

COMPARATIVE STUDY ON VISUAL IMPRESSION STRUCTURE FOR CAR FRONT GRILL BETWEEN JAPAN AND THAILAND

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ABSTRACT

The front grill is one of the most important parts on the automobile front design, and it is of significance for automobile manufactures to understand consumers' visual preference for its design. Our purpose is to produce front grill panels that are more attractive for local consumers. In this paper, the structures of visual impression in observing the front grills of Sport Utility Vehicles (SUVs) and pickup trucks were investigated by using many adjectives and comparison was made between Japanese and Thai consumers. Thirteen different front grills were chosen from the best-selling automobile brands in the world as experimental stimuli. Semantic Differential (SD) method was used to quantify visual impression, and twenty-one pairs of antonym adjectives such as 'glossy' and 'matte' were selected from the result of our previous investigation. Approximately two hundred people participated from Japan and Thailand in total. SD data from the two nations were analyzed by Principal Component Analysis (PCA), and it was clear that the structure of visual impression for a car front grill was different between Japanese and Thais, in particular, the most important principal components were 'luxuries feel' and 'sharpness' for Japanese, whereas 'stylishness' and 'lightness' for Thais. The relationship among adjectives on the first and second principal component diagram was also different between the two nations. After connecting these results with morphological features, it will be useful for manufactures to propose the more attractive products that match the preference of local consumers.

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Keywords: car front grill, visual impression, comparison by nationalities, principal component analysis

1. INTRODUCTION

Thailand is one of the biggest nations in the ASEAN region, and its market has been rapidly expanding. Recently, there are many factories of Japanese products such as cars and home appliances and they are very popular in Thailand. We have researched the visual preference of Thais to develop the automobile products matching the needs of the local customers [1] - [3].

The front grill is one of the most important parts on the automobile front design and it is significant for manufactures to understand consumers' visual impression for its design [4] [5]. This study aims to produce front grill panels that are more attractive to many consumers in each nation in cooperation with a Japanese automobile parts manufacturer.

In our study, the structures of the visual image for front grills of Sports Utility Vehicles (SUVs) and pickup truck were surveyed by using adjectives that express visual impression. And then the experimental data was analyzed by Principal Component Analysis (PCA), and the results from the two nations were compared.

2. METHOD

Thirteen front grills, which have different vertical length, design module and surface color were selected from best-selling automobile brands in the world as experimental stimuli. These three morphological features on a front grill will be used in the analysis of the relationship between visual image and physical attribute. In our thirteen stimuli, there were a variety of grills with vertical length from short to long, three types of design module: line-type, V-type, and mesh-type, and the percentage of silver and black on the surface of a grill frame (Table1). Thirteen front view images of a SUV and a pickup truck were prepared and printed on A3 sized photo paper as experimental stimuli.

The Semantic Differential (SD) method of a rating scale of seven steps was applied for this survey (Figure1). Twenty-one pairs of antonym adjectives such as 'glossy' and 'matte', 'ordinary' and 'special', 'luxury' and 'non-luxury' were selected (Table2) from the result of our previous survey to quantify visual impression for front grills. A survey form of SD method was written in Japanese for Japanese respondents and in Thai for the Thais. Ninety-six Japanese and ninety-seven Thais participated in total (Table3). After collecting SD data, it was analyzed by the PCA to clarify the visual image structure of respondents.

3. RESULTS AND DISCUSSION

The SD data from Japanese and Thai participants was compared through the PCA as shown in Table 4. Four principal components that have an accumulated contribution rate of about 60% were derived in each nation. The first principal component for Japanese includes 'luxury' and 'fine-quality' as adjectives with high score, whereas for Thais 'cool' and 'stylish'. The second

Table 1: Morphological features

Grill No.	A	B	C	D	E	F	G	H	I	J	K	L	M
Length*1	S	S	M	L	S	M	L	M	S	S	M	L	L
Design*2	L	V	L	L		L	M	M			V	L	M
Surface*3	S	S	SB	S	S	S	B	B	B	S	SB	SB	B

