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| Title | A study of the effect that interaction and context of digitalized signage have on user satisfaction : for optimized system and service design |
| Sub Title | |
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| Publisher | 慶應義塾大学大学院メディアデザイン研究科 |
| Publication year | 2010 |
| Jtitle | |
| JaLC DOI | |
| Abstract | The objectives of this study is to divide the interactive factors which is created by applying the keyword of digitalization to new media, digital signage into user control, responsiveness, two-way communication, personalization and pleasure, and understand interactions between personal characteristics by analyzing user satisfaction according to personal characteristics like innovation and self- control. For this, we set up the study models and hypotheses based on studying previous literature. In order to verify this, we carried out survey for 20s-30s users. Besides this, we also aim to verify the effects and user's reaction based on the quantitative data from large scaled promotion using digital signage through implementing digitalization.<br>In the result of the study, first, the interactive factors of digital signage are shown to have effect on user satisfaction. The responsiveness, two-way communication, pleasure and personalization among interactive factors have effect on user satisfaction. However, user's control is not shown to have effect on user satisfaction.<br>This means that users expect the full implementation of digitalization into digital signage while the most of the current signage system is lack of it. From this, we can forecast that such factors like two-way communication and personalization will play core roles. This result also shows that these factors including real-time, two-way, and personalization which are used to be ignored can play such important roles. After expanding the possible service areas in digital signage, the supply of various contents and user's convenience should be improved to increase user's interaction.<br>And personal innovation partially has effect on interaction and satisfaction. Personal innovation is shown to be meaningful for the effect which user control and two-way communication have on satisfaction. This means that users feel high satisfaction when they can form and control something easy to deal with. The satisfaction also could be higher when users can find solutions for the questions easily with the content changed suitable for user's demand.<br>This study aims to understand the media characteristics by analyzing the interactive factors about digital signage service. |
| Notes | 修士学位論文. 2010年度メディアデザイン学 第81号 |
| Genre | Thesis or Dissertation |
| URL | https://koara.lib.keio.ac.jp/xoonips/modules/xoonips/detail.php?koara_id=KO40001001-00002010-0081 |

# Master's Thesis
# Academic Year 2010

**A Study of the Effect that Interaction and Context of Digitalized Signage have on User Satisfaction**
**-for Optimized System and Service Design-**

Graduate School of Media Design,
Keio University

Hwanggon Kim

## Abstract of Master's Thesis Academic Year 2010

# A Study of the Effect that Interaction and Context of Digitalized Signage have on User Satisfaction -for Optimized System and Service Design-


## Summary

The objectives of this study is to divide the interactive factors which is created by applying the keyword of digitalization to new media, digital signage into user control, responsiveness, two-way communication, personalization and pleasure, and understand interactions between personal characteristics by analyzing user satisfaction according to personal characteristics like innovation and self- control. For this, we set up the study models and hypotheses based on studying previous literature. In order to verify this, we carried out survey for 20s-30s users. Besides this, we also aim to verify the effects and user's reaction based on the quantitative data from large scaled promotion using digital signage through implementing digitalization.

In the result of the study, first, the interactive factors of digital signage are shown to have effect on user satisfaction. The responsiveness, two-way communication, pleasure and personalization among interactive factors have effect on user satisfaction. However, user's control is not shown to have effect on user satisfaction.

This means that users expect the full implementation of digitalization into digital signage while the most of the current signage system is lack of it. From this, we can forecast that such factors like two-way communication and personalization will play core roles. This result also shows that these factors including real-time, two-way, and personalization which are used to be ignored can play such important roles. After expanding the possible service areas in digital signage, the supply of various contents and user's convenience should be improved to increase user's interaction.

And personal innovation partially has effect on interaction and satisfaction. Personal innovation is shown to be meaningful for the effect which user control and two-way communication have on satisfaction. This means that users feel high satisfaction when they can form and control something easy to deal with. The satisfaction also could be higher when users can find solutions for the questions easily with the content changed suitable for user's demand.

This study aims to understand the media characteristics by analyzing the interactive factors about digital signage service.



## Keyword

Interaction, Digitalization, Digital Signage, user context, two-way communication



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# Chapter 1 Introduction

## 1.1 Study Background

With the development of information communication technology and the digital technology and the advance of network broadband, various new media have appeared while the boundary of the media which is used to be in the inherent area breaks down. With this development, now it is possible to provide mass information for reasonable price. There is a new movement to restructure the media area in the aspect of digitalization, which was previously not digitalized. In this process, digital signage is the one which is getting attentions. Even though it did not get a lot of attentions compared to its market size because of the previous concept of just outdoor billboard, recently it brings new attentions after raising the essential characteristics which can provide the contents suitable for user's location context following current digitalization trend.

Digital signage is not only innovative media which can show the media convergence phenomenon, but also a business area which can have huge influence on the existing advertising business. Because of the current price drop for overall display and the participation of new service providers and other various factors of network based, it gets new attentions in the aspect of the usefulness with that users can get the necessary contents in the location where they spend a lot of time. While companies are in the process of various reviewing before getting into the market, the interest as new advertising media gets increased. Like the digital view and the digital pole which were used in the real project, the full scale of digitalized signage is introduced, which is about interaction through touch screen connecting to network. This actually shows the usefulness of digital signage. This new signage system does not broadcast one-sided advertisement or images, but provides users with the necessary information in two-way interactions wherever they are.

According to the digital signage forum, the future digital signage Japanese market will be grown up to 1 trillion yen, and it is expected to be ranked as the 4$^{th}$ advertising media for the share of the existing advertising media. However, since the current predictions about the expectation effect mostly focused on the displaying stage of the existing outdoor billboard, the prospect could be conservative. Just like the example in Korea, if most of the Seoul subway stations have digital view systems and every location like subway have digitalized signage to provide users with the information they need, it is possible that the market size will be bigger than expected.

It is expected that such appearance of new media will bring various changes in the existing advertising market as well as the expansion of new platform. As there are already various changes in the existing advertising market including terrestrial broadcasting,

cable TV, internet, newspaper and magazine, digitalized signage characterized as the location context has built up a new advertising market with its own differentiation. If the changes of the media using rate can affect on the existing advertising strategy by giving values on the areas which the existing media did not have, it is possible for digitalized signage to create new media advertising area because it can bring user's time to the area of the media usage.

## 1.2 Study Objectives

Most of the studies of digital signage were an extension of user's reception for outdoor advertising. They were mostly about presentation methods of images through display and user satisfaction as well as quantitative studies on the measurement of user's using rate. That is why it is hard to find studies on digitalized signage which have core attributes of digitalization. It is relatively rare to find studies on the receiving manners for contents, recognition as personal media, differentiation from other media, motives for using, satisfaction level and attitude towards media. Since a lot of studies are leaning towards the aspect of effect like measuring for using rate, user's reception has been relatively negligently dealt with. In this study, we aim to draw the user centered result about how they use and be satisfied with the contents based on their receiving characteristics in the aspect of interaction after selecting digitalized signage which is implemented from interaction, real-time and scalability, which are core attributes of digitalization as study subjects.

The detailed objectives of this study are like below.

First, we aim to study the characteristics after analyzing the awareness of the interactive factors about services that provide two-way multimedia contents of digital signage. For last 20 years, interaction has been widely discussed in the areas of advertising, marketing, communication, information science, computer science and education. However, the study on interaction in the area of digitalized signage was not that active.

Second, we aim to understand how users recognize, feel and react for the contents based on the location context according to receiver's characteristics. There were not many studies of connecting receiver's characteristics in the aspect of interaction. The previous studies on digital signage were mostly about how many time users watched the displayed images. However, through the further study of user's reactions based on their characteristics, we can directly contribute to the future service design of digitalized signage which is possible for interaction.

The meaning of this study is to analyze interaction based on two-way service in order to directly contribute to the detailed service designs of digitalized signage, and provide basic materials about users understand, feel and reaction for this new media.

# Chapter 2 Theoretical Background

## 2.1 Concept and Subject of Digitalized Signage

### 2.1.1 Definition of Digitalized Signage

In order to clearly define digitalized signage, it is necessary to understand what the concept of the digitalization means. It is because we like to define it based on the standard of what media implement the core factors of digitalization. In this study, we understand the layered concept about basically three core factors. We judge based on the fact if it is implemented as three core factors of interaction, real-time and scalability. Because it is estimated that interaction is the core attribute which puts together all the three basic factors, we put the emphasis on the interaction.

The three attributes of digitalization are like below.

- Interactive / interoperable
- Simultaneous / Real-time
- Customizable / Personalized

We define the media in which three above core attributes were implemented as the digitalized media. About digital signage that is the subject of this study we have same definition. The digital signage system which implements three core attributes is defined conceptually as digitalized signage.

According to this definition, the system where users directly interact among current digital signage could be the subject of this study. For most of digital signage, there are a lot of systems which provide users with fixed one-sided contents using network system. However, it needs to be clear that the systems without interaction are excluded from this definition.

Even though the existing digital signage has various strengths in the aspect of providing users with contents transmitted through digital using display, we like to make it clear that essentially it does not get out of the range of outdoor billboard, and has no basic attribute of new media.

The reason why we chose the digital view of the digitalized system which was used in the real project of this study is that the system is possible to fully interact according to the above definition. In order to settle down as a new medium, it needs to implement essentially differentiated factors from the existing media. We clarify the subject of this study by defining digitalized signage as a new medium which is possible for interaction.

### 2.1.2 Appearance Background

The appearance background of digitalized signage could be divided into two aspects of supply and demand. The supply aspect includes technical, economic and strategic aspects while the demand aspect is two-way and convenience aspects. For the supply aspect, there is development of high-speed internet technology and a strategic aspect which is that communication and service providers use the maximum of the existing infrastructure to create economic effect while there is another strategic aspect of advertising business that expands business model as excavating new advertising media. As the development of display technology, enhanced communications network, image compression and transmission technology, it becomes possible to provide services among the public, and evidently this is the appearance background. The development of media relevant technology which can be represented as the digital convergence caused in the convergence phenomenon between all kinds of media business and service providers, and the boundaries of each medium and industry become unclear. As seeing in the case of recent digital multimedia broadcasting and the terrestrial DMB, there is convergence phenomenon overcoming the existing boundaries while the boundaries of each medium are breaking down. With the beginning of the media digitalization, the trend of the media technology development gives a new aspect to the area of the signage. In the aspect of the profit model for media, such trend creates various attempts.

