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Evaluating Users' Emotional Response to Iranian Ancient Products Using Kansei Engineering

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Abstract

Iranian animal-shaped pottery vessels dating back to about 1500 B.C. are good examples of emotional design in ancient Iran. These objects were functional vessels made inspired by different animals in real or abstract shapes. This research aims to evaluate the users' emotional response to these vessels using the Kansei engineering approach. Understanding these emotional responses is significant as it helps in designing products inspired by these ancient objects that resonate better with users' emotional and psychological needs. With the cross-sectional and descriptive methodology, five animal-shaped vessels belonging to different historical periods and discovered from different places were selected. By choosing 15 kansei emotion words a questionnaire using the 5-point semantic differential method set, and participants were asked to answer a similar questionnaire for each vessel. The images of five objects were provided to all the participants and they had to answer the five questionnaires by looking at them. The number of participants was 51, ranging from 15 to 50 years old. For data analysis, the factor analysis method was used for clustering the Kansei words, and then ANOVA analysis was applied. Based on the analysis, the result shows that the attractiveness of animal-shaped vessels for participants depends on the form, indicating a preference for familiar forms derived from nature that are similar to mental images. Functionality is also an important aspect of this type of design. For designers, understanding these emotional responses can significantly enhance the design process, leading to products that better meet users' emotional and psychological needs.

Keywords

Kansei Engineering, Iranian Ancient Products, Animal-Shaped Ceramics, Emotional Design.

Introduction

The origins of useful and appropriate product design go back to ancient times (Bürdek, 2005). Pottery has been one of the first arts and crafts in which humankind has included his taste and design talent; ancient man, along with learning pottery techniques, by combining his creativity with the practical values of pottery, has led this art industry to a new path of life (Ghorbani, 2023). Herbert Reid, a historian of art history, writes in The Meaning of Art: *The art of any land and the sensitivity of any nation can be measured by the art of pottery, and this is a reliable scale*. The art of pottery is so fundamental and depends on the basic needs of any civilization that the ethnic spirit inevitably manifests itself in it (Kianasl, 2008). A very high level of art and creativity in making pottery can be seen in animal-shaped potteries belonging to the history of Iran. These valuable vessels and creations have been the result of the understanding of the aesthetics and semiotics of form by the potters of ancient Iran (Kiani, 1978).

Now, after centuries, by studying these valuable surviving objects, while identifying the aesthetic features of these traditional works, one can create modern works using the semantic wisdom of the past and be inspired by them to present designs tailored to the needs of modern man (Amouian, 2016). Creative new product design is critical key success of many companies and in this regard, user goals are the main factors in designing a product (Putri et al., 2022). On the other hand, results showed that today the emotional preferences of users are the driving force for designers to innovate (Gong et al., 2022).

Pottery as one of the best samples of handicraft from view point of emotional design has many capacities for develop to creative new product designs based on the user's psychological needs. For this purpose, in this study, these potteries are evaluated and studied relying on kansei engineering method as a tool to identify the user's feelings and perception. Kansei is generally referred to sensitivity, sensibility, feeling, and emotions (Daud et al., 2019; Göken & Alppay, 2023). With more and more attention to people's psychological cognition and emotion in design, the concept of kansei engineering has been widely used in all kinds of product design (Wu & Yu, 2020; Chen, 2023). The literature review indicates that kansei engineering is a valuable tool for understanding and integrating emotional responses in product design. This methodology is particularly significant in the context of historical potteries, where it helps in preserving and reinterpreting traditional aesthetics in modern design.

The standard procedure of kansei engineering has the kansei evaluation experiment and multivariate statistical analysis. The following three steps are the most common procedure: the first step- selection of kansei words: collecting and choosing adjectives, second step- kansei evaluation experiment: psychological evaluation experiments on various products with a questionnaire that contains kansei words, and third step- multivariate analyses on evaluation data (Ishihara et al., 2022).