*1 Vertical length of grill ... S: Short M: Middle L: Long

*2 Design module of grill ... L: Line-type V: V-type M: Mesh-type

*3 Surface color of grill ... S: Silver B: Black SB: Silver & Black

Table 2: 21 pairs of adjectives

Thailand	English	Japanese		Japanese	English	Thailand
ซับซ้อน	complex	複雑な	—	単純な	simple	เรียบง่าย
ธรรมดา	ordinary	普通の	—	特別な	special	พิเศษ
หรูหรา	luxury	高級な	—	高級でない	nonluxury	กระเจอก
น่าประทับใจ	impressive	印象の強い	—	印象の弱い	unimpressive	ไม่น่าประทับใจ
ไม่มีอะไรโดดเด่น	plain	地味な	—	派手な	flashy	สะดุดตา
ดูก้าวหน้า	advanced	先進的な	—	先進的でない	regressive	ล้าหลัง
มืดทึบ	dark	暗い	—	明るい	bright	สว่าง
เป็นเส้นตรง	straight-lined	直線的な	—	曲線的な	curving-lined	มีความโค้งมน
ไม่มีสไตล์	unstylish	スタイリッシュでない	—	スタイリッシュな	stylish	มีสไตล์
มันวาว	glossy	つやのある	—	つやのない	matte	ผิวด้าน
ไม่มีมิติ	2-dimentional	平面的な	—	立体的な	3-dimentional	มีมิติ
เท่	cool	クールな	—	クールでない	uncool	เชิมน/เชย
หนัก	heavy	重い	—	軽い	light	เบาๆ
บอบบาง	delicate	弱い	—	強い	strong	แข็งแกร่ง
นิ่งเฉย	passive	受身な	—	アグレッシブな	aggressive	ดุดัน
ดูโฉบเฉี่ยวปราดเปรียว	sporty	スポーティーな	—	スポーティでない	unsporty	ไม่โฉบเฉี่ยวปราดเปรียว
ตัดกันอย่างชัดเจน	high-contrast	コントラストの強い	—	コントラストの弱い	low-contrast	ไม่ค่อยตัดกัน
ดี	fine	細かい	—	粗い	rough	ห่าง
มีคุณภาพต่ำ	low-quality	上質でない	—	上質な	fine-quality	มีคุณภาพสูง
ไม่ดึงดูดใจ	unappealing	魅力的でない	—	魅力的な	appealing	ดึงดูดใจ
ไม่ชอบ	unfavorite	嫌いな	—	好ましい	favorite	ชอบ

การออกแบบของหมายเลข _____ ให้มีความรู้สึกตามความหมายดังต่อไปนี้
(The design of No. _____ gives the following feeling for me.)

No. _____
(The design of No. _____ gives the following feeling for me.)