In the aspect of the time when users are exposed to the media, connectivity to the advertising industry was seeked, and new interest in the areas where is relatively lack of media usage was raised. Signage gets new attentions because it can provide contents based on the location context in the outdoor activities of media receivers. As receivers are newly included in the media in the aspect of advertising strategy, its own value was discovered as the $4^{th}$ advertising media. Even though digitalized signage is not much different from the existing internet services in the aspect of receivers, it has possibility to develop into the new differentiated media because users can get the necessary information suitable for the context. In regards of the information that can be changed under the context of the media receivers, providing information suitable for the receivers' location context is the core part for receivers' needs. The users who are in the context of subway stations focusingly dealt in this study may have needs on real-time information like location information including maps, information of subway and connecting bus routes, weather and additional information like news while waiting for the subway. Digitalized signage has new meanings to provide such information through the user's interaction.

### 2.1.3 Characteristics

Looking at the service characteristics of digitalized signage, first, it uses high-speed internet network as a transmission method using basic infrastructure, IP of internet communication. Second, as a consumer interface, it basically has built-in input/output installation like touch screen and camera. Third, it provides real-time services through the multicasting technology of streaming technology. While the current trend is to provide users with almost every information from PC after forming partnerships with service providers like portal sites, it is distinctive from the existing digital signage that provides limited information. As it is possible to link with equipment like Smartphone, it shows development potentials as personalized media which is hard to implement in the location context. In the service area, there are also different points from other media because similar services can bring conceptual confusion.

Digitalized signage delivers the existing contents like video, picture, voice and data to users after changing them into same packet formation. It transmits after changing into the IP address attached packet data with same formation not only for the video which is easily accessed through the terrestrial, satellite and cable broadcasting, but also for data, voice and picture through the information service. It is a very distinctive point because the characteristics of such services were not implemented in the existing signage.

Since digitalized signage has input system which is possible for user's interactions including touch screen, internet phone and camera, it is differentiated from the existing digital signage in the aspect of providing real-time information based on the user's needs. This is the core part of interaction and the most distinctive characteristic from the current discussions of digital signage.

Digital signage is distinguished from the existing media like terrestrial and satellite broadcasting because it can place the information suitable for user's needs based on the location context of users. The essential distinctive point of this new media is that it is possible to place the most necessary information in real-time under the location context of users.

## 2.2 Current Status of Digital Signage

### 2.2.1 Current Status of Service

Currently, the digitalized signage service area is quite limited. Especially, the services which are fully operated with clear business model commercially can be counted on the fingers. The digital view which was selected for the real project in this study has values to be introduced in the aspects of having business model and implementing interaction

which is the basic attribute of digitalized signage.

February 2010, the digital view was installed experimentally in the service area of Seoul Metro subway. 980 systems were experimentally installed in the all subway stations including 1, 2, 3, and 4 lines. Currently, sales for advertising contract are actively going on after the pilot management period of about 6 months. In the aspect of advertising unit price which shows the value of the media, its unit price keeps going up more than the existing magazines or subway free newspapers.

Since it was installed as the total composed of the existing general guide map, public phone booth, and internet facilities on the top of the digitalization of Seoul subway, the result of it has been evaluated as being successful through the pilot management period. However, there are a little bit of trial and errors with the verification process in the area of the commercial marketing, the profitability of the media and the stability of management.

Reviewing in the aspect of evaluation as advertising media, evaluations of any media could be different depending on its characteristics, surrounding environment, sales policy and price when the media get into the market. The digital view has the composed characteristics of various advertising media because most of the advertising includes lighting advertisement on right side and local advertisement in the center with video advertisement from the right monitor. As the price of advertisement is different depending on the floating population and the level of the station, and the location of installation, today the price is divided into A, B, C, by the estimation of floating population.

Recently, it receives favorable reviews after linking the local advertisement to the searched regions or areas which are shown in the map service of the digital view connecting local advertisement provided from portal services. Like above, digitalized signage creates new patterns of user's media usage and structures the suitable advertising system into the business model. After this, there are attempts to use various location contexts besides the subway stations.

As digitalized signage targeting squares where a lot of people gather beside the subway stations, the digital pole pilot services are fully operated. Today, it is located in the roadside of Gang Nam station in Seoul. While mainly providing various image contents, it efficiently implements the interactive factors which mediate meetings in the square with the map information and text function. Besides this, it is introduced that digitalized signage which is possible to use in various location context like airport, hotel and shopping mall, and there is a sense of movement that this every digitalized signage will be interoperated in the future.

## 2.3 Previous Discussions about Interaction

For last 20 years, interaction has been widely discussed in the areas of advertising, marketing, communication, information science, computer science and education. However, it has been used by scholars while having vague or no definition of it.
Interaction is recognized as the core constituent who is distinguished between internet and traditional media. Globally, this characteristic brings new attentions, and
It is recognized as the core part when defining new media.
It is because that interaction changes the one-sided communication structure of the existing media to the two-way structure. As a natural attribute in the communication, broadcasting and personal communication, interaction is applied to every media areas, and recognized as an important factor. Interaction creates not only smooth communication between users and their relationship, but also advertising effect and new value by the information about user's interaction. Interaction for the media is the essential factor which can decide the main attribute and the success of the new media.
Digitalized signage is expected to act as the core factor which can appeal the differentiated factors of this medium to the users.

### 2.3.1 Definition of Interaction

Originally, interaction was studied as the core characteristic of internet medium differed from traditional media. In the ubiquitous computing environment like today when so many new media is introduced everyday and various high-tech products combined of new parts and equipment are produced, we can continuously use the contents we want without any limitations of time and location. Therefore, after understanding the interactive relationships with users act as the core variable, interaction in the ubiquitous computing environment is understood as the core strategic method to structure long term relationship with users overcoming the media characteristics. Wu (2000) argued that it is necessary to approach interaction between users with different views, and this study is important in order to understand and use the media as the area possible for observation and control.
As digitalized signage has been fully begun, interaction became an important characteristic of media after the differentiation of the existing digital signage was collapsed. In other words, the competing structure was created, in which only media that interact with users can have differentiation getting out of the one-sided structure. This can be understood in the same context as the traditional media like newspaper and broadcasting aim to evolve into the media which can interact one another. While papers try to reduce the gap between media and individual through the internet, broadcasting

aim to continuously develop into two-way and interactive structure like real-time or internet broadcasting from the one-sided standardized structure.

As studies on interaction about new media are progressed in various areas, we extract the parts suitable for digitalized signage among them.

Depending on the focus of the interest, the concept of interaction could be divided into process centered, characteristics centered, awareness centered, and multidimensional. (Lee, Tae Min, 2003)

In the aspect of the communication effect, these three levels were divided by interactions between users and message, human and machinery, and the place of dispatch and receivers. The process centered definition shows exchanges and responsiveness as the main factors, which coincides with this study.

<Table 2-1> the process centered definition of interaction

| researchers | Definition and Explanation | Core Factors |
|---|---|---|
| Ha & James(1998) | Degree of reaction to each communication desire between communicator and audience | Responsiveness |
| Pavlik(1997) | Multilateral communication between a sender and a receiver or various senders and receivers | Two-way communication |
| Steuer(1992) | Degree of participation in modifying the forms and the contents of environment mediated in real-time | Real-time participation |
| Bezjian-Avery, etal(1998) | In the interactive system, consumers control the contents of interaction about demanding and providing information. | User control |

The characteristics centered definition for interaction focuses on general characteristics like user control and two-way communication, and the special characteristics like search engines and chatting rooms(McMillan, Hwang, 2002), and the role exchanges and mutual relations. This aspect presents the interactive results of machinery and the definition of what attributes media and products should have. In other words, as the core factors of

speed and the range of operation through the actions of machines and human, it explains the attributes like user control and two-way communication.

<Table 2-2> the characteristics centered definition of interaction

| Researchers | Definition and explanation | Core Factors |
|---|---|---|
| Rice(1984) | Ability to make it possible to exchange roles between senders and receivers in real time or delayed time | User control and role exchanges |
| Hofman,Novak & Young(2000) | The speed of interaction is the concept of contributing to absorption, and based on the response time. | Time demanded for interaction |
| Rogers(1986) | Degree of controlling mutual conversation between participants in new communication system based on computer | User control |

Looking at the awareness centered definition for the concept of interaction, there are various composing factors shown including awareness of interaction, control, personalization, awareness of responsiveness, activity, reality, two-way communication and time sensitiveness.

<Table 2-3> the awareness centered definition of interaction

| Researchers | Definition and Explanation | Core Factors |
|---|---|---|
| Day(1998) | The essence of the interactive marketing is not the information about customers, but explanation in the information from customers. | consumer involvement |
| Wu(1999) | Awarded interaction is explained as the concept composed with responsiveness and voyage. | Awareness of voyage and responsiveness |

| | | |
|---|---|---|
| Wu(2000) | Degree of control which individual feels for the interactive process, degree of personalization and response of communication | Awareness of control, responsiveness and personalization |

Since the objectives of this study is to find out the processes which affect on satisfaction of digitalized signage after extracting composing factors of interaction, we aim to approach with the multidimensional definitions which compromise above three definitions.

### 2.3.2 Composing Factors of Interaction

Even though we looked at the definitions of process centered, characteristics centered and awareness centered for interaction, interaction has the multidimensional structure which is hard to be defined in one word. Because couple studies which understand the composing factors with single dimension have shown limitations of understanding interaction systematically, we aim to understand interaction with the multidimensional concepts. In other words, we focus on the user's active roles. Therefore, we base on the composing factors of interaction which was suggested by Dholakis et al. (2000).

