Experiential effect for developing specialist's Kansei process and affective evaluation

Characteristics of designer's subconscious evaluation as Kansei process in Designing -2-

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While evaluating products, a specialist of the field tend to make better evaluation comparing to the non-specialist. In design field, we supposed there can be significant difference between specialist = designer and customer = potential user. In this research, we defined the specialist of product design as professional designer and compared to the students without design education. For the comparison, we applied SD method for the subjective evaluation and brain function measured by NIRS (Near Infra-Red Spectrascopy) system. For the experimental preparation, we arranged three categories of product, TV, Car and personal product. Among these categories, we prepared four different brands at similar price range. Also, among the products, we carefully selected one product brand that subject affiliate to. This means we can check if there is a kind of bias based on the affiliation. We prepared those stimuli shown on monitor at five seconds and asked them to selecting appropriate grade on SD adjective pair shown on the same screen. From the result of SD evaluation, we confirmed the significant tendency of severe evaluation for design aspect. At the same time, they tend to evaluate negatively on the emotional aspect. On the other hand, there was product dependent positive evaluation in specialist group than students. This means the specialist may evaluate not only based on their preference but also by experimental analysis such as engineering property and emotional and economical knowledge. From the analysis of brain function of pre-frontal cortex, we found significant difference in function of center part synchrony with the characterized evaluation we found on the product.

Key words: Designer, Kansei, brain function, physiology, affective measurement

1. Introduction

Recently, with the development of engineering and flexible manufacturing, our ability of design in producing new product is expanding. As a result, there are enormous number of product customer can choose. Then they have to sharpen their sense of choose a product. At the same time, the ability of intuitive evaluation of idea, function and proposal become more important to designers. Generally, the idea that there can be significant difference of this intuitive evaluation among designers and non-designers can be widely acceptable. Kansei is well known as a method of Kansei Engineering. In Japanese, kansei is used with multiple definition of sensibility, emotion, desire and Sinnlichkeit[1]. Especially, kansei represent an intuitive process directing the understanding for make decision. [2] In this research, we will define kansei as this pre-cognitive mental process to guide our understanding to desirable direction. Designers tend to have more active and accurate kansei in design evaluation.

In our last experiment in 2011[1], we used Near Infra-Red Spectrascopy (NIRS) system for measuring pre-frontal brain cortex that is proofed to detect functional difference of kansei.[1],[3],[4],[5] Also, there are many research capturing characteristic function of brain by using NIRS.[6],[7],[8],[9],[10] In this case, we found specific difference between the evaluation of design educated and non-design educated on the 'Feasibility of Structure' in subjective evaluation and physiological measurements (NIRS) but no significant difference in

evaluation of simple-complex or simple-decorative. This can illustrates the difference of designer's evaluation as well as the effect of design education. However, this result also indicates the educational factor may affect more in technical evaluation than feeling based evaluation such as simplicity. Even though with this result, we still have feeling that designers use tacit knowledge more effectively for intuitive evaluation than common people.

So, in this research, we hired professional designers and students to include significant difference in designing and tried to evaluate if there can be difference in ability and tendency in intuitive evaluation on product design.

2. Objective

1) To investigate difference in design evaluation between professional designers and non-design based university students. 2) Compare the subjective preference between experience based and preference/ownership based evaluation. 3) Compare the subjective evaluation and physiological evaluation by using Near Infra-Red Spectorascopy (NIRS) and find if there are characteristics of design evaluation in brain function.

3. Experiment

3.1 Experimental condition

There is a difficulty to ask participants, especially professional designers, to place where product placed. Also, it is very difficult to measure physiological condition while participants are moving around. So, the stimuli have to be shown on screen and subjects are asked to sit on chair and look forward without nodding action while experiment.

3.2 Subjects

As the representative of common people, we collected 30 non-design educated university students (age 20-30, 19 male, 11 female). For the professional subject, we could ask 12 professional designers (from three companies, aged 27-44, 8 male and 4 female) from several major Japanese companies.

3.3 Measurement system (NIRS)

For measuring the brain function while evaluation, we used wearable optical topography system WOT-100 (Hitachi-Medico co. Ltd.) that covers major area of frontal cortex.

Figure 1. WOT-100 system.

