evaluate an impression while seeing four kinds of chair images with a big screen. And, the preferences of each subject were evaluated by ‘One pair pieces of Comparative Approach’ in detail. The total amount of subjects of this experiment were 16 persons, the persons who have a design experience were 8 peoples, and the persons who don't have a design experience were 8 peoples. (From now, I will use the terms 'design field group' and 'non-design field group'. The 'design field group' means the subject group which has a design experience, and 'non-design field group' means the subject group which doesn't have a design experience.)

Fig 2 Scenery of experiment

4. Results and Discussions

In the first experiment, the subject evaluated the five visual-information criteria while he/she looking at the image of one kind of chair. After that, the subject evaluated his preference to the observed chair. This was experiment's 1 cycle. The subject evaluated four kinds of chairs, four times in the same way. Lastly, subject chose the chair he/she wanted to buy most among the 4 types of chairs at the end of the 4 cycle experiment. The evaluations of each chair were gathered from the results of the experiments on 40 subjects. (Table 1)

Table 1. The evaluation of the chair from the visual information of each chair



The evaluation of each chair was gathered from the results of the experiments on 40 subjects. The following was concluded from gathering the evaluations of the subjects. The following sentences gather the evaluations of the subjects.

-Chair NO.1 : The general evaluation is not good. But the color evaluation is high.

-Chair NO.2 : The general evaluation is the highest among the four chairs. The criteria of the color and the style are higher than the other criteria.

-Chair NO.3 : The result of the evaluation resembles that of the chair N.1, but the general evaluation is a little higher than chair N.1. Only the evaluation of the criteria of the color is high.

-Chair NO.4 : The general evaluation is good. The criteria of the color and the comfortable feeling of a form are evaluated highly.

Table 2 The comparison of the preference degree to each chair

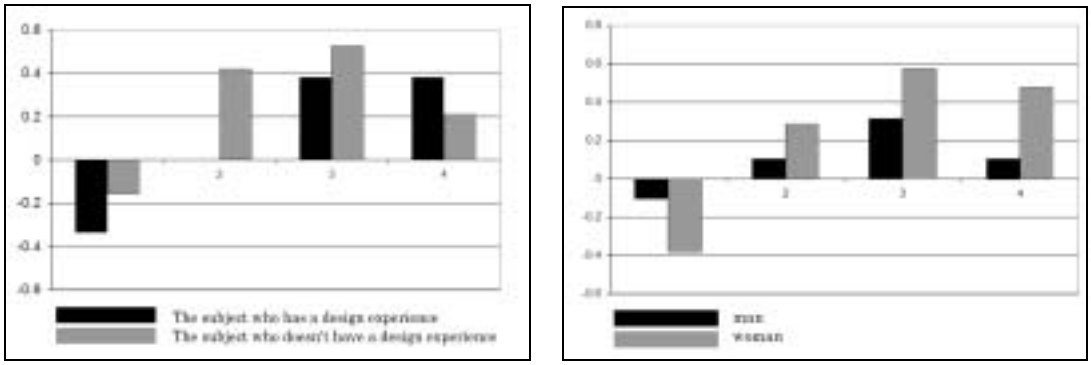
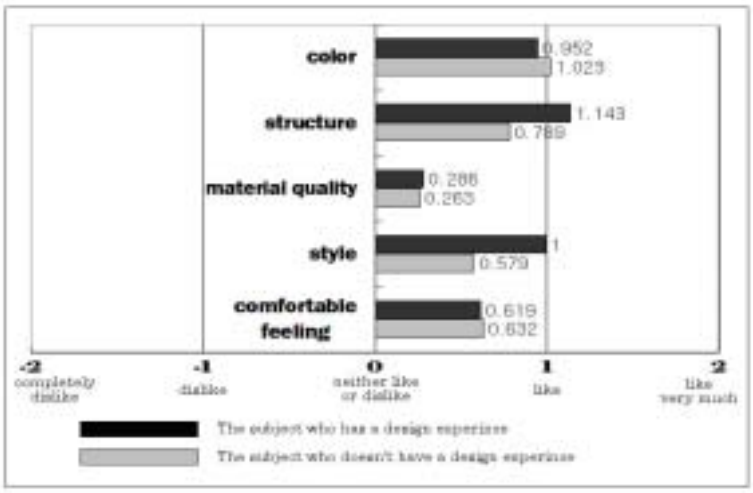


