

Application of Kansei Engineering Techniques to the Redesign of Turkish Coffee Maker

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ABSTRACT

Turkish Coffee Maker is a well-known product that was invented and first manufactured in Turkey. Although it is a novel product, there is a huge demand for these machines as well as competition among the manufacturers. These companies are already implementing many innovation strategies. However, the study aims to carry out a computer-aided innovation method named Kansei Engineering in the Turkish Coffee Maker domain. Furthermore, many sub-methods were conducted in this research. These are extracting Kansei words, selecting specimens, choosing product properties, conducting affinity diagrams, SD Surveys, Factor, QT1, Descriptive and Multiple Linear Regression Analysis. In total, 257 Turkish people have participated in the study. It is expected that the findings will be beneficial for design experts who are redesigning Turkish Coffee Maker.

Keywords: Kansei Engineering · New Product Development · Turkish Coffee Maker

INTRODUCTION

Turkish Coffee is a well-known, cultural beverage being consumed by Turkish people frequently. Before the Turkish Coffee Maker's invention, people generally have made this beverage in traditional coffee pots. Arçelik developed the first patented Turkish coffee-making device (Telve) in 2003, and it gained an impressive reputation both in Turkey and abroad after being launched. Following this great commercial as well as cultural success, a large amount of demand has occurred for Turkish Coffee Maker. Many electronic household companies have started to design and manufacture these machines. Thus, the competition began among these companies, and the need for innovative strategies has occurred.

In this study, Kansei Engineering is considered as one of these strategies. This paper aims to conduct Kansei Engineering methodologies on the Turkish Coffee Maker domain. It is expected that the findings will guide designers in their idea and concept generation processes of these machines. Moreover, it is aimed to reach consumers' emotions about these products and link them with these machines' design properties.

Kansei Engineering is an innovation methodology that is customer-oriented (Nagamachi, 2002), emotional (Schütte, 2002) and computer-aided (Schütte, 2002; Bouchard, Lim and Aoussat, 2003). This methodology is especially famous in the east and was founded at Hiroshima University by Nagamachi in the 1970s. According to Nagamachi (2002) "*Kansei engineering aims at a translation of Kansei (customers' feelings) into the product design field including product mechanical function.*". Furthermore, Schütte (2002) explained this methodology as "*building a bridge between customers' feelings and product measurements*". He proposed a theoretical model on Kansei Engineering (KE) processes that includes six steps: choosing the domain, spanning semantic space, spanning product properties, synthesis, a test of validity, and model building (Schütte, 2002). This paper follows a similar path with Schütte's model.

On the other hand, some part of Nagamachi and Lokman's (2016) KE Type 2 model was also used in this study. Similar to this model, the low-level Kansei words are extracted after selecting the target. Then, by conducting SD Survey and Factor Analysis, high-level Kansei word-pairs are determined.

Besides these models, some Kansei Engineering case studies inspired this investigation. For instance, the study of Mamaghani, Rahimian, and Mortezaei (2014) has affected the Factor Analysis of this research. Moreover, Alves's (2018) research on water bottles assisted in selecting the specimens, determining the product properties, conducting QT 1 analysis, and multiple linear analysis. Lastly, Razza and Paschoarelli's (2015) case study on disposable razors inspired showing the affective dimensions of Turkish Coffee Maker.

METHODS AND MATERIALS

Many methods were conducted in this study and they were grouped into four parts to explain them clearly. These are choosing the domain, spanning the semantic space, study 1 and 2. While choosing the domain, an observational study was carried out on seven dealers in Izmir and Istanbul, Turkey. This domain is the one-pot Turkish Coffee Maker without a water tank for working young adults (between 20-45 ages).

SPANNING THE SEMANTIC SPACE

In this part of the research, following the studies of Schütte (2002) and Nagamachi and Lokman (2016), low-level Kansei words were extracted. Unlike this literature, awarded product descriptions and jury statements from Red Dot Design Awards (www.red-dot.org) and IF Design Awards (ifworlddesignguide.com) were used to gather Kansei words in this study. Additionally, the customer reviews in e-commerce websites such as Amazon (www.amazon.com.tr), trendyol (www.trendyol.com.tr), gittigidiyor (www.gittigidiyor.com), n11 (www.n11.com), and hepsiburada (www.hepsiburada.com); sectoral news and relevant Kansei engineering articles are the other sources that Kansei words were gathered.

