

Design Experience System for Customers of Tombstones

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Abstract

Aim of this research is to provide a design experience system for potential customer of tombstone as well as recording their way of experience and self-evaluation to refresh the database on *kansei****** evaluation of this system. Also this system could trace the process of customers designing as well as their self-evaluated image as statistical data. The recorded process and evaluation is used by way of analysis to reflecting to the *kansei* database which changes the portal view or design data of tombstone in visual scattered map style.

This system is running on the web site. Firstly the viewer is requested to enter their personal preference and characteristics determined as effective to characterize their personality. Then a scattered map appear. This adaptable map made them easy to search customers' preference in design. Next, customer can see the shape of tombstones in small pictures and move/select them. After the selection, Customer can see the larger image in three dimension. Since the tombstone is constructed in many pieces, they can modify selected style in the shape, position, and texture as they like. Customer can brows from the design view to simulation view. On the background process, customer's profile, selected tombstone, and modification are recorded as a data. This data can be analyzed by Canonical Correlation Analysis to determine the relationship between shape and *kansei* evaluation.

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******Kansei* means a ability of intuitive understanding stimulated by sensory. Realized by people as an irrational but somewhat confident feeling to things.

Preface

With the development of information technology, the relationship between consumer and designer is changing. For the consumer, the range of their request can expand with the flexible manufacturing system as well as flexible ordering system. However, there is still limitation for consumer to get the request but un-aware image through those systems. In another words, there are not design environment for the consumer. Providing the design system for consumer, consumer can be a real customer. There were some approaches for visualization in design process by Pasman et al [1], [2]. In this research, the effect of scattered map is proved. In this research, theme to create the designing system for customer, effective design process will not be the same as the full-design process such as for designers. It should contain a guided process, designing support or even the interaction through the design database. In this research, based on the preceding study presented by Honjo, et al [3, 4], we focused on the design system of tombstone including the interface to the image database and customer modifiable simulation system. Research consists with three parts. 1) Design the personalized entrance with the image database. 2) User modifiable simulation system 3) Logging and analysis system for the “designing process” by customer.

1: Design the Personalized entrance with the image database

For building a tomb, user need to think about not only the price but also the design before the order. Because it should have name engraved on it, the product is a kind of personal one. However usually the consumer cannot see the real shape before the contract. Then a real sample or the image database system is highly required as user’s experience.

1-1 Expression, profile, and form factors:

Firstly, we made an investigation with 19 expression words, 30 sample tombstones, and 12 customer’s profile (6 customer’s profile parameter and 6 self -determined customer’s preference) to 175 panels (male: 106, female: 69). [3,4]

1-2 Effective customer’s profile to the expression

With the result of ANOVA, it is turned out that the preference characters for forms such as Novelty, Decoration and Artistic are relatively effective to personal difference in *kansei*. We use these for key-categories to determine user’s *kansei* status. Although religion status, family status, expected price range, preference to the material, purchase timing are less significant, these are important for marketing purpose.

1-3 Essential *kansei* expression words

Also the similar words were determined through Principal Component Analysis [5] and Cluster Analysis to the expression to the 30 tombstones by the 175 panels. Then, we could define at most 12 words representing essential *kansei* evaluation. (shadows on figure 1)

1-4 Sample’s *Kansei* values : Relation between form factors and *kansei* expression

There were three factors, *kansei* expression, form factors, and samples. We applied a Canonical Correlation Analysis to define the reasonable relationship between *kansei* expression and form factors [6].