Table 2 is the result with 40 subjects' intuitive preference degrees to each chair. The design field group evaluation is high with the chair N.4 and 3. The non-design field group' evaluation is high with the chair N.3 and 2. As for the evaluation by the gender, all of the male and female groups were the chair N. 3, and 4, and 2, and chair N.1 order. However, "Like and Dislike" are clearer among the female group than the male group. Table 3 shows the evaluation criteria of the chair which was chosen as the chair the subject wanted to buy.

Table 3. The chosen chair and the evaluation of the subject



Among the subjects of the design field group, the criteria of the ‘structure’ and ‘style’ are highly regarded. On the other hand, among the subjects of the non-design field group, the criteria of the ‘color’ is highly overwhelming. And, the evaluation of ‘the comfortable fleeing from a form’ is higher among the subjects of the non-design field group than the subject of design field group. Also, the standard deviation of the evaluation score of the two groups was compared. As a result, the design field group has fewer deviations (the standard deviation: 0.35) of the evaluated value than the non-design field group the standard deviation: 0.28).

And, the evaluated value of the criteria of ‘material quality’ is near 0. Because the image quality which was used by the experiment this time wasn't very good, and it doesn't show the characteristic of the material, in the material item, the evaluation of the criteria of ‘neither like nor dislike’ was most.

As for the result of the evaluation by the gender, both results were similar. From this, it is determined that the biggest difference of the evaluation of the product is with the design (design field or non-design field) rather than the gender. The result which subject chose the chair he/she wanted to buy was difference from the evaluation of preference. For a more detailed analysis, the preference of subject was analyzed by ‘one pair of methods of comparative analysis’. The subjects in this experiment were 16 peoples. The subjects of design field group were 8 person, the subjects of non-design field group were 8 person too.

Table 4 The sample score by ‘one pair of methods of comparative analysis’

	2	1	0	-1	-2	θ_i	μ_k	σ_k	δ_k
A1/A2	2	4	1	7	2	-3	-0.1875	-0.281	0.094
A2/A1	2	7	2	5	0	6	0.375		
A1/A3	1	4	1	8	2	-6	-0.375	-0.281	-0.094
A3/A1	0	8	2	4	1	3	0.1875		
A1/A4	1	4	4	5	2	-3	-0.1875	-0.281	0.094
A4/A1	2	6	4	4	0	6	0.375		
A2/A3	2	5	6	0	3	1	0.1875	0.031	0.156
A3/A2	4	8	6	0	1	2	0.125		
A2/A4	2	7	1	5	1	3	0.2125	0.063	0.250
A4/A2	2	5	3	6	0	3	0.1875		
A3/A4	3	7	0	6	2	3	0.125	-0.031	0.156
A4/A3	4	3	2	6	1	1	0.1875		
Total number of people	24	81	32	60	15	21			

	π_k			
	chair N.1	chair N.2	chair N.3	chair N.4
chair N.1		0.281	0.281	0.281
chair N.2	-0.281		-0.031	-0.063
chair N.3	-0.281	0.031		0.031
chair N.4	-0.281	0.063	-0.031	
total	-0.843	0.375	0.219	0.249
α_i	-0.2108	0.0938	0.0548	0.0623

The total score by every chair combination （ μ_{ij} ）

The score which revised the direction of the combination（π_{ij} = （ μ_{ij} - μ_{jj} ） / 2)

The influence by a order of combination （ $\delta_{ij} = (\mu_{ij} - \mu_{jj}) / 2 = \mu_{ij} - \pi_{ij}$ ）

Table 4 is the table which computes the score of each chair which is due to ‘one pair pieces of comparative approach’ and table 5 shows a result with the score of each chair. As the result, Chair NO.2 was the highest, chair NO.4, 3, 1 order.

