

Understanding Key Attributes in Mobile Service: Kano Model Approach

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Abstract. This study investigated how customers perceive currently available 3G mobile services. More specifically, by using the Kano model, it tried to categorize them into five quality attributes: Attractive, One-Dimensional, Must-Be, Indifferent, and Reverse. The results showed that picture messaging, instant messaging, navigational aid, and mobile internet are considered as “one-dimensional quality attributes”. That is, the higher the level of fulfillment of these mobile services, the higher the customer’s satisfaction, and vice versa.

Keywords: Multimedia Mobile Service, 3G Technology, Kano Model.

1 Introduction

The mobile Internet can be defined as a combination of Internet and mobile technology that allows users to access the Internet via their mobile devices, such as cellular phones and PDAs [8]. Since the mobile Internet can be accessed anytime and anywhere, users can use it in various contexts. Users of the traditional (wired) Internet can use it in mostly limited contexts, such as in an office or at home. Therefore, compared to the traditional (wired) Internet, the mobile Internet has greater potential to create more opportunities to deliver advanced services to users. Specifically, 3G technology enables mobile users to access various multimedia services across mobile networks at the high speed [9]. Still, mobile users could use Internet-like services by using the Wireless Application Protocol (WAP) in 2G mobile networks, but this 2G technology has provided very limited support for data services due to its low data transfer rate. Since the market for voice communications has reached its maturity, telecommunication companies must develop new businesses and markets [6] [10]. Although the growing penetration rate of 3G based mobile devices has increased the number of mobile Internet users rapidly, the main usages of the mobile Internet still stem from 2G based data services, such as Short Messaging Service (SMS), ring/avatar download service, and 2D stand-alone games [1]. Telecommunication companies have introduced many innovative multimedia services, but only early adopters use these pioneering services. The adoption rate of the mobile services is much slower than that of the traditional Internet services. The 3G-based mobile

services stimulate the curiosity of early adopters, but they cannot fully satisfy the high expectations and the various needs of majority [8]. Although users have 3G enabled mobile devices, they do not see urgent needs about 3G mobile services. In order to commercialize mobile services successfully, telecommunication companies need to discover customers’ needs and to develop attractive services that satisfy these needs.

2 Research Objectives

Traditional studies on service quality proposed the one-dimensional quality model. This model assumes a linear relationship between the fulfillment of customers’ needs and their satisfaction or dissatisfaction experience. If perceived service quality exceeds customers’ expectation, it results in customer satisfaction. If not, it results in customer dissatisfaction [13]. One of the criticisms for the one-dimensional model is that it simplifies the real world too much [5]. For example, the communication quality of mobile phones might affect the customer’s satisfaction levels in the past, but it might not affect the customer’s satisfaction levels anymore. If the communication quality has problems, it might cause dissatisfaction. The communication quality of mobile phones is a service that causes dissatisfaction, not satisfaction. There are different service attributes that cause the customer satisfaction and that cause the customer dissatisfaction.

Table 1. Service Attributes of Kano Model

Attributes	Explanation
Attractive Attribute	Its fulfillment brings more than proportional satisfaction, but it does not bring dissatisfaction if it is not met.
One-Dimensional Attribute	The higher level of fulfillment, the higher the customer satisfaction and vice versa.
Must-Be Attribute	If its fulfillment is insufficient, customers will be dissatisfied. Even if its fulfillment is sufficient, it will not cause customer satisfaction.
Indifferent Attribute	Its fulfillment does not bring satisfaction and dissatisfaction.
Reverse Attribute	Its fulfillment causes dissatisfaction.

Source: Kano et al., 1984

In order to address this limitation, Kano suggests a two-dimensional model [7]. He emphasizes that satisfaction and dissatisfaction are two independent concepts and should be considered independently. He defines the service attributes which are related to only satisfaction levels as “Attractive Service Attribute”, the service attributes which are related to only dissatisfaction levels as “Must-be Service Attribute”, and the service attributes which can cause both satisfaction and dissatisfaction as “One Dimensional Attributes”. In addition, the service attributes, which customers do not care if they are or are not present, are defined as “Indifferent Service Attributes”. [Table 1] explains service attributes of the Kano model.

Companies introduce various mobile services, but customers appreciate values from only a few of them. Customers might even neglect most of them. Thus, it is critical to identify services that result in satisfaction, dissatisfaction, or no interest. Companies need to allocate their resources to improve the quality of the services that affect customer satisfaction, and they need to eliminate the services that cause the dissatisfaction. In order to develop various strategies for mobile services, telecommunication companies need to know which services cause satisfaction, dissatisfaction, or no interest.