The methodology begins with selecting and determining the kansei words. Next, product samples are collected which will be used as stimuli and assessed by respondents using these kansei words. The collected data are then processed using statistical tools to analyze relations between kansei words and design elements of products such as: *partial correlation coefficient analysis, multiple linear regression analysis, partial least squares (PLS), principal components analysis (PCA), quantification theory type 1(QT1), rough set analysis, cluster analysis (CA), multiple linear regression analysis, analysis of variance (ANOVA), analytical hierarchical process (AHP), and factor analysis (FA)* (Kobayashi & Kinumura, 2017; Chen et al., 2018; Zeydan & Öcal, 2021; Hu & Yan, 2023).

In the present research, selected images of ancient Iranian pottery along with questionnaires containing kansei words and based on the 5-point semantic differential (SD) method provided to users and their feelings received qualitatively; qualitative information is then converted into numerical data through statistical software and their analysis leads to the extraction of design elements and the user's feeling of animal-shaped pottery.

Methodology

As a type of research methodology, the current study is cross-sectional and descriptive method. Kansei engineering usually starts with questionnaires and surveys (Liu et al., 2023). The process of implementing kansei engineering is: determining the domain, span of semantic space, span the space of product properties, and synthesis (Dewi & Ferlania, 2021). Kansei Engineering method involves a series of steps. According to Matsubara, the first step involves the selection of suitable kansei words, usually obtained from the literature. The second part involves the kansei evaluation experiment, where participants will rate the design samples using the kansei words with a semantic differential scale (Matsubara et al., 2011). SD evaluation is useful to study words as a scale in terms of the semantic space of each kansei word (Hapsaril et al., 2017). The answers were represented by the scale and they would be analyzed using factor analysis in the next step. The last step involves a statistical procedure that will analyze the relationship between kansei words and the product design elements (Pratiwi & Wijayanto, 2023). SPSS software was used for statistical analyses.

Semantic Space (Selection of Kansei Words)

The kansei words used for the elevation of the potteries were obtained through a procedure according to Nagamachi and Lokman with the initial set of words collected from literature, product descriptions, customer reviews, and customer review titles (Nagamachi & Lokman, 2011; Papantonopoulos et al., 2021). Finally, a list of 15 kansei words was listed as follows in Table 1.

Table 1: *Kansei Words.*

Energizer	Strict	Classy	Cute	Attractive
Innovative	Friendly	Lovely	Satisfactory	Alive
Fresh	Intimate	Functional	Precious	Smooth

Product Space (Pottery Samples)

To define the product space, the properties of selected samples were broken down to determine the items and categories. In this case, five items were determined (Neck form, Body shape, Body texture, Handle, and Leg form). Each one of these items has their own categories which are shown in Table 2. This table at the last section, after performing statistical processes, has been very helpful in the discussion and conclusion sections.

Table 2: *Design Items and Categories Classification of Pottery.*

No	Item Name	Category		
1	Neck Form (2 Categories)	One Hole	Three Holes	
2	Body shape (2 Categories)	Representative	Abstract	
3	Body Texture (2 Categories)	Plain	Drawn	
4	Handle (2 Categories)	Yes	No	
5	Leg form (3 Categories)	Flat	Short	Tall

Regarding pottery samples, the final samples were selected for questioning users as a result of two stages of study and a review of the types of these products. In the first stage, by referring to the Museum of Ancient Iran, all kinds of animal pottery in this museum were observed and photographed. In the next step, images of similar products available in museums abroad were extracted through written sources and Internet sites. By collecting more than 50 samples of images from animal pottery of ancient Iran, these products were evaluated and finally, five samples were selected for this research. Through the selection of the five final samples, an effort has been made that no two potteries be similar in terms of age, place of discovery, and form. Pictures of five final pottery samples are presented below (Figures 1-5).

Figure 1: *Sample A. Deer-shaped ceramic vessel, belonging to 1350-800 BC, Discovered in western Iran, 14 * 35.56 cm, LACMA Private Collection, Los Angles. Retrieved from https://collections.lacma.org/node/241152.*

Figure 2: *Sample B. Ceramic jug in combination with camels and water jugs, belonging to the Parthian period, Discovered in Dasht-e Moghan, Iran. 20*28*21cm. Private collection (Kambakhshfard, 2007).*

Figure 3: *Sample C. Four-legged vessel, belonging to 700-800 BC, Discovered in Lorestan, Iran. 18.1 * 17 * 21.5cm, Cleveland Museum of Art, Retrieved from https://www.pinterest.com/pin/310326230559813808.*