Table 5 The preference score of each chair

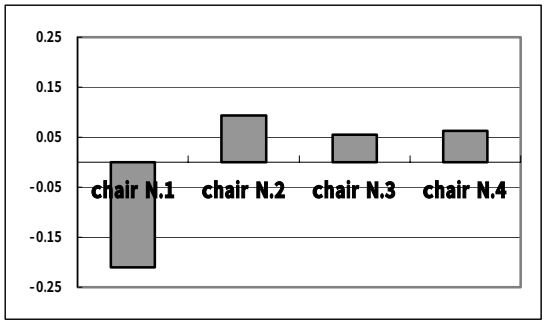
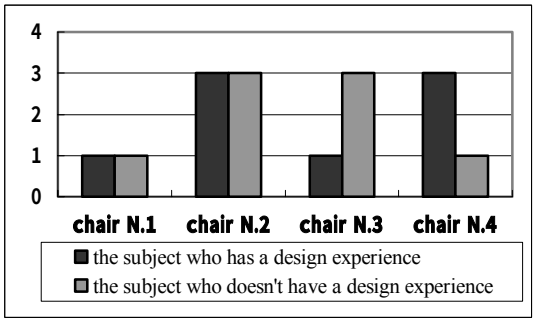


Table 6 The comparison of the chosen chair



The result of preference (comparing in the combination) is difference from the result of have evaluated intuitively a chair. Table 6 is the graph of the chair which was chosen to want to buy. The choice of design field group is different from it of the non-design field group also. The subjects of design field group chose a lot of chair N.2 that the evaluation of ‘style’ was high chair. But, the subjects of non-design field group chose a lot of chair N.3 that the evaluation of ‘color’ was highly regarded well.

Table 7 is a result of relation between the evaluation score of preference by ‘one pair of methods of comparative analysis’ and the chair to want to buy. 11 subjects chose a chair of the highest preference score as the chair to want to buy. And, 12 subjects chose a chair of the lowest preference score as the chair will not buy. This result was compared by whether the subjects have a design experience. As a result, on the non-design field group, the 81.3% of 16 persons chosen a chair according to the ‘preference evaluation score’ as the level preferring buy or not buy. But on the design field group, the only 62.5% of 16 persons chosen a chair on the same condition

Table 7. The relation between the preference evaluation score and the chosen chair

		Chaie N.1	Chaie N.2	Chaie N.3	Chaie N.4
Non design field group	sub.1	0.125	-0.5	0.625	-0.25
	sub.2	0	1	0.875	0.125
	sub.3	-1.25	0.875	0.5	-0.125
	sub.4	0.25	0.875	1	0.375
	sub.5	-0.5	0.125	-0.25	0.625
	sub.6	-0.5	0.5	0.5	-0.5
	sub.7	0.625	-0.25	0.25	1.125
	sub.8	0.25	1.25	0.75	0.25
Design field group	sub.9	-0.375	0.5	0.75	-0.875
	sub.10	0.25	0.875	0.25	-0.875
	sub.11	-0.25	0.625	-0.875	0.5
	sub.12	0.125	0.375	0.375	0.125
	sub.13	-0.125	-0.125	1	1.25
	sub.14	-1.25	1.125	0.375	-0.25
	sub.15	1	-0.25	-0.625	0.625
	sub.16	0.25	0.875	-0.875	-0.25

A chair which the subject chose as want to buy
A chair which the subject chose as will not buy

Table 8. The relation between ‘the principal component analysis’ and the chosen chair