- User control
- Responsiveness
- Real-time interaction
- Connectivity
- Personalization

  Pleasure

In this study, five factors have been set up for interaction of digitalized signage based on the previous studies. While mentioned as the important composing factor of interaction, the definition of user control is the degree of individual's feeling the control of interaction. In the study of interaction awarded of web, Wu (2000) suggested personal differences, interaction and lively feeling as the preceding factors, and the interactive levels including awarded control, awarded responsiveness and awarded personalization.

Responsiveness is defined as the degree of answering quickly and appropriately about the users' demands or inquiries.

The definition of two-way communication is the degree of the possibility for the reciprocal communication in the communication media or messages between more than

two communicators. Personalization means the degree of providing the personalized products, services and information in order to satisfy the individual's needs.
Pleasure is defined as the degree of awareness of self enjoyment in the process of using specific products or services.
Based on the above five composing factors, we aim to verify which factors have effect on the user satisfaction in digitalized signage.

## 2.4 Location Context

Since various variables occur with the appearance of new media, it is essential to seek for new study methods. Because digitalized signage has the fundamental characteristic which is that the media is used in the specific location, it is necessary understand what relations this part has with interaction and user satisfaction because the essential characteristics have the direct relations with the effect on the media usage.
Even though there were no needs to consider the location context in the studies of interaction focusing on internet, in digitalized signage, it is essential to have basic studies on the user's situations in the location context. Since it is hard to find previous studies on which factors of the location context should be put as variables, we verify satisfaction after considering the diversity of options which should be gone through in order to get the solutions and the degrees of how urgently users want the needs.
The urgency of needs is the understanding of expectation in time about the response results for the needs users want in current context. Like the example of the bus route information, in the location context, there will be needs about information which is necessary in order to move to another location. By setting up the variable as urgency of needs, we like to understand the relation between interaction and satisfaction in the situation of urgent needs.
User selection of needs is to understand the degree of freedom and the amount of options which users can take to satisfy the needs. By looking at the aspect of various routes users can take to obtain the information has direct relation with satisfaction in digitalized signage, we aim to be helpful to designs of optimized system and services. In order to provide suggestions of what degree of freedom should be provided to maximize the user satisfaction, we compose this as one of the control variables.

## 2.5 User Satisfaction

### 2.5.1 Definition of Satisfaction

Satisfaction could be defined as the status in which such results are created to meet

user's demand and expectation and then repurchases of the products and services are made with the customer's continuous credibility. Generally, the definition of satisfaction could be different depending on focusing on whether result or process.

As the core factor of marketing concept, the concept of customer satisfaction has been raised as the main interest in the marketing area, and approached with the various methods by researchers. It has been developed into various forms in order to evaluate customer's judgment about the service quality and experience.

In this study, we aim to define satisfaction focusing on the users' evaluation about their service experience. We define the users' evaluation about the factors were not satisfied in other media in the process of experiencing other services of digitalized signage as the relative satisfaction.

### 2.5.2 User Satisfaction

The concept of user satisfaction is divided into two while one is focusing on the result and the other on the process. Both of them are defined as the evaluation like that the consuming experience is better than the minimum expectation. (Lee, Jun Ong et al, 2006) As the concept of customer satisfaction and the service quality can be mixed up in using, it is hard to distinguish the differences unless there is a clear concept because it is decided by the comparison of the result and the expectation. While customer satisfaction is assumed as a function of mismatch between customer's pre-expectation and awareness, it is called disconfirmation paradigm in the documents of customer satisfaction, and it is also called gap model in the documents of service quality.

While customer satisfaction is the overall customer evaluation which providers feel to provide, the service quality could be the passive expectation which customers expect in the relatively small range. Even though the service quality has effect on customer satisfaction, and customer satisfaction has effect on the purchase intention, overall service quality does not have effect on the purchase intention directly.

What users want from services could be defined as the status of continuous preference by giving satisfaction and impression more than the expectation.

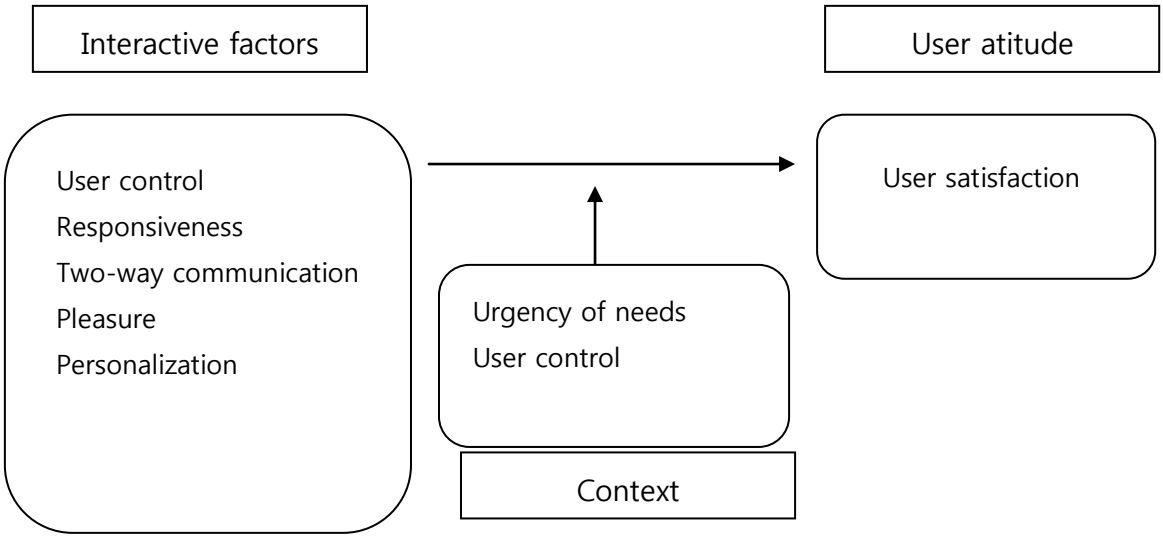
In this study, we assume the users' position as using media actively in the current context instead of looking at them as the passive position just like the existing digital signage.

Chapter 3 Study Methods

## 3.1 Study Model

The objectives of this study are to analyze the interactive factors of digitalized signage as well as to look at satisfaction according to each characteristic. Based on the domestically and internationally reported theses, relevant academic magazines, various internet information and articles, we reconstruct the composing factors suitable for the characteristics of digitalized signage for the conceptual definition of interaction. While regarding user control, responsiveness, two-way communication, personalization and pleasure as the composing factors of interaction, we verify the effect on user satisfaction after putting the location context of the receiver characteristics as the control variable.
The study model of this study is derived like <Picture 3-1> below.

<Picture 3-1> Study Model




## 3.2 Establishment of Hypothesis

### 3.2.1 Hypotheses about the Composing Factors of Interaction

Some theses studied that the credibility about the sites and the relation absorption are increased when awarded responsiveness and user control in mobile are getting higher. There is also a thesis on the effect of responsiveness and two-way communication on the using motives and the intention.
However, there are not many theses on the effect of interaction on satisfaction in digital signage. Therefore, as assuming that the composing factors of interaction in digitalized

signage have effect on satisfaction, then we set up the hypotheses like below.

Hypothesis 1. Interactive factors of digitalized signage have plus effect on user satisfaction.
Hypothesis 1.1 User control has plus effect on user satisfaction
Hypothesis 1.2 Responsiveness has plus effect on user satisfaction.
Hypothesis 1.3 Two-way communication gives plus effect on user satisfaction.
Hypothesis 1.4 Personalization has plus effect on user satisfaction.
Hypothesis 1.5 Pleasure gives plus effect on user satisfaction.

### 3.2.2 Hypotheses about Satisfaction

The different point of this study compared with other studies on satisfaction is that we did not consider the personal characteristic as an important variable. It is because the current location context is considered as more important variable than the personal characteristic in digitalized signage. We assume that satisfaction is affected by the current needs without any relation with the personal characteristic. This part should be investigated more in future studies. However, since this study investigates correlation between interaction and satisfaction, we do not treat it as an important moderating variable.
In order to reflect satisfaction based on the location context from the moderating variable, we set up the hypotheses like below.

Hypothesis 2. User satisfaction about meeting the degree of urgency of the needs is high.
Hypothesis 3. The higher user control of the needs is, the higher user satisfaction is.
Hypothesis 4. The effect of interaction on satisfaction is different depending on the degree of urgency.
Hypothesis 4.1 The higher the degree of urgency is, the higher the effect of user control on satisfaction is.
Hypothesis 4.2 The higher the degree of urgency is, the higher the effect of responsiveness on satisfaction is.
Hypothesis 4.3 The higher the degree of urgency is, the higher the effect of two-way communication on satisfaction is.
Hypothesis 4.4 The higher the degree of urgency is, the higher the effect of personalization on satisfaction is.
Hypothesis 4.5 The higher the degree of urgency is, the higher the effect of pleasure on satisfaction is.
Hypothesis 5. The effect of interaction on satisfaction is different depending on the

degree of self-control for needs.

Hypothesis 5.1 The higher self-control of the needs is, the higher the effect of user control on satisfaction is.

Hypothesis 5.2 The higher user control of the needs is, the higher the effect of responsiveness on satisfaction is

Hypothesis 5.3 The higher user control is, the higher the effect of two-way communication on satisfaction is.

Hypothesis 5.4 The higher user control of the needs is, the higher the effect of personalization on satisfaction is.

Hypothesis 5.5 The higher user control of the needs is, the higher the effect of pleasure on satisfaction is.

### 3.2.3 Operational Definition of Variables

Based on the previous studies related to the measured variables, operational definition and the number of measured items about each concept presented in the study model, the user control among the composing factors of interaction in digitalized signage is defined as the degree of that users freely select and control the contents they want. Three items of measurement are extracted: the degree of easiness to use, the degree of free selection for the wanted contents and the degree of user control.

