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What are the critical value attributes sought by software users?

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Completed Research

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Abstract

Using a grounded theory approach, our study (Kakar and Kakar, 2022) identified 6 types of values derived by software users. Although the participants in the debriefing session agreed with the values sought by them in using software as well as with the items in these values, there were differences in opinion about which values were critical to them. They asked whether we could analyze the data or collect more data to objectively find out the critical values in software use. We found the request to be interesting and conducted this study to investigate. We conducted the study using the widely accepted Kano model for attribute classification. The finding show that as expected items identified under Psychological Safety (comfort value) and Quality Value were key (must-have) for software users. By finding out the critical values in software use, perhaps for the first time in literature, this study has implications for software project managers and product managers in prioritizing the valuable features they should provide in their software application or product.

Keywords (Required)

Kano method, Utilitarian value, Quality value, Psychological Safety. User satisfaction.

Introduction

In our previous study (Kakar and Kakar, 2022)c) we conducted a ground theory approach to identify the various values sought by users from the use of software. We identified six values after coding the user responses and factor analysis (see Table 3 for details). Based on the items extracted during factor analysis, we named and defined each of these vales as follows:

Quality Value is value derived from the perceived quality and ease of use in using the product, Social value reflects the product's ability to enhance social self-concept, and Hedonic value is the utility derived from the feelings or affective states that a product generates, Utilitarian Value reflects the functional or practical value of the product, Epistemic value reflects the feeling of novelty and exploration in using the product and Psychological safety refers to the comfort value of product use.

However, the previous study did not identify which among these six values are most critical to the users. This is important as project/ product managers can determine which features to prioritize in the software product to enhance user satisfaction and prevent user dissatisfaction. We used the well-established Kano model (Löfgren and Witell, 2008) after collecting additional data to find out. The findings are discussed, and the practical implications of the study are highlighted.

Literature review

Value Perspective

The utilitarian – hedonic conceptualization of product values as distinct and independent constructs was already established in consumer research literature. This, according to Diefenbach, Kolb and Hassenzahl (2014), led to the introduction of equivalent constructs of hedonic and pragmatic quality later in Human-

Computer Interaction (HCI) literature (Hassenzhal, Platz, Burmester and Lehner, 2000; also see Diefenbach, Kolb and Hassenzahl, 2014) and of perceived usefulness and perceived enjoyment in Technology Acceptance Model (TAM) literature (Davis, 1989; Venkatesh, 1999). Later studies suggested that software products and services can also provide self-esteem and status benefits to its users (e.g., Kakar, 2018). Users can derive self-esteem and social status by sharing their knowledge and expertise with other users. A consolidated summary of differences between Utilitarian Value(UV), Hedonic Value (HV) and Social Value (SV) (Table 1).

UTILITARIAN VALUE	HEDONIC VALUE	SOCIAL VALUE
Represents "shoulds" or reasoned preferences (Bazerman, Tenbrunsel and Wade-Benzoni, 1998)	Represents "wants" or affective preferences (Bazerman, Tenbrunsel and Wade-Benzoni, 1998)	Represents social meaning and self-expression choices of the user (Elliot, 1997)
Targets Homo Economicus - Consumers are utility calculator (Rintamaki, 2006)	Targets Homo Ludens - Consumers are guided by senses (Rintamaki, 2006)	Targets Homo Faber - Consumers convey their personalities, lifestyles and beliefs through conspicuous
Is functional and practical (Stelmaszewska, Fields and Blandford, 2004)	Is enjoyment, novelty, aesthetics, unexpectedness, fun (Stelmaszewska, Fields and Blandford, 2004)	Is symbolic, expressive, relational (Smith and Colgate, 2007) (Belk, 1988)
Is a means to an end (Babin and Harris, 2011)	Is an end in itself (Babin and Harris, 2011)	It can be both a means (social status) and an end in itself (self-esteem) (Rintamaki, 2006)
Helps accomplish practical goals/ tasks (Smith and Colgate, 2007)	Provides sensory benefits (Smith and Colgate, 2007)	Provides relational and network benefits (Smith and Colgate, 2007)
Generates cognitive satisfaction response when fulfilled (Chitturi et al., 2007; Berman, 2005)	Generates affective delight response when fulfilled (Chitturi et al., 2007; Berman, 2005)	Builds self-esteem and social status when fulfilled (Elliot, 1997)
Can be Objectively appraised (Chitturi, 2009)	Is Subjective, Experiential (Chittri, 2009)	Is Interactional, Relational (Elliot, 1997)