		Chaie N.1	Chaie N.2	Chaie N.3	Chaie N.4
Non design field group	sub.1	0.11568	0.68138	1.68138	0.46021
	sub.2	-0.22074	-3.98065	2.36583	-0.05499
	sub.3	-2.29091	2.40505	-0.43195	-0.99857
	sub.4	1.18194	-1.63904	1.38312	-0.95922
	sub.5	1.23326	0.29327	-1.31856	1.63667
	sub.6	-2.41858	-1.85594	-0.75881	-1.58287
	sub.7	0.16895	0.58601	0.31108	1.54345
	sub.8	0.58227	-1.80687	1.21848	-0.43488
Design field group	sub.9	-0.37585	-1.62074	1.55971	2.15484
	sub.10	1.43799	-0.34645	-0.41679	-1.22169
	sub.11	-0.43627	0.99108	-1.83690	1.23249
	sub.12	-0.05825	0.62569	-0.88680	1.53431
	sub.13	1.69882	1.10834	0.69794	2.89399
	sub.14	-2.97626	1.11173	-0.80437	3.34437
	sub.15	0.81785	1.50599	-2.87880	1.59862
	sub.16	1.65912	0.14007	-1.40725	-0.41859

A chair which the subject chose as want to buy
A chair which the subject chose as will not buy

The chosen chair was analyzed by ‘the principal component analysis as a multivariate analysis. As the result of ‘the principal component analysis’, it interpreted the ‘1st principal component score’ as the ‘ideal preference as evaluation by the Comprehensive judgment’. Because, the ‘1st principal component score’ becomes high when the five visual information criteria value becomes strong with the all of 4 chairs.

11 subjects of 16 persons chose the highest chair from the score of the ‘ideal preference as evaluation by the Comprehensive judgment’ to want to buy. And, 11 subjects chose a chair of the lowest score of ‘ideal preference as evaluation by the Comprehensive judgment’ as the chair will not buy

This result was compared by the existence of a design experience. As a result, on the non-design field group, the 75% of 16 persons chosen a chair according to the ‘ideal preference score as evaluation by the Comprehensive judgment’ as to as the level preferring buy or not buy. But on the design field group, the only 62.5% of 16 persons chosen a chair on the same condition

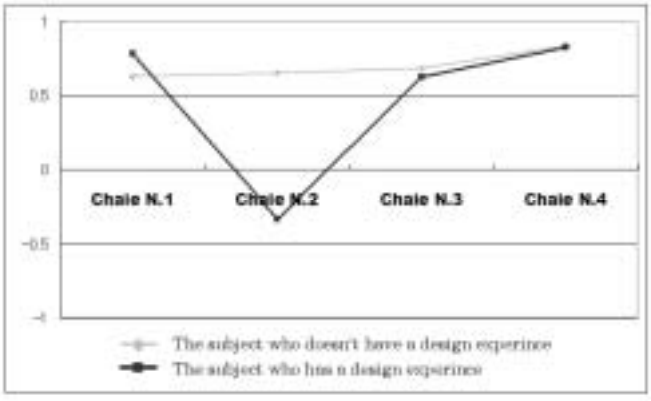
As a result, the correlation coefficient of two items was 0.67005. This result means that the intuitive preference of the user relates to the ‘evaluation by the Comprehensive judgment’. However, the coefficient of correlation of design field group was 0.592, and it of non-design field group was 0.754.

And I checked the correlation coefficient with the score of the ‘ideal preference as evaluation by the Comprehensive judgment’ and the ‘evaluation score of preference by ‘one pair of methods of comparative analysis’ also. As a result, the correlation coefficient of two items was 0.67, shows that the preference of the user relates to the ‘evaluation by the Comprehensive judgment’. The coefficient of correlation of design field group was 0.631, and non-design field group was 0.696.

However, from the table 9 it was fined out that the subject’ of design field group correlation coefficient of two items was more stable than design field group. Specifically, on design field group, the coefficient of correlation of chair N.2 was -0.333. This chair was most popular in the design field group.

