

모바일 서비스 고객선호도에 관한 실증연구*

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An Experimental Examination of Customer Preferences on Mobile Interfaces*

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■ Abstract ■

Designing mobile interfaces is fundamentally different from designing online interfaces. Not only are there differences in underlying technologies, but also in the way people use mobile interfaces. If these differences are not taken into account in designing mobile interfaces, mobile services are likely to fail. If mobile services do not deliver what people want, these services will fail no matter how excellent the underlying technology is. The user interface design commonly used in mobile services is based on multi-layered approach, which is not very user-friendly. A well designed single layered user interface will be more user friendly than the conventional one and it will be having edge over others. However, it is quite difficult to provide a single layered user interface in a small screen.

This study aims at examining how design attributes of mobile interfaces affect customer preferences. In order to explore customer preferences to each design attribute of mobile interfaces, we measure and analyze customer's WTP (Willingness To Pay) toward their different interface designs. Ultimately, throughout the study, we try to answer how to design mobile interfaces in small screen of mobile devices. In addition, we propose an optimal design solution that customers likely prefer.

Keyword : User Interface (UI), Willingness To Pay (WTP), Mobile Service

논문접수일 : 2006년 07월 27일 논문게재확정일 : 2006년 10월 30일

* 본 연구는 한양대학교 일반 교내 연구비 지원으로 연구되었음.

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1. Introduction

Recently, the use of mobile Internet through various handsets, such as cellular phones and PDAs, has become popular. As the user population of the high-speed Internet service is growing quickly, many users are more inclined to use the Internet for multimedia entertainment, such as games, movies, and music. In terms of mobile Internet, its main usage is also concentrated on entertainment, such as ring/avatar downloads. With the rapid increase of the Internet usage, the growing penetration of wireless devices, and the rapid technological innovation, wireless technology shifts the world of wired Internet to the wireless mobile Internet. Mobile technology, however, still very much in its infancy regarding usability, network speed, display capabilities and computing performance. While the next generation of wireless devices (3G) promises a platform matching the performance of desktop computers, this does not provide higher usability of mobile devices and their applications.

The Internet has provided an easy and effective way of delivering information and services to millions of users who are connected to a wired network. Evidently, this wired network addresses two major constraints: time and place. These limitations have raised the issue of the mobile Internet, which enables users to access information from any place at any time. The mobile Internet is expected to deliver flexibility in time and place to individuals. In order to promote the use of the mobile Internet, several conditions are needed to be fulfilled. The first condition is the widespread use of mobile devices that connect individuals to the mobile network.

The mobile device, once considered a luxury, has become the conventional communication tools. The second condition is the technological support to guarantee the communication quality. Recently, the rapid technological innovations in the areas of telecommunication have made it possible to provide secure, fast, and quality communication through the wireless network. At this moment, the first and the second conditions are satisfied. The third condition is the development of mobile services that provide intangible values to customers. In order to fulfill this condition, we need to develop mobile services that are differentiated from online services. If similar services are provided over both the wired and wireless networks, one of the biggest hurdles may be customers' psychological resistance against paying fees for the services that have been free of charge previously. A main differentiation strategy for mobile services is to provide timely information at right places. In order to provide timely information to customers, mobile services need to have more intuitive, rich interface as well as contents themselves. However, as the size of mobile devices has become smaller, it is quite difficult to provide intuitive and rich interfaces. The portion of interface in the success of mobile services has become increased.

This study aims at examining how user interface design attributes of mobile services affect customer preferences. In order to explore customer preferences to each design attribute, we measure customer's WTP (Willingness To Pay) toward different interface designs. Ultimately, the study tries to answer how to design mobile interfaces in small screen of mobile devices. In addition, it proposes an optimal menu design

solution that customers likely prefer. In the areas of mobile devices and services, many studies have focused on user satisfaction issues.