In recent years, text mining applications have become popular in extracting Kansei words in Kansei Engineering researches (Hsiao, Chen, and Liao, 2017; Chiu and Lin, 2018). Similarly, in this study, “text mining” was used in extracting Kansei Words. On the Trendyol marketing website (www.trendyol.com.tr), 1600 reviews of customers were analyzed. WebHarvy, which is a web scraping software was preferred to extract the text from the source. Then, Microsoft Excel was used to translate all text into words and sort them depending on the repetition frequency.

Until this stage, 384 Kansei words were extracted. Because working with 384 Kansei words is difficult and time-consuming, the KJ (affinity diagram) method (Lokman and Kamaruddin, 2010) was carried out to reduce the number of Kansei Words by keeping the critical information. In the study of affinity diagrams, words with similar meanings were grouped, and each group was given a representative name. Then, the study continued with 105 words.

STUDY 1

To select the product properties, customer comments were used similar to the extraction of Kansei words, in this study. Most repetitive product features that are body volume, width, shape, and weight were chosen. After that, 10 varied Turkish Coffee Maker products (with one-pot and without water tanks) were determined as the specimens.

In the SD Survey 1, to measure the customer feelings about these specimens, Osgood’s semantic differential method was conducted. 7 points Likert scale is used

with the visuals of 10 products and 5 Kansei word pairs. In total, 21 surveys and 105 Kansei word pairs were evaluated. These surveys were shared with the participants via social media such as LinkedIn, WhatsApp. 210 Turkish volunteers have participated in the study; their ages were ranging from 20 to 45. 128 are women, and 82 are men of the participants.

In the synthesis stage, “semantic space” and “space of properties” were connected. Considering the models (Schütte, 2002; Nagamachi and Lokman, 2016) factor and multiple linear regression analyses were conducted in IBM SPSS V.26 software. Thus, significant design factors and correlations between Kansei words and product features of Turkish Coffee Maker were investigated.

STUDY 2

Via factor analysis, the representing words of the factors (high-level Kansei words) were chosen for the second study and SD Survey 2. These selected word-pairs are youthful-older; easy to use-not easy to use; pleasurable-non-pleasurable; innovative-non-innovative; stylish-unfashionable; functional-non-functional; artistic-non-artistic.

After forming the high-level Kansei words, some of the key product properties were chosen. Alves’s (2018) research was examined while determining these features. The selected items and categories are body shape (curvy-orthogonal), body volume (small-large), the material of coffee pot (plastic-steel) and, body colors (black and black-red). According to Alves (2018), the samples should include the pre-selected product features. Figure 1 shows these 8 Turkish Coffee Maker specimens involved in SD Survey 2.



Figure 1. Specimens of the Second SD Survey

Similar to SD Survey 1, in SD Survey 2, a 7 point Likert scale was used with the visuals of 8 specimens and 7 Kansei word-pairs. 47 Turkish participants responded to the survey. Their ages were ranging from 20 to 35. 25 are women, and 12 are men of the volunteers. In the synthesis phase, SD Survey 2 responses were analyzed in IBM SPSS v.26 software. Via this program, QT1 (Alves, 2018) and descriptive (Razza and Paschoarelli, 2015) analyses were conducted.

RESULTS AND DISCUSSION

RESULTS OF STUDY 1

Factor Analysis

Factor analysis was conducted to define the factors affecting the appeal of Turkish Coffee Maker in the market. The first factor “stylish” represents 12.371% of data. This factor has the biggest impact on the market success of these machines. The other factors represent 6.911%, 6.258%, 5.908%, 4.877%, etc...of all data. The tenth and the eleventh factors have a minimum impact on product appeal.

Mamaghani et al. (2014) carried out a similar factor analysis on the domain of ketchup sauce bottles. The first factor of this study explains 43.672% of the data and the other factors have smaller effects than the first factor in this study. There is a significant difference between Mamaghani et al.’s (2014) and this research in terms of the first factors. The first factor in Mamaghani et al.’s (2014) study has high domination among the other factors. It is estimated that the reason for this situation is the differences between the numbers of evaluated Kansei words. While 105 words were evaluated in this study, Mamaghani et al.’s (2014) tested 29 words in their case study.