11	(complex) 複雑	1	2	3	4	5	6	7	単純 (simple) 単純
12	(ordinary) 普通	1	2	3	4	5	6	7	特別 (special) 特別
13	(luxury) 高級	1	2	3	4	5	6	7	高級でない (non-luxury) 高級でない
14	(impressive) 印象的	1	2	3	4	5	6	7	印象の無い (non-impressive) 印象の無い
15	(plain) 地味	1	2	3	4	5	6	7	派手な (fashiony) 派手な
16	(adventurous) 先進的	1	2	3	4	5	6	7	先進的でない (non-adventurous) 先進的でない
17	(dark) 暗い	1	2	3	4	5	6	7	明るい (bright) 明るい
18	(straight-lined) 直線的	1	2	3	4	5	6	7	曲線的 (curving-lined) 曲線的
19	(stylish) スタイリッシュ	1	2	3	4	5	6	7	スタイリッシュでない (non-stylish) スタイリッシュでない
20	(delicate) 繊細	1	2	3	4	5	6	7	つやのある (matte) つやのある
21	(cool) 涼しい	1	2	3	4	5	6	7	立体的な (3-dimensional) 立体的な
22	(heavy) 重い	1	2	3	4	5	6	7	クールでない (non-cool) クールでない
23	(delicate) 繊細	1	2	3	4	5	6	7	軽い (light) 軽い
24	(delicate) 繊細	1	2	3	4	5	6	7	強い (strong) 強い
25	(passive) 受身的	1	2	3	4	5	6	7	アグレッシブな (aggressive) アグレッシブな
26	(sporty) スポーツ	1	2	3	4	5	6	7	スポーツでない (non-sporty) スポーツでない
27	(low-quality) 低品質	1	2	3	4	5	6	7	コントラストの強い (high-contrast) コントラストの強い
28	(appealing) 魅力的	1	2	3	4	5	6	7	コントラストの弱い (low-contrast) コントラストの弱い
29	(unappealing) 魅力的でない	1	2	3	4	5	6	7	粗い (rough) 粗い
30	(unappealing) 魅力的でない	1	2	3	4	5	6	7	上質な (fine-quality) 上質な
31	(unappealing) 魅力的でない	1	2	3	4	5	6	7	魅力的でない (non-appealing) 魅力的でない
32	(unappealing) 魅力的でない	1	2	3	4	5	6	7	好ましい (favorable) 好ましい

Figure 1: Survey form in Japanese and Thai

Table 3: Respondents

a) Japanese people

	Male	Female	Total
20s～30s	21	18	39
40s～50s	20	19	39
60s～	10	8	18
Total	51	45	96

b) Thai people

	Male	Female	Total
20s～30s	29	25	54
40s～50s	12	19	31
60s～	4	8	12
Total	45	52	97

principal component for the Japanese includes 'high-contrast' and 'rough', and whereas the Thais 'light'. The third principal component in common in both nations is 'simple'.

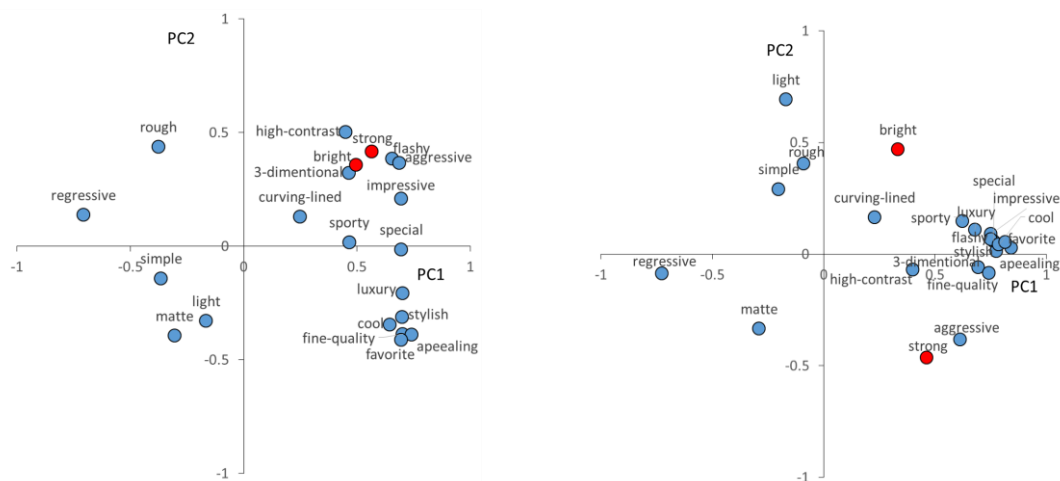
Table 5 describes the four principal components that are named after the adjectives by the PCA. On the broader basis, a visual impression structure of Japanese people consists of two