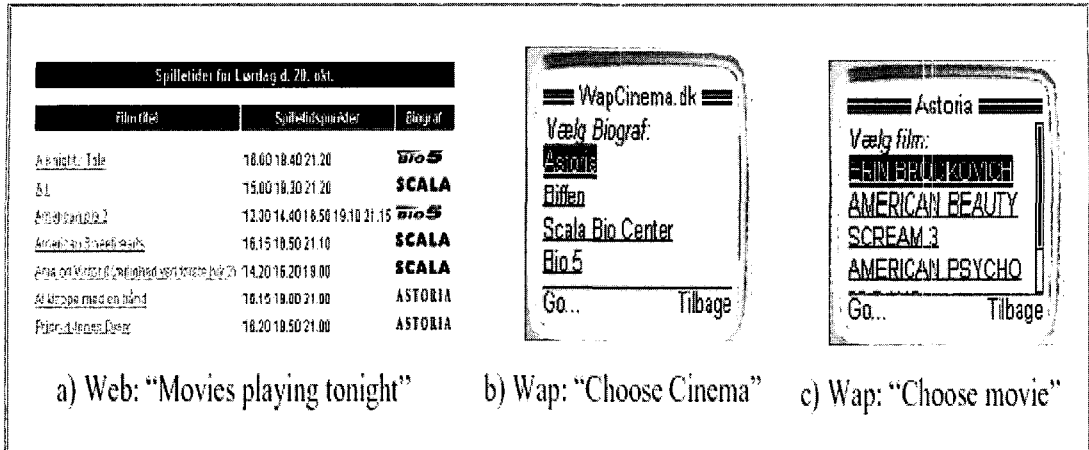
2. User Interface Issues of Mobile Services

Mobile communication technology is undoubtedly very significant developments in the electronic system field in recent years. All sections of mobile communications are growing rapidly. Apparently the growth of voice applications has benefited us a lot. However, the data applications have lagged behind. Recently the system operators are making provision to transmit data over the cellular systems, which were primarily designed for voice. The mobile telecommunication industry needs to develop services for the mobile data markets, not only to pay back their investments, but also to stay competitive in the future.

Mobility is at the heart of these wireless systems, where people can transmit and receive information wherever they are and whenever they choose, even when they are moving. The user interface and the size of mobile devices are the main concerns in designing mobile services. A well designed single layered user interface will be more user friendly than the conventional one and it will be having edge over others. However, it is quite difficult to provide a single layered user interface in a small screen. Designing mobile interfaces is fundamentally different than designing online interfaces on the Internet. Not only are there differences in underlying technologies, but also in the way people use mobile interfaces. If these differences are not taken into account in designing mobile interfaces, mobile

services are likely to fail. If mobile services do not deliver what people want, these services will fail no matter how excellent the underlying technology is. Designing usable interfaces for tomorrow's mobile devices is not trivial but involves a series of challenges on HCI (Human Computer Interaction). Mobile services require efficient ways to record and access information under circumstances that are often quite different from those where desktop computers are used. Displays on mobile devices are small, means of input are limited and use-contexts are very dynamic. The usability of mobile services consequently suffers from interfaces being very compact and cluttered with information, demanding the user's full attention. Many people say that mobile services are not yet attractive and usable for customers. There clearly is a lack of understanding of real user needs and how mobile internet can help users satisfy those needs.

Wireless Application Protocol(WAP) phones are a growing relevant part of the mobile market, and the number of WAP services offered is rapidly increasing. However, usability is crucial for these services which must be easily operated on small screens and keyboards. One of the reasons that many WAP sites have failed is that many service providers simply tried to carry their websites over to the mobile Internet. This shows that little thought has been given to the characteristics of mobile Internet and to the specific needs of people who use their mobile devices in real life. Understanding the fundamental differences between mobile and the web is essential for the success of mobile services. <Figure 1> compares a web interface with a mobile interface. Using the web site, users view



〈Figure 1〉 Web Interface and Mobile Interface

all relevant information in one page. Whereas, accessing the services from WAP-based phones, users require a lot of clicking in a pre-defined sequence, due to the division of information into a large number of sub-pages. By following sequential menus, users can find specific mobile services. Generally, interfaces of WAP-based mobile services require minimal attentions and interactions. The usability of mobile services consequently suffers from interfaces being very compact and cluttered information. It is crucial to design the menus which can get the user's full attention, remaining simple and the required interaction minimal.