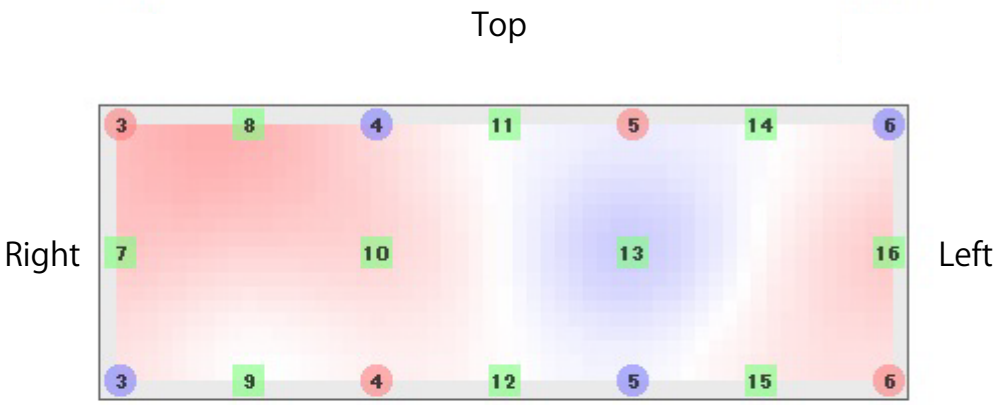

Figure 2. Measuring channel of WOT-100. Based on international 10-20 method, 7 and 16 are the dorsolateral prefrontal cortex (DLPFC).[11], [12], [13]

Table1. SD scale set for subjective evaluation

Original	+	+	+	-	+	+	+	Imitate
Fresh	+	+	+	-	+	+	+	Board
Beautiful	+	+	+	-	+	+	+	Ugly
Functional	+	+	+	-	+	+	+	Poor functioned
Expensive	+	+	+	-	+	+	+	Affordable
Desirable	+	+	+	-	+	+	+	Undesirable
Good texture	+	+	+	-	+	+	+	Bad texture
Comfortable	+	+	+	-	+	+	+	Uncomfortable
Familiar	+	+	+	-	+	+	+	Unfamiliar
Innovative	+	+	+	-	+	+	+	Conventional
Easy to use	+	+	+	-	+	+	+	Uneasy to use
Like	+	+	+	-	+	+	+	Dislike

Table 2. Profiling question (Answered in Yes / No)

1. tend to watch trends	6. love goods
2. tend to impulse buying	7. love to consume
3. tend not to discard things	8. love memory
4. easy to empathy	9. full of hobby
5. stick to fixed idea	10. eager to get new things

3.4 Subjective Evaluation

Referencing previous research by Sogabe et al, and Terauchi [15] for product evaluation and attachment, we selected 12 adjective sets and prepared seven-point liner scale evaluation. (SD scale)During the experiment, these scales was shown on the monitor screen. Subjects are asked to answer on screen using mouse.

Also, to confirm general tendency toward product, profile questioner has been asked before the evaluation (Table 2.). Also, as post questioner, we confirmed if they possessed product in stimuli after the evaluation session.

3.5 Stimulus

For stimulus depending on the professional designer's major, TV, Car, home electronic products and digital camera are chosen. This variation was important to differ the level of preference.

Table 3. Product categories and relation to the subjects of professional designers

	If some of professional subject works at the manufactures?
TV	Yes / No / No / Yes
Car	No / Yes / No /Yes
Home electronic products	Yes / No
Digital camera	Yes / No

Figure 3. stimulus

3.6 Procedure

Because of the recruiting of professionals, we set up same experimental environment as shown on Figure 4 at subjects' working area, because we had to visit there to perform experiment.

Depending on the size of monitor, we adjusted the distance from monitor screen to subject to keep the same viewing angle.

All monitors are in black and, the brand name and other graphics on the monitor product has been hidden with tape.

Experiment has been consist with:

1) profiling question session (paper based),

2) product evaluation session (on-screen) with physiological measurement of brain function,

2-1) rest (20sec with gaze at center + mark),

2-2) watch product (10sec)

2-3) evaluation on SD-scale on screen

repeat 14 times (including two conditioning stimulus prior to the target stimuli (figure 3.).

3) post question (paper based).

