The investigation analysis of preference factor about glasses design for women

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Abstract: Though a lot of glasses design for women are proposed and displayed in a shop recently, it is difficult for a customer to select them. For the purpose, the fundamental research on what kind of glasses design is prefered from a viewpoint of a customer is thought to be required. Then, the purpose of this research would analyze about the glasses design liked by women. As the method of research, image words contributed to the attitude of likes the glasses design were calculated by multiply regression analysis, and cognitive parts (form elements) affected to each image word of the glasses design were extracted by rough sets. Before the calculation, these image words and cognitive parts were extracted by the evaluation grid method. Samples of seventy-one kinds of glasses were evaluated into five steps about each image word on the subject of twenty women. Four image words "foppish (fashionable), pretty, decent, intellectual" in twelve contributed to liking were calculated using the data mentioned above. Next, the relationship between four image words and cognitive parts was extracted based on the decision class using the data of each image word. From the result, the hierarchical relation from the attitude to cognitive parts about the preference has been clarified. Furthermore, the verification experiment of the result of the hierarchical relation was conducted on the subject of a designer working in a design office, who proposed three design sketches reflecting the whole result of the attitude and emphasized pretty and intellectual in it with some useful comments to improve the method.

Key words: Industrial design, Design evaluation, Rough sets

1. Introduction

Though many glasses designed by designers are displayed and sold in the shop of glasses today, consumers have a lot of labors to search the product suitable for likes out of these many glasses. Glasses are the representation of limited production of diversified products from a few composition elements, and also have very sensitivity as a product. Therefore, the maker of glasses mainly performs the policy that consumers chose the product suitable for likes from these many various glasses with which the maker provides them. However, the research on the preference of a consumer is few. The result of the hearing investigation to glasses maker conducted in July 2004 has showed that research on the design harmonized with a face was mainly and quantitative research on the taste factor of the design from a view of consumers is very few as the result supporting the above mention. Moreover, the opinion from the selling side that the glasses design suitable for
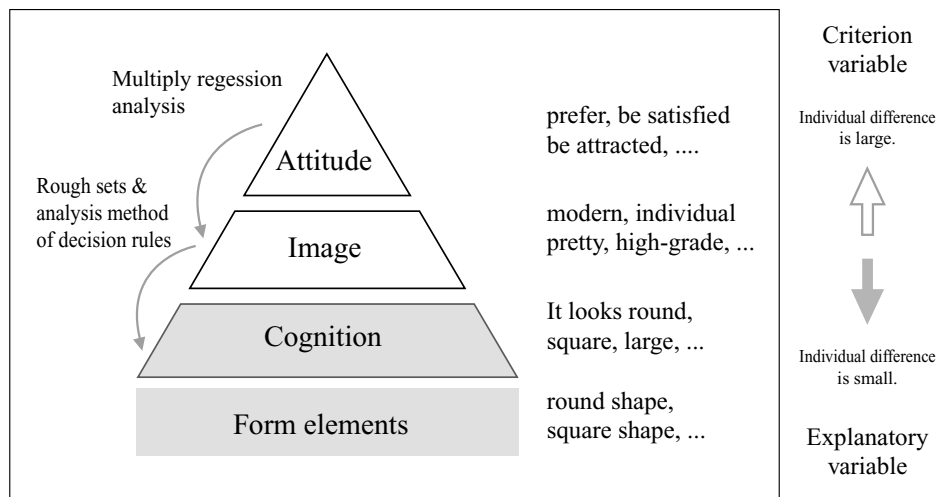
Fig.1 Class relation of analytic process in the research

a face is not necessarily selected was also obtained. Therefore, it is found that a consumer's taste is also an important element for the preference of a glasses design.

Then, in this research, the taste factor of a glasses design is quantitatively analyzed using Kansei Engineering technique. Moreover, verification and the subject of the analysis result would be considered by the experiment designing glasses conducted on a designer working in the office using it.