3. Willingness To Pay(WTP)

WTP(Willingness To Pay) is defined as the maximum monetary amount that an individual would pay to obtain goods or service[1]. Mostly, WTP has been used in the fields of psychology, economics[1, 8, 9], and marketing[2, 3]. It is crucial in estimating the demand curves and determining optimal pricing schedules[10]. These

studies have focused on cognitive structure of customer to specific tangible or intangible goods under experimental environment. It is widely used to provide information to policy makers, regarding the economic value of non-market or non-pecuniary environmental assets. For example, it can be used to determine the value of a proposed habitat improvement program or the level of compensation for coastal fishers after an oil spill. It is conceptually appropriate to an environmental improvement or gain. In addition, in the areas of marketing or psychology, it is widely used to understand cognitive processes of humans. In this study, by measuring WTP for various interface designs, we try to investigate what features of interface design attributes affect customers' WTP.

To measure WTP, there are two methods: contingent method and conjoint method. In the contingent method, arbitrary goods or service are presented with specific prices, and then respondents take or reject the offers. While the contingent method asks respondents to evaluate real products, the conjoint method asks them to

evaluate hypothetical products. The conjoint method allows researchers to presents respondents with a choice set that contains several alternatives that vary along several attributes, including price. Respondents decide the rankings among the alternatives. Based on the rankings, researchers can analyze the preferences and utilities of respondents for specific goods/service.

The major objective of this study is to examine impacts of interface design features of mobile services on customer preferences. To investigate customer preferences, it collects respondents' WTP to specific interface designs of mobile services. To analyze the WTP data, it uses the conjoint method.

4. Research Methodology

This study aims at examining how user interface design attributes of mobile services affect customer preference. In order to analyze the impacts of specific attributes on customers' preferences, this study employs conjoint analysis. A conjoint analysis is one of the most widely-used methods which are designed to analyze consumer needs. This method shows 1) relative importance of various utilities considered by consumers when they purchase service and 2) a service that consists of the most ideal combination of those utilities. In this study, a specific research model to conjoint analysis is shown in <Figure 2>.

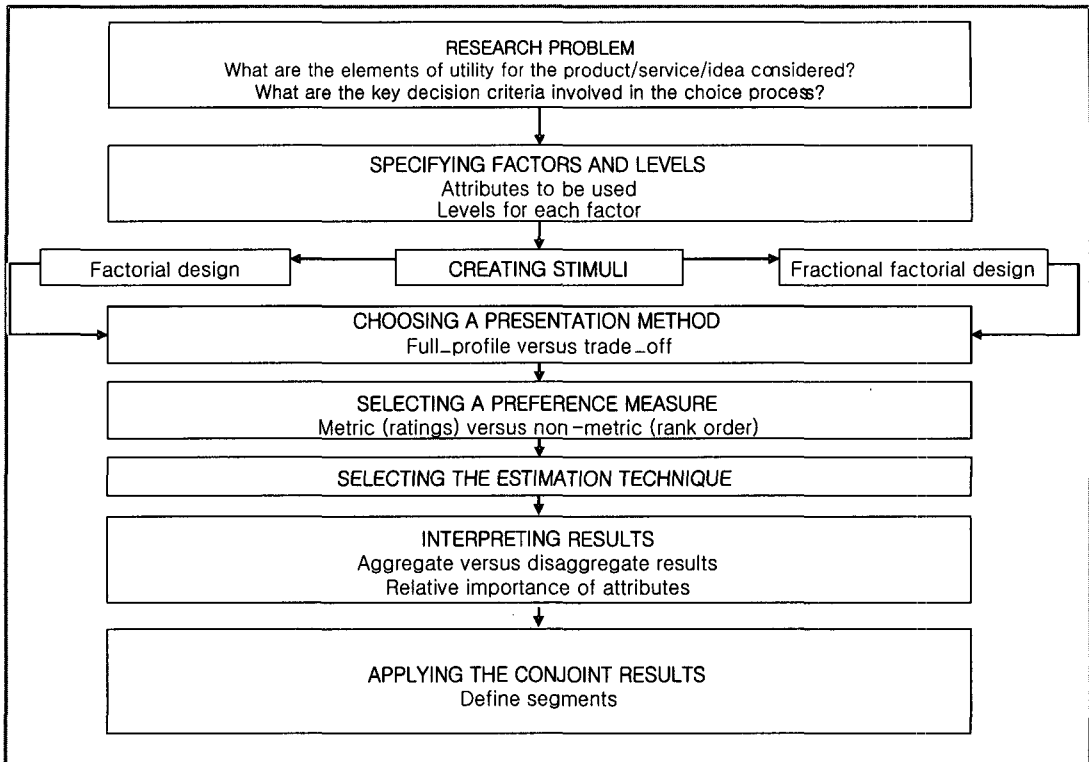
Conjoint analysis originates from mathematical psychology. The basic goal lies in analyzing how much influence two or more independent variables (in this study, interface attributes) exert on determination of orders or values with re-