Responsiveness is operationally defined as the degree of answering rapidly and appropriately about user's demands and inquiries. Referring to the previous studies, three items of measurement are extracted. The operational definition of two-way communication is the degree of providing information, answering and changing the contents suitable for user's demands, and three items are extracted based on the previous studies.

The operational definition of personalization is the degree of providing services, products and information suitable for users' demands, and three items are extracted.

Pleasure is operationally defined as the user's joy which is felt while participating in digitalized signage, and three items are extracted.

The urgency of needs is defined as how much information is demanded in the limitation of current time and location, and three items are extracted according to each situation.

The definition of self-control for needs is about how effectively can find the solution about the needs, and two items are extracted.

### 3.2.4 Investigation Methods

The objectives of this study are to investigate the composing factors of interaction in the using environment of digitalized signage, and study what effect of multidimensional composing factors of such interaction has on user satisfaction according to the characteristics of each context. Through the survey of the empirical study for 20-30s who participated in the promotion and services in the real project, total 5480 questionnaires were collected with the feedbacks about their experience of using. We analyzed the data from 2300 respondents after removing users' repetition overlapped through data cleaning.

According to the basic assumption which is that users' activeness affects on user satisfaction, we aim to study in the limited range of relatively young generations. It is because it is judged that sampling from other age groups can distort the study result for the study objectives.

We tried to get relatively accurate investigation after conducting one on one interview using Korean style twitter system (Yozm). In order to verify the study model and hypotheses presented based on the theoretical background, we analyzed the established hypotheses and study questions according to the conceptual flow based on the survey data.

### 3.2.5 Statistical Analysis

As collecting total 2300 questionnaires through the data cleaning, the detailed methods used in the statistical process are like below.

First, we measured the credibility of questions by conducting credibility test for each question.

Second, we analyzed complaint factors together after analyzing the main component with the propriety analysis.

Third, we used correlation analysis to understand the relation between satisfaction and the interactive factors of digitalized signage.

Fourth, we used moderating regression analysis for the urgency of needs and the self-control of needs in order to look at the effect of the interactive factors, the result from the correlation analysis on satisfaction.

Fifth, we conducted basic frequency analysis after dividing interaction, the urgency of needs and the self-control of needs into top, middle and bottom in order to analyze the study hypothesis 4.

Sixth, in order to understand interaction of digitalized signage, the average and the standard deviation of satisfaction, we used descriptive statistics while empirical analysis

was verified in the significance level of $P<0.05$,$P<0.01$,$P<0.001$, and used statistical analysis.

# Chapter 4 Real Project

## 4.1 Outline of Real Project

In this study, the most important task in order to conduct the real project for empirical analysis is to construct the digitalized signage system which can implement all the composing factors of interaction. Since the existing digital signage has no or limited interaction with users even with its network, there are almost no converged services. After deciding to design a new project for this study, we aim to conduct a promotion which can implement five composing factors of interaction in this project. The digital view system is selected as the basic system for this study.

The digital view is the digitalized signage system which is installed in total 101 subways in Seoul, Korea. As currently total 980 systems are installed, various services including internet phone are provided through service partnerships with portal businesses.

The representative service groups which digital view currently provide are like below.

- Map service
- Station information service
- Information service of surrounding region
- Connecting route service
- Real-time information service: Real-time search word, Weather, Popular movies etc.
- Living information service like coupons
  Internet phone service

Since this system basically can implement three core characteristics of the digitalization, we conducted the empirical study based on this system in real project like below. This project is to initially show the music video of 2AM, popular idol group in subway stations for time of their new album sales using digital view system. This project got a lot of attentions even from other media persons because it is very rare to initially show music videos in subway even in other countries.

The process conducted in the real project is like below.

- On web, we make an announcement of viewing schedule and the information of national subway stations which play the music video connecting with Korean style twitter service (Yozm).
- We simultaneously open the music video in the public through total 628 digital view systems.

- By inputting QR code in music video, users can upload their opinions about the music video right after in Korean style twitter system, and share their opinions in real-time.
- Once uploading photos taken of the music video into specific address, users can see the opinions in real-time from the website.
- Through specific address which can be accessed by Smartphone, users can look at the additional information like behind cuts of the music video any time.
- Users uses Smartphone automatically win in the event promotion and we conduct survey among these users.
  We conduct verification after analyzing users' access information.
-

In this project, we composed service in order to reflect five composing factors of interaction to meet the objectives of the study. By extracting users participated in real-time and conducting survey, we could obtain accurate data for the empirical experiment. Especially, as getting feedback from broad range of users through the video contents like music video, we aim to minimize errors from sampling.
Consequently, we collected questionnaires from 2300 users, and we tried to overcome the limit of the survey investigation by conducting one on one interview in real-time.

### 4.2 System Composition

Since the overall result of the study is decided depending on whether an appropriate system for the objectives of this study could be constructed or not, we introduce the outline of the system used in this project.
Digital view has a formation of providing after building partnerships between businesses construct infrastructure and hardware system and businesses provide contents and services.

The main composing factors of the system could be divided into three.
a. Contents distribution server
This system is essentially to change the websites provided by the portal business into the formation more suitable for the digital view display, and provide right contents when receiving users' responses. Portal businesses construct and manage this system with the formation of providing their own basic services in real-time.
If contents pages and services applied web standard are constructed in this server in order to provide users with new services or contents, they are provided through internet infrastructure, and its high flexibility could be the strength. In case of the promotion pages and interaction services for this project, we provided services by registering in this

server after composing services.

b. Realtime relay server

This system is in charge of overall infrastructure and management of the digital view.

It copies and saves important pages in order to increase responsiveness of users' interaction while dispersing traffics in the server groups with high availability in the peak time of users' demands. Since this system is in charge of important functions like dispersing traffics in real-time especially in case of video contents which are in use of multicasting and demand of high traffic, it plays an important role for real time transmitting music videos and HD videos to each branch.

c. Digital view terminal

This system is a user's input/output terminal based on touch screen while it is actually installed in subway stations for interface with users.

As it is divided into each service area, it provides by dividing areas matching to the degree of interaction with users. It is in charge of all sorts of functions for users to get the information in needs from the server using touch screen and internet phone system.

### 4.3 Practice Result

The quantitative result from this project is like below.

- Exposure system : Total 628 system
- Broadcasted number : 2,995,552 times played
- Total impression : 4,831,652 imps
- User review number(feedback) : approximately 280,000 feedback
- Event application number : approximately 53,000 application
- Survey application : 5,480
- Final survey respondents : 2,300 (a population)

In order to meet the objectives of this study and exclude the possibilities of other factors, we distributed survey applications online to users suitable right after getting users' feedback. We extracted final survey respondents focusing on users who were in various location contexts in order to exclude doubleness in their experience of using.

## Chapter 5 Study result

### 5.1 General characteristics of Respondents

We exercised the sampling work from 2300 population for further analysis. The demographic characteristics of the respondents are like <Table 5-1>. Out of total 230 questionnaires work for analysis, women (58.7%) are more than men (41.3%) while for age groups, 30s (52.2%) are more than 20s (47.8%).

<Table 5-1> General characteristics

| | | Frequency | Percent |
|---|---|---|---|
| Sex | Man | 95 | 41.3 |
| | Woman | 135 | 58.7 |
| Age | 20s | 110 | 47.8 |
| | 30s | 120 | 52.2 |
| Total | | 230 | 100.0 |

### 5.2 Credibility Verification

Like <Table 5-2>, in order to understand stability, consistency and forecasting possibility about each item of the collected questionnaires, we used Cronbach's α coefficient as a credibility coefficient. However, Since more than 0.6 is generally considered as having no problem in the credibility of measure in socioscientific investigation methods without any accurate standard about credibility, this study also evaluate the credibility based on the standard more than 0.6. In this study, we verified the credibility of the measuring tool by inner consistency using Crongach's α coefficient. The result is shown to satisfy the credibility level with more than 0.7 for all of user control, responsiveness, two-way communication, personalization, pleasure, and urgency of needs, user control of needs and satisfaction of respondents.

<Table 5-2> Credibility verification

| Division | Cronbach's α |
|---|---|
| User control | 0.812 |
| Responsiveness | 0.777 |
| Two-way communication | 0.758 |

| | |
|---|---|
| Personalization | 0.769 |
| Pleasure | 0.790 |
| Urgency of needs | 0.885 |
| User control of needs | 0.716 |
| Satisfaction | 0.872 |

5.3 Factor Analysis

As we see that items about user control are loaded to each factor (factor loading: more than 0.7) like <Table 5-3>, it means that survey respondents recognize each factor as the same level. Therefore, as responding result from respondents show high correlation among measurements when measuring different concepts with the same scale, we could say that the validity of distinction is very high.

<Table 5-3> Analysis of user moderating factor

| | Component |
|---|---|
| | Control |
| Control3 : Users themselves organize and control | 0.878 |
| Control 2 : selecting contents wanted freely | 0.848 |
| Control 1 : degree of easiness to use | 0.833 |
| Eigenvalue | 2.182 |
| Variation explanatory power | 72.729 |
| Cumulative explanatory power | 72.729 |
| Kaiser-Meyer-Olkin measurement = 0.707 | |
| Bartlett's test of sphericity chi-squared = 233.230*** | |

Like <Table 5-4>, we can see that items about responsiveness are loaded to each factor (factor loading: more than 0.7). It means that survey respondents recognize the responsiveness as the same level. Therefore, as responding result from respondents show high correlation with measured factors when measuring different concepts with the same scale, we could say that the validity of distinction is very high.

