KEER2010, PARIS | MARCH 2-4 2010
INTERNATIONAL CONFERENCE ON KANSEI ENGINEERING AND EMOTION RESEARCH 2010

THE APPLICATION OF SELECTIVE SENSITIVITY TO DESIGN
FOCUS ON VISUAL PERCEPTION

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ABSTRACT

The human face is a complex multi-signal system from which we can infer a great deal of information at no more than a glance. Such information refers to age, sex, attitudes, personality traits, and emotion. Owing to the evolutionary significance of decoding facial signals, humans seems to have developed a selective sensitivity to the relevant features, and configurations, even if presented in rather abstract ways. Such information is encoded and perceived in car fronts. Previous researches come within the scope of this research by the subjects' gender. In consumer researches, gender is introduced as key consideration when segmenting consumer along the transactional/relational continuum with culture. It estimated that females determine 80% of consumption, purchase 60% of cars and own 40 % of all stocks as of 2008. Little wonder that female's consumption becomes more and more important in all over the industries. This research is on the process of aiming at exploring the application of human's selective sensitivity to design. Under the purpose, we investigated: 1) whether gender makes difference in visual perception: 2) if so, what stimuli showed the significant in subjects' gender and didn't. From the results: 1) we found that gender makes difference in visual perception in some stimuli: 2) also, characterized the stimuli that showed the significant and didn't in gender difference. In the experiment, the subjects evaluated the automotive front pictures on "masculinity" and "adulthood" traits with Semantic Differential method.

Keywords: *Kansei, Design methodology, Gendered perception*

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1. INSTRUCTION

The human face is a complex multi-signal system from which we can infer a great deal of information at no more than a glance-in other words, after only 100 ms of exposure [1]. Such information refers to age, sex, attitudes, personality traits, and emotion [2]. Important components in facial expressions of emotions include the eyebrows, eyelids, and mouth. The movements from the global pattern of such widely recognized expressions as happiness, sadness, surprise, disgust, anger, and fear [3]. Accordingly, people often draw many inferences from the facial appearance of other people [2]. Owing to the evolutionary significance of decoding facial signals, humans seems to have developed a selective sensitivity to the relevant features, and configurations, even if presented in rather abstract ways [4]. Such information is encoded and perceived in car fronts [5]. The idea that cars have faces has been proposed [6, 7], and has been investigated systematically [2]. This research is built on that previous researches approaching at new design method.

In consumer researches, gender is introduced as key consideration when segmenting consumer along the transactional/relational continuum with culture. It estimated that females determine 80% of consumption, purchase 60% of cars and own 40 % of all stocks [8]. Little wonder that female's consumption becomes more and more important in automotive industries. In the recent research on gender differences and emotion, females exceeded males in their ability to recognize emotions whether expressed by males or by females [9]. Also, in the research by Cezarry B. et al. [10], gender differences in the rated intensity were found. From the results of the research, for male subjects higher intensity ratings for dynamic than for static expressions were noted in the case of anger, whereas in the case of happiness, no differences were observed. For female subjects, however, differences for both anger and happiness were significant. In other words, its effect depends on the subjects' gender and emotional valence. That's why we focused on the subjects' gender, also, to explore the differences from the automotive fronts.

This research is on the process of aiming at exploring the application of human's selective sensitivity to design. Under the purpose, we investigated: 1) whether gender makes difference in visual perception: 2) if so, what stimuli showed the significant in subjects' gender and didn't.

2. EXPERIMENTAL

2.1. Materials

We used an event related design, in which on hundred thirty-nine automotive front pictures presented in random order. Therefore, the stimuli showed unpredictably, also in counter-balanced. One hundred thirty-nine automotive models were selected from thirty-five brands. The perspective of all pictures was the front of automobile considering important pattern in facial perception; two eyes, one nose, and one mouth. All pictures were filtered in gray scale to avoid from color effect. And license plates erased, although brand logos were retained. Finally, all pictures rendered at 580*370 pixels. Experiment screen was at 550*500 pixels.

2.2. Subject

15 males and 15 females in the 20 to 32 yr age range (mean= 24.77, SD±4.25) participated in the experiment. The mean age of the male subjects was 22.87±1.64 (SD), and of the female subjects was 26.67±3.48 (SD).

2.3. Procedure

Subjects told that this was a research about the Semantic Differential with automotive fronts, and carried 2 times of pre-test before conducting main experiment. The stimuli were displayed on a computer monitor [Figure 1]. All instructions were in Japanese. The subject was instructed to make the ratings using the subjective states, which are: Each trait on below the stimulus that you will use to rate your feelings about the stimuli. The evaluation traits are two: masculinity (male-/female-like) and adulthood (child-/adult-like). You can use the on screen slider below the stimuli. Your feelings towards the stimuli were the scale. The more appropriate the adjective seems, the closer you should put your slider to it.