gard to dependent variables (in this study, customer's WTP). It is used to understand how consumers develop preferences for products or services, which encompass, as usual, multi-attributes and multi-attribute levels.

Utility is a consumer's subjective measurement of preference that is evaluated for each level of attributes. The utility values associated with each level of attributes are summed as the overall utility. Then, products or services with higher utility are assumed to be of a better choice for consumers. The strength of conjoint analysis arises from its flexibility of accommodating metric or non-metric dependent variables and general assumptions about the relationships of independent and dependent variables[7]. After its introduction to marketing and decision-making problems by Green and Rao (1971), conjoint analysis has been one of the popular tools for measuring product preference of purchasers and consumers over 30 years [5, 6]. It has also been used to market segmentation and optimal product positioning[4]. In order to apply the conjoint analysis into this research, we go through the following steps.

Step 1 : Specifying Factors and Levels

WAP phones are a growing relevant part of mobile services. In order to use WAP based mobile services, users explore a menu hierarchy. Analyzing relative impacts of interface design-attributes, we are identifying the influencing factors that affect customers' WTP throughout focus group interview. Its result shows that the amount of information shown in the menu and its structures are crucial factors. The information shown in the menu includes information



〈Figure 2〉 Research model to conjoint analysis

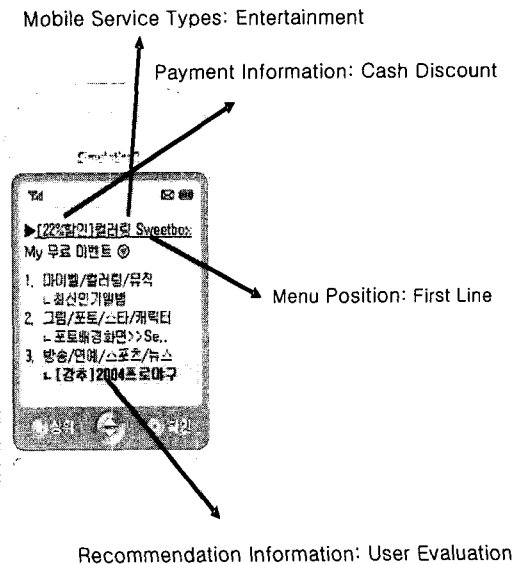
about mobile service types, payment, and recommendation to specific mobile services. Based on the amount of information shown in the menu, customers choose specific mobile services and decide how much they pay for the services. Due to the small screens of mobile devices, customer's purchasing decisions are very sensitive to the amount and the content of information shown in the menu. Another important factor is its position in the menu. Throughout the interview, we find that customers differently respond to the same service depending on the menu position of the service. [Figure 3] shows different levels of menu design attributes of mobile service. In this study, we examine how the menu design attributes affect customer's WTP.

Step 2 : Choosing a Presentation Method

In spite of its popularity[11], a major weakness of conjoint analysis is that respondents participating in conjoint experiment have to evaluate a number of hypothetical product profiles. The number of hypothetical product profiles increases exponentially as the number of attributes and attribute levels increases. Note that it is usual to have more than 10 attributes when we design commercial products using conjoint analysis. If each attribute has four attribute levels, respondents must evaluate 410 hypothetical products. To reduce the number of hypothetical products, a fractional factorial design can be used.

Since this study has four attributes with

Attributes	Levels
Mobile service type shown in menu	Entertainment Service
	Information/Communication service
	No Information about Mobile Service Type
Payment information of mobile service shown in menu	Cash Discount information shown in menu
	Coupon Information shown in menu
	No Information about payment shown in menu
Menu position of mobile service	First Line
	Second Line
	Middle Line
Recommendation Information about mobile services shown in menu	Log Data Based Recommendation
	User Evaluation Based Recommendation
	No Information



Log Data Based Recommendation : Based on the number of users who access a specific mobile service, system operators add a mark, [Hit], in front of the mobile content.
 User Evaluation Based Recommendation : System operators add a mark, [Strongly Recommended], for new or popular mobile services.

