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Effect of Product Appearance and Performance on the Consumer's Affection in the Design of Mobile Phones

Sungyup Kim[1], Sungjoon Park[2], Sungmin Kim[1], Eui S. Jung[3]

[1]Graguate School of Industrial Management and Security, Korea University, Seoul, 136-701
[2]Department of Industrial and Management Engineering, Namseoul University, Cheonan, 330-707
[3]Division of Information Management Engineering, Korea University, Seoul, 136-701

ABSTRACT

Product developers nowadays must consider not only the technological satisfaction of consumers but their affective needs as well. These affective needs are greatly affected by the appearance and performance functions of the product, which are simply called in this study appearance-based affection and performance-based affection. This study examined these two affective factors that must be considered while designing mobile phones. Extracted relationship between the two factors was processed in five steps. The first step includes gathering potential affective expressions that are needed to evaluate the levels of consumer's affection for mobile phone design in the pool of adjectives. In the second step, a simple frequency analysis was done from a consumer survey to extract frequently used affective expression. The third step was to extract primary tasks for mobile phones and to perform an experiment or a survey for the evaluation of mobile phones using those tasks. Representative affective factors were then extracted in the fourth step based on factor analysis. Finally, using ANOVA, the extracted representative affective factors were prioritized to draw a relationship between appearance-based affection and performance-based affection. The result of this study suggests each of appearance-based affections and performance-based affections that should be considered in designing mobile phones.

Keywords: Appearance-based affection, Performance-based affection, Consumer's affection, Mobile phone design, Representative affective factor

1. Introduction

Consumer's technological demands are becoming higher as the current market shifts to market driven consumer (Ulrich, 2007). As a result many products that fulfill those demands on various functions are being released, but in reality fail many times. The reason for these failures is that although a product meets the technological demands of consumers, the affective aspect of the product has not been properly considered (Jeong and Lee, 2005). Affection has become the new paradigm since many companies are doing their best to invent products that satisfy consumer's affection (Gobe, 2007).

This trend is the same in the mobile phone market as well. Consumer demand of complex functions and design are becoming higher. Also consumers want their phones to express their individuality, and therefore buy products that satisfy those subjective consumer needs. The consumer's affection can be divided in appearance-based affection from the aesthetic aspect and the performance-based affection from the performance satisfaction aspect. Consumer preference may vary between the aesthetic and performance satisfaction aspect. So, both of these sides should be considered in designing mobile phones.

In the fields of Kansei engineering, researches focused

Corresponding Author: Eui S. Jung
Address: Division of Information Management Engineering, Korea University, Seoul, 136-713. Mobile: 010-8746-3391, E-mail: ejung@korea.ac.kr

both on appearance-based affection (Jung and Jung, 2002) and performance-based affection (Jeong and Lee, 2005; Jeong and Lee, 2006). However, research on the relationship between appearance-based affection and performance-based affection are rarely found. To effectively reflect consumer's affection in designing mobile phones, research on consumer's affection is in definite need.

2. Research procedure

The study first suggests the relationship between appearance-based affection and performance-based affection, and precedes the steps mentioned in Figure 1. In order to suggest consumer's affection that should be considered first. First of all, affection adjectives on mobile phone and tasks for evaluating affection on mobile phone were selected. And then, we extracted the representative affective factors were extracted through factor analysis. At the end, we extracted the representative affective factors though ANOVA.

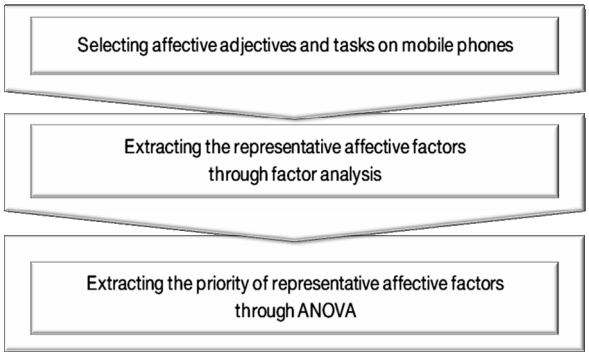

Figure 1. Procedure for extracting the priority of affection

3. Selecting affective adjectives and tasksof mobile phone use

3.1 Extracting affective adjectives related to mobile phones

We collected 490 affective adjectives to construct the affection adjective pool related to mobile phones through literature review and previous research (Han et al., 1997; Jung et al., 2002; Jung et al., 2000; Kim et al., 1998; Lee, 2009; Seo et al., 2006). Also, we collected 34 affective adjectives through the review of internet clubs and professional sites. Finally, we collected 21 affective adjectives additionally through think aloud method. As a result, we could extract a total of 357 affection adjectives by eliminating duplicative and non-relative affective adjectives through the previous three steps.