So, subjects experienced 14 times of rest - watch – evaluate session. The experiment has done under certification of research ethic committee of University of Tsukuba.

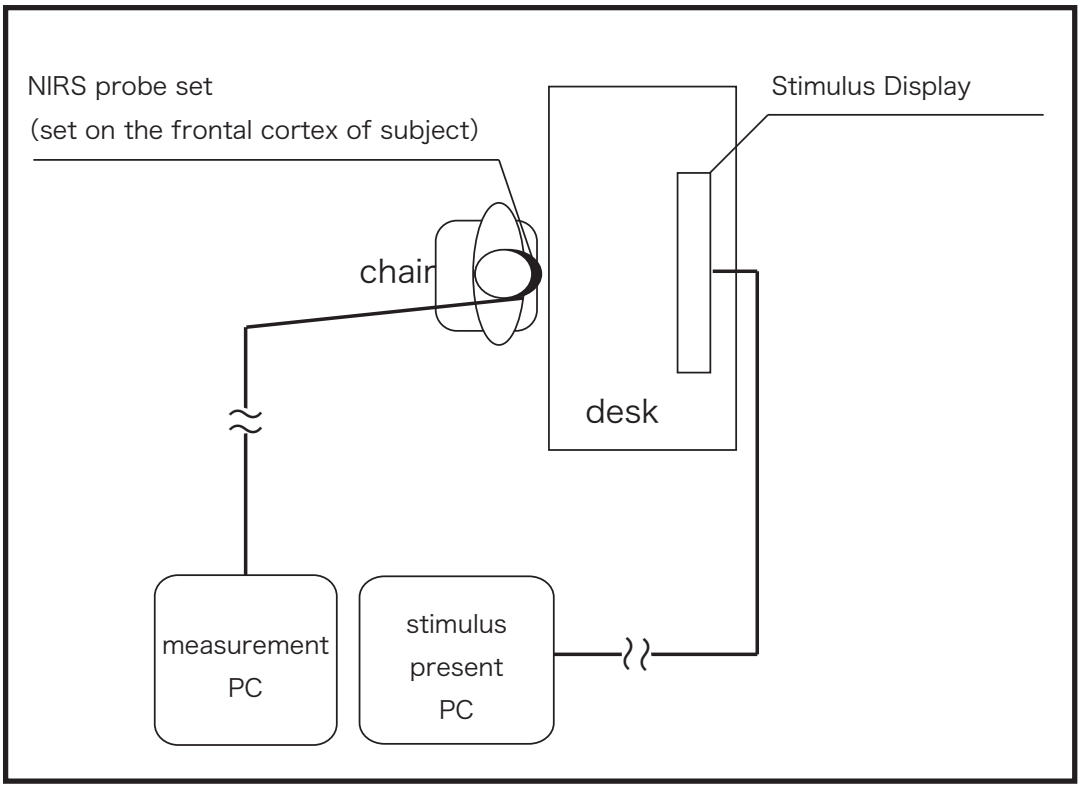

Figure 4. Experiment set up

3.8 result 1: profile questioner

To know if there are significant profile-category between subject group, non-liner canonical correlation analysis has been applied to the result of answer to the Profiling question. As the result of stepwise method, [1. tend to watch trends] and [7. love to consume] turned out the effective characteristics to define professional and general university student (canonical correlation coefficient: 0.576). This means professionals aware their tendency to watch trend and more positive for consuming.

3.9 result 2: Brain function while evaluation and user groups

Firstly, to avoid artifact, we applied 0.02Hz for hi-pass and 0.8Hz for low-pass filter. Also, referencing the Fukushima et al [16], we excluded data with more than 0.1 mMmm of difference between sampling. Also, the NIRS data contains natural change of blood flow during the evaluation, we applied subtraction method for normalize data using last 10 second of '2-1) rest' section to zero and last 5 second of '2-2) watch product'.

For first analysis, we used oxyHb for the index of brain function and compare the significant difference between group and measurement channel by product by multiple discriminant analysis.

As a result of discriminating professionals and students, we found two products (C and L) which showed significant difference between professional designers and general university students. In case of C, designers' response tend to be lower on ch11 and greater on ch 13 (see Figure 2.). In case of L, designers' response tend to be grater in ch12 compare to students.