<Figure 3> Design Attributes of Menu Design in Mobile Interface

three levels each, all possible hypothetical products are 81(3*3*3*3). If we use a full-profile method, respondents would have difficulty in answering all 81 questions. For this reason, the number of questions is needed to be diminished to a proper level. As an alternative to a factorial design, we use a fractional factorial design. This approach is a way to reduce the number of questions. The number of initial questions(81 questions) is reduced to 9 questions(refer to <Table 1>). Based on the fractional factorial design, 9 hypothetical products are generated.

Step 3 : Selecting a Measure of Consumer Preference

Based on 9 hypothetical products, we design

a menu screen (Refer to <Figure 4>). In order to measure customer preferences to specific hypothetical products, the study employs the rank-order method, rather than the rating method. Respondents are asked to provide the maximum monetary amounts that they would pay to get these products. Based on the amounts, we investigate how much each menu design attribute of mobile services affects customer's WTP.

Data Collection and Sample Demographics:

We interviewed 150 respondents, consisting of 86 males and 64 females. Since most of wireless internet users are younger, most of respondents consist of 12~19 year olds in this study. Therefore we have an interview

〈Table 1〉 Hypothetical Mobile Service Interfaces

Mobile Service Interface	Mobile Service Type	Payment Information	Menu Position of Mobile Service	Recommendation Information About Mobile Service
P1	No Information	No Information	First Line	User Evaluation Based Recommendation
P2	Entertainment	Coupon	Middle Line	User Evaluation Based Recommendation
P3	No Information	Cash Discount	Middle Line	No Information
P4	Information /Communication	Cash Discount	Second Line	User Evaluation Based Recommendation
P5	Information /Communication	No Information	Middle Line	Log Data Based Recommendation
P6	Entertainment	Cash Discount	First Line	Log Data Based Recommendation
P7	Entertainment	No Information	Second Line	No Information
P8	Information /Communication	Coupon	First Line	No Information
P9	No information	Coupon	Second Line	Log Data Based Recommendation

Log Data Based Recommendation: Based on the number of users who access a specific mobile service, system operators add a mark, [Hit], in front of the mobile content.

User Evaluation Based Recommendation: System operators add a mark, [Strongly Recommended], for new or popular mobile services.

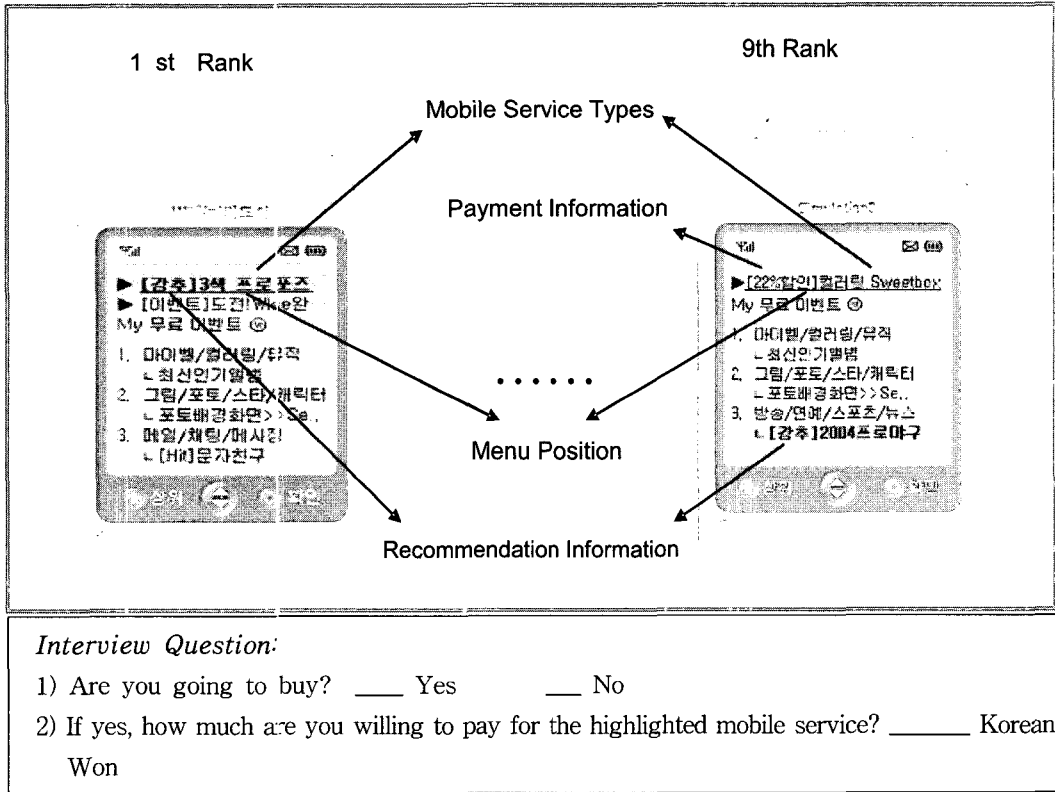
〈Table 2〉 A survey design of mobile internet service