2. The analytic method

The fundamental view of Kansei Engineering related especially with a product design is reducing affective "attitude" or "image" of man to concrete "form elements" (Physical quantity) which can be used as knowledge of a design. This relation can be hierarchically illustrated as shown in the left-hand side of Fig.1. As shown in the right-hand side of Fig.1, a reverse problem will be solved as the relation between the criterion variable of the attitude or the image and the explanatory variable of the form element from an analytical viewpoint. In addition, an image may not exist depending on goods.
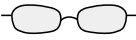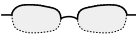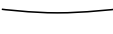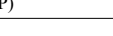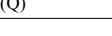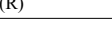
This class relation has the feature that individual difference is decreasing from a higher rank to a lower rank. That is, it is the analysis method of Kansei Engineering to solve a relation from the upper rank with large individual difference to a lower rank with little individual difference. Also as knowledge of a design, this class relation is effective. Moreover, it can be said that the accuracy of the reverse problem via "image" in the middle becomes high , rather than the reverse problem of "cognitive part" directly from "attitude" is solved.

Therefore, in this research, the relation between the attitude and the image is calculated by multiply regression analysis in the procedure shown in the left-hand side of Fig.1, and the relation between the image and the cognitive part is calculated by both rough sets [1] and the analysis method of decision rules we proposed [2][3], from which the research applied to Kansei Engineering began these days. In addition, evaluation words of the attitude and the image and cognitive parts are extracted by the evaluation grid method proposed by Sanui.

3. Extraction of evaluation words and cognitive parts

Though how to extract evaluation words is a general method to select and arrange the reference related to the target product, it is a specialist's viewpoint and it is possible to differ from a consumer's viewpoint. Then, the evaluation grid method that is a method of clinical psychology has been used. On the other hand, although

Table 1 Cognitive parts of the glasses

I t e m		C a t e g o r y		
1	Material	Plastic (A)	Metal (B)	Tortoiseshell (C)
2	Frame pattern	Edge (D)	No edge (E)	Pair (F)
		Nylon (G)	Reverse Nylon (H)	
3	Whole form	Big (I)	Middle (J)	Slim (K)
4	Top of lens	(L) linear R	(M) Curve	(N) Circle / (O) V characters
5	Bottom of lens	(P)	(Q)	(R) / (S)
6	Lens pattern	Uniform (T)	Spread (U)	Narrows (V)
7	Bridge	One bridge (W)	Top continuation (X)	Peculiarity (Y)
8	Design of joint portion	It is. (a)	Nothing (b)	
9	Side pattern	Portion (c)	Unity (d)	Decoration (e)
10	Frame color	Gold (f)	Silver (g)	Red system (h)
		Dark brown (k)	Feature color (m) [Yellow, green, blue]	Pattern (n)
11	Color of ear portion	Red system (r)	Black system (s)	White (t)
		Feature color (u) [Yellow, green, blue]	Pattern (w)	

extracted "form elements" from the form classification in many cases, it is apprehensive to extract portions that a consumer does not recognize as form elements. Therefore, in this research, cognitive parts were defined as form elements that consumers can recognize. In October 2004, the evaluation grid method was conducted on five female students using 71 kinds of glasses sample photographs taken in the glasses shop. Consequently, one attitude word "likes", twelve image words, and cognitive parts of eleven items shown in Table 1 were extracted.