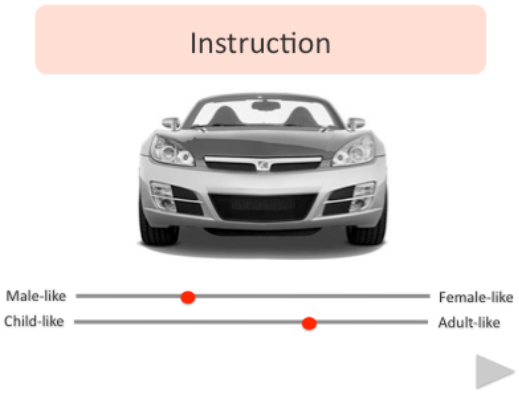

Figure 1: The situation of the experiment: Semantic Differential evaluation

3. ANALYSIS & RESULTS

3.1. The clusters in the subjects's gender

We conducted Cluster Analysis to explore the characteristics of the stimuli.

3.1.1. On the masculinity (male-/female-like) trait

We clustered the evaluated-value by the male subjects in three whereas by the female subjects clustered in four considering the distance of the clusters [Table 1]. We clustered at the point that showed sharp change at the first time in the distance graph. In The characteristics of each clusters in each gender as follows:

Cluster I in the male subjects named "M*m* (**M**ale-like in the **m**ale subjects)"

Cluster I in the female subjects named "M*f* (**M**ale-like in the **f**emale subjects)"

Cluster II in the male subjects named "F*m* (**F**emale-like in the **m**ale subjects)".

Cluster II in the female subjects named "F*f* (**F**emale-like in the **f**emale subjects)".

Cluster III in the male subjects characterized as "Neutral", named "MF*m* (**M**ale-/ **F**emale-like in the **m**ale subjects)".

Cluster III in the female subjects characterized as "Neutral", and named "MF*f* (**M**ale-/ **F**emale-like in the **f**emale subjects)".

Cluster IV in the female subjects characterized as "somewhat Female-like", and named "sF*f* (**s**omewhat **F**emale-like in the **f**emale subjects)".

Table 1: The evaluated-value on the masculinity trait

The clusters in the male subjects		**The clusters in the female subjects**	
M*m*			M*f*
F*m*			F*f*
MF*m*			MF*f*

			sF*f*

Considering the clusters [Table 1], it inferred that the evaluation value of the females were more complex then males' in the Female-like.

3.1.2. On the adulthood (child-/adult-like) trait

Regarding the results of the Cluster Analysis, the evaluated-value by the male subjects was clustered in four whereas by the female subjects were clustered in three [Table 2]. We clustered at the point which showed sharp change at the first time in the distance graph. The characteristics of each clusters in each gender as follows:

Cluster I in the male subjects characterized as "Neutral", and named "CA*m* (**C**hild-/ **A**dult-like in the **m**ale subjects)".

Cluster I in the female subjects characterized as "Neutral", and named "CA*f* (**C**hild-/ **A**dult-like in the **f**emale subjects)".

Cluster II in the male subject named "C*m* (**C**hild-like in the **m**ale subjects)".

Cluster II in the female subject named "C*f* (**C**hild-like in the **f**emale subjects)".

Cluster III in the male subject named "A*m* (**A**dult-like in the **m**ale subjects)".

Cluster III in the female named "A*f* (**A**dult-like in the **f**emale subjects)".

Cluster IV in the male subjects named "sC*m* (**s**omewhat **C**hild-like in the **m**ale subjects)".

Table 2: The evaluated-value on the adulthood trait

The clusters in the male subjects		The clusters in the female subjects	
CA*m*			CA*f*
C*m*			C*f*
A*m*			A*f*
sC*m*			

Considering the clusters [Table 2], it inferred that the evaluation value of the males were more complex then females' in the Child-like.

3.2. The stumuli which showed the significant in subjects' gender

The data were analyzed using one-way ANOVA. In this study, the distribution of response was the evaluated-values of 139 pictures: the factor was subjects' gender. The evaluation

scale was from 1 to 381. In the results, we chose five stimuli [see the colored in the Table 1,2] which showed the definite significant to compare the stimuli which showed the insignificant in subjects' gender.

3.2.1. On the masculinity (male-/female-like) trait

Twenty-six pictures showed the significant in gender differences among one hundred thirty-nine pictures.

Table 3: The significant results of the evaluation which p value was less than 0.05 on the masculinity trait, the means of the value in the subjects' gender, and the cluster of the stimulus characterized in.