Attributes	Detail
Demographic	<ul style="list-style-type: none"> ◦ Males : 86 people, Females: 64 People ◦ Over 12 years~under 19 years
Mobile Service Experience	<ul style="list-style-type: none"> ◦ Under one time : 74 people ◦ Over two times~under three times : 28 people ◦ Over four times~under five times : 8 people ◦ Over six times~under seven times : 2 people ◦ Over seven times : 4 people
Location	<ul style="list-style-type: none"> ◦ House : 35 people ◦ Nomadic : 14 people ◦ School : 8 people ◦ Anywhere, Anytime : 59 people

with students of two high schools. The survey, which lasted a total of three weeks, on 150 subjects, obtained 116 valid results, excluding 34 results containing omissions or random answers (see <Table 2>). And questionnaire survey was conducted as an individual face-to-face interview

5. Result and Discussion

We interviewed 116 respondents, consisting of 53 males and 63 females. Since most of wireless internet users are younger, most of respondents consist of 12~19 year olds in this study.



<Figure 4> A Sample Interview Question

In addition to portraying the impact of each level (entertainment, information / communication, no information et al.) with the part-worth estimates, conjoint analysis can assess the relative importance of each design factor (information about mobile service type, payment of mobile service, position of mobile service, and recommendation to mobile service). Since the part-worth estimates are on a common scale, the greatest contribution to overall utility of preference, and hence the most important factor, is the factor with the highest range of part-worth.

5.1 Interpreting Result

The focus of conjoint analysis is to explore

customer preferences for product attribute levels and the customer benefits that may flow from the product attributes. In addition, it allows us to measure part-worth functions at the individual level. Hence, if preference heterogeneity is present, by using cluster analysis, we can identify groups that have distinct preferences.

In this study, we examine the relative impacts of menu design attributes of mobile services on customer's WTP. We try to find an optimal menu design of mobile services that high-valued by users. <Table 2> reports the means of the part-worth and relative importance for 116 subjects. The greater the relative importance, the more an attribute influences your preferences for mobile services. If the information

about mobile service types is shown in menu, there is the highest possibility that customers purchase mobile services (27.51%). In other words, customers utilize information about mobile service types as critical information in purchasing of mobile services. The second influential menu design attribute is the payment information of mobile services shown in menu, (26.53%), the third is the positions of mobile services within menu (23.21%), and the last is recommendation information (22.75%). Based on the result, we can say that the understanding customers are the most important factor in terms of menu design. Many companies pay a lot of money to locate their services in higher positions in the menu, or use recommendation information to sell their services. Based on our study, we found that mobile customers tend to be more sensitive to services themselves, rather than the artificial information, such as recommendation information or menu positions,

In terms of part-worth for the mobile service types, customers prefer entertainment mobile services to other services. This result proves the actual usages of mobile Internet. Many users tend to use entertainment services, rather than other types of mobile services. In terms of payment information, customers prefer the mobile service shown its cash discount information in the menu. When they use a specific mobile service, their decisions heavily depend on the payment information, especially on cash discount information. Regarding to recommendation information about mobile services, customers prefer the mobile service marked "Strongly Recommended" in the menu. Normally, service operators mark specific mobile services as "Strongly Recommended", when the services are popular

and new. "Hit" marks are less attractive for customers than "No Information". In terms of menu position, customers are likely to purchase a mobile service in the middle line, rather than the second line or the first line. The relative importance of design attributes will guide the menu design of mobile services. The result shows that, for identical services, their different menu designs affect customer's purchasing power.