Based on the discussion above, this study has the following research objectives.

Research Objective 1) The first objective is to discover how customers perceive 3G mobile services, based on Kano model.

Research Objective 2) The second objective is to understand how 3G mobile services are perceived differently between experienced users and non-experienced users.

3 Research Methodology

The main purposes of this study are to explore how customers perceive 3G mobile services and what factors affect the customer perceptions. In order to answer the above question, we used the Kano questionnaire. In general, there are three steps to develop and administer the Kano questionnaire: identify service attributes, develop Kano questionnaire, and determine service attributes [13].

Step 1: Identify Service Attributes

Currently, many studies have examined the adoption patterns for mobile services. Carlsson et al. (2005) grouped 13 mobile services into four categories (communication, entertainment, reservations and purchases, and information), and investigated their usage levels [4]. Nysveen et al. (2005) identified four major mobile services (text messaging services, contact services, payment services, and gaming services) and examined user intentions to the services [11]. The 2005/2006 National Technology Readiness Survey¹ examined the usages of 17 mobile services that can be enhanced by 3G technology. [Table 2] summarizes the classifications of mobile services. The first step to develop the Kano questionnaire is to identify service attributes that will be grouped into five Kano attributes. Based on the mobile services which the above studies examined and which mobile operators currently provide, this study identifies 12 mobile services (Refer to Table 2).

Step 2: Develop the Kano Questionnaire

The Kano questionnaire consists of pairs of customer requirement questions: how do you feel if a feature is present (functional questions), and how do you feel if the same feature is not present (dysfunctional questions). Depending on customers' responses on two types of questions (functional/dysfunctional questions), we determine whether a specific mobile service is an attractive attribute, an one-dimensional attribute, a must-be attribute, an indifferent attribute, or a reverse attribute. [Figure 1] shows a part of the Kano questionnaire. A customer answers choosing one of three alternatives (Satisfied, Neural, Dissatisfied) for functional questions and dysfunctional questions.

Step 3: Determine Service Attributes

Based on the responses to the functional and dysfunctional questions, each mobile service is classified into one of the six Kano categories. If the customer answers, for example, "I am satisfied" as regards "if you can order cinema tickets online" – the functional form of the question, and answers "I am neutral" as regards "if you cannot

¹ "2005/2006 National Technology Readiness Survey,"

http://www.rhsmith.umd.edu/ces/pdfs_docs/NTRS-2005-06.pdf

Table 2. Mobile Services

Nysveen et al. (2005)	Carlsson et al. (2005)	National Technology Readiness Survey	This Study
Text Messaging Contact Payment Gaming	Communication - SMS - MMS - Mobile Email Entertainment - Ring Tones - Icons and Logos - Listening to Music - Games Reservations and Purchases - M-Banking - Payment - Reservation of Movie Ticket etc. - Making Reservations, Purchasing Flight/Train Tickets - Shopping Information - Personalized Information Messages - Internet Browsing - Checking Time Tables - Location Based Services	- Text messaging - Mobile Web or Internet - Send and receive e-mail - Picture messaging - Bluetooth technology, which provides a wireless connection between devices over a short distance - Play MP3 or other music files uploaded from your computer or another device you own - Broadband Internet access - Use GPS (Global Positioning technology) to get directions or navigate to a certain address or place of interest - Download audio content over the air - Video messaging - Listen to live radio programming over the air - Streaming music content over the air - Watch video content uploaded from your computer or another device you own - Watch live video programming over the air - View streaming video content over the air - Participate in live video conferences - Download video content over the air onto your mobile phone or device	- Picture Messaging - Mobile Shopping - Instant Messaging - Video Conferencing - Radio on Demand - Mobile TV - Video on Demand - Navigational Aid - Mobile Games - Mobile Banking - Mobile Internet - My Space (Social Networking)


<p>Videoconferencing Service allows you to see and hear the person you are talking to in real-time and they will see and hear you.</p>	
<p>Have you used Videoconferencing Service (Yes/No)? []</p>	
<p>If your cell phone <u>HAS</u> Videoconferencing service, how do you feel? []</p> <p>1. I am SATISFIED. 2. I am NEURAL. 3. I am DISSATISFIED</p>	
<p>If your cell phone <u>DOES NOT HAVE</u> Videoconferencing service, how do you feel? []</p> <p>1. I am SATISFIED. 2. I am NEURAL. 3. I am DISSATISFIED</p>	

Fig. 1. Kano Questionnaire

order cinema tickets online” – the dysfunctional form of the question, the combination of the answers in the evaluation table produces category I, indicating “online ticket purchase” is an indifferent requirement from the customer’s viewpoint (Refer to Figure 2). He/she does not care whether it is present or not.