Number of picture & the automobile		P value (R sq)	The evaluated-value	The cluster
2		< 0.008 (0.23)	M: 150.6 F: 58.8	MF*m* M*f*
7		< 0.041 (0.14)	M: 238.4 F: 176.3	F*m* sF*f*
15		< 0.047 (0.13)	M: 188.2 F: 112.9	MF*m* MF*f*
16		< 0.002 (0.30)	M: 267.3 F: 158.8	F*m* sF*f*
22		< 0.008 (0.22)	M: 256.7 F: 141.3	F*m* MF*f*
24		< 0.039 (0.14)	M: 106.9 F: 44.5	M*m* M*f*
29		< 0.028 (0.16)	M: 214.1 F: 119.5	F*m* MF*f*
35		< 0.003 (0.28)	M: 135.3 F: 59.3	MF*m* Mf
36		< 0.019 (0.18)	M: 199 F: 103.1	F*m* M*f*
39		< 0.001 (0.31)	M: 261.6 F: 175.3	F*m* MF*f*
41		< 0.008 (0.23)	M: 276.9 F: 193.9	F*m* sF*f*
44		< 0.038 (0.15)	M: 177.3 F: 101.9	MF*m* M*f*
52		< 0.039 (0.14)	M: 100.3 F: 53.4	M*m* M*f*

Number of picture & the automobile		P value (R sq)	The evaluated value	The cluster
58		< 0.017 (0.19)	M: 130.9 F: 68.6	MF*m* Mf
70		< 0.023 (0.17)	M: 204 F: 122.7	F*m* MF*f*
74		< 0.005 (0.25)	M: 216.8 F: 113.3	F*m* MF*f*
81		< 0.024 (0.17)	M: 136.7 F: 81.9	MF*m* M*f*
103		< 0.023 (0.17)	M: 186.9 F: 118.3	MF*m* MF*f*
104		< 0.003 (0.28)	M: 176.3 F: 99.1	MF*m* M*f*
106		< 0.015 (0.19)	M: 232.1 F: 152.5	F*m* MF*f*
113		< 0.0001 (0.48)	M: 274.1 F: 133.1	F*m* MF*f*
115		< 0.008 (0.22)	M: 257.2 F: 174	F*m* sF*f*
118		< 0.011 (0.21)	M: 209.6 F: 127.1	F*m* MF*f*
123		< 0.034 (0.15)	M: 115.8 F: 177.4	M*m* sF*f*
135		< 0.002 (0.29)	M: 233.8 F: 125.7	F*m* MF*f*
139		< 0.014 (0.20)	M: 227.7 F: 141.8	F*m* MF*f*

3.2.2. on the adulthood (adult-/child-like) trait

Sixteen pictures showed the significant in gender differences among one hundred thirty-nine pictures. Interestingly, the male and the female subjects showed similar value on some stimuli [see the 43, 49 in the Table 4].

Table 4: The significant results which p value was less than 0.05 on the adulthood trait, the means of the value in the subjects' gender, and the cluster of the stimulus characterized in.

Number of picture & the automobile		P value (R sq)	The evaluated-value	The cluster
41		< 0.006 (0.24)	M: 121.4 F: 217.1	C*m* sC*f*
43		< 0.049 (0.13)	M: 81.5 F: 138.7	C*m* C*f*
49		< 0.009 (0.22)	M: 240 F: 310.3	A*m* A*f*
53		< 0.022 (0.17)	M: 215.8 F: 292.7	sC*m* A*f*
63		< 0.007 (0.24)	M: 137 F: 237.1	C*m* A*f*
64		< 0.004 (0.27)	M: 151.7 F: 250.9	CA*m* A*f*
75		< 0.009 (0.22)	M: 134.4 F: 218.6	C*m* sC*f*
76		< 0.001 (0.34)	M: 144.1 F: 228.1	C*m* sC*f*
77		< 0.032 (0.15)	M: 153.1 F: 219.4	CAm sCf
79		< 0.02 (0.18)	M: 217.5 F: 281.2	sC*m* A*f*
81		< 0.01 (0.21)	M: 215.6 F: 291	sC*m* A*f*
114		< 0.009 (0.22)	M: 109.6 F: 206.2	C*m* sC*f*
121		< 0.007 (0.23)	M: 162.7 F: 237.8	CA*m* A*f*
124		< 0.012 (0.21)	M: 160 F: 245.7	CA*m* A*f*
126		< 0.036 (0.15)	M: 162.8 F: 218.1	CA*m* sC*f*
129		< 0.01 (0.21)	M: 175.3 F: 256.6	AC*m* A*f*

3.3. The stumuli, which showed the significant in subjects' gender and didn't

In the results of exploring the stimuli which showed the significant in subjects' gender, we chose the five stimuli among that. Also, we chose the five stimuli which the insignificant difference in subjects' gender.