Table 1 presents the variables having values bigger than .650. Factors up to eleven were selected that the eigenvalue became greater than 1. Nagamachi and Lokman (2016) stated that “*they give each factor a name that contains a common meaning that covers all the Kansei words with the high loading values.*” Similar to Nagamachi and Lokman (2016), the factors of this Turkish Coffee Maker domain (with one pot, without water tank for young adults) were named as stylish, energetic, trend follower, ideal capacity, functional, desirable, youthful, remarkable, strong, cultural, and smart.

11 factors were found in this Turkish Coffee Maker KE study. On the other hand, in Mamaghani et al.’s (2014) study, only 5 factors were shown because they eliminated the factors with low impacts as being insignificant. However, in this study, because the cultural and smart Kansei words may still inspire the designers, they were shown as factors although they have lower impacts. Moreover, 12. and 13. factors were eliminated similar to Mamaghani et al.’s (2014) study.

Table 1. Result of Factor Analysis with Rotation Varymax

F1-Stylish	F2-Energetic	F3-Trend Follower	F4-Ideal Capacity
Well-considered	.799	Joyful .727	Trend .739
Stylish	.758	Energetic .660	Follower .731
Contemporary	.691	Showy .656	Pleasantly Colored .703
Pleasant	.655		Sympathetic .698
			Elegant .675
			Innovative .675
F5 Functional	F6-Desirable	F7-Youthful	F8-Remarkable
Functional	.797	Want to own .782	Beautiful .840
Successful	.792	Timeless .774	Young .741
			Remarkable .833

Reformist	.778	design		Speedy	.741	Luxury	.813
Sturdy	.665	Like it	.649	Fashionable	.736	Balanced	.669
F9-Strong		F10-Cultural		F11-Smart			
Strong	.657	Cultural	.690	Smart	.695		
Natural	.654						

Multiple Linear Regression

The results of multiple linear regression are shown in Table 2. According to the findings, designing Turkish Coffee Maker in small volume and narrow evokes the customers' feelings of "stylish, trend follower, reformist, desirable, youthful, remarkable, and strong". On the other hand, designing these machines in curvy forms evokes the energetic emotions of customers. Lastly, light products reveal energetic, ideal capacity, youthful and remarkable feelings of the customers on these machines.

The Unstandardized Coefficients B and Partial Correlation Coefficients values obtained from the analysis are also displayed in Table 2. For instance, for small body volume, this would mean that for every one-unit increase in small volume, trend follower (the dependent variable) increases by 0.868 units. Moreover, PCC values $> .500$ are shown in bold. In this multiple linear regression analysis, Alves's (2018) case study was followed.

Table 2. Results of Multiple Linear Regression

Items	Body Volume		Body Width		Body Shape		Bodyweight	
	Small-Large	Wide-Narrow	Curvilinear-Linear	Heavy-Light	B	PCC	B	PCC
KW	B	PCC	B	PCC	B	PCC	B	PCC
Stylish	-1.243	-.683	1.226	.508	-.266	-.320	.567	.472
Energetic	-.810	-.396	-.173	-.064	-.718	.077	.776	.576
Trend follower	-.868	-.663	1.216	.699	.077	.129	.351	.406
Ideal Capacity	-.359	-.325	.012	.008	.006	.011	.527	.725
Reformist	-.702	-.551	1.017	.601	.119	.205	.222	.264
Desirable	-.928	-.531	1.659	.714	.108	.135	.417	.361
Youthful	-.948	-.777	1.069	.660	-.134	-.240	.438	.544
Remarkable	-1.005	-.739	1.452	.804	-.237	-.381	.459	.511
Strong	-.365	-.513	.501	.530	-.104	-.320	.167	.356

RESULTS OF STUDY 2

Affective Dimension

Table 3 shows the affective dimensions of the Turkish Coffee Maker as the result of descriptive analysis. 47 Turkish people participated in this study and rated an SD scale from 1 to 7. In Table 3, the Kansei words at the top are related to the high level (7 points); the Kansei words at the bottom are related to the low level (1 point). The bold numbers are the highest and lowest scores.

According to the results, "Product 2" has the highest scores on all the variables except "Ease to Use". On the other hand, "Product 7" has the lowest scores on all the variables. Additionally, "Product 3" and "Product 5" were rated with the minimum score for the variable "Ease to Use". "Product 1" was rated with the greatest score for the same variable.