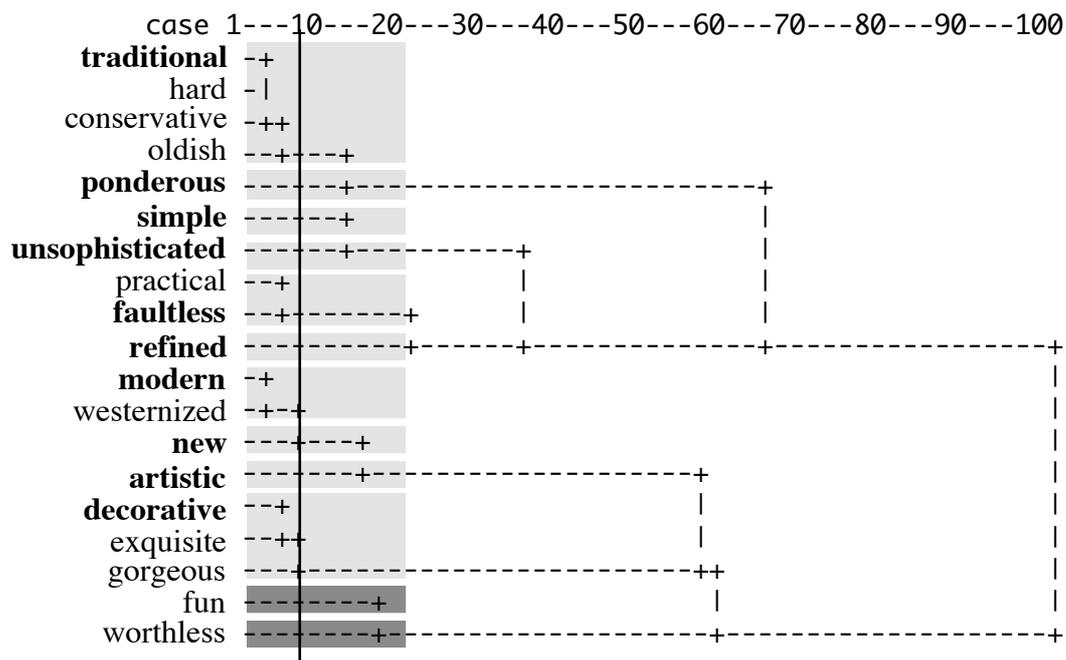


figure 1: Effective evaluation word for tombstone

The result showed there were good canonical correlation factors that have good correlation coefficient between *kansei* expressions and form factors. Table 1 shows the all of the canonical correlation factors. For example, the first factor represents the *kansei* expression of “traditional” is highly related to the form factor of the shape of upper unit. The second factor represents the simplicity that is related with orientation, number of steps, top line and front angle of upper stone. The third factor also represents the artistic aspect but with a traditional point of view. The effective form factors are flower base, engraving and arabesque like decoration. This factor suggests that a kind of artistic feeling came from the arrangement of decorative patterns. The fourth factor represents the traditional. The related form element is incense holder. This means the part represents the traditional feeling strongly. The fifth factor represents refined artistic. For this feeling, wall type affect strongly. The sixth factor is for modern image. The modern image came from the presence of incense stick holder combination with wall type. The seventh factor related to unsophisticated and faultless. This image is a kind of negative emotion. For this feeling, traditional orientation and engraving support strongly. The eighth factor represents a new image. It come from the wall style especially upper stone’s design. The ninth factor represents traditional and new image. Engraving is a key factor to this evaluation.

Thus samples’ *kansei* values are defined as sample score of the canonical correlation coefficient.

table 1: Canonical Correlation Coefficient between *Kansei* evaluation and form factor.