From this results, it found that, when a user buy a some product, a person of non-design field group more evaluate the visual information of the product as the ‘Comprehensive judgment’ than a person of non-design field group.

Table 9. the correlation coefficient of two items



The relation of the delightfulness feeling and the preference was examined by the frequency-rhythm of the ‘α –wave’ from the frontal lobe. The delightfulness feeling of subjects can be measured with this equipment which I used for this experiment. Its name is ‘HSK-centered rhythm monitor slim’ (Figure 3). This equipment

measures brain waves in a very simple way. Therefore, the subjects can feel relaxed during the experiment.

Fig.3 HSK-centered rhythm monitor slim

The ‘left brain frequency-rhythm degree (0-1)’ corresponds to ‘Excitement - appeasement’. And, the ‘right brain frequency-rhythm degree (0-1)’ corresponds to ‘pleasantness - unpleasantness’. If the left and right brain frequency-rhythm degrees of are near 1, subject’s feelings become ‘appeasement’ and ‘pleasantness’. And, if the frequency-rhythms degree of left and right brain are near 0, subject’s feelings become ‘excitement’ and ‘unpleasantness’. But, the brain waves were very different among individuals. Therefore, I compared the each subject’s brain waves to the four chairs.

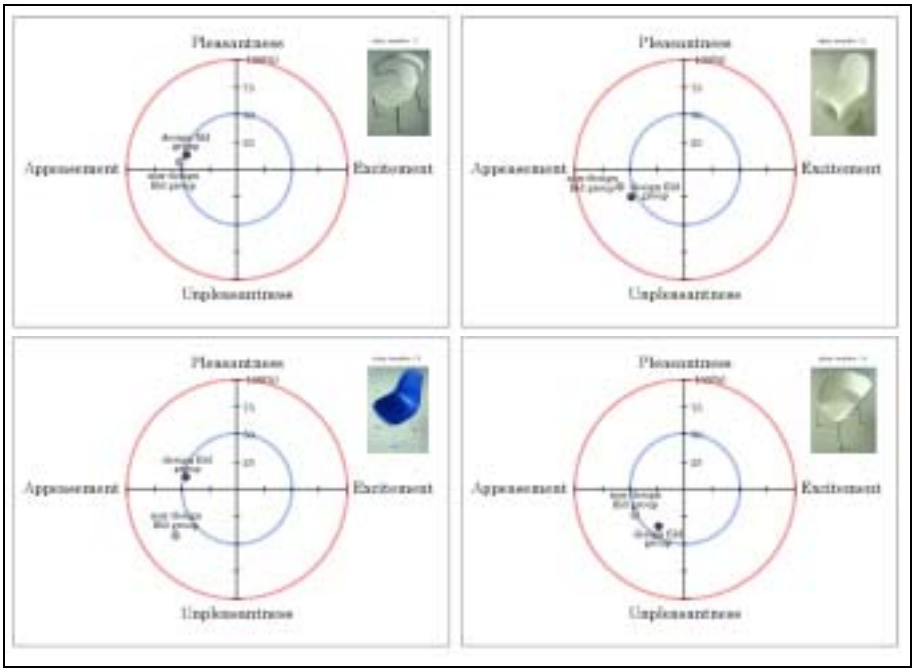
As a result of the experiment, the delightfulness feeling didn’t relate much to the chosen chair. (Table 10) The relation of the delightfulness feeling and the preference evaluation from the visual information of chairs is low, and this means that the user don't always choose a chair which has a comfortable feeling.