Table 4: PCA scores of Japanese people and Thai people

a) Japanese people					b) Thai people				
	component1	component2	component3	component4		component1	component2	component3	component4
acumulated contribution rate(%)	0.331	0.437	0.52	0.578	acumulated contribution rate(%)	0.371	0.444	0.505	0.565
simple	-0.364	-0.142	0.647	-0.13	simple	-0.202	0.291	0.614	-0.352
special	0.696	-0.015	-0.388	0.027	special	0.763	0.058	-0.233	-0.028
luxury	0.702	-0.207	-0.046	-0.125	luxury	0.679	0.109	-0.044	-0.201
impressive	0.696	0.208	-0.147	-0.025	impressive	0.75	0.089	-0.009	-0.147
flashy	0.656	0.385	-0.146	0.133	flashy	0.75	0.067	-0.104	-0.079
regressive	-0.706	0.137	0.078	-0.1	regressive	-0.727	-0.088	0.052	0.139
bright	0.498	0.357	0.404	0.33	bright	0.335	0.468	0.156	0.53
curving-lined	0.25	0.13	-0.334	0.226	curving-lined	0.23	0.164	-0.334	0.417
stylish	0.699	-0.312	0.096	-0.035	stylish	0.776	0.014	-0.026	-0.012
matte	-0.305	-0.395	-0.524	-0.256	matte	-0.29	-0.335	-0.303	-0.502
3-dimensional	0.464	0.322	-0.27	0.235	3-dimensional	0.694	-0.06	-0.093	0.134
cool	0.645	-0.345	0.197	-0.163	cool	0.787	0.042	0.067	-0.12
light	-0.165	-0.33	0.129	0.782	light	-0.169	0.692	-0.264	-0.266
strong	0.566	0.415	0.066	-0.442	strong	0.463	-0.464	0.434	0.191
aggressive	0.688	0.366	-0.043	-0.051	aggressive	0.612	-0.384	0.172	0.08
sporty	0.467	0.017	0.203	0.032	sporty	0.624	0.148	-0.092	-0.12
high-contrast	0.45	0.501	0.211	0.033	high-contrast	0.4	-0.069	-0.195	0.364
rough	-0.376	0.437	0.451	-0.132	rough	-0.09	0.406	0.458	0.086
fine-quality	0.702	-0.387	0.136	-0.1	fine-quality	0.743	-0.085	0.198	-0.1
apealing	0.742	-0.389	0.196	-0.02	apealing	0.843	0.027	0.025	-0.114
favorite	0.695	-0.413	0.283	0.032	favorite	0.816	0.053	0.098	-0.152

Table 5: Principal components of Japanese people and Thai people

	component1	component2	component3	component4
Japanese people	luxuries feel	sharpness	simpleness	lightness
Thai people	stylishness	lightness	simpleness	gloss



a) Japanese people

b) Thai people

Figure 2: Relationship among adjectives

main factors; 'luxuries feel' and 'sharpness', whereas 'stylishness' and 'lightness' were the main factors for the Thais.

Figure 2 shows the PCA scores of each adjective on the first and second principal component diagram. The horizontal axis describes the first principal component and the vertical axis the second principal component. We can easily find the common and/or different points of features between the two nations. For example, the distance between the two adjectives such as 'appealing' and 'fine-quality' is very close in both nationalities, but about 'bright' and 'strong', close among the Japanese, far among the Thais.

4. CONCLUSION AND FUTURE WORKS

The visual impression structure for front grills was surveyed by the SD method and analyzed by the PCA, and the results were compared between Japanese and Thais. We grasped that the structure has common and different points in the two nations. Also, some effects of the morphological feature to visual impression were found, for instance, the vertical length of a grill would affect 'stylishness'. After the survey, we designed new front grill for the Thais using computer graphics (CGs) based on these results in cooperation with a manufacturer and presented it at an exhibition of automobile parts in Bangkok. It received a high evaluation rate by Thai visitors.

We are still analyzing the SD data by gender, age, and a lifestyle of respondents. New results related to these attributes of consumers will be clear in near future. When the analysis is done, many front grill designs using CGs should be created to confirm the effect of each morphological feature. The results from the study will be useful for manufacturers to propose more attractive products that match the preferences of local consumers.

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