Table 1. Differences among Value Dimensions (adopted from Kakar, 2022)

User Satisfaction/ Dissatisfaction

Customer satisfaction is a key indicator of product performance. It is argued that satisfaction leads to reduced price elasticity, increased cross-buying, increased loyalty, and positive word of mouth. Numerous empirical studies confirm a positive relationship between profitability and customer satisfaction (e.g., Anderson, Fornell and Lehmann, 1994; Eklo ̈f, Hackl and Westlund, 1999; Ittner and Larcker, 1998). End-user satisfaction with software is also an considered a significant factor in ensuring its success and use (Ives, Olson, and Baroudi, 1983; Torkzadeh and Doll, 1991; Delone and Mc Lean, 1992; Seddon, 1997). As software projects are often constrained by limited resources, project managers must decide how to deploy the scarce resources parsimoniously to achieve the highest level of user-satisfaction.

It should be noted however that satisfaction and dissatisfaction are not the opposite of a unipolar scale but two different dimensions. According to the two factor theory attributes are either "satisfiers" or "dissatisfiers" (Kakar, 2013). Satisfiers are those attributes that can cause satisfaction when implemented in a product but no dissatisfaction when not implemented into the product while Dissatisfiers are those that cause dissatisfaction when not implemented into the product but no satisfaction when implemented into the product. They are similar to "motivators" and "hygiene" factors respectively of the Motivation-Hygeine theory (Herzberg and Synderman, 1967) in job satisfaction. Thus, satisfaction and dissatisfaction operate on two different continua caused by two different set of factors.

The two-factor theory is supported by research (Swan and Combs,1976; Maddox 1981; Cadotte and Turgeon, 1988; Johnston and Selvestro, 1990). However, later research also identified product attributes that cause satisfaction when implemented into the product and dissatisfaction when not implemented into the product (Brandt, 1987; Brandt and Reffet, 1989; Stauss and Hentschel,1992; Johnston,1993; Anderson and Mittal,2000). This third factor, satisfier/ dissatisfier, gave rise to the three factor theory which is now popular as the theory of attractive quality (Kano et al, 1993).

The theory of attractive quality uses the Kano survey method to identify three types of factors "Basic" (Dissatisfiers or Hygiene factors), "Performance" (Satisfiers) and "Excitement" (Satisfiers or Motivators). Must-be factors are prerequires and should be implemented into the product to make it successful, performance factors make the product competitive and Excitement factors or Exciters differentiate the product from competition.

Kano survey method:

In the Kano Survey Method subjects respond to two questions for every attribute: the functional question "How do you feel if this feature is present?" and dysfunctional question "How do you feel if this feature is NOT present?" The first question concerns the reaction of the user if the product includes that feature, the second concerns his reaction if the software does not include that attribute. The user must choose one of the five possible options for the answers for both the functional and dysfunctional question: 1. I like it this way, 2. I expect it this way, 3. I am neutral, 4. I can live with it this way, 5. I dislike it this way. Asking both functional and dysfunctional question helps managers assess user priorities. If the user expects some attribute feature to be present, but can live without the feature, it is not a mandatory or critical feature. Based on the user responses to the questions in both functional and dysfunctional form for each of the user's requirements, the quickest way to assess the questionnaires is to map response for each attribute in Table 2 and using plurality of subject responses to determine the attribute category to which it belongs. The plurality of responses of all participants determines the overall category for the attribute.