Dimension		1	2	3	4	5	6	7	8	9
Canonical Correlation Coefficient		0.999	0.996	0.992	0.983	0.938	0.931	0.915	0.900	0.825
kansei expression	traditional	1.25	0.20	1.30	8.17	0.11	1.64	0.47	13.73	5.22
	modern	0.01	0.70	0.82	1.54	0.26	2.13	2.04	0.12	0.63
	simple	0.74	5.16	2.09	0.01	0.10	0.05	0.37	0.63	0.17
	decorative	0.12	0.62	0.26	1.24	0.40	0.48	0.10	0.80	1.15
	new	0.48	2.07	1.04	0.06	0.50	0.01	1.27	27.04	6.25
	ponderous	0.65	0.80	0.65	0.12	0.01	0.70	0.04	0.03	0.26
	unsophisticated	0.50	1.60	0.06	0.82	0.16	0.04	4.97	3.24	0.09
	refined	0.00	0.85	0.01	0.03	2.89	0.01	0.47	0.08	0.10
	artistic	0.00	0.51	2.32	1.12	4.88	0.09	0.09	1.86	1.79
faultless	0.85	0.07	0.70	1.50	3.14	1.29	5.12	0.97	0.50	
form factors	Orientation	0.02	0.77	0.10	0.05	0.10	0.01	1.41	0.48	0.14
	Number of steps	0.11	1.09	0.12	0.39	0.05	0.15	0.07	0.01	0.24
	top line	0.23	0.91	0.86	0.15	0.02	0.09	0.41	0.25	0.05
	upper unit	0.80	0.07	0.13	0.10	0.84	0.20	0.44	0.74	0.10
	color	0.04	0.07	0.01	0.31	0.59	0.02	0.33	0.73	0.02
	surin	0.01	0.01	0.06	0.00	0.06	0.11	0.02	0.18	0.05
	flower vase	0.29	0.26	1.80	0.01	0.00	0.09	0.17	0.13	0.01
	incense stick holder	0.23	0.00	0.02	0.50	0.22	0.89	0.05	0.06	0.11
	surface finish	0.04	0.08	0.02	0.02	0.23	0.01	0.13	0.02	0.00
	front angle of upper stone	0.01	0.81	0.02	0.14	0.01	0.12	0.85	0.41	0.00
	balance of upper/lower stones	0.10	0.05	0.17	0.19	0.16	0.07	0.47	0.05	0.02
	color	0.03	0.33	0.12	0.09	0.66	0.15	0.27	0.04	0.04
	material	0.02	0.11	0.24	0.03	0.16	0.02	0.18	0.12	0.15
	wall type	0.01	0.06	0.07	0.01	1.32	0.61	1.00	0.90	0.01
	engraving	0.11	0.01	1.85	0.01	0.05	0.28	1.57	0.21	1.27
	edge decoration	0.04	0.08	0.29	0.03	0.07	0.25	0.07	0.44	0.19
	upper unit edge	0.02	0.00	0.02	0.05	0.58	0.01	0.05	0.01	0.00
	upper unit cutout	0.07	0.12	0.00	0.02	0.13	0.30	0.24	0.19	0.01
	arabesque like decoration	0.12	0.03	1.99	0.12	0.03	0.28	0.48	0.59	0.01
	Object Scores	1	-0.15	-1.25	-0.36	-0.46	0.51	1.12	-1.22	-0.65
2		-1.59	0.87	0.15	-0.42	-1.31	0.88	-0.88	-0.26	-0.49
3		0.11	1.02	1.03	-0.08	-1.31	-0.99	0.01	0.52	-2.15
4		0.99	1.60	1.42	-0.13	-0.07	-1.00	-0.09	0.98	0.46
5		0.05	-2.16	-0.20	1.25	-1.16	0.98	0.54	-0.81	-0.30
6		-0.60	0.22	-0.93	0.99	1.62	-2.13	-0.36	-0.49	0.48
7		-0.67	1.48	2.26	0.04	0.11	0.14	1.27	-0.75	2.11
8		1.06	0.51	0.19	1.33	0.42	-0.54	0.94	-0.98	-1.28
9		0.26	0.63	-1.09	-0.75	1.78	1.75	0.95	-0.86	-0.68
10		1.42	-1.48	-1.10	-1.40	-0.33	-0.43	0.47	2.53	-0.05
11		1.72	-0.39	-0.89	1.18	-0.35	0.16	0.64	1.53	-0.59
12		-0.24	0.50	0.36	1.07	1.20	0.41	0.85	2.40	0.38
13		0.32	0.27	1.81	-1.25	-0.53	0.73	-1.21	0.27	-0.01
14		-0.01	-1.61	2.09	-0.24	2.04	-0.57	-1.69	-0.16	-1.49
15		-0.25	-0.31	-1.29	1.01	0.01	-0.78	-1.01	-0.73	1.13
16		0.31	1.16	-0.77	2.07	-1.29	0.00	-2.03	-0.66	0.24
17		-0.58	-1.14	0.50	1.19	-1.44	-0.84	0.63	0.21	0.02
18		-1.74	-0.11	-0.51	-0.18	0.12	-0.16	0.64	-0.37	-0.74
19		-0.84	-0.16	-0.50	-1.62	-0.71	-1.39	0.88	-1.22	-1.49
20		-2.13	0.09	0.27	-0.11	-0.38	1.32	1.49	1.10	-0.10
21		-0.38	0.66	-0.70	-0.54	1.55	0.30	-1.04	-0.13	-1.25
22		-0.54	0.54	-1.60	-0.56	0.02	-1.15	0.91	-0.28	0.42
23		-0.80	-0.52	-0.73	-1.91	-0.92	-0.77	-0.07	0.18	1.18
24		0.22	1.53	-1.29	-0.62	0.31	1.11	-1.86	0.97	-0.42
25		-0.18	-0.69	0.65	0.16	-0.54	-1.39	-1.16	0.76	0.97
26		-0.47	-0.51	0.31	0.40	1.51	0.35	0.56	0.72	1.16
27		-0.48	-0.96	0.43	1.49	-0.08	1.78	0.14	-0.40	-0.87
28		1.75	-0.39	0.59	-0.53	0.97	-0.77	1.15	-1.64	0.29
29		1.78	1.57	-0.48	-0.02	-0.84	0.82	0.89	-0.77	0.75
30		1.65	-0.95	0.39	-1.36	-0.92	1.06	-0.33	-1.03	0.26

1-5 Classification of customer

With the categorical combination of three effective customer's profile, ([novelty], [decoration] and [artistic]) customer can classify into eight groups. (table 2).

1-6 Relation between customer's profile and *kansei* values

From the result of 1-1, 175 panels can be classified into eight different groups. Then 19 expressions can be condensed by averages to the 12 *Kansei* evaluation according to the classification showed on Figure 1.