Frequency analysis was conducted for extracting affective adjectives related to mobile phones. Subjects participated in the survey which selected 50 affective adjectives related to mobile phone among the pool. A total of 67 participants were recruited as volunteers, who were 36 males and 31 females. The average age of the participants was 27.46. As a result of frequency analysis, 43 affective adjectives which represented major affection were extracted as affective adjectives related to mobile phones.

3.2 Selecting tasks for evaluating affective adjectives related to mobile phones

We selected the tasks for evaluating the level of affection on mobile phones. The tasks were consisted of the functions which represented high level of importance and high frequency of the use in previous research (Chung et al.,

Table 1. Tasks for evaluating affective adjectives in the use mobile phone

Tasks for evaluating appearance-based affective adjectives
- Examine the external design of a mobile phone
- Turn on the mobile phone and examine internal design
- Examine the size of a mobile phone
- Examine the display size of a mobile phone
- Examine the weight of a mobile phone
- Touch the surface of a mobile phone and examine the quality of the material

Tasks for evaluating performance-based affective adjectives
- Carry a mobile phone
- Check the call history and make a call
- Search the name in phone book and text massage
- Input a new number to phonebook
- Check current time and set the alarm
- Connect internet and search data

2009; Jeong and Lee, 2005; Kim et al., 2006; Song et al., 2009; Yoon et al., 2004) (Table 1).

4. Extracting the representative affective factors through factor analysis

A survey was conducted to extract the representative appearance-based affections and performance-based affections through factor analysis. A total of 87 participants were recruited as volunteers, who were 51 males and 36 females. The average age of the participants was 29.37. After executing the task, the importance score of 43 affective adjectives related to mobile phones was marked in terms of appearance-based affection on a scale of 100 points. And then, the importance score of 43 affective adjectives related to mobile phones for was marked in terms of performance-based affection in the same way.

4.1 Reliability test of the survey data

Reliability test was conducted to evaluate the reliability of surveyed data. We used Cronbach's coefficient alpha as a reliability criterion. In this case, the reliability was inferred if Cronbach's coefficient alpha was nearly 1 (Lee and Lim, 2005). As a result, Cronbach's coefficient alpha of the survey data on appearance affection was 0.932 and that of performance affection was 0.941, which implies that the survey data was reliable.

4.2 Screening affective adjectives

MSA (Measure of Sampling Adequecy) was obtained to screen affective adjectives. Affective adjectives were eliminated if the MSA value was below 0.5 (Hair et al., 2009). As a result, five appearance-based affective adjectives and two performance-based affective adjectives were eliminated. And then, KMO (Kaiser-Meyer-Olkin) was obtained to examine the variable appropriation of appearance-based affective adjectives and performance-based affective adjectives. The variables are appropriate if KMO value was over 0.5 (Hair et al., 2009). KMO value of appearance-based affective adjectives was 0.743 and the value of performance-based affective adjectives was 0.693. According to KMO value, the appropriation of the samples was identified.

4.3 Factor analysis of affective adjectives

Factor analysis was conducted to extract representative appearance-based affection and performance-based affection. We conducted factor analysis using varimax method. The affective adjectives were eliminated if the communality value was below 0.5. And the affective adjectives that were multiply loaded were also eliminated the result was illustrated in Table 2 and 3.

As a result of the factor analysis on appearance-based affective adjectives, 25 affective adjectives were chosen as

Table 2. Factor analysis of affective adjectives on appearance aspect

	F1	F2	F3	F4	F5	F6	
	Unique	Luxurious	Fancy	Slim	Durable	Modernistic	Communality
Innovative	0.94	0.18	0.02	0.12	0.17	-0.06	0.96
Stimulating curiosity	0.91	0.06	0.19	0.17	0.20	-0.06	0.94
New	0.87	0.28	0.07	-0.12	0.03	-0.05	0.86
Creative	0.82	0.15	0.08	-0.15	-0.12	0.21	0.78
Fresh	0.81	0.18	0.11	0.33	0.25	-0.15	0.90
Brilliant	0.72	0.21	0.36	0.26	0.00	-0.15	0.79
Harmonious	0.70	0.26	0.25	0.19	0.28	-0.05	0.74
Aesthetic	0.29	0.87	0.15	0.06	0.07	0.04	0.87
Luxurious	0.17	0.76	0.36	0.08	0.16	-0.09	0.78
Hight-class	0.28	0.71	0.26	0.37	0.23	-0.07	0.85
Sophisticated	0.40	0.67	0.14	0.39	0.20	0.04	0.83
Pretty	0.22	0.08	0.83	-0.13	0.24	-0.06	0.82
Appealing	0.12	0.12	0.80	0.34	0.06	-0.08	0.80
Colorful	0.17	0.28	0.75	0.21	0.06	0.11	0.73
Cute	0.14	0.26	0.71	0.33	-0.06	0.15	0.73
Agile	0.15	0.12	0.19	0.87	0.01	-0.05	0.84
Slim	0.11	0.19	0.17	0.85	0.22	0.20	0.88
Thin	0.30	0.39	0.14	0.73	0.20	0.04	0.84
Durable	0.06	0.02	0.03	-0.19	0.86	0.31	0.88
Substantial	0.09	0.20	0.07	0.34	0.79	0.03	0.79
Stable	0.33	0.01	0.31	0.03	0.75	0.18	0.80
Modernistic	-0.06	-0.27	0.16	0.20	0.16	0.75	0.73
Simple	0.12	0.20	-0.17	0.18	0.21	0.72	0.68
Slick	-0.26	-0.21	0.14	-0.06	0.22	0.70	0.67
Sensuous	0.07	0.39	-0.09	0.14	-0.06	0.68	0.65
% of variance	22.43	13.19	12.63	12.58	10.23	9.49	80.55

