Dashboard Design Factors on Emotional Change:
How Separation between Center-Fascia
and Center-Console, Button Orientation
and Button Arrangement Influence Emotion

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Abstract. This study aims to find out which kind of car interior design factors influence human emotion change. A special focus was given on emotional effects of dashboard design. The selected design factors of dashboard, which are commonly observed in luxury cars, were the separation between center-fascia and center-console, the orientation of each button and the arrangement of buttons. Perceived luxuriousness and preference were measured out of seven points via an online questionnaire. It was hypothesized that i) when center-fascia and center-console are divided than when they are integrated, ii) when button orientation is horizontal than when it is vertical, iii) when buttons are arranged horizontally than when they are arranged vertically, perceived luxuriousness and preference would be increased. 2 x 2 x 2 repeated-measures ANOVA was conducted on perceived luxuriousness and preference with division, orientation and arrangement as factors. Results showed that when button orientation is horizontal, perceived luxuriousness and preference were higher. Perceived luxuriousness and preference were also higher when buttons are arranged horizontally. An interaction effect between button orientation and arrangement on preference was found. This implies that higher preference can be triggered when at least one factor is horizontal. No other significant effects were found.This study was conducted to make a car interior design guideline which associates particular design factors that trigger particular emotional response. Future studies should investigate low-level psychological elements and conduct factor analysis of various emotional adjectives.

Keywords: Dashboard, Kansei-enginerring, Car Interior, button, center-fascia, luxuriousness.

1   Intro

The market for imported cars in Korea has grown in recent years. For that reason, manufacturers have to consider various factors of car design to satisfy a wide range of users. The number of consumers who consider Kansei-design is increasing and so is the competitiveness within the design industry. Car manufacturers focus more on

Kansei-factors – luxury material, elaborate finishing touches, convenience system, etc. – than traditional specs – speed, horse-power, fuel efficiency, etc. (Bahn et al. 2006). This international market trend triggers the Kansei study on design and engineering factors of the car exterior and interior. There are many Kansei studies on car interiors: the Kansei-evaluation of car interior materials(Shin et al, 2002), developing luxuriousness-model of car crash pad(Bahn et al, 2006), research on car seat design factors(Han et al, 2000), evaluation of touch sense on car interior(Park et al, 2013), the Kansei-engineering on car interior image(Tanoue et al, 1997), and study on Kansei-study on car interior(Jindo et al, 1997).

Most of these studies focus on responses to visual or tactile characteristics of interior details. However, it is necessary to study interiors holistically because the same trend might not be observed uniformly across the individual components. Leder et al(2005) have studied the overall frontal interior by using holistic view image. In this study, they chose three design factors and combined these factors to make their stimuli, which looked like the general front interior of a car and could be perceived more holistically. They controlled the rest of the factors that can affect one's kansei – interior materials (Shin et al., 2002), seat design (Han et al., 2002), crash-pad material, color, surface (Bahn et al., 2006) – and by doing so just the form of the interior could be evaluated

In this study, we are interested in emotional change with respect to design factors of the car dashboard. We observed three flagship models of major Europian luxury car brands and a representative domestic luxury model. Because the focus was on luxuriousness, we selected the most high-end model of each brand and extracted the common design factors.

2   Experiment

We studied the effect of particular design factors on perceived luxuriousness and preference by using the methodology from Leder et al. (2005). The models chosen for stimuli creation   were Mercedes Benz S-Class (2014), BMW 7 Series (2013), Audi A8 (2014), and Hyundai Equus (2013). Each of these is the flagship models of their respective brand and represent the brand's pride, and therefore seemed appropriate in studying about perceptions on luxuriousness. We discovered three common design factors, as indicated in Figure 1.

Three extracted design factors are 1) separation between center-fascia and center-console, 2) the orientation of each button, 3) and the arrangement of buttons. These characteristics are commonly observed in many luxury cars.

From these findings, we set up our hypothesis as below. Perceived luxuriousness and preference would increase when:

1. the center-fascia and center-console are divided than when they are integrated,
2. the button orientation is horizontal than when it is vertical,
3. the buttons are arranged horizontally than when they are arranged vertically

Fig. 1. Design factors of each brand flagship(from left Audi A8, BMW 7 series, Benz S-Class, Hyundai Equus)

2.1   Participants

There were a total of 88 participants (39 male and 49 female). The average age was 26.16 and the range was 20 – 34 years.

2.2   Apparatus and Stimuli

Experimental stimuli were generated through Adobe Illustrator CS6 , similar to those used in Leder et al. (2005) and based on the interior of the BMW 7 Series. All other design factors except independent variables were controlled for experiment. The three independent variables were i) separation between center-fascia and center-console(integration/separation), ii) orientation of each button(horizontal/vertical), iii) arrangement of buttons(horizontal/vertical). The stimuli created for this study are shown in Figure 2.

The experiment was carried out as an online survey using Google Docs Form. The URL generated by this form was sent to participants via e-mail or mobile phone.