This part of the study follows Razza and Paschoarelli's (2015) research about disposable razors. These razor products have a long history and many varieties. Thus, in this study, 40 specimens were used and rated. However, the Turkish Coffee Maker is a novel product and has less variety in the market. Therefore, in this part of the study, 8 branded coffee maker products of Turkey were evaluated.

Table 3: Evaluation of Affective Dimension





Highest side of the scale (7)	Youthful	Easy to Use	Pleasurable	Innovative	Stylish	Functional	Artistic
Product 1	4,06	5,87	4,13	3,57	4,34	5,09	4,19
Product 2	5,19	5,66	5,36	4,81	5,15	5,17	4,85
Product 3	3,79	4,89	4,55	4,70	4,91	5,15	3,43
Product 4	4,06	5,36	3,51	3,70	3,23	4,79	4,60
Product 5	4,28	4,89	4,19	4,43	4,30	4,66	3,87
Product 6	4,57	4,94	3,87	4,21	3,74	4,62	4,77
Product 7	3,43	4,89	3,19	3,40	2,96	4,45	3,32
Product 8	3,87	4,98	3,62	3,72	3,55	4,53	3,40
Lowest side of the scale (1)	Non Youthful	Not Easy to Use	Upleasant	Non-Innovative	Non-Stylish	Non-Functional	Non-Artistic

QT 1 Analysis

The results of QT 1 analysis show that there are strong and positive correlations between “Coffee Pot with Plastic” and “Youthful”; “Small Body Volume” and “Easy to Use”; “Black Body Color” and “Innovative” and “Curvy Body Shape” and “Artistic”. Table 4 displays the values of PCC (Correlations Partial) and Unstandardized Coefficients B. In Table 4, PCC values $> .700$ are presented.

In this QT1 analysis, Alves's (2018) KE case study on water bottle packaging was followed. The disadvantage of QT1 analysis is the ability to test a low amount of product features. For instance, in this study, only two color alternatives could be evaluated. Therefore, in future studies, PLS analysis will be conducted additionally. Thus, more colors and properties of these machines would be tested.

Table 4: Results of QT1 Analysis

Kansei Words	Property	PCC	Level			
Youthful	Material of Coffee Pot	.788	Plastic Steel	-0.322		0.322
Easy to Use	Body Volume	.808	Small Large	-0.337		0.337
Innovative	Body Color	.804	Black Red-Black	-0.415		0.415
Artistic	Body Shape	.703	Curvy Orthogonal	-0.330		0.330

CONCLUSION

The theoretical structure of this paper proposes to search the differences between

traditional-manual products and electronic versions in terms of evoking emotions. The results of factor analysis show that Turkish Coffee Maker include 9 hedonic and 2 pragmatic factors. On the other hand, it is estimated that traditional coffee pots do not have all these hedonic factors. One reason may be the coffee pots are being kept in the kitchen drawers and the machines are being displayed on kitchen counters. This theoretical approach would be searched and analyzed in similar product groups such as tea pot-machine; toast tool-machine; citrus juicer-machine, etc.

As mentioned above, Turkish Coffee Makers include 11 factors. The first three factors (hedonic values) represent the highest part 12.271%, 6.911%, 6.258% of data gradually. It means that this product should be redesigned to evoke the feelings of “stylish, energetic and trend follower” for young adults. The fourth (5.908%) and fifth factors (%4.877) are the pragmatic factors which are ideal capacity and functionality. It displays that Turkish Coffee Maker also needs to be designed to evoke these pragmatic feelings.

In this study, there were two main syntheses of Kansei words and product features. Firstly, Multiple Regression outcomes suggest that designers should develop Turkish Coffee Maker in small volume and curvilinear forms, narrow, and as light as possible. Secondly, QT1 results show that industrial designers need to design coffee pots with plastic material and the main body in black color, small volume, curvy forms. These proposals are valid for the same domain.

LIMITATIONS & FURTHER STUDIES

This research is a part of an ongoing Ph.D. dissertation that the findings will be used in another experimental study. A design brief will be created with these design inputs, and then, almost 10-15 professional industrial designers will redesign a Turkish Coffee Maker considering this brief. In their design processes, protocol analysis will be conducted. Thus, the ideas and experiences of industrial designers on Kansei Engineering will be searched and documented.

However, the most significant limitation of the study can be considered to be the COVID-19 pandemic situation which forces the researchers to conduct their studies online. In the future, SD surveys can be carried out face-to-face.

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