Table 3. Factor analysis of affective adjectives on performance aspect

	F1	F2	F3	F4	F5	F6	F7	
	Unique	Technical	Simple	Slim	Luxurious	Fancy	Inconvenient	Communality
Creative	0.82	0.27	0.06	0.09	0.25	0.02	-0.07	0.83
Attractive	0.76	0.26	-0.01	0.15	0.29	0.24	0.03	0.81
Stand-out	0.74	0.44	-0.03	0.08	0.07	-0.02	0.12	0.77
Characteristic	0.71	0.22	-0.20	-0.08	0.22	0.26	0.02	0.72
Brilliant	0.67	0.24	0.04	0.09	0.12	0.32	0.40	0.79
Innovative	0.20	0.85	-0.01	0.00	0.34	0.01	0.01	0.88
Hight-tech	0.13	0.81	0.00	0.14	0.06	0.27	0.07	0.78
Up-to-date	0.37	0.81	0.00	0.18	0.15	0.04	0.17	0.87
Distinct	0.47	0.71	-0.03	-0.08	-0.02	0.15	-0.06	0.76
Modernistic	0.29	0.69	0.09	0.20	0.27	0.07	-0.24	0.74
Simple	0.10	-0.08	0.90	-0.11	0.07	-0.04	0.14	0.86
Easy	-0.28	0.16	0.86	0.01	0.07	0.01	-0.10	0.85
Convenient	0.25	-0.15	0.83	-0.13	0.00	-0.10	0.12	0.81
Casual	-0.10	0.06	0.72	0.38	-0.01	0.09	-0.14	0.70
Light	-0.09	0.09	0.66	0.36	-0.17	-0.30	0.17	0.73
Agile	0.14	0.07	-0.04	0.91	0.18	0.11	0.06	0.90
Slim	0.15	0.07	0.04	0.86	0.20	0.18	0.11	0.86
Thin	-0.26	0.24	0.31	0.69	0.34	0.08	0.07	0.82
Luxurious	0.30	0.06	-0.03	0.11	0.80	0.14	0.19	0.81
Hight-class	0.22	0.28	-0.12	0.31	0.73	0.16	0.15	0.81
Slick	0.20	0.27	0.19	0.41	0.64	0.29	0.07	0.82
Charming	0.26	0.35	0.11	0.20	0.63	0.33	-0.05	0.75
Cute	0.05	0.13	-0.03	0.11	0.15	0.89	-0.01	0.84
Pretty	0.24	0.11	-0.10	0.09	0.31	0.79	0.28	0.89
Appealing	0.35	0.21	-0.16	0.26	0.13	0.73	0.28	0.88
Intricate	0.02	0.05	0.01	0.09	0.08	0.07	0.95	0.93
Heavy	0.09	-0.06	0.13	0.08	0.14	0.19	0.91	0.91
% of variance	14.73	14.60	12.74	10.87	10.32	10.04	8.68	81.98

affective adjectives that explain appearance-based affection efficiently. Among those 6 representative affective factors were finally extracted and defined as Unique, Luxurious, Fancy, Simple, Durable, Modernistic from a focused group interview. And the 6 representative affective factors could explain 80.55% of performance-based affection.

As a result of the factor analysis on performance-based affective adjectives, 27 affective adjectives were chosen as affective adjectives that explain performance-based affection efficiently. 7 representative affective factors were finally extracted and defined as Unique, Technical, Simple, Slim, Luxurious, Fancy, Inconvenient from the focused group interview. And the 7 representative affective factors could explain 81.98% of performance-based affection. These results of appearance and performance affections were shown in Table 4.