<Table 5-4> Analysis of responsiveness factor

| | Component |
|---|---|
| | Control |
| Response 3: responding to demands quickly | 0.907 |
| Response 2: quick operational response, short display time | 0.805 |
| Response 1 : degree of responding to demands | 0.787 |
| Eigenvalue | 2.091 |
| Variation explanatory power | 69.694 |
| Cumulative explanatory power | 69.694 |
| Kaiser-Meyer-Olkin measurement = 0.621 | |
| Bartlett's test of sphericity chi-squared = 221.939*** | |

As we see that items about two-way communication are loaded to each factor (factor loading: more than 0.7) like <Table 5-5>, it means that survey respondents recognize two-way communication as the same level. Therefore, as responding result from respondents show high correlation among measurements when measuring different concepts with the same scale, we could say that the validity of distinction which tests if they recognize as different concepts is very high.

<Table 5-5> Analysis of two-way communication factor

| | Component |
|---|---|
| | Control |
| Item 3 : easily finding the questions and answers for demands | 0.860 |
| Item 2 : easy to change the contents for demands | 0.836 |
| Item 1 : providing plentiful information suitable for demands | 0.768 |
| Eigenvalue | 2.029 |
| Variation explanatory power | 67.643 |
| Cumulative explanatory power | 67.643 |

| Kaiser-Meyer-Olkin measurement = 0.673 |
|---|
| Bartlett's test of sphericity chi-squared = 177.063*** |

As we see that items about pleasure are loaded to each factor (factor loading: more than 0.7) like <Table 5-6>, it means that survey respondents recognize pleasure as the same level. Therefore, as responding result from respondents show high correlation among measurements when measuring different concepts with the same scale, we could say that the validity of distinction is very high.

<Table 5-6> Analysis of pleasure factor

| | Component |
|---|---|
| | Control |
| Item 3 : lots of fascinating stuff to watch, concentrating on watching | 0.871 |
| Item 2 : being absorped in watching contents | 0.846 |
| Item 1 : feeling expectation and pleasant value about contents | 0.791 |
| Eigenvalue | 2.099 |
| Variation explanatory power | 69.982 |
| Cumulative explanatory power | 69.982 |
| Kaiser-Meyer-Olkin mesurement = 0.685 | |
| Bartlett's test of sphericity chi-squared = 203.284*** | |

We see that items about personalization are loaded to each factor (factor loading: more than 0.7) like <Table 5-7>. Therefore, as showing high correlation, we could say that the validity of distinction is very high.

<Table 5-7> Analysis of personalization factor

| | Component |
|---|---|
| | Control |
| Item 3 : providing services suitable for users | 0.859 |
| Item 2 : providing information suitable for user's demands, plentiful information | 0.843 |

| contents | |
|---|---|
| Item 1 : easy to find additional information suitable for user's demands | 0.815 |
| Eigenvalue | 2.112 |
| Variation explanatory power | 70.396 |
| Cumulative explanatory power | 70.396 |
| Kaiser-Meyer-Olkin measurement = 0.701 | |
| Bartlett's test of sphericity chi-squared = 201.904*** | |

In this study, as KMO price is shown as 0.886, it is pretty good like <Table 5-8>. For Bartlett's test of sphericity which shows the suitability of factor analysis, the price of identity matrix of the correlation matrix is 829.678 while the significance level is 0.000. This means that using factor analysis is suitable. We see that items about the urgency of needs are loaded to each factor (factor loading: more than 0.7). As responding result from respondents showing high correlation with measured factors, we could say that the validity of distinction is very high.

<Table 5-8> Analysis of the urgency of needs factor

| | Component |
|---|---|
| | Control |
| Item 3 : usually urgent when looking for information in subway stations | 0.799 |
| Item 2 : usually going through difficulties if not able to access to the information needed in subway stations | 0.789 |
| Item 1 : usully asking help from other people when not able to access to the information needed in the information board in subway stations | 0.743 |
| Eigenvalue | 4.454 |
| Variation explanatory power | 55.681 |
| Cumulative explanatory power | 55.681 |
| Kaiser-Meyer-Olkin measurement = 0.886 | |
| Bartlett's test of sphericity chi-squared = 829.678*** | |

In this study, as KMO price is shown as 0.703, it is suitable like <Table 5-9>. For Bartlett's

test of sphericity which shows the suitability of factor analysis, the price of identity matrix of the correlation matrix is 269.410 while the significance level is 0.000. This means that using factor analysis is suitable. We see that items about the user control of needs are loaded to each factor (factor loading: more than 0.7). As responding result from respondents showing high correlation with measured factors, we could say that the validity of distinction is very high.

<Table 5-9> Analysis of the user control of needs factor

| | Component |
|---|---|
| | Control |
| Item 2 : Besides the information urgently looking for, if there are other information, looking at them together | 0.684 |
| Item 1 : Preferring lots of options wanted even in case of urgency | 0.658 |
| Eigenvalue | 2.503 |
| Variation explanatory power | 41.718 |
| Cumulative explanatory power | 41.718 |
| Kaiser-Meyer-Olkin measurement = 0.703 | |
| Bartlett's test of sphericity chi-squared = 269.410*** | |

In this study, as KMO price is shown as 0.835, it is pretty good like <Table 5-10>. For Bartlett's test of sphericity which shows the suitability of factor analysis, the price of identity matrix of the correlation matrix is 565.297 while the significance level is 0.000. This means that using factor analysis is suitable. As we see that items about satisfaction are loaded to each factor (factor loading: more than 0.7), it means that survey respondents recognize satisfaction as the same level. Therefore, as responding result from respondents show high correlation among measurements when measuring different concepts with the same scale, we could say that the validity of distinction which tests if they recognize as different concept is very high.

<Table 5-10> Analysis of satisfaction factor

| | Component |
|---|---|
| | Control |
| Satisfaction 2 : satisfaction degree of | 0.854 |

| | |
|---|---|
| service use and contents methods | |
| Satisfaction 5: satisfaction degree of service | 0.838 |
| Satisfaction 1 : degree of recommending to other people | 0.829 |
| Satisfaction 3: degree of mood felt by users | 0.795 |
| Satisfaction 4: recognition degree of media which satisfy user's desire | 0.762 |
| Eigenvalue | 3.333 |
| Variation explanatory power | 66.655 |
| Cumulative explanatory power | 66.655 |
| Kaiser-Meyer-Olkin measurement = 0.835 | |
| Bartlett's test of sphericity chi-squared = 565.297*** | |

5.4 Hypotheses Verification

Hypothesis 1 is that Interactive factors of digitalized signage have plus effect on user satisfaction. In order to verify this, the result of correlation analysis with the subordinate hypotheses is like below.

Hypothesis 1-1 User control have plus effect on satisfaction.
Hypothesis 1-2 Responsiveness has plus effect on satisfaction.
Hypothesis 1-3 Two-way communication gives plus effect on satisfaction.
Hypothesis 1-4 Personalization has plus effect on satisfaction.
Hypothesis 1-5 Pleasure gives plus effect on satisfaction.

When looking at the relation between interactive factors and user satisfaction like <Table 5-11>, interaction and user satisfaction show plus correlation. We can see the higher interaction is, the higher user satisfaction is.

<Table 5-11> Effect of interactive factors on user satisfaction

| | | Interaction | | | | | Dependent variable |
|---|---|---|---|---|---|---|---|
| | | Control | Responsiveness | Two-way | Pleasure | Personalization | satisfaction |
| Interaction | Control | 1 | | | | | |
| | Responsiveness | 0.529(*) | 1 | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Two-way | 0.488(*) | 0.608(*) | 1 | | | |
| | Pleasure | 0.356(*) | 0.301(*) | 0.381(*) | 1 | | |
| | Personalization | 0.512(*) | 0.524(*) | 0.624(*) | 0.471(*) | 1 | |
| Dependent variable | Satisfaction | 0.550(*) | 0.488(*) | 0.502(*) | 0.572(*) | 0.653(*) | 1 |

(* p<0.01)

When looking at the effect of interaction of digitalized signage on satisfaction like <Table 5-12>, the higher user control, pleasure and personalization is with this regression model, the higher user satisfaction is. Therefore, hypothesis 1-1, 1-4 and 1-5 above are selected.

<Table 5-12> Effect of interactive factors on user satisfaction

| | B | Standard error | Beta | t | Significance probability |
|---|---|---|---|---|---|
| (Constant) | -0.046 | 0.193 | | -0.236 | 0.814 |
| User control | 0.210 | 0.056 | 0.210 | 3.771* | 0.000 |
| Responsiveness | 0.099 | 0.061 | 0.096 | 1.617 | 0.107 |
| Two-way | 0.013 | 0.071 | 0.012 | 0.184 | 0.855 |
| Pleasure | 0.283 | 0.048 | 0.300 | 5.895* | 0.000 |
| Personalization | 0.400 | 0.072 | 0.346 | 5.544* | 0.000 |
| F=58.249*, R2=0.565 | | | | | |

(* p<0.001)

Hypothesis 2 is that the higher the urgency of needs, the higher user satisfaction is.
In order to verify this hypothesis, we conducted regression analysis. Like <Table 5-13>, we can see that regression coefficient of the urgency of needs gives significant effect. This regression model is shown as being statistically suitable. Therefore, the higher the urgency of needs is, the higher user satisfaction is. Thus hypothesis 2 is selected.

<Table 5-13> Effect of the urgency of needs on user satisfaction

| | B | Standard error | Beta | t | p |
|---|---|---|---|---|---|
| (Constant) | 2.398 | 0.229 | | 10.457 | 0.000 |
| Urgency of needs | 0.219 | 0.069 | 0.205 | 3.160* | 0.002 |
| F=9.986*, R2=0.042 | | | | | |

(* p<0.01)

Hypothesis 3 is that the higher user control of needs is, the higher user satisfaction is.
In order to understand the effect of user control of needs on satisfaction, we conducted regression analysis. Like <Table 5-14>, we can see that user control of needs has significant effect on user satisfaction through the regression coefficient of self control. This regression model is shown as being statistically suitable. We can see that the higher user control of needs is, the higher user satisfaction is. Therefore, hypothesis 3 is selected.