4. Related analysis between an attitude and an image

First, thirteen words of the attitude and the image extracted in the preceding chapter were evaluated into five steps to twenty female students using the questionnaire shown in Fig.2 for multiply regression analysis. And average value of twenty subjects about each evaluation word was calculated based on the evaluation data (71 kinds of samples x 13 evaluation words x 20 subjects). Next, image words (the explanatory variable) contributed to the attitude of likes (the criterion variable) were calculated by multiply regression analysis. The result is shown in Fig.3. The result of official approval was also satisfactory. In addition, , "novel" of high correlation

Fig.2 Questionnaire of an attitude and images
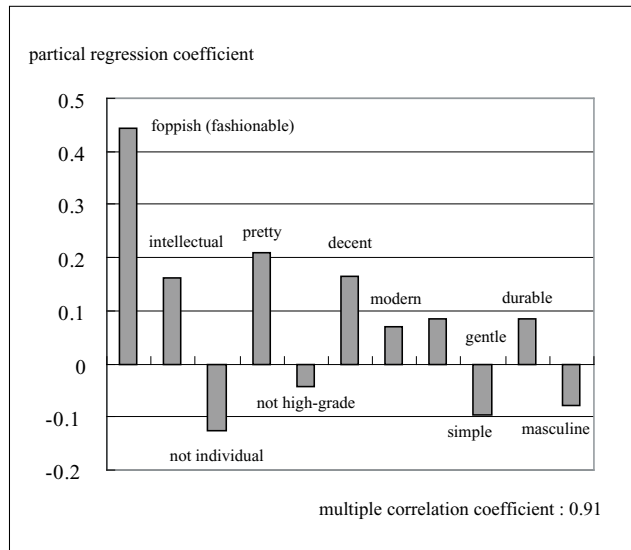
Fig.3 Result of multiply regression analysis

with "foppish" was deleted from examination of Multicollinearity. As shown in Fig.3, it is found that glasses design with images of very foppish, pretty, decent and intellectual is loved more from a view of four image words strongly contributed to the attitude. In addition, these four evaluation words are used also for rough sets and the analysis method of decision rules after the following chapter.

5. Related analysis between an image and a cognitive part

As the criterion variable, each quantitative data of four images greatly contributed to an attitude used by multiply regression analysis calculation of the preceding chapter was classified into three decision classes. On the other hand, as the explanatory variable, each sign of the category for every item shown in Table 1 is assigned in accordance with the content of each sample. The decision table with the criterion variable of "foppish" is created by this procedure. Each other decision tables of "decent", "pretty" and "intellectual" were created similarly. Next, rough sets were calculated from these four decision tables, and decision rules of each image were obtained. The result calculated by the analysis method of decision rules was visually expressed intelligibly based on those each decision rules as shown in Table 2.

6. Discussions

Each design specification of the glasses of four images can be read in the conclusion of Table 2. If the attitude is searched for by use of the class relation shown in Fig.1 based on this result, from the right end of Table 2, The glasses liked by the female college student would be the half rim frame design of a somewhat smaller metal material, the top of its lens with a curve, the bottom of its lens with a linear R or a circle, the lens pattern with a uniform or a little spread, the white side pattern in a portion, and mainly a gold or silver frame. As this result summarized the contents of a glasses design loved best at the time of the investigation, this result of the class relation from the attitude to the cognitive parts shown in Table 2 becomes the precious data when performing new design trials, such as idea emphasized prettiness more or reversing the ranking of the important degree of an image. Then, the verification experiment aiming at the above was conducted on a designer working in the office.

Table 2 The conclusion of analysis results from images to cognitive parts about the attitude

				Foppish	Pretty	Decent	Intellectual	Prefer
1	Material	Plastic	A					
		Metal	B				○	·
		Tortoiseshell	C					
2	Frame pattern	Edge	D					
		No edge	E					
		Pair	F					
		Nylon	G			○	●	○
		Reverse Nylon	H					
3	Whole form	Big	I					
		Middle	J	●	●		○	○
		Slim	K			●	○	○
4	Top of lens	linear R	L	○		○	○	○
		Curve	M					
		Circle	N					
		V characters	O					
5	Bottom of lens	linear R	P	●		○		○
		Curve	Q					
		Circle	R		○		○	○
		V characters	S					
6	Lens pattern	Uniform	T				●	○
		Spread	U	○		○		○
		Narrows	V					
7	Bridge	One bridge	W		○			·
		Top continuation	X					
		Peculiarity	Y	○				·
8	Design of joint portion	It is.	a					
		Nothing	b	▲	○	△	▲	·
9	Side pattern	Portion	c	○	○			○
		Unity	d				○	·
		Decoration	e					
10	Frame color	Gold	f		○	●	○	○
		Silver	g	○		○	○	○
		Red system	h		○			·
		Dark brown	k					
		Feature color	m		○			·
		Pattern	n					
11	Color of ear portion	Red system	r					
		black system	s				○	·
		White	t		●	○		○
		Feature color	u					
		Pattern	w					
	The degree of much consideration of an image (Partial regression coefficient)			0.442	0.209	0.165	0.163	