Table 4. Representative affective factors

Appearance aspect (% of variance)	Performance aspect (% of variance)
Unique (22.43%)	Unique (14.73%)
Luxurious (13.19%)	Technical (14.6%)
Fancy (12.63%)	Simple (12.74%)
Slim (12.58%)	Slim (10.87%)
Durable (10.23%)	Luxurious (10.32%)
Modernistic (9.49%)	Fancy (10.04%)
	Inconvenient (8.64%)

As a summary, consumer's affection on mobile phones from the aspect of appearance was caused by 6 those of affective factors (Unique, Luxurious, Fancy, Slim, Durable, Modernistic). And the affection from the aspect of performance was caused by 7 those of affective factors (Unique, Technical, Simple, Slim, Luxurious, Fancy, Inconvenient). The result showed a difference of affective factors between appearance and performance aspects. According to the result, we derived 13 affections that must be considered in the design of mobile phones.

5. Extracting the priority of the representative affective factors through ANOVA

5.1 Extracting the importance of each representative affective factors

A survey was conducted to extract the importance of 13 representative affective factors in evaluating the level of consumer satisfaction on mobile phones. A total of 30 participants participated as volunteers, who were 17 males and 13 females. The average age of the participants was 28.56. And Cronbach's coefficient alpha of the surveyed data was 0.869. The importance score was marked on the scale of 100 points. After the survey, we conducted one-way ANOVA to find the difference in the importance scores among the representative affective factors. As a result of ANOVA, a difference was found to be significant at $\alpha = 0.05$ (p-value = 0.021). Thus, we derived the result that a priority of representative affective factors exists.

5.2 Grouping the representative affective factors

We conducted the post-hoc analysis using SNK (Student-Newman-Keuls), which was illustrated in Table 5. Although the importance of each representative affective factor was not grouped independently, we grouped the importance by comparing their mean values. Thus, we derived a priority in seven groups.

Table 5. The result of post-hoc analysis (SNK)

Representative affection	Groups					
	A	B	C	D	E	F
Unique (*Appearance*)	A	GROUP 1				
Technical (*Performance*)		B	GROUP 2			
Unique (*Performance*)		B				
Slimple (*Performance*)		B	C	GROUP 3		
Slim (*Performance*)			C	D	GROUP 4	
Luxurious (*Appearance*)				D	E	GROUP 5
Luxurious (*Performance*)				D	E	
Fancy (*Appearance*)					E	GROUP 6
Slim (*Appearance*)					E	
Fancy (*Performance*)					E	
Inconvenient (*Performance*)						GROUP 7
Durable (*Appearance*)						F
Modernistic (*Appearance*)						F

▶ Group1: Unique_*Appearance*
▶ Group2: Technical_*Performance*, Unique_*Performance*
▶ Group3: Simple_*Performanc*
▶ Group4: Slim_*Performanc*
▶ Group5: Luxurious_*Appearance*, Luxurious_*Performance*
▶ Group6: Fancy_*Appearance*, Slim_*Appearance*, Fancy_*Performance*
▶ Group7: Inconvenient_*Performance*, Durable_*Appearance*, Modernistic_*Appearance*

6. Discussion and conclusion

The main purpose of this research was to define appearance-based affection and performance-based affection and to suggest a priority of consumer's affection in designing mobile phones.

It was found from the research that consumers had different level of affections between appearance and performance aspects. And we found that the appearance-based affection arises from Unique, Luxurious, Fancy, Slim, Durable, Modernistic affections and that the performance-based affection arises from Unique, Technical, Simple, Slim, Luxurious, Fancy, Inconvenient affections. A grouping by the importance of representative affective factors was tried through ANOVA. We derived that consumer affection must be considered in the design of mobile phones from different affective factors with their priorities. We expect that the result from this research can help suggest the direction of mobile phone design satisfying consumer affection.

For more direct reflection of the research, a relationship between consumer's affection and design components of mobile phones should be studied for further research. We expect that the design of competitive products which satisfy consumer's affection can be made possible.

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Author Listings

Sungyup Kim icemanid@korea.ac.kr

Highest degree : BS, Department of Industrial Engineering, Korea University

Position title : MS Candidate, Graduate School of Industrial Management and Security, Korea University

Areas of interest : Product design and development

Sungjoon Park sjpark@nsu.ac.kr

Highest degree : PhD, Graduate School of Industrial Engineering, POSTECH

Position title : Professor, Department of Industrial and Management Engineering, Namseoul University

Areas of interest : Product design and development, Human Factors, Kensei Engineering

Sungmin Kim iampreppie@korea.ac.kr

Highest degree : MS, Graduate School of Industrial Management and Security, Korea University

Position title : PhD Candidate, Graduate School of Industrial Management and Security, Korea University

Areas of interest : Product design and development

Eui S. Jung ejung@korea.ac.kr

Highest degree : PhD, Graduate School of Industrial Engineering, Pennsylvania State University

Position title : Professor, Division of Information Management Engineering, Korea University

Areas of interest : Product design and development, Human Factors, Kensei Engineering

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