<Table 5-14> Effect of user control of needs on user satisfaction

| | B | Standard error | Beta | t | p |
|---|---|---|---|---|---|
| (Constant) | 2.415 | 0.294 | | 8.202 | 0.000 |
| User control of needs | 0.207 | 0.087 | 0.156 | 2.384* | 0.018 |
| F=5.684*, R2=0.024 | | | | | |

(* p<0.05)

Hypothesis 4 is that the effect of interaction on satisfaction is different depending on the degree of urgency. In order to verify this, we have hypothesis 4-1 which is that the higher the degree of urgency is, the higher the effect of user control on satisfaction is.
After setting up false hypothesis like this, we conducted the moderating regression analysis in order to understand the moderating effect of user control of needs in the effect of independent variable, user control of needs on satisfaction. As a result, user control factor of needs has effect on satisfaction. In Mode 3 where interaction item is added, which is an urgency factor of needs as independent and moderating variable, it is shown that interaction item for urgency of needs*user control gives significant effect on satisfaction. Thus we can understand that urgency of needs has moderating effect in the relation between user control and satisfaction.

<Table 5-15> Moderating effect of urgency of needs which user control has on satisfaction

| Independent variable | Mode 1 | | Mode 2 | | Mode 3 | |
|---|---|---|---|---|---|---|
| | B | β | B | β | B | β |
| (Constant) | 1.289 | | 0.974 | | 3.213 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| User control | 0.551 | 0.550*** | 0.533 | 0.532*** | -0.143 | -0.143 |
| Urgency of needs | | | 0.116 | 0.104 | -0.593 | -0.534* |
| Urgency of needs*User control | | | | | 0.212 | 1.019** |
| R2 | 0.303 | | 0.313 | | 0.340 | |
| ΔΔ | 0.303 | | 0.011 | | 0.027 | |
| F | 98.963*** | | 51.769*** | | 38.864*** | |

(* p<0.05, ** p<0.01, *** p<0.001)

According to the result of satisfaction analysis based on user control and the urgency of needs, it is shown that correlation effect between user control and urgency of needs is statistically significant, and the urgency of needs itself is not significant. Thus hypothesis 4-1 is selected.

Hypothesis 4-2 is that the higher the urgency of needs is, the higher the effect of responsiveness on satisfaction is. In the result of moderating regression analysis in order to understand the moderating effect of urgency factor of needs in the effect of independent variable, responsiveness on satisfaction, it is shown that interaction item does not affect on satisfaction, and the urgency of needs has no moderating effect in the relation between responsiveness and satisfaction.

<Table 5-16> Moderating effect of the urgency of needs in the effect of responsiveness on satisfaction

| Independent variable | Mode 1 | | Mode 2 | | Mode 3 | |
|---|---|---|---|---|---|---|
| | B | β | B | β | B | β |
| (Constant) | 1.632 | | 1.176 | | 2.429 | |
| Responsiveness | 0.551 | 0.488*** | 0.483 | 0.472*** | 0.041 | 0.040 |
| Urgency of needs | | | 0.156 | 0.141 | -0.214 | -0.193 |
| Urgency of needs*Responsiveness | | | | | 0.190 | 0.584 |
| R2 | 0.239 | | 0.258 | | 0.268 | |
| ΔΔ | 0.239 | | 0.020 | | 0.010 | |
| F | 71.490*** | | 39.485*** | | 27.564*** | |

(* p<0.05, ** p<0.01, *** p<0.001)

As looking at the result of satisfaction analysis according to the urgency of needs and

responsiveness, it is shown that correlation effect between responsiveness and urgency of needs is statistically significant, and responsiveness is significant while urgency of needs is shown not to be significant. Thus hypothesis 4-2 is dismissed.

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Hypothesis 4-3 is that the higher urgency of needs is, the higher the effect of two-way communication on satisfaction is.

In the result of moderating regression analysis in order to understand the moderating effect of urgency factor of needs in the effect of independent variable, two-way communication on satisfaction, it is shown that two-way communication factor and urgency of needs affect on satisfaction. Thus the urgency of needs has moderating effect in the relation between two-way communication and satisfaction. As looking at the result of satisfaction analysis according to two-way communication and the urgency of needs, correlation effect between two-way communication and the urgency of needs is shown not to be significant, and two-way communication and the urgency of needs are shown to be significant. Therefore, hypothesis 4-3 is selected.

<Table 5-17> Moderating effect of the urgency of needs in the effect of two-way communication on satisfaction

| Independent variable | Mode 1 | | Mode 2 | | Mode 3 | |
|---|---|---|---|---|---|---|
| | B | β | B | β | B | β |
| (Constant) | 1.398 | | 0.843 | | 2.401 | |
| Two-way | 0.570 | 0.502*** | 0.558 | 0.492*** | 0.023 | 0.020 |
| Urgency of needs | | | 0.183 | 0.164 | -0.276 | -0.248 |
| Urgency of needs*Two-way | | | | | 0.212 | 1.019** |
| R2 | 0.252 | | 0.279 | | 0.292 | |
| ΔΔ | 0.252 | | 0.027 | | 0.013 | |
| F | 76.985*** | | 43.994*** | | 31.087*** | |

(* p<0.05, ** p<0.01, *** p<0.001)

Hypothesis 4-4 is that the higher urgency of needs is, the higher the effect of pleasure on satisfaction is.

In the result of moderating regression analysis in order to understand the moderating effect of urgency factor of needs in the effect of independent variable, pleasure on satisfaction like <Table 5-18>, it is shown that pleasure factor and urgency of needs have effect on satisfaction. However, it is shown that correlation item of urgency of needs*pleasure has no effect on satisfaction, the urgency of needs has no moderating

effect in the relation between pleasure and satisfaction.

<Table 5-18> Moderating effect of the urgency of needs in the effect of pleasure on satisfaction

| Independent variable | Mode 1 | | Mode 2 | | Mode 3 | |
|---|---|---|---|---|---|---|
| | B | β | B | β | B | β |
| (Constant) | 1.419 | | 0.905 | | 2.246 | |
| Pleasure | 0.541 | 0.572*** | 0.530 | 0.561*** | 0.104 | 0.110 |
| Urgency of needs | | | 0.170 | 0.153* | -0.236 | -0.212 |
| Urgency of needs*Pleasure | | | | | 0.127 | 0.609 |
| R2 | 0.328 | | 0.351 | | 0.360 | |
| ΔΔ | 0.328 | | 0.023 | | 0.010 | |
| F | 111.038*** | | 61.293*** | | 42.432*** | |

(* p<0.05, ** p<0.01, *** p<0.001)

Hypothesis 4-5 is that the higher the urgency of needs is, the higher the effect of personalization on satisfaction.

In the result of moderating regression analysis in order to understand the moderating effect of urgency factor of needs in the effect of personalization on satisfaction like <Table 5-19>, urgency of needs affects on satisfaction. However, it is shown that correlation item has no effect on satisfaction, and the urgency of needs has no moderating effect in the relation between personalization and satisfaction. Thus hypothesis 4-5 is dismissed.

<Table 5-19> Moderating effect of the urgency of needs in the effect of personalization on satisfaction

| Independent variable | Mode 1 | | Mode 2 | | Mode 3 | |
|---|---|---|---|---|---|---|
| | B | β | B | β | B | β |
| (Constant) | 0.780 | | 0.655 | | 2.028 | |
| Personalization | 0.755 | 0.653*** | 0.743 | 0.642*** | 0.283 | 0.245 |
| Urgency of needs | | | 0.050 | 0.045 | -0.354 | -0.318* |
| Urgency of needs*Personalization | | | | | 0.134 | 0.605 |
| R2 | 0.426 | | 0.428 | | 0.436 | |

| | | | |
|---|---|---|---|
| Δ | 0.426 | 0.002 | 0.008 |
| F | 169.176*** | 84.882*** | 58.256*** |

(* p<0.05, ** p<0.01, *** p<0.001)

Hypothesis 5 is that the effect of interaction on satisfaction is different depending on the degree of user control for needs.

In order to verify this, there is a hypothesis 5-1 which is that the higher user control of needs is, the higher the effect of user control on satisfaction is. We set up false hypothesis like hypothesis 5-1. In the result of moderating regression analysis in order to understand the moderating effect of user control of needs in the effect of user control on satisfaction like <Table 5-20>, user control factor affects on satisfaction. It is showed that correlation item has no effect on satisfaction in Mode 3 where correlation item was added, which is user control factor of needs as independent variable and moderating variable. We can tell that awareness of user control for needs has no moderating effect in the relation between user control and satisfaction. Thus hypothesis 5-1 is dismissed.

<Table 5-20> Moderating effect of user control in the effect of user control on satisfaction

| Independent variable | Mode 1 | | Mode 2 | | Mode 3 | |
|---|---|---|---|---|---|---|
| | B | β | B | β | B | β |
| (Constant) | 1.289 | | 1.086 | | 1.382 | |
| User control | 0.551 | 0.550*** | 0.540 | 0.539*** | 0.445 | 0.445 |
| User control of needs | | | 0.072 | 0.052 | -0.018 | -0.013 |
| User control of needs *User control | | | | | 0.029 | 0.127 |
| R2 | 0.303 | | 0.305 | | 0.306 | |
| ΔΔ | 0.303 | | 0.003 | | 0.000 | |
| F | 98.963*** | | 49.871*** | | 33.168*** | |

(* p<0.05, ** p<0.01, *** p<0.001)

Hypothesis 5-2 is that the higher user control of needs is, the higher the effect of responsiveness on satisfaction is.

In the result of moderating regression analysis in order to understand the moderating effect of user control of needs in the effect of responsiveness on satisfaction like <Table 5-21>, responsiveness factor affects on satisfaction. However, it is shown that correlation

item has no effect on satisfaction, and the awareness of user control for needs has no moderating effect in the relation between responsiveness and satisfaction. Thus hypothesis 5-2 is dismissed.