Table 10. The result of the brain waves and the chosen chair

	The shaking wave rhythm of left brain to the chair No.1	The shaking wave rhythm of left brain to the chair No.2	The shaking wave rhythm of left brain to the chair No.3	The shaking wave rhythm of left brain to the chair No.4
1	0.93809	0.68242	0.68901	0.47656
2	0.366861	0.43569	0.48192	0.5585
3	0.4079	0.40161	0.35789	0.46634
4	0.69642	0.69289	0.86434	0.63437
5	0.52206	0.50459	0.24584	0.63841
6	0.47168	0.56304	0.48242	0.43348
7	0.49457	0.48681	0.57343	0.38468
8	0.36004	0.42044	0.46343	0.53066
9	0.35936	0.25989	0.30171	0.32056
10	0.51456	0.43911	0.56381	0.37312
11	0.58086	0.56304	0.48242	0.43347
12	0.44705	0.54827	0.36705	0.65762
13	0.49577	0.55189	0.58514	0.53462
14	0.27496	0.36663	0.62428	0.44335
15	0.6405	0.35543	0.43211	0.2943
16	0.37131	0.38015	0.24878	0.51936

The coefficient of the correlation between the delightfulness feeling and the preference evaluation of the subject was 0.1438. And, the coefficient of the correlation between the delightfulness feeling and the ‘evaluation by the ideal preference as evaluation by Comprehensive judgment’ was 0.26362. This result means that the comfortable feeling relates little to preference, and the ‘ideal preference as evaluation by the Comprehensive judgment’.

Table 11. The result of the comfortable feeling of each chair



The subjects of ‘the design field group’ showed the tendency of ‘excitement’ to all of the four chairs, because they are checking a more detailed characteristic of the chair.