Functional Question	Dysfunctional Question				
	Like	**Expect**	**Neutral**	**Live with**	**Dislike**
Like	Q	E	E	E	P
Expect	R	I	I	I	B
Neutral	R	I	I	I	B
Live with	R	I	I	I	B
Dislike	R	R	R	R	Q

B-Must have requirements or Basic Features
P-Performance requirements or Expected Features
E-Excitement requirements or Augmented Features
R-Reverse, i.e. wrong features, that would make the consumer experience worse
Q-Questionable, i.e. the consumer answers is inconsistent
I-Indifferent, i.e. the consumer does not care about this feature

Table 2. Kano Method used for categorizing Value Attributes

Method of Data Collection   Round 2 of the study was conducted using the Kano survey method for 39 items from the previous study (Kakar and Kakar, 2022) (see Table 3 for details). The same 222 subjects who participated in the the previous study (Kakar and Kakar, 2022) (Round 1) provided data. The subjects who provided their response to the Kano questionnaire were 19-24 years old. 51.3% respondents were female, and 49.7 % respondents were male. The average age of respondents was 19-23.2 years and average length of software user experience of 12.2 years. A sample pair of questions question for item UV is "How do you feel if using this software improves your work performance" and "How do you feel if using this software does not improve your work performance". The subject provides one of the following responses for each question "1. I like it this way, 2. I expect it this way, 3. I am neutral, 4. I can live with it this way, 5. I dislike it this way". If the plurality of subject responses are Like it for the first

functional question and disklike if for the first dysfunction question then using Table 2 the item is categorized as Performance value item.

To test the validity of the categorizations using the Penalty Reward Contrast Analysis Method (PRCA), subjects also rated their overall satisfaction with the softwaree using a single item 7 point scale (Andrews and Withey, 1976) with a neutral midpoint of 4, terrible at one end of the scale (1) and delighted at the other end of the scale (7): 1 - Terrible   2 – Unhappy 3 – Mostly Dissatisfied 4 – Neither Satisfied nor Dissatisfied 5 – Mostly Satisfied 6 – Pleased 7 – Delighted. Single-item measures offer advantages of being short, flexible, and easy to administer (Pomeroy, Clark and Philip, 2001). They are also less time consuming and not monotonous to complete (Gardner, Cummings, Dunham. and Pierce, 1998), thus reducing response biases (Drolet and Morrison, 2001a). Hence, they are appropriate for use in large scale studies (Robins, Hendin, and Trzesniewski, 2001).

Results and Analysis

The finding of the study is shown below. All items or attributes of Utilitarian Value were categorized by participants as Performance attributes, all items of Hedonic Value and Social Value were categorized by participants as Excitement attributes, all items of Quality Value and Psychological Safety were categorized by participants Must-have attributes, one item of Epistemic value was categorized as Performance attribute and 2 items were categorized as Excitement attributes.

Items	Description	Value Category
	Utilitarian Value (UV)	
UV1	Using this software improves my work performance.	Performance
UV2	Using this software increases my productivity.	Performance
UV3	Using this software enhances my effectiveness.	Performance
UV4	I find this software to be useful.	Performance
UV5	Using this software helps me to complete my tasks effectively.	Performance
UV6	I find this software to be helpful in accomplishing my functional goals.	Performance
	Hedonic Value (HV)	
HV1	While using this software product, we feel happy.	Excitement
HV2	Compared to other similar things I could have done, the time spent using this software was truly enjoyable.	Excitement
HV3	When using this software, I feel excited.	Excitement
HV4	I have a very nice time while using this software.	Excitement
HV5	While using this software product, I am able to forget my problems.	Excitement
HV6	While using this software product, I feel happy.	Excitement
	Social Value (SV)	
SV1	Patronizing this software product fits the impression that I want to give to others.	Excitement
SV2	I am eager to tell my friends/acquaintances about this software product.	Excitement
SV3	I feel that I belong to the user cohort of this software product.	Excitement
SV4	I found this software product to be consistent with my style.	Excitement