<Table 5-21> Moderating effect of user control of needs in the effect of responsiveness on satisfaction

| Independent variable | Mode 1 | | Mode 2 | | Mode 3 | |
|---|---|---|---|---|---|---|
| | B | β | B | β | B | β |
| (Constant) | 1.632 | | 1.430 | | 2.275 | |
| Responsiveness | 0.500 | 0.488*** | 0.487 | 0.476*** | 0.187 | 0.183 |
| User control of needs | | | 0.072 | 0.052 | -0.178 | -0.129 |
| User control of needs*Responsiveness | | | | | 0.088 | 0.385 |
| R2 | 0.239 | | 0.241 | | 0.245 | |
| Δ R2 | 0.239 | | 0.003 | | 0.004 | |
| F | 71.430*** | | 36.060*** | | 24.457*** | |

(* p<0.05, ** p<0.01, *** p<0.001)

Hypothesis 5-3 is that the higher user control of needs is, the higher the effect of two-way communication on satisfaction is.

In the result of moderating regression analysis in order to understand the moderating effect of user control of needs in the effect of two-way communication on satisfaction like <Table 5-22>, two-way communication factor has effect on satisfaction. However, it is shown that correlation item has no effect on satisfaction, and the awareness of user control of needs has no moderating effect in the relation between two-way communication and satisfaction. Thus hypothesis 5-3 is dismissed.

<Table 5-22> Moderating effect of user control of needs in the effect of two-way communication on satisfaction

| Independent variable | Mode 1 | | Mode 2 | | Mode 3 | |
|---|---|---|---|---|---|---|
| | B | β | B | β | B | β |
| (Constant) | 1.398 | | 1.069 | | 1.776 | |
| Two-way | 0.570 | 0.502*** | 0.554 | 0.488*** | 0.307 | 0.270 |
| User control of needs | | | 0.113 | 0.082 | -0.098 | -0.071 |
| User control of | | | | | 0.073 | 0.291 |

| needs*Two-way | | | | | | |
|---|---|---|---|---|---|---|
| R2 | 0.252 | | 0.259 | | 0.261 | |
| Δ R2 | 0.252 | | 0.006 | | 0.002 | |
| F | 76.985*** | | 39.653*** | | 26.627*** | |

(* p<0.05, ** p<0.01, *** p<0.001)

Hypothesis 5-4 is that the higher user control of needs is, the higher the effect of pleasure on satisfaction is.

In the result of moderating regression analysis in order to understand the moderating effect of user control of needs in the effect of pleasure on satisfaction like <Table 5-23>, pleasure factor affects on satisfaction. However, it is shown that correlation item has no effect on satisfaction, and the awareness of user control of needs has no moderating effect in the relation between pleasure and satisfaction. Therefore, hypothesis 5-4 is dismissed.

<Table 5-23> Moderating effect of user control of needs in the effect of pleasure on satisfaction

| Independent variable | Mode 1 | | Mode 2 | | Mode 3 | |
|---|---|---|---|---|---|---|
| | B | β | B | β | B | β |
| (Constant) | 1.419 | | 0.965 | | 1.218 | |
| Pleasure | 0.541 | 0.572*** | 0.530 | 0.561** | 0.448 | 0.474 |
| User control of needs | | | 0.146 | 0.106 | 0.070 | 0.051 |
| User control of needs*Pleasure | | | | | 0.024 | 0.109 |
| R2 | 0.328 | | 0.339 | | 0.339 | |
| Δ R2 | 0.328 | | 0.011 | | 0.000 | |
| F | 111.038*** | | 58.101*** | | 38.607*** | |

(* p<0.05, ** p<0.01, *** p<0.001)

Hypothesis 5-5 is that the higher user control of needs is, the higher the effect of personalization on satisfaction is.

In the result of moderating regression analysis in order to understand the moderating effect of user control of needs in the effect of personalization on satisfaction like <Table 5-24>, personalization factor has effect on satisfaction. However, it is shown that correlation item has no effect on satisfaction, and there is no moderating effect. Therefore, hypothesis 5-5 is dismissed.

<Table 5-24> Moderating effect of user control of needs in the effect of personalization on satisfaction

| Independent variable | Mode 1 | | Mode 2 | | Mode 3 | |
|---|---|---|---|---|---|---|
| | B | β | B | β | B | β |
| (Constant) | 0.780 | | 0.730 | | 1.456 | |
| Personalization | 0.755 | 0.653*** | 0.752 | 0.650*** | 0.511 | 0.442 |
| User control of needs | | | 0.018 | 0.013 | -0.207 | -0.150 |
| User control of needs*Personalization | | | | | 0.074 | 0.297 |
| R2 | 0426 | | 0.426 | | 0.429 | |
| Δ R2 | 0.426 | | 0.426 | | 0.003 | |
| F | 169.176*** | | 84.273*** | | 56.518*** | |

(* p<0.05, ** p<0.01, *** p<0.001)

# Chapter 6. Conclusion

## 6.1 Study Result and Discussion

Digitalized signage is such an important service nowadays while various businesses try to enter into its market for life or death. As converged service with new formation, digitalized signage based on context brings huge attentions as a new medium. However, there are not many studies on satisfaction in the aspect of interaction or differences of services which users feel.

Through studying previous literature, we extracted user control, responsiveness, two-way communication, personalization and pleasure as composing factors of interaction as well as urgency of needs and user control of needs as moderating variables about location context. Through the effect of these factors, we established hypotheses which are about giving effect on user satisfaction. In order to verify 17 hypotheses, we used one on one online survey, and verified the hypotheses using collected total 2300 questionnares. For statistic analysis, we conducted factor analysis and credibility test about each question while using correlation analysis and moderating regression analysis. The study result is like below.

First, it is appeared that the interactive factors of digitalized signage affect on user satisfaction. In other words, the higher interaction is, the higher satisfaction is. The higher user control, personalization or pleasure from interaction is, the higher satisfaction is. However, two-way communication and responsiveness show relatively low figures. It means that users are not satisfied with two-way communication which looks for information and contents suitable for their demands. In the aspect of interaction which is called the biggest characteristic of digitalized signage, users for media are not satisfied with one-sided formation, but are actively in use media while searching for information and contents.

For continuous development of digitalized signage as an industrial area, service providers need not only to actively provide specialized information suitable for users, but also develop contents meet the users' expectation and expand the service area.

Second, it is shown that the urgency of needs partially affects on interaction and satisfaction. The urgency of needs has effect on satisfaction as a moderating variable for user control and two-way communication. The urgency of needs is the degree of intention to get necessary information for current context as quickly as possible. In the relation with satisfaction, the bigger the degree of urgency is, the higher the satisfaction is. In the relation with user satisfaction, the fact that having effect on user control of needs could be interpreted as relatively high satisfaction when users can organize and

control the contents in the media which is easy to use.

Third, it is shown that user control of needs does not have big effect. In other words, user control of needs is not that related with satisfaction compared to the urgency of needs. For location context, it is important to get information in needs quickly and easily while there are no such big needs for the degree of freedom which means operating information by him. We think that this gives important suggestions for designs of future digitalized system. Summary of the study hypotheses is like below.

<Table 6-1> Result table of study hypotheses

| Contents | Study hypotheses | Verification result |
|---|---|---|
| Hypothesis 1-1 | User control has plus effect on user satisfaction. | selected |
| Hypothesis 1-2 | Responsiveness has plus effect on satisfaction. | dismissed |
| Hypothesis 1-3 | Two-way communication gives plus effect on satisfaction. | dismissed |
| Hypothesis 1-4 | Pleasure gives plus effect on satisfaction. | selected |
| Hypothesis 1-5 | Personalization has plus effect on satisfaction. | selected |
| Hypothesis 2 | The higher the urgency of needs is, the higher satisfaction is. | selected |
| Hypothesis 3 | The higher user control of needs is, the higher satisfaction is. | selected |
| Hypothesis 4-1 | The higher the degree of urgency is, the higher the effect of the user control on satisfaction is. | selected |
| Hypothesis 4-2 | The higher the degree of urgency is, the higher the effect of responsiveness on satisfaction is. | dismissed |
| Hypothesis 4-3 | The higher the degree of urgency is, the higher the effect of two-way communication on satisfaction is. | selected |
| Hypothesis 4-4 | The higher the degree of urgency is, the higher the effect of pleasure on satisfaction is. | dismissed |
| Hypothesis 4-5 | The higher the degree of urgency is, the higher the effect of personalization on satisfaction is. | dismissed |
| Hypothesis | The higher the user control of needs is, the higher the | dismissed |

| | | |
|---|---|---|
| 5-1 | effect of user control on satisfaction is. | |
| Hypothesis 5-2 | The higher the user control of needs is, the higher the effect of responsiveness on satisfaction is | dismissed |
| Hypothesis 5-3 | The higher the user control is, the higher the effect of two-way communication on satisfaction is. | dismissed |
| Hypothesis 5-4 | The higher the user control of needs is, the higher the effect of pleasure on satisfaction is. | dismissed |
| Hypothesis 5-5 | The higher the user control of needs is, the higher the effect of personalization on satisfaction is. | dismissed |

### 6.2 Suggestive points for designs of digitalized signage with high satisfaction

Based on the result about those hypotheses, the suggestive points of this study is like below.

First, by empirically investigating interaction as multidimensional concepts in digitalized signage area, it contributed to systematize interaction. As conducting conceptual study based on theoretical previous study and verification of validity through large scaled sampling investigation, we provided the theoretical foundation about interaction. By applying interaction which was studied limitedly in internet environment into new media, we comprehensively dealt with the composing factors which were used to stay within the conceptual level.

Second, as higher user control, personalization or pleasure brings higher satisfaction, this provides suggestive points for system designs to maximize the user communication. The previous digital signage used to be one-sided contents transmitting system without considering user's user control. We can understand that now users demand new system where they can demand the contents they want and organize various contents in new media.