5.2 Cluster Analysis

One of the most common uses of conjoint analysis is to group respondents with similar part-worths or importance values to identify segments. Because of the following reasons, conjoint analysis can be used as a useful method for implementing market segmentation and product positioning[4]. Based on 116 respondents, the study identifies three mobile service customer groups. Three clusters consist of 52, 28, and 36 respondents. In this study, we are to do cluster analysis as shown in <Table 3>.

In terms of mobile service types, respondents in three clusters have a similar preference structure. All of them give a significant preference to entertainment mobile services. However, regarding to payment information, menu position, and recommendation information, respondents in three clusters have different preferences. Respondents in cluster 1 prefer the mobile service shown cash discount information, located at the middle line, and marked as "Strongly Recommended" in the menu. Respondents in cluster 2 prefer the mobile service located at the second line in the menu position and marked as "Hit" in the menu. Unlike respondents in other

<Table 3> Part-Worth and Relative Importance

Attribute	Part-Worth			Relative Importance (%)
	1	2	3	
Mobile Service Type	Entertainment	Information /Communication	No Information	27.51
	1.74	0.32	0.94	
Payment Information of Mobile Services	Discount	Coupon	No Information	26.53
	1.54	0.96	0.50	
Menu Position of Mobile Services	First Line	Second Line	Middle Line	23.21
	1.20	0.48	1.33	
Recommendation Information of Mobile Services	Log Data Based Recommendation	User Evaluation Based Recommendation	No Information	22.75
	0.85	1.16	0.99	

two clusters, they do not seriously consider the payment information when they choose a specific mobile content. Respondents in cluster 3 prefer the mobile service shown coupon information and located at the first line in the menu. Unlike respondents in other two clusters, they do not seriously consider the recommendation information when they choose a specific mobile content. Respondents in cluster 2 and in cluster 3 have totally different preferences. While the cluster 2 regards the recommendation information as a critical factor in buying a mobile service, it does not seriously consider payment information in buying a mobile service. The cluster 3 seriously considers payment information, not payment information.

Due to the small screens of mobile devices, the amount of information shown in the menu is minimal. Therefore, mobile service designers try to find out the condensed information that can catch customer's eyes. Some, like cluster 2, are sensitive to payment information shown in

the menu. Others, like cluster 3, are sensitive to recommendation information shown in the menu. The result states the need to personalize the menu design for mobile services, as well as to personalize the mobile services.

6. Conclusion

One often meets the argument that, due to the complexity of the service model and the convergence of technologies and services expected in mobile services, it is very little relevant research available to help us understand the mobile services and their users. The main purpose of the study is to explore attributes that influence customers' preferences to mobile interfaces. To explore the relative importance of the design attributes of mobile interfaces, the study uses conjoint analysis. It finds that the most influential attribute is the mobile service types. This finding supports the current phenomenon that the main usage of mobile services is concen-

〈Table 4〉 Cluster Analysis

Attribute	Item	Cluster		
		Cluster 1	Cluster 2	Cluster 3
Mobile service type	Entertainment	0.45	1.70	0.41
	Information/communication	-0.87	-0.45	-0.57
	No information	0.42	-1.25	0.17
Payment information	Discount	1.16	-0.02	0.08
	Coupon	-0.81	-0.57	1.47
	No information	-0.35	0.60	-1.56
Menu position of mobile service	First line	-0.01	-0.17	0.79
	Second line	-1.13	0.15	-0.19
	Middle line	1.15	0.01	-0.59
Recommendation information about mobile service	Log data	-0.71	0.35	0.28
	User evaluation	1.10	-0.07	-1.01
	No information	-0.39	-0.27	0.73

trated on entertainment services. Although this study tries to understand customers of mobile services empirically, it has very limited contributions to theoretical development. In addition, regarding to the relationships between attributes of mobile services and customers' preferences, it does not provide a theoretical explanation. However, the study helps us to understand mobile customers.

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