SV5	I felt like a smart user by selecting this software product.	Excitement
SV6	This software product gave me something that is personally important or pleasing for me.	Excitement
	Psychological Safety (PS)	
PS1	I know if I make a mistake in using the software, I can recover easily.	Must Have
PS2	I have security concerns while using this software. R	Must Have
PS3	The diagnosis and correction of software defects require minimal time and effort.	Must Have
PS4	The help function is very useful in resolving problems.	Must Have
PS5	The software can resume working quickly and recover affected data in case of a failure.	Must Have
PS6	Software updates can be installed easily and continue to work ss expected after the change.	Must Have
PS7	The software warns me if I commit an error.	Must Have
PS8	The response of customer support is prompt and effective.	Must Have
PS9	The software is capable of maintaining a specified level of performance in case of software and hardware errors.	Must Have
	Epistemic Value (EV)	
EV1	I can intuitively navigate the software menu options to explore its various functions.	Excitement
EV2	There is always something new and exciting every time I use the software.	Excitement
EV3	It is as if I am embarking on a great adventure while using the software.	Excitement
	Quality Value (QV)	
QV1	The software utilizes resources efficiently.	Must Have
QV2	The software is easy to use.	Must Have
QV3	The software is easy to learn.	Must Have
QV4	The software can be modified easily.	Must Have
QV5	The software is defect free.	Must Have
QV6	The software can be moved easily to another hardware or software environment.	Must Have
QV7	The software can be installed easily	Must Have

Table 3. Kano categorization of Value Item

Testing Validity of Results

To test validity of these categorizations we adapt the widely accepted PRCA (Penalty Reward Contrast Analysis) (e.g., Brandt, 1987; Anderson and Mittal, 2000; Brandt, 1988; Matzler and Sauerwein, 2002; Mittal, Ross and Baldasare, 1998) technique to determine the dissatisfaction if a particular value (e.g., UV) for the software is low and satisfaction level if the value is high. Validation was done at the level of 6 Values as the sample size did not permit the validation to be done at the level of individual items. PRCA methods involves the use of regression analysis with two sets of dummy variables representing each value. A value of (1, 0) indicates the level of a particular value derived by the software is high (1 SD above mean) and a value of (0, 1) indicates the value derived is low (1 SD below mean). Based on this coding scheme, multiple regression analysis was conducted with overall software satisfaction for the value-added set as

dependent variable and the individual subject responses (high or low) to the 6 values of the software as independent variable. Two regression coefficients are obtained after regression analyses — one to measure the impact when value provided by the software is high and when the value provided by the software is low. The results are summarized in Table 4 below.

Name of the Value	Satisfaction at High Value	Dissatisfaction at Low Value
Utilitarian Value	0.337**	-0.321**
Hedonic Value	0.267**	-0.032
Social Value	0.206**	-0.045
Psychological safety	0.061	-0.437***
Epistemic Value	0.108*	-0.53
Quality Value	0.069	0.126*

*p<0.05 **p<.01 ***p<.001

Table 4. Results of PRCA Analysis

Thus, PRCA analysis (Table 4) shows that UV is Performance value attributes, HV, SV and EV are Exciters and PS and QV are Must-Have value attributes. This is in accordance with their value categorizations of the items of these values in Table 3.

Discussion

In this study we answer the question raised by the participants of our e previous study: Psychological safety and Quality Value are Must-have value attributes of software users. Among the two Psychological Safety has higher level of dissatisfaction when not provided to the software user. It implies that Psychological Safety and to a lesser extent Quality value are prerequisites and the software is unlikely to succeed without these values. Utilitarian Value on the other hand is a performance requirement. It will make the software product competitive. The higher the utilitarian value the higher the user satisfaction from the use of software. Hedonic Value, Social value and Epistemic Value are Exciters. They will differentiate the software from competition. In terms of priority, software project/ product managers should first ensure high levels of Psychological Safety and Quality Value to be accepted in the marketplace, followed by Utilitarian value to compete successfully with other software products. Once these values are fulfilled then software can focus on providing hedonic Value, Social Value and Epistemic Value to attract and delight the software user.

Conclusion

Using the well-established Kano Method, this study answers the research question raised in the introduction section regarding critical value attributes sought by software users. Psychological Sfety and Quality Value were identified as the critical must-have value features for the software product to be accepted by users. Introducing software product features that provide these values (see items in Table 3) will prevent user dissatisfaction. However, they do not add enhance user satisfaction levels as users take these features as granted and absolutely expect them to be provided in the software. Yet, without providing the must-have features, investing in enhancing performance and exciting value features will not help reduce user dissatisfaction and preclude user acceptance of the software

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