Figure 4: *Sample D. Bull-shaped ceramic bowl, belonging to the 13th century BC, Discovered in Marlik, Iran. Louvre Museum (Rafiei, 1998).*

Figure 5: *Sample E. A teapot with a long tube similar to a bird's head and beak, belonging to 900 to 800 BC, was Discovered from the seventh layer of Sialk, Iran. 21.5 *32cm. Personal Collection, New York (Kambakhshfard, 2007).*

Participants

The questioning process of this research was not limited to any specific group and was conducted in general. Participants were aged from 15 to 50 years old and included a mix of different demographics to ensure diverse perspectives. Subjects were randomly selected, ensuring their ability to read and a balanced gender representation with 28 females and 23 males participating. Emphasis was placed on the relative balance of participants' gender from the beginning of the study according to the emotional and aesthetic dimensions of the study; because it was possible that some feelings and emotions were significantly different due to gender differences and intrinsic characteristics.

Kansei Evaluation Experiment

After the selection of the Kansei words and finalizing five samples of pottery for questioning, a relevant questionnaire was developed and presented to the participants. Fifteen selected Kansei words were included in the questionnaire using a 5-point SD scale ranging from *Not at all* to *Very much*. According to the number of five samples, five similar questionnaires (with different headers) were provided to the participants; each of them answered 75 questions in total. To start the research, five clear images of animal pottery samples were printed in A5 size and provided to participants along with five questionnaires. Also, in this study's questioning process, different order of questionnaires from A to E was offered to the candidates to avoid possible similarity in answers due to the same order of the images.

Statistical Analysis

One of the most statistical methods used for evaluation results in Kansei Engineering is factor analysis (Wang et al., 2021). In the current study, factor analysis was performed by the use of the average values of the Kansei ratings for the pottery. The results from the factor analysis were interpreted based on the relative positions of the product properties on the Kansei words and their distribution along the dimensions (Papantonopoulos et al., 2022). In fact, factor analysis reduces the number of Kansei words into several factors (Rosyidi et al., 2017).

Results and Discussion

The average ratings for each sample are shown below in Table 3.

Table 3: *Overall Ratings for each Sample.*

Kansei Word	 A	 B	 C	 D	 E
Energizer	3.18	3.72	3.33	3.50	3.45
Strict	3.19	3.23	3.31	3.76	3.27
Classy	3.25	2.84	3.35	3.54	3.62
Cute	3.48	4.12	3.54	3.82	2.89
Attractive	3.56	3.41	3.50	3.70	3.52
Innovative	3.96	4.05	4.19	3.76	3.47
Friendly	3.21	3.54	3.17	3.33	3.07
Lovely	3.43	3.88	3.23	3.68	3.36
Satisfactory	3.27	3.47	3.41	3.37	3.37
Alive	3.41	3.90	3.25	3.62	3.03
Fresh	3.11	3.82	3.21	3.39	3.01
Intimate	3.19	3.80	2.94	3.31	3.05
Functional	2.50	3.07	3.13	2.64	3.47
Precious	2.96	3.05	3.52	3.17	3.52
Smooth	2.50	2.78	2.80	2.78	2.82

Data Factor Analysis

After calculating the average scores of each word, the factor analysis process was performed on the data. The purpose was to find out which of the Kansei words could be introduced together as an index in the form of a hidden attribute variable, and whether the questionnaire could be presented based on several indicators. Accordingly, the correlation matrix was drawn to show the degree of similarity and relationships between variables (Table 4). This matrix represents the relationships between variables (Kansei words); numbers greater than 0.5 are subject to the same relation shown in the table. The main diameter of this table indicates the degree of correlation of each attribute with itself, which of course is equal to 1. Numbers above the original diameter are the same as the numbers below. Therefore, to show the relationships between variables, only numbers greater than 0.5 in the lower part of the main diameter are distinguished and specified. The corresponding table is displayed in Table 4.

According to Table 4, for example, the word *classy* is related to the words *precious and attractive*, and these ratios can be seen in lines for all words. But to find out how significant these relations are and in how many clusters they can be categorized, it was necessary to examine the variances.