Then the correlation between classifications of panels and nine *Kansei* values (canonical correlation factors) can be produced. Thick letters on table 3 show the highly related components to the group.

table 2: grouping factors of panel's profile

groups	basic form		detailed elements		Shape	
	Originality	Traditional	Gorgeous	Unsophisticated	Unique	Ordinary
1	*		*		*	
2	*		*			*
3		*	*		*	
4		*	*			*
5	*			*	*	
6	*			*		*
7		*		*	*	
8		*		*		*

table 3: matching pattern of group of panels and canonical correlation factors

group of panels	canonical correlation factors								
	1	2	3	4	5	6	7	8	9
1	-0.877	0.989	-0.359	-0.958	-0.094	-0.900	-0.842	-0.481	-0.202
2	-0.956	0.988	-0.071	-0.881	0.108	-0.969	-0.983	-0.296	-0.002
3	-0.951	0.981	-0.087	-0.889	0.091	-0.965	-0.927	-0.312	-0.019
4	-0.985	0.961	0.057	-0.814	0.233	-0.983	-0.971	-0.172	0.126
5	-0.517	0.839	-0.717	-0.972	-0.581	-0.559	-0.457	-0.957	-0.667
6	-0.968	0.981	-0.026	-0.859	0.152	-0.979	-0.948	-0.253	0.043
7	-0.955	0.989	-0.073	-0.882	0.106	-0.969	-0.982	-0.298	-0.004
8	-1.000	0.896	0.235	-0.696	0.404	-0.988	-0.998	0.007	0.301

1-7 Image map system

According to the factors, a image map system of the scattering pattern of images, personalized to the viewer's *kansei* preference can be created.

Within the system, viewer will be asked name, sex, occupation as well as the *kansei* preference to the tombstone (figure 2,3). Then a scattered image map appears (figure 4). In this map, the image positions are differ according to the data of the customer.



figure 2: question for the profile



figure 3: question for the profile



figure 4 : scattered maps of small images of tombstone



figure 5 : scattered map with different profile

With the different customer's profile, the map appears in different positioning (figure 5). This difference supports the easiness of browsing. The system was created with Macromedia Director [7], [8] and visible through the web browser.

As the customer's brows with cursor of the computer, the particular image that located under the cursor will be magnified on the top-right corner of the window. When the customer found the preferred image, he can select it with point and dragging to the bottom-right area of the window to proceed.



figure 6: start window of design experience



figure 7: selected parts are shown in 3D

2: Design experience system for the customer

With selecting the preferred image, customer can proceed to the design experimental process. In the process, the selected image is shown on right area of the window. With the vertical bar on right end of the window, customer can change the image to the next one closer to the first one in Euclid distance on the scattered map that came through.

On this window, customer can see buttons on the magnified image. (figure 6) Customer can choose any part or all parts of tomb-stones on the magnified image. (figure 7) In this case, customer moved to another image and selected some parts used in different tombs. Un-selected parts are shown as left directed arrow icon. Selected parts are shown in right directed arrow icon with different color. This difference suggests customer can remove, or set back to the original tomb, the parts with the arrow.

Selected parts are stored in 3D data. So that customer can rotate or put up and down but also move the parts to anywhere. It is possible to move the parts apart from another parts. Supporting the freedom of

modeling intervention check was turned off. On figure 7, customer made a thick base and rather westernized style of top stone with flower base. There are no limits of numbers of selection or position on the modeling space. After the selecting process, customer can also select the material. There are many stone appropriate for the tombstone. According to the advice of stone design office, we selected the 20 stone patterns for simulation. In the figure 8, the brownish granite had selected. Then the next simulation is available. In the next simulation, user will select a graveyard from the several typical images of Japanese graveyard (figure 9). For simulation, 3D modeled situation will not give customer more reality than the pictures. Then the photograph of typical graveyard was used. On the other hand, like the selection of stone patters, as many image of the graveyards are selectable on left top panel. Each photograph has its own shot angle, the direction, size, lights and angles are automatically adapted to the background. Now customer can confirm their image. After the design experiment, user can contact to the manufacture for estimation or more action for the design. All this system is written in Ligo language of Macromedia Director.



figure 8: simulation with stone patterns



figure 9: simulated image in the graveyard



figure 10: simulation in the graveyard-2-



figure 11: simulation in the graveyard-3-



figure 12: simulation in the graveyard-4-

3: Record of experience

With the experience of design, customer's profile and preference are recorded. For this action, we created a set of *behavior*, the functional unit in Lingo language. These are similar to the dynamic analysis system[9], [10]. Also, all the design experiment process including the selected parts, or stones are logged with time stamps in a text data. The data would be placed on the server's directory. This data is useful for the consultation by the professional tombstone designers as well as the sales support.

4: Conclusion

In the sense of creating preferred design, the performance of giving the design experience to user can be examined. With Lingo language, designers can easily to prepare the experiment system. Also, with the logging *behavior* and Analysis *behaviors*, the customers' experience can be used for the creation process. Also with the analysis of this log, we will find an indication to the emergence of sense of understanding driven by the function of *Kansei*.

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