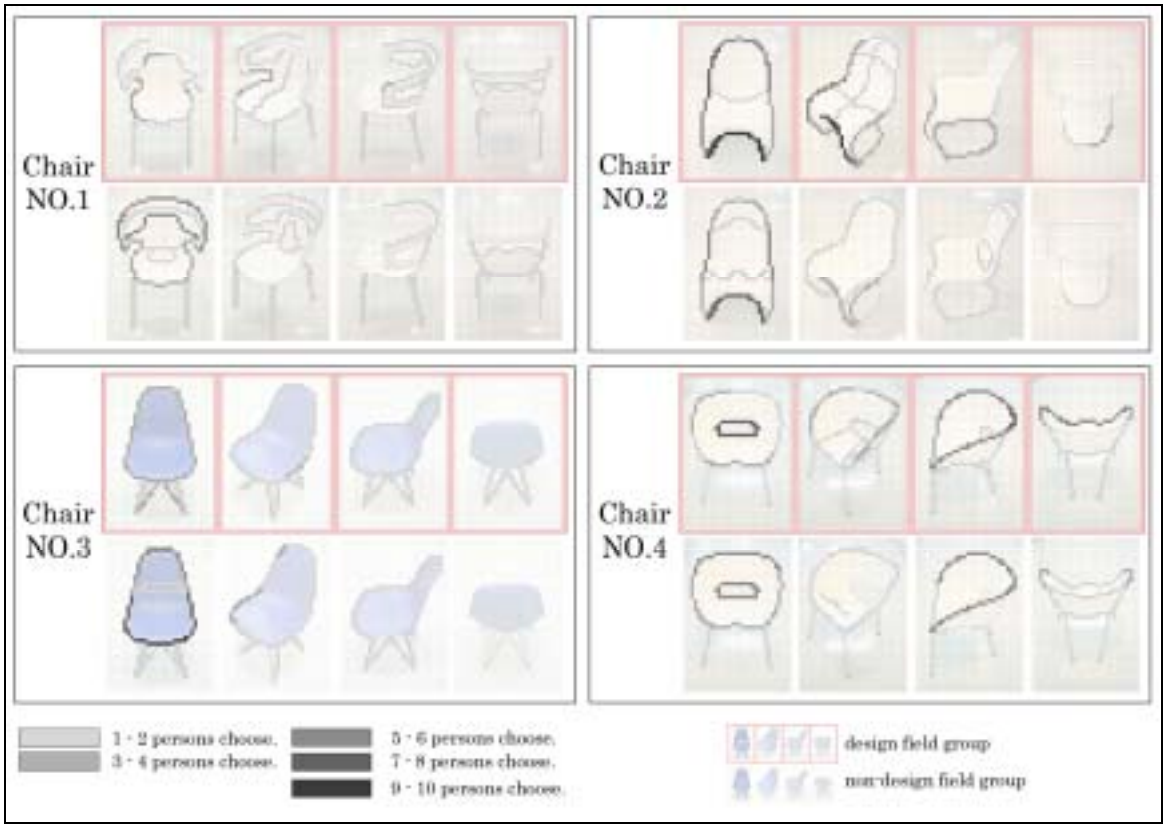


Fig.4. The favorite places the subjects highlighted the chairs from the different 4 directions

The 40 subjects freely highlighted the place which they liked place in the each chair among 4 directions. (Figure. 4) As a result, the highlighted spot of the subject differed from the hypothesis that there would be the most highlights in the image of the semi-side direction which subjects can feel a solid-feeling. The 40 subjects highlighted the most in the image from the front view of all chairs. This result means that the subjects think the image from the front view of some product is a typical image of those products, and whether the subjects like or dislike' the chair is most determined by the visual information from the front view. As for this result, many catalogs and web-sites in which there are many images from the semi-side direction of products, should think more of the information from the front view.

-Chair NO.1 : The part of the support for the back was liked.
-Chair NO.2 : There was most places to like generally in this chair. The whole appearance and circular space below were specifically liked.
-Chair NO.3 : The wide seat surface was liked
-Chair NO.4 : The big support for the back and the seat surface which wraps up a body were liked.

The subjects of 'the design field group' most highlighted and highly evaluated chair NO.2, and as a result they most wanted to buy Chair NO2. Also, the subjects of 'non-design group most highlighted and highly evaluated Chair NO.3, too. This means that a product which there is most visual information to like is chosen. Also, the highlighted places of 'the non-design filed group' were more front appearances than 'the design field group.'

5. Conclusions

From this research, it was found that the preference of the design field group and the non-design field group were roughly different in the case of how to evaluate and choose a product. In the difference of the way in which the subjects choose and to judge 'Like or Dislike' by accepting visual information from a product, the design experience difference is bigger than the gender difference. The subjects of 'the non-design field group' choose a product of good 'color', 'style' and as the visual impact is strong, but the subjects of 'the design field group' choose a product of good structure and style.

Also, it became clear that the subjects' intuitive preference of 'the design field group' is nearer the 'ideal preference as evaluation by the Comprehensive judgment' than 'the non-design field group'. This result means that the person who doesn't have design experience chooses a product by the 'ideal preference as evaluation by the Comprehensive judgment'.

Even though, the subjects feel a solid-feeling from a semi-side direction, the users see more attentively the visual information from the front view better. This result means that the front view image has an influence on preference more than any other direction.

An evaluation of preference to the product has no relation with a delightfulness feeling from the experiment on the brain wave measurement. It is thought that the delightfulness feeling is one of the *Kansei*. It is a more complex feeling than a preference. Therefore the delightfulness feeling is affected by something other than the preference, too. However, when choosing a product, the subjects of 'the design field group' had the tendency to be excited. Because the person who has design experience judges more positively and actively the various

criteria of a product.

Also, I would like to clarify the characteristic of the '*kansei* quality' which has the biggest meaning as the index on the product selection now, and to advance the research about the design process in which a user satisfied with *Kansei.* The designers and the general public people should not be so stop only differently. A designer has to clarify the different characteristics of the 2 groups and should put him/herself in the user's sin order to make that which satisfies the user most.

I think that rather than tempting the users with just cool images, the designer should first examine the users' decision making process tendencies in this way, one can produce the user friendly design.

I would like to research the characteristics of the *Kansei* of the user and the designer more, and to become the researcher who closes the gap between the sides of designer and users.

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