Table 4: *Correlation Matrix.*

Energizer	1													
Strict	.194	1												
Classy	-.420	.470	1											
Cute	.514	.251	-.728	1										
Attractive	-.327	.825	.686	-.095	1									
Innovative	-.082	-.238	-.663	.636	-.369	1								
Friendly	.715	.130	-.794	.934	-.246	.421	1							
Lovely	.781	.252	-.588	.761	-.074	.036	.919	1						
Satisfactory	.848	.034	-.446	.471	-.535	.259	.556	.440	1					
Alive	.609	.205	-.750	.955	-.111	.435	.985	.908	.423	1				
Fresh	.810	.107	-.785	.901	-.352	.429	.977	.875	.721	.929	1			
Intimate	.765	-.011	-.773	.767	-.330	.180	.943	.961	.496	.909	.913	1		
Functional	.373	-.325	.140	-.460	-.552	-.310	-.286	-.247	.557	-.446	-.095	-.164	1	
Precious	-.059	.022	.584	-.615	-.080	-.253	-.647	-.657	.261	-.737	-.473	-.670	.778	1
Smooth	.656	.334	.198	-.011	-.136	-.210	.057	.087	.788	-.064	.245	.025	.734	.688	1
Kansei Word	Energizer	Strict	Classy	Cute	Attractive	Innovative	Friendly	Lovely	Satisfactory	Alive	Fresh	Intimate	Functional	Precious	Smooth

In the next steps of statistical data analysis, correlation matrixes were drawn and used together with a table of rotating factors to determine the number of clusters. Based on these analyzes, 15 Kansei words in four general factors were identified in Table 5:

Table 5: *Rotated Matrix.*

Variable (Kansei word)	**Factor**			
	1	**2**	**3**	**4**
Energizer	.769	.619	-.025	-.156
Strict	.161	.144	.976	-.032
Classy	-.695	.101	.568	-.429
Cute	.819	-.042	.146	.554
Attractive	-.177	-.316	.915	-.177
Innovative	.166	-.107	-.224	.954
Friendly	.961	.029	-.020	.273
Lovely	.990	.007	.090	-.112
Satisfactory	.481	.827	-.159	.243
Alive	.945	-.111	.080	.298
Fresh	.922	.234	-.068	.300
Intimate	.984	.000	-.175	-.024
Functional	-.249	.822	-.423	-.289
Precious	-.678	.733	.024	-.060
Smooth	.056	.978	.186	-.076

Based on the rotated matrix in Table 4, words with a specific value of more than 0.5 in each column are placed in a cluster. Based on this, 15 Kansei words of this research can be classified into four clusters according to Table 6:

Table 6: *Clusters of Kansei Words.*

Cluster 1	Energizer	Cute	Friendly	Lovely	Alive	Fresh	Intimate
Cluster 2	Satisfactory	Functional	Precious	Smooth			
Cluster 3	Strict	Classy	Attractive				
Cluster 4	Innovative						

Analysis of Variance (ANOVA) Test

The ANOVA test allows a comparison of more than two groups at the same time to determine whether a relationship exists between them. In other words, in this study, to know the significant relationship (difference) between the means of different variables, ANOVA analysis has been performed.

In the ANOVA test, different groups are measured; in other words, in the present study, ANOVA analysis may be performed if different groups of candidates respond to the sample A questionnaire, another group to the B questionnaire, and other different groups to the rest of the questionnaires. Therefore, to perform the ANOVA analysis process, the candidates were randomly divided into five groups and it was assumed that each group answered only one questionnaire (related to a type of pottery). Based on what ANOVA analysis showed, in the case of *lovely* and *Innovative* words, five groups had significantly different opinions about them. The comparison diagram is drawn in Figure 6.