Fig. 2. Experimental stimuli

2.3   Experiment Design and Procedure

The experiment used a within-participant design. Participants completed the survey by choosing answers about luxuriousness and preference on a 7-point Likerts scale, where 1 means "Not luxurious or preferred at all" and 7 is "Most luxurious or preferred". After finishing each stimulus evaluation, participants clicked the "next" button to continue. There were 8 combination stimuli based on three independent variables. To prevent any ordering effects and learning effects, the order of stimulus presentation was randomized by a balanced Latin square.

3   Result

Collected data were analyzed using the statistics package program PASW Statistics 18. A 2x2x2 repeated measures ANOVA was conducted.

3.1   Luxuriousness

Valid data on perceived luxuriousness from 86 participants were analyzed by repeated measures ANOVA. Data from two participants missing data was excluded. Value of descriptive statistics is indicated in Figure 3.

A main effect of button orientation on perceived luxuriousness was observed ($F(1, 85) = 4.643$, p = .034). They were perceived more luxurious when button orientation is horizontal (m = 4.009, s.e. = .097) than when vertical (m = 3.846, s.e. = .103). Moreover, a main effect of arrangement of buttons was found as well ($F(1, 85) = 7.008$, p = .010). When buttons were arranged horizontally (m = 4.029, s.e. = .099), they were perceived more luxurious than when arranged vertically (m = 3.826, s.e. = .102). There were no other main effects or interactions.

	m	sd	n
S11	4.06	1.056	85
S12	3.91	1.175	85
S21	4.00	1.256	85
S22	3.76	1.168	85
I11	4.13	1.282	85
I12	3.94	1.277	85
I21	3.93	1.225	85
I22	3.70	1.398	85

Fig. 3. Desciptive statistics value on luxuriousness

3.2   Preference

Value of descriptive statistics of preference is indicated in Figure 4. Data from six participants with incomplete values were excluded from analysis and repeated measures ANOVA on 82 values were conducted.

A main effect of button orientation on preference was observed ($F_{(1, 81)} = 7.433$, $p = .008$). This means people preferred the design when each button were laid out

horizontally ($m = 4.006$, *s.e.* $= .108$) than when shown vertically ($m = 3.805$, *s.e.* $= .110$). Similarly, a main effect of arrangement of buttons was found ($F_{(1,\ 81)}= 6.709$, $p = .016$). Participants preferred having buttons arranged horizontally($m= 4.012$, *s.e.* $=.111$), than buttons arranged vertically ($m = 3.799$, *s.e.* $= .111$).

In addition, an interaction effect between button orientation and arrangement of buttons was found ($F_{(1,\ 81)}= 5.302$, $p= .016$). Figure 5 indicates that when each button was laid out horizontally, there was no effect of button arrangement on preference. However when laid out vertically, horizontal arrangement of buttons is more pre-ferred than otherwise. Likewise, when buttons were arranged horizontally, people didn't show a clear preference for arrangement direction. Nevertheless, if buttons were arranged vertically, the horizontal buttons were preferred. No other significant effects were found.

	m	sd	n
S11	4.10	1.096	81
S12	3.98	1.227	81
S21	4.05	1.323	81
S22	3.63	1.262	81
I11	3.99	1.252	81
I12	3.96	1.271	81
I21	3.91	1.229	81
I22	3.62	1.254	81

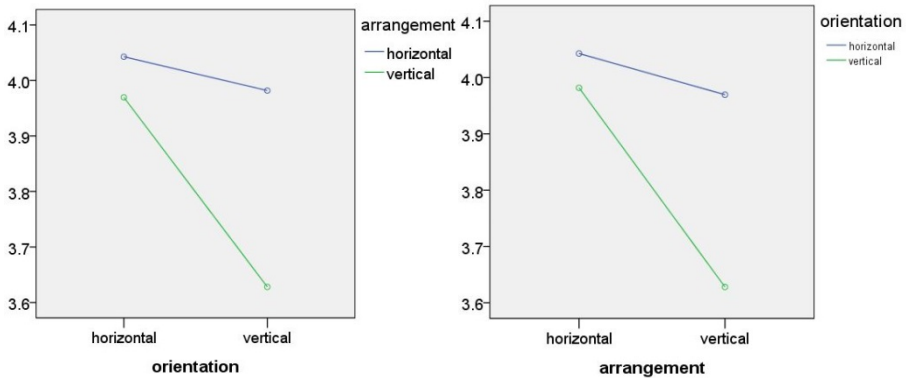**Fig. 4.** Descriptive statistics value on preference

Fig. 5. Interaction effect between orientation and arrangement on preference

4   Discussion and Future Direction

This study examined the car interior design factors–button orientation, arrangement of buttons–which affect people's emotion. The effect of separation between center–fascia and center-console on both emotion–perceived luxuriousness and preference – were not found. Participants' inability to detect the differences of this factor could

have influence this outcome. Nevertheless, the other two factors were identified as valuable for use in design guides. The observed effects were significant between these two factors on perceived luxuriousness and preference.

It is recommended that future research employ stimuli with different viewing perspectives. For example, the separation between the center-fascia and center-console can be more noticeable from a more diagonal angle. Moreover, low-level research dealing with luxuriousness is scarce. It would be valuable if Kansei-design factors can be explained by low-level perception research. Finding the perceptual mechanism involved in feelings of luxuriousness will be the next step in this line of research.

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