Step 4: Administer the questionnaire

In order to improve the quality of responses, we had group interviews (7~10 respondents), instead of simply distributing and collecting the questionnaires. Since

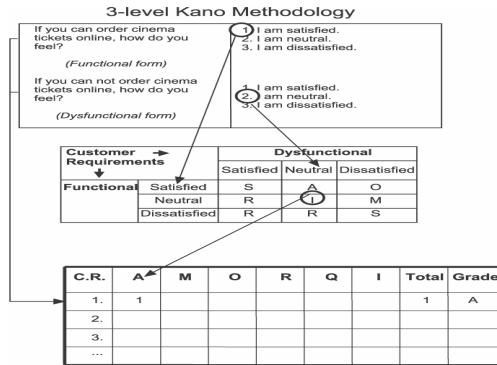


Fig. 2. Interpretation of Kano Questionnaire

the Kano questionnaire was to be new to respondents, we explained the purposes of this study and gave detail directions about filling out the questionnaire. Based on the Kano questionnaire, we asked university student respondents the two types of questions for each 3G mobile service. For this study, we selected university students as our respondents. The 83 responses were selected for the data analysis. The data sample consisted of 44 women and 39 men. The ages of most of the respondents were between 20 and 25.

4 Preliminary Data Analysis

This study examined the current usage status of 12 current mobile services that will be enhanced by 3G technology in the future. The results show that the most common mobile services used by US university students are picture messaging (87%) and mobile games (81%). Since the respondents of the study were university students, they tended to use the cellular phones for personal uses rather than work or business uses. In the same data sample, the least used mobile services were mobile banking (10%) and video conferencing (10%) services. In addition, due to the limited availability of phones with cutting-edge features, very few respondents used radio/video on demand services (11%). This result indicates that the diffusion and adoption of advanced mobile services, such as videoconferencing, streaming video/audio, broadcasting, have not progressed as expected. Although more advanced 3G mobile services are available, many respondents used the limited mobile services, such as mobile messaging services and mobile games, which they can use without 3G technologies.

Research Objective 1) The first objective is to discover how customers perceive 3G mobile services, based on Kano model.

[Table 3] summarizes the attribute classification for each of the 12 mobile services. The simplest method to group the mobile services is evaluation and interpretation based on the frequency of responses. However, because there are some cases that the largest percentage and the second largest percentage of a given category do not have significant differences, we need to test if there are significant differences between their proportions. For example, regarding to mobile game, the largest percentage of

Table 3. The Percentage of Each Mobile Service Attribute of Kano Quality Attribute

	S (%)	A (%)	O (%)	R (%)	I (%)	M (%)	P-value	Category
Picture Messaging	1.2	24.1	46.99	4.82	15.66	7.23	0.0000*	O
Mobile Shopping	1.2	21.69	3.61	10.84	57.83	4.82	0.0000*	I
Instant Messaging	2.41	19.28	48.19	4.82	25.3	0	0.0000*	O
Video Conferencing	2.41	36.14	8.43	10.84	39.76	2.41	0.2386	C
Radio on Demand	3.61	31.33	12.05	3.61	46.99	2.41	0.0016*	I
Mobile TV	2.41	30.12	9.64	13.25	39.76	4.82	0.0700	C
Video on Demand	0	30.49	10.98	13.41	45.12	0	0.0034*	I
Navigation	2.41	26.51	45.78	2.41	20.48	2.41	0.0012*	O
Mobile Game	1.2	33.73	38.55	7.23	14.46	4.82	0.0722	C
Mobile Banking	0	26.51	14.46	14.46	42.17	2.41	0.0024*	I
Mobile Internet	2.41	27.71	50.6	2.41	13.25	3.61	0.0000*	O
My Space	0	26.51	15.66	13.25	40.96	3.61	0.0004*	I

S: Skeptical Evaluation A: Attractive Attribute O: One-Dimensional Attribute M: Must-Be Attribute I: Indifferent Attribute R: Reverse Attribute C: Combination : p<0.01

respondents perceives it as one-dimensional attribute (38.55%) and the second largest percentage of respondents perceive it as attractive attribute (33.73%). It is very hard to say that mobile game is one-dimensional service attribute. In this study, we selected the two dominant categories for mobile services, and tested for the significant difference between the two categories, using z-test. When we could not find significant differences, we categorized the mobile services into “combination”, which means no definite classification can be made.