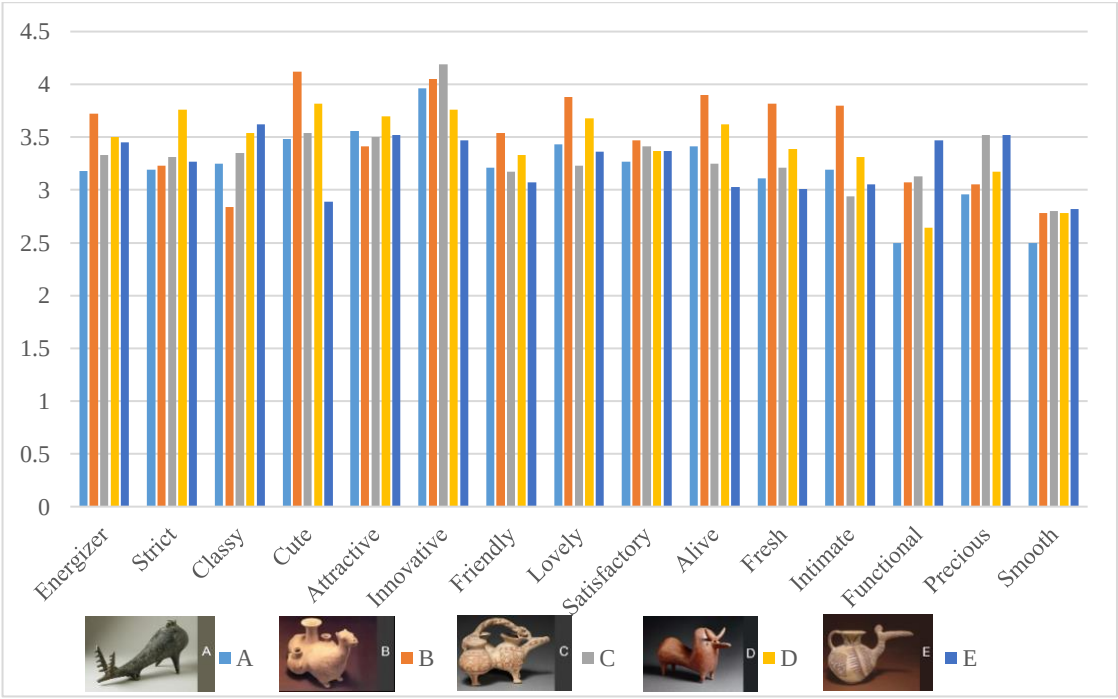

Figure 6: *Comparison diagram in the average values for five pottery samples.*

According to ANOVA results, there was a significant difference between the opinions of Group 3 (pottery C) and Group 2 (pottery B) regarding the word *lovely*. Based on the chart above, users considered pottery B to be the most loveable pottery and C to have the lowest. ANOVA analysis shows that this difference between the lowest and the highest average likelihood in pottery - that is, between models C and B- is significant and decisive. The word *Innovative* has a similar output to ANOVA analysis.

There was a significant difference in the *Innovative* variable between pottery C and E. ANOVA analysis confirms this difference between E and B. According to the lower statistics of B than C in the above diagram, if the significance of this difference between B and E is true, it is also true between C and E. There was a significant difference between A and E on *Functional* and *Precious* words. That means the use of a particular animal form on a pottery can create confusion about its intended function.

Conclusion

Today, in the design domain, product design pays more attention to the improvement and promotion of the user experience and emotional satisfaction or emotional perception. Kansei engineering as a powerful technique for translate human psychological needs to the design parameters, is a user demand-oriented product design engineering technology. As a result of statistical analysis and clustering of words, looking at the formal differences of the studied samples (whether natural or abstract) can be concluded as follows: due to the results of this research, it seems that when the user confronts animal-shaped pottery, he prefers to see a real body with all the logical and explicit characteristics of an animal rather than seeing a usable container. In this case, it does not matter to the user whether this statue as a container is a *functional* product or not, he *loves* a statue with its real and logical aspects; when he confronts a sculptural container, he expects a real animal form to communicate with him explicitly and logically. In this case, the animal with real form is one that is close to its natural characteristics in terms of proportions and states; these aspects make the animal form *alive* and *fresh*. Any exaggeration, brevity, and irrational departure from the natural form endangers the *lovability* of the animal container for the user. It seems that the shape of the potteries' neck, and whether it has a drawn surface or not, has not made a big difference in how users perceive it. One reason for this might be that these potteries are usually kept in museums and people don't expect to use them in their daily lives. In the end, it seems that potteries that have been able to depict recognizable images of animals have gained more attention from users, regardless of their functional features.

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