●＞○   ▲, △ Inconsistency item

7. Verification experiment

In order that this result may verify whether it is utilizable for the proposal of an actual design, the verification experiment in November 2004 was conducted. The concrete contents of an experiment are as follows. First, after the designer observed the glasses in the hand in shops in advance, detailed explanation was given to the designer about the contents of the conclusion mentioned the preceding chapter. And it requested to him that a design plan was decided based on these contents of explanation and some idea sketches were created. As the result of this experiment, the designer presented idea sketches and comments from three viewpoints shown in Table 3.(1) Though it is not difficult to design based on the composition (configuration) of the glasses of the shown analysis result for the sake of the simple composition, it can become an average design. Fundamentally, it is considered to be dependent on a designer's capability what kind of design is carried out based on the analysis result.

(2) As for the glasses design, not only an overall configuration but also expressing an image by the partial ornament and plastic processing in details is possible, so that it is a subject how far it is obtained by analysis.

(3) Since the analyzed result is the structural class relation, as design knowledge of the design at the time of considering a design concept and design specification, it can be effective by discussing this relation flexibly.

From the above mention, though this analysis result can be used as knowledge of the design for the actual design to some extent, it is shown that further improvement is needed.

Table 3   The example of he proposal design by the verification experiment

Plan and concept	Sketch proposal	Explanation
(1) Basic principles of sketch : After the form of the outline of a lens is determined as the most important point, the frame form is made according to it. **(2) The whole concept common to three proposals :** a) Simple configuration without unnecessary ornaments and patterns to the frame b) Molding expressed foppish (fashionable) and decent based on pretty **(3) The added concept :** The design expressed beauty and composure which is not conspicuous too much, while making much of positioning as accessories		**The proposal expressing the attitude of "liking":** A sharp image is directed with the lens form spreading outside. The proposal fulfilled conditions altogether mostly. B,G,K,M,P,T,W,b,c,g,t **The proposal emphasized "pretty":** The design considered the balance in respect of practical use, with a little large view of a size and the size of the degree of middle. "Pretty" is directed by a red color and roundness. A,D,J,M,R,T,X,b,d,h,r **The proposal emphasized "intellectual":** The design not spoiled sharp image by its slim, in spite of a lens with big roundness. As a whole, smartness is directed by the gold frame and the unity in the side pattern. B,G,K,M,R,T,W,b,d,f,s

8. Conclusion

In this research, first of all, the evaluation word (the attitude and image) and the cognitive part of glasses using 71 kinds of glasses samples were extracted. And the evaluation words were evaluated into five steps, and the average value of each sample and the decision class used by rough sets were calculated. The class relation of the attitude, the image and the cognitive part shown in Fig.1 were clarified based on the calculated value. Consequently, four images strongly contributed in an attitude were obtained. As the result of considering by rough sets and the analysis method of decision rules based on four images and the decision class of cognitive parts of the glasses shown in Table 1, the class relation of Table 3 was obtained quantitatively. We had a designer verify whether this analysis result can utilize for the proposal of the actual design based on this result. Through the verification experiment, this research shows that the result is possible enough to use as design knowledge when designing glasses. Moreover, it was indicated not only that there is some room of improvement for a new design but also that the information on molding and the ornament of details is insufficient.

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