Third, we need strategic approaches based on location context in digitalized signage environment. Current digital signage system is provided without any basic designs about how to provide what information according to location context. The strategic approaches about such location context are important not only for designs of interactive media, but also for ruling success or failure of service itself. Even though the strengths of digitalized signage are raised and interaction of media is guaranteed, the service that did not consider the characteristics of location context will be unsuccessful and the limitation of media themselves will be ruled. Looking at the current situation, systems did not consider the characteristics of media are fallen behind without having any differentiation of media

Fourth, as mentioned in the previous study, digitalized signage competes not only with the existing digital signage, but also with all the media like broadcasting, paper, magazine and internet. In order to promote early settlement and expansion in current media convergence era, it is important to secure various contents and provide quick updated contents suitable for situation. However, current contents and services provided suitable for user satisfaction is not satisfying. As empirically suggested in this study, we could see unsatisfactory statistic results even though contents meet the user's demand are the most important factor.

Fifth, we need studies on the system which has scalability to change current digital signage into digitalized signage. Reviewing the empirical result of the effect of interaction on user satisfaction, the effect compared to the cost of digital signage which is spreading to various areas is pretty low. It is time to have strategic approaches in order to settle down digitalized signage as a new medium.

The meaning of this study is to academically investigate the relation between user satisfaction and interaction of new media by understanding correlation through empirical analysis in digitalized signage area about interaction which has been discussed focusing on internet media while aiming to give direct assistance to compose service and content and design optimized digitalized signage in working level. By applying location context factor about new media as a variable, we think that this study suggested an important viewpoint for designing future business or service models.

### 6.3 Limitations and Future Studies

In order to understand satisfaction about interaction of digitalized signage, we figured out correlation according to the characteristics of location context after establishing composing factors of interaction. Even though this study has a lot of contribution theoretically or in working level, there are couples limitations like below in the process of analyzing investigation and verifying results.

First, it is the aspect of demographic data collection. Since limiting age groups as relatively young people like 20s and 30s, it is not a comprehensive study including various generations which digitalized signage covers. As ruling generations familiar with new media, future studies need to deal with wide range of generations.

Second, since we analyzed the composing factors of interaction for previous studies, it is lack of measuring items which reflect the characteristics of digitalized signage. We did not conduct the depth-verification of composing factors which are possible to play important roles including real-time factor in interaction. Future studies need to more clearly distinguish composing factors meaningful to digitalized signage because new media will have different interaction compared to the existing media.

Third, comparative study with the existing digital signage was not enough. By studying interaction focusing on the concept of digitalized signage, the part of user satisfaction about the existing digital signage was dropped. The study on user satisfaction of the existing digital signage should be carried out as well through future studies.

Fourth, extracted items about location context are not various. Due to the lack of variety of extracted items about location context which is established as an important moderating variable, we had unclear results about specifically how there are relations with user satisfaction. More flexible approaches about this are needed for future studies.

Through future studies, important suggestive points should be provided for designing systems with high user satisfaction based on depth-analysis of essential differentiation of digitalized signage.

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**Questionnaire**

**"Consumer questionnaire about satisfaction of digitalized signage"**

**Hello?**

**Thank you for participating in this survey. This questionnaire is to study your satisfaction about the marketing promotion using "Digitalized Signage" (Digital view).**

**The result of this study will contribute to providing you with better services while your valuable opinions are actively reflected in future marketing promotions. This questionnaire is submitted unsigned. Since only numbers are statistically analyzed without using any personal data, the secrecy of your personal information is completely guaranteed. We promise that all the responding results will be only used for the objective of improving satisfaction of marketing promotion. Please feel free to contact to the numbers below if you have any questions. Thank you again for sparing your time for the survey.**

**2010.10**

**Kim, Hwang Gon**

Digitalized signage (Digital view) is convenient services established in subway stations, which provide various information. Already lots of people use this ordinarily. As conducting a marketing promotion using digital view, we like to have your honest opinions.

Please answer to the questions sincerely and honestly based on usual thinking and feeling while using it.

This is an example to show how to answer to questions.

| Questions | Not at all | Just a little | Moderat-ely | Quite alot | Very much |
|---|---|---|---|---|---|
| I like TV dramas. | 1---------2----------3----------4----------5 | | | | |

**Part 1. General questions**

**This is a basic survey for people who usually often use digitalized signage (digital view). These questions are only for people who have experience of using digital view in subway stations. Please answer the questions only when you are between 20(including 20) and 40(excluding 40) years old.**

1. Do you often use digital view?
A. often use usually
B. sometimes only when needed
C. rarely use unless it is urgent

2. How often do you use digital view in a week?
A. everyday
B. 4 ~ 5 days
C. 2 ~ 3 days
D. less than one day

3. What service do you use often?
A. surrounding map service
B. subway and bus route service

C. living service like weather
D. real-time search word service
E. information service like movie
F. event service like coupon
G. internet phone service

4. How long have you used digital view service?
A. about a week
B. less than a month
C. less than 3 months
D. 5 months (since pilot service)

**Part2. Opinions about awareness of interection in digitalized signage (digital view)**
**Interactin is to provide suitable information for user's demand getting out of one-sided service in which users just watch the contents provided. Please answer the questions if you have experience to search information in digital view.**

1. These questions are about user control when using digitalized signage. User control is the degree of users' selecting and controlling freely the contents they want.

| Questions | Not at all | Just a little | MOdera-tely | Quite alot | Very much |
|---|---|---|---|---|---|
| Digital view is easy to use. | 1---------2----------3----------4----------5 | | | | |
| Possible to select freely the contents wanted. | 1---------2----------3----------4----------5 | | | | |
| Easy for users to organize, control and operate by themselves | 1---------2----------3----------4----------5 | | | | |

2. These questions are about responsiveness of digitalized signage.
Responsiveness is the degree of responding quickly and appropriately about user's demands or inquiries.

| Questions | Not at all | Just a little | Moderat ely | Quite alot | Very much |
|---|---|---|---|---|---|
| Digital view responds suitably to | 1---------2----------3----------4----------5 | | | | |

| | |
|---|---|
| user's demand. | |
| The operational response of touch screen is quickly practiced, and time for display is not so long. | 1---------2----------3------------4----------5 |
| It responds quickly to user's demands. | 1---------2----------3------------4----------5 |

3. These questions are about two-way communication of digitalized signage.
Two-way communication is the degree of changing contents, answering questions and providing information suitable for user's demand.

| Questions | Not at all | Just a little | Moderat-ely | Quite alot | Very much |
|---|---|---|---|---|---|
| Digital view is easy to change contents suitable for user's demand. | 1---------2----------3------------4----------5 | | | | |
| It is easy to find questions and answers suitable for user's demand. | 1---------2----------3------------4----------5 | | | | |
| It provides plentiful information suitable for user's demand. | 1---------2----------3------------4----------5 | | | | |

4. These questions about pleasure of digitalized signage.
Pleasure is the degree of feeling enjoyment and delight while using this service.

| Questions | Not at all | Just a little | MOdera-tely | Quite alot | Very much |
|---|---|---|---|---|---|
| Digital view provides enjoyable information and service plentifully. | 1---------2----------3------------4----------5 | | | | |
| Tend to be absorbed in the content usually. | 1---------2----------3------------4----------5 | | | | |
| Tend to enjoy the time when I am using the service usually. | 1---------2----------3------------4----------5 | | | | |

5. These questions about personalization of digitalized signage.
Personalization is the degree of providing information and services matching for user's demand.

| Questions | Not at all | Just a little | MOdera-tely | Quite alot | Very much |
|---|---|---|---|---|---|
| Digital view provides information matching for user's demand. | 1---------2----------3----------4----------5 | | | | |
| Easy to find information matching for user's demand. | 1---------2----------3----------4----------5 | | | | |
| It provides services suitable for user's demand. | 1---------2----------3----------4----------5 | | | | |

**Part 3. Opinions about needs and satisfaction according to location of digitalized signage**

1. These questions are about situations of getting urgent information in digitalized signage.
Urgency of needs is the degree of urgent situation of getting information in location like subway stations.

| Questions | Not at all | Just a little | Moderat-ely | Quite alot | Very much |
|---|---|---|---|---|---|
| A lot of times of using digital view in subway stations are like looking for information urgently. | 1---------2----------3----------4----------5 | | | | |
| A lot of times going through difficulties in case of not being able to get information wanted through digital view. | 1---------2----------3----------4----------5 | | | | |
| Tend to ask other' passengers when I cannot the required information. | 1---------2----------3----------4----------5 | | | | |

2. These questions are about process of getting information in digitalized signage.
User control of needs is about process of getting information in location like subway stations.

| Questions | Not at all | Just a little | Moderat-ely | Quite alot | Very much |
|---|---|---|---|---|---|

| | |
|---|---|
| When getting information in subway stations, I do not want to see other additional information besides the information wanted. | 1---------2----------3------------4----------5 |
| When searching for information in subway stations, I want the information wanted to show on top of it. | 1---------2----------3------------4----------5 |

3. These questions are about user satisfaction.

User satisfaction is the degree of feeling satisfaction while using digitalized signage.

.

| Questions | Not at all | Just a little | Moderat-ely | Quite alot | Very much |
|---|---|---|---|---|---|
| Overall, I am satisfied. | 1---------2----------3------------4----------5 | | | | |
| I think Digital view usually satisfy the right answers. | 1---------2----------3------------4----------5 | | | | |
| I feel satisfied and convenient when I am using Digital view. | 1---------2----------3------------4----------5 | | | | |
| I am satisfied with the use and service methods of digital view. | 1---------2----------3------------4----------5 | | | | |
| I fully recommend digital view to other people. | 1---------2----------3------------4----------5 | | | | |

**Part 4. Demographic characteristics**

**These questions are about interpretation and categorization of data.**

**We promise that this information will not be used for other purposes. Please draw circles on the alphabet applying to you.**

1. What is your sex?

A. Man

B. Woman

2. What is your age?

A. 20s

B. 30s

C. 40s

D. 50s