Using the same NIRS response, we checked the correlation between 'preference to the brand' and brain function using the pre questioner of brand attitude. The result showed two products (B and J) showed significant difference between 'prefer to brand' group and 'without prefer to brand' group. In case of B, 'prefer to brand' tend to have greater function in Ch 9. In case of J, 'prefer to brand' tend to have greater function in Ch 15.

Using same NIRS data, we analyzed another grouping using ownership. We set up user group of 'own' and 'not-own' for each product. Then applied same analysis using discriminant analysis but there are not any significant result. This is because of the size of 'own' group.

One more grouping pattern we applied was 'know well' and 'barely know'. However, only E showed the significant difference with less functioning ch13 at 'know well' group.

Table 4. Summary of brain function and subjects' group

Group	product with CHs of significant diffrence	CH	Canonical correlation	Canonical correlation coefficient	positive group
Professoinal / Students	C	11	0.654	1.75	student
		13		-1.351	
	L	12	0.974	-*	professional
preference to brand	B	9	0.618	- *	prefer to brand
	J	15	0.662	- *	prefer to brand
Ownership	-	-	-	- *	-
Knowledge	E	13	0.741	- *	barely know

* multiple discriminant analysis could not be performed according to BOX M's statistical check

3.9 result 3: SD scale evaluation and user groups

At each time after the product viewing subjects evaluated their feeling using 7-point SD scale. Using same subjects' category, we analyzed the result if there are effective SD-scale for distinguish groups using same method to NIRS case (3.8).

For first analysis, we used 12 pairs of SD scales for the independent valuable and compare the significant difference between group by product using multiple discriminant analysis.

As a result of discriminating professionals and students, we found eight products (A, B, C, D, E, F, G and H) showed significant difference. In case of A, only Like-Dislike sale was effective and designers' response tend to be dislike on this product. In case of B, only the Expensive-Affordable scale was effective and designers' response tend to be affordable on this product. For the product C, three scales: Fresh-Board, Comfortable-Uncomfortable, Innovative-Conventional are determined as effective factor. In this case, professionals tend to evaluate Innovative, uncomfortable but Fresh. For product D, only Comfortable-Uncomfortable was effective and professionals tend to evaluate Uncomfortable. On the product E, professionals tend to evaluate Affordable. For F, professionals evaluate Affordable but Bad-textured. For the product G, Box M linearity test showed the result could not applied to linear discriminant analysis. However, checking the average of most significant scale, professionals tend to evaluate Affordable. For product H, professionals tend to evaluate Affordable. Most effective SD scale discriminate professionals and students in case of E-H was Expensive-Affordable. This can be because of their economical situation not the design ability. But the case of A-D, effective scale was different depending on the product.

Using the same SD evaluation, we checked the correlation between 'preference to the brand' using the pre questioner of brand attitude for each product. The result showed three products (B, J and I) showed significant difference between 'prefer to brand' group and 'without prefer to brand' group. In case of B, Box M linearity test showed the result could not applied to linear discriminant analysis. However, checking the average of most significant scale, 'prefer to brand' group tend to evaluate the product as Familiar. In case of J, 'Functional-poor Functioned' became most effective SD scale to distinguish group and 'prefer to brand' tend to evaluate Functional for the product. In case of I, 'prefer to brand' tend to evaluate Innovative than 'not preferred to brand' group.

Using same SD evaluation data, we analyzed grouping of ownership. In this case, only the product A showed clear different response by group. In this case, the 'Owner' group evaluate 'Familiar' to the product.

One more grouping pattern we applied was 'know well' and 'barely know'. This case, G and H showed the significant difference. In case of G, 'barely know' group tend to evaluate Ugly. In case of H, 'know well' group tend to evaluate Expensive but Conventional.