3.3.1. On the masculinity (male-/female-like) trait

Figure 2: The stimuli that showed the definite significant in the masculinity trait

In the male subjects, four of the stimuli which showed the definite significant were clustered in Fm, and one of that was in MFm. In the female subjects, three of the stimuli

which showed the definite significant were clustered in sMf, one of that in Mf, and one was in sFf.

Figure 3: The stimuli that showed the insignificant in the masculinity trait

In the male subjects, four of the stimuli that showed the insignificant were clustered in M*m*, and one of that was in MF*m*. In the male subjects, three of the stimuli which showed the insignificant were clustered in sF*f*, and two of that were in M*f*.

3.3.2. On the adulthood (child-/adult-like) trait

Figure 4: The stimuli that showed the significant in the adulthood trait

In the male subjects, three of the stimuli that showed the definite significant were clustered in CAm, and one was in Cm. In the female subjects, three of the stimuli which showed the definite significant were clustered in Af, one was in Mf, and other was in CAf.

Figure 5: The stimuli that showed the insignificant in the adulthood trait

In the male subjects, two of the stimuli that showed the insignificant were clustered in CAm, one was in Cm, and other was in Am. In the female subjects, two of the stimuli which showed the definite significant were clustered in Cf, two were in CAf, and one was in Af.

3.3.3. The stimuli that showed the significant in the both traits

Figure 6: The stimuli that showed the significant in the both masculinity also the adulthood traits

The two of the stimuli showed the insignificant in the both traits. The stimuli were clustered in Fm, FAm, sFf, Mf, also, in Cm, CAm, CAf, Af.

4. CONCLUSIONS

This research is on the process of aiming at exploring the application of human's selective sensitivity to design. Under the purpose, we investigated: 1) whether gender makes difference in visual perception: 2) if so, what stimuli showed the significant in subjects' gender and didn't. From the results: 1) we found that gender makes difference in visual

perception in some stimuli: 2) also, characterized the stimuli that showed the significant and didn't in gender difference. The conclusions as follows:

In the results of the cluster analysis: Considering the clusters [see Table 1], it inferred that the evaluation value of the females were more complex then males' in the Female-like. Also, it inferred that [see Table 2] the evaluation value of the males were more complex then females' in the Child-like.

The stimuli that showed the significant: Twenty-six pictures showed the significant in gender differences among one hundred thirty-nine pictures. Sixteen pictures showed the significant in gender differences among one hundred thirty-nine pictures. Interestingly, the male and the female subjects showed similar value on some stimuli [see the 43, 49 in the Table 4].

In the comparisons of the stimuli which showed the significant and didn't: We chose five stimuli [see the colored in the Table 1, 2] which showed the definite significant to compare the stimuli which showed the similarity in subjects' gender. In the male subjects, four of the stimuli which showed the definite significant were clustered in F*m*, and one of that was in MF*m* [see the Table 1, 2]. In the female subjects, three of the stimuli which showed the definite significant were clustered in sM*f*, one of that in Mf, and one was in sF*f*. In the male subjects, four of the stimuli that showed the insignificant were clustered in M*m*, and one of that was in MF*m*. In the male subjects, three of the stimuli that showed the insignificant were clustered in ♂F*f*, and two of that were in M*f*. In the male subjects, three of the stimuli which showed the definite significant were clustered in sC*m*, and one was in C*m*. In the female subjects, three of the stimuli which showed the definite significant were clustered in A*f*, one was in M*f*, and other was in CA*f*. In the male subjects, two of the stimuli that showed the insignificant were clustered in sC*m*, one was in C*m,* and other was in A*m*. In the female subjects, two of the stimuli which showed the definite significant were clustered in C*f*, two were in CA*f*, and one was in A*f*.

The stimuli that showed the significant in the both traits: Two stimuli showed the insignificant, which were clustered in F*m*, FA*m*, sF*f*, Mf, also, in C*m*, CA*m*, CA*f*, A*f*.

This research is on the process aiming to propose new design method with both learned and inherent sensibilities, such as selective sensibility, and found the similarities and the differences of the stimuli considering the subjects' gender or not. Regarding the results of the research, the prospect for future research is to look closer at the stimuli were found from the present analyses both. Furthermore, incorporating researches which based on neuroscience with our research would allow even more interesting conclusions, such as related to the reports that face perception evoked activation in a distributed network that included regions in the visual cortex, limbic system, prefrontal cortex, and reward circuitry [11], also facial beauty evokes activation in the reward circuitry [12, 13].

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