The results show that picture messaging, instant messaging, navigational aid, and mobile Internet is considered as “one-dimensional attributes”. That is, the higher the level of fulfillment of these mobile services, the higher the customer’s satisfaction, and vice versa. Typically, customers explicitly ask for these one-dimensional attributes. However, the analysis shows that more advanced and newer mobile services, such as mobile shopping, radio on demand, video on demand, mobile banking, and my space, were perceived as indifferent attributes. These mobile services do not affect customer satisfaction and dissatisfaction. This result suggests that telecommunication companies need to invest their efforts and resources to enhance one-dimensional attributes rather than indifferent attributes.

In order to calculate the average impact of a mobile service on customers’ satisfaction and dissatisfaction, Berger et al. (1993) suggest an index, the customer satisfaction (CS) coefficient [2]. It tells whether satisfaction can be increased by meeting a requirement, or whether fulfilling the requirement only prevents customers from being dissatisfied. The CS-coefficient is indicative of how strongly a mobile service may cause satisfaction or, in case of its unfulfillment, customer dissatisfaction. The CS-coefficient can be calculated by the following equations.

$$\text{Better Index} = (A+O)/(A+O+M+I) \quad \text{Worse Index} = -(O+M)/(A+O+M+I)$$

The positive better index indicates customer satisfaction will increase by providing the mobile service, and the negative worse index means that customer satisfaction will decrease by not providing a mobile service. The closer the better index is to 1, the greater the influence on customer satisfaction. The closer the worse index is to - 1, the greater influence on customer dissatisfaction. [Table 4] summarizes better indexes and worse indexes for 12 mobile services. For instance, a good picture messaging service

Table 4. Better Index vs. Worse Index

	Better Index	Worse Index
Picture Messaging	0.7564	- 0.5769
Mobile Shopping	0.2877	- 0.0958
Instant Messaging	0.7273	- 0.5195
Videoconferencing	0.5138	- 0.1250
Radio on Demand	0.4676	- 0.1559
Mobile TV	0.4714	- 0.1714
Video on Demand	0.4789	- 0.1268
Navigation	0.7595	- 0.5063
Mobile Game	0.7894	- 0.4737
Mobile Banking	0.4789	- 0.1972
Mobile Internet	0.8228	- 0.5696
My Space	0.4862	- 0.2222

with a positive CS coefficient of 0.76 brings more than proportional satisfaction. A bad picture messaging service with a negative CS coefficient of -0.58 can increase dissatisfaction. In customer satisfaction and dissatisfaction, the picture messaging service is the most important factor. For mobile shopping, even if companies provide a bad service, it does not cause much dissatisfaction (Worse Index= - 0.1). Picture messaging, navigation, and mobile Internet have relatively high better indexes and worse indexes meaning that, among the 12 mobile services, these three mobile services are considered the most important services.

Research Objective 2) The second objective is to understand how 3G mobile services are perceived differently between experienced users and non-experienced users.

Secondly, this study explores the perception differences between customers who have used the services and customers who have not used the services. Unlike the analysis for the first research objective, this analysis simply counted the number of occurrences without statistical analysis due to the small sample size.

One of the important issues in a Kano analysis is the evaluation of Kano categories with nearly equal number of occurrences. The most frequent observations approach works well when one category dominates the sample [12]. However, as the difference between the frequencies of two classifications gets narrower, proper classification becomes unclear [12]. [Table 5] shows first dominant categories and second dominant categories of 12 mobile services. As shown in [Table 5], some mobile services have nearly equal numbers of occurrences in the first and second dominant categories. For those services, no clear classification can be determined. In order to handle this issue, this study employed two methods. Walden (1993) suggests the following method to decrease the noise levels [13].

If (One-dimensional + Attractive + Must-be) > (Indifferent + Reverse + Questionable),

Then Maximum (One-dimensional, Attractive, Must-be)
 Else Maximum (Indifferent, Reverse, Questionable)