Table 5. Summary of SD evaluation and subjects' group

Group	product with SDscales of significant diffrence	SD scale	Canonical correlation	Canonical correlation coefficient	positive group	Evaluation by professional
Professoinal / Students	A	Like-Dislike	0.654	1.000	student	dislike
	B	Expensive-Affordable	0.459	1.000	student	affordable
	C	Fresh-Board	0.630	0.653	professional	fresh
		Comfortable-Uncomfortable		-1.070	student	uncomfortable
		Innovative-Conventional		0.898	professional	innovative
	D	Comfortable-Uncomfortable	0.575	1.000	student	unfconfortable
	E	Expensive-Affordable	0.494	1.000	student	Affordable
	F	Expensive-Affordable	0.513	0.606	student	Affordable
		Good texture-Bad texture		0.656	student	Bad texture
	G	Expensive-Affordable	0.700	- *	student	Affordable and dislike
	H	Expensive-Affordable	0.693	1.000	student	Affordable
Preference to brand	B	Familiar-Unfamiliar	0.409	- *	prefer to brand	
	I	Functional-Poor functioned	0.352	1.000	prefer to brand	
	J	Innovative-Conventional	0.337	1.000	prefer to brand	
Ownership	A	Familiar-Unfamiliar	0.402	1.000	Owner	
Knowledge	G	Beautiful-Ugly	0.363	-1.094	barely know	
		Functional-Poor functioned		0.769	well know	
		Easy to use-Uneasy to use		0.744	well know	
	H	Innovative-Conventional	0.171	-0.817	barely know	
		Expensive-Affordable		1.090	well know	

* multiple discriminant analysis could not be performed according to BOX M's statistical check

4. Discussion

4.1 Brain function and subject group

Contrary to expectation, only two products showed clear difference in brain function by professionals and students. In both case, different functioning area was ch11 or ch12. These are Orbitofrontal cortex area and still undefined clearly but regarded as sensibility. However, we could find only two products case so it is hard to say this is the characteristics of professional.

Depending on the preference, ownership and knowledge, while only found on two products, ch9 and 15 tend to be activated while the subjects preferred. This can be a very little tendency found in combination of particular product and subject group.

Since we had to omit data because of artifacts, we have to increase the number of the subject and we may have more concrete relation between subject's tendency and brain function.

4.2 Subjective evaluation (SD scale) and subject group

Clear different evaluation tendency has been found in 8 out of 12 product between professional designers and university students. Although the effective scale was differed depending on the product, 'Expensive-Affordable', evaluation in price dependent scale, has been most characteristic. In addition, car products tend to be differently evaluated by professionals and students in 'Good texture-Bad texture'. Assuming that this scale as the functional evaluation, there was difference in evaluation in functional or economical point of view. This may reflect the different economical status of professionals and students. In the contrary, there was more feeling based difference in TV products such as 'Like-Dislike', 'Fresh-Board', 'Comfortable-Uncomfortable'. However, as the tendency of evaluation, professionals did more critical evaluation than students. Although this found only in few products, this point can be regarded as the professional's characteristics. This feeling based evaluation may originate not only from professional training but preference to brand or ownership. The result of discriminant analysis using preference to the product, ownership and knowledge, there were fewer products showed clear difference based on these subjects profile but almost of the case, group of 'prefer to brand', 'Owner' and 'well know' gave the positive evaluation. This can be the cause of attachment effect. However the effect is not strong enough to affect any kind of product and still the professional tendency was stronger.

4.3 Brain function measurement and Subjective evaluation.

From the profile data, it was assumed that professional designers tend to have following trend and more eager to consume. From the SD evaluation, it is said that designers tend to do more criticized evaluation.

Interesting point was that only the product C showed difference in both brain function and subjective evaluation between professional designer and students. This product was the only non-Japanese and all the subjects were Japanese. This means the effect of knowledge, preference were very different depending on the professional experience.

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5. Conclusion

Our last research, we found difference in the kansei process between design educated people and non educated only in evaluation of structure of the product, not the shape evaluation nor like-dislike. In this research, we could define the professionals' characteristics can be characterized as criticizing evaluation. Comparing the subjective preference of experience based and preference/ownership based, preference and ownership effect was not so stronger than professional aspect. In other words, there we confirmed smaller effect of affiliation in case of professionals. In comparison of subjective evaluation and brain function, we found more related phenomenon in 'preference to brand' aspect but not related in other aspects. Only we have to point out 'when subjects affected very clear difference', in case of C, the brain function showed similarity. This means, the brain function in frontal cortex measurement can be more linked to the preference-based evaluation than professional aspect. With this

result we will continue to consider the affection of professional aspect and affiliation based aspect with different arrangement of stimuli.

This research has been done by support of ‘Grants-in-Aid for Scientific Research’ (B) 23611004.

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