Table 5. Experienced Customers vs. Non-Experienced Customers

		Sample Size	1 st Dominant Category (Largest Percentage)	2 nd Dominant Category (Second Largest Percentage)	Category (Based on Walden Method)	Better Index	Worse Index
Picture Messaging	Experienced	72	O: 38 (53%)*	A: 16 (22%)	O	0.79	0.65 ²⁾
	Non-Experienced	11	I: 5 (45%)	A: 4 (36%)	I	0.50	0.10
Mobile Shopping	Experienced	12	I: 6 (50%)	A: 4 (33%)	I	0.50	0.17
	Non-Experienced	71	I:42 (59%)	A:14 (20%)	I	0.25	0.08
Instant Messaging	Experienced	51	O: 36 (71%)	I: 7 (14%)	O	0.85	0.75
	Non-Experienced	32	I:14 (44%)	A: 11 (34%)	I	0.52	0.14
Video Conferencing	Experienced	8	A: 7 (88%)	I: 1 (13%)	A	0.88	0.00
	Non-Experienced	75	I: 32 (43%)	A: 23 (31%)	I	0.47	0.14
Radio on Demand	Experienced	9	A:4 (44%)	O: 3 (33%)	A	0.78	0.33
	Non-Experienced	74	I: 37 (50%)	A: 22 (30%)	I	0.43	0.13
Mobile TV	Experienced	12	A: 7 (58%)	O: 3 (25%)	A	0.83	0.25
	Non-Experienced	71	I: 31 (44%)	A: 18 (25%)	I	0.40	0.16
Video on Demand	Experienced	10	O: 5 (50%)	A: 3 (30%)	O	0.80	0.50
	Non-Experienced	73	I: 36 (49%)	A: 22 (30%)	I	0.42	0.06
Navigation	Experienced	33	O: 21 (64%)	A: 9 (27%)	O	0.97 ¹⁾	0.68
	Non-Experienced	50	O: 17 (34%)	I: 16 (32%)	O	0.63 ²⁾	0.40 ¹⁾
Mobile Game	Experienced	67	O: 32 (48%)	A: 22 (33%)	O	0.86	0.57
	Non-Experienced	16	I: 7 (44%)	A: 6 (38%)	I	0.46	0.00
Mobile Banking	Experienced	8	A: 4 (50%)	I: 2 (25%)	A	0.71	0.14
	Non-Experienced	75	I: 33 (44%)	A: 18 (24%)	I	0.45	0.20
Mobile Internet	Experienced	53	O: 36 (68%)	A: 11 (21%)	O	0.922)	0.731)
	Non-Experienced	30	A: 12 (40%)	I: 8 (27%)	A	0.64 ¹⁾	0.29 ²⁾
My Space (Social Networking)	Experienced	30	A: 11 (37%)	I: 9 (30%)	A	0.68	0.29
	Non-Experienced	53	I: 25 (47%)	A: 11 (21%)	I	0.36	0.18

*Category: Number of Respondents (Proportion) S: Skeptical Evaluation A: Attractive Attribute O: One-Dimensional Attribute M: Must-Be Attribute I: Indifferent Attribute R: Reverse Attribute

The sixth column of [Table 5] summarizes the results of the Walden’s method. Although both user groups have the same perceptions to some mobile services, they also have different perceptions to most of the mobile services.

The second method is to look for market segment differences. In order to explore the perception differences between customers who have used and who have not used

the mobile services, this study calculates better and worse indexes for mobile services. The better and worse indexes in [Table 5] suggest that, by improving the navigation and mobile Internet services, we can improve both “Experienced” and “Non-Experienced” customers’ satisfaction levels. On the other hand, by improving the mobile Internet service, we can reduce the unsatisfaction levels of both groups. Additionally, the picture messaging service is closely related to the unsatisfaction levels of “Experienced” customers, whereas the navigation service is closely related to the unsatisfaction levels of “Non-Experienced” customers.

5 Conclusion

Successful companies understand that their business strategies need to be developed to satisfy the specific needs of their customers. Any strategy that is based on a try-everything mentality often leads to inefficiency and poor customer services. In order to develop business strategies tailored to meet the specific customer needs, companies need to get close to customers and understand how customers perceive their products and services. This study tried to investigate how customers view 3G mobile services. The results show that customers perceived picture messaging, navigation, and mobile Internet as a one-dimensional service attribute: an element that results in satisfaction when it is fulfilled and in dissatisfaction when not fulfilled. Since these services represent the critical elements of customer satisfaction among the various 3G mobile services, telecommunication companies need to improve the quality of these services. For the services with indifferent service attributes that do not result in satisfaction or dissatisfaction, companies need to develop marketing strategies to disseminate the values of these services to their customers.

Although this study provides good insights into the current usage status of 3G mobile services, there are important limitations that provide good opportunities for further research. The major findings of this study were based on the responses from university students in USA. Thus, there is a need to expand the geographic scope to other states in the USA, other countries, and other respondent groups to verify the findings from this study.

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