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SOCIAL INFLUENCE AND TASK-TECHNOLOGY FIT
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AN EMPIRICAL STUDY OF USERS' PERCEPTION AND
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SOCIAL INFLUENCE AND TASK-TECHNOLOGY FIT IN TECHNOLOGY ACCEPTANCE: AN EMPIRICAL STUDY OF USERS' PERCEPTION AND USE INTENT IN M-COMMERCE

By

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ABSTRACT

SOCIAL INFLUENCE AND TASK-TECHNOLOGY FIT
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During the last few years, high-speed 3G mobile technologies have been proliferating rapidly, signaling prospects for the mobile Internet. However, such great expectation is only an anticipation of the marketers in mobile telecommunication industry, and while the projected numbers are not fully guaranteed to be attained, there still exist controversies regarding the future of mobile Internet and m-commerce. After an extensive review of the m-commerce literature, we found that little has been studied on the factors that drive the users' acceptance of this new technology. This dissertation specifically examines the main factors that drive technology acceptance by testing the effects of TTF and Social Influence on the TAM model's variables in the context of m-commerce.

An experimental setting was conceived to artificially create a 3x2 (positive/neutral/negative social influence by good/poor task-technology fit) between-subjects factorial design, in which subjects were randomly assigned to one of six conditions. A total of 210 college students participated in the study. Data analysis results indicated that there are significant main effects of Social Influence and TTF, as well as interaction effects, on users' perceptions and intention to use.

Based on these findings the followings could be inferred: First, positive social influence was crucial in forming positive perception on a new technology and high

intention to use it, and when combined with appropriate goodness of fit between task and technology, the effect on use intent would maximize. Second, although task-technology fit impacts the users' success of trials in finding music titles, it does not directly affect their perceived ease of use and perceived usefulness, but rather has an indirect effect through perceived TTF. Third, perceived ease of use has almost no effect on perceived usefulness and use intent, but instead, perceived usefulness was found to significantly associate with users' willingness to use a new technology. These findings suggest that as much as TTF plays an important role in shaping and changing users' perception on new mobile technologies, social influence is equally, if not more, influential when it comes to the decisions of these new users toward an intention to actually use them.

DEDICATION

To my beautiful wife, Yoon

my beloved son, Sean

and my unborn child

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TABLE OF CONTENTS

LIST OF TABLES

List of Figures

CHAPTER 1

INTRODUCTION

Mobile Internet: A Brief Summary of the Current Situation

Technological advances in wireless and mobile communications has made it possible to use the Internet on small handheld devices such as personal digital assistants (PDAs) and cellular phones. The current most widely used mobile technologies are the 2G, or second generation, standards, which include GSM (Global System for Mobile), CDMA (Code Division Multiple Access) and TDMA (Time Division Multiple Access), and dominate mobile communications in more than 160 countries (Schone, 2004). However, 3G (third generation) wireless technologies are increasingly moving into the spotlight as telecommunication carriers gradually shift from 2G to 3G infrastructure. 3G is the collective term used for several engineering proposals to make wireless networks more data-capable than 1G analog and 2G digital cellular systems. Wideband CDMA (W-CDMA, also known as Universal Mobile Telecommunications System, or UMTS), CDMA2000, and Time Division Synchronous CDMA (TD-SCDMA), are among the leading 3G standards. Today, most of the European countries have already awarded the W-CDMA, allowing for a data transmission rates of up to 2 Mbps (Buellingen and Woerter, 2004). Japan started even earlier than any other countries with their NTT DoCoMo's mobile Internet services based on their own 3G standard, Freedom of Mobile Multimedia Access (FOMA, an adaptation of W-CDMA) (Nadel, 2002). In South Korea, where the number of high-speed mobile Internet subscribers relative to the total number of mobile subscribers reached 51.1% in 2002, the introduction of the 3G mobile technology, CDMA2000, also gained great popularity (Minges, 2005).

However, in the United States, the development of the 3G cellular technology was stunted by the competition of various technological standards, and most carriers have shown more interest in intermediate and less ambitious 2.5G technologies. Telecommunication carriers have been reluctant to roll out 3G networks because of the growing popularity of the high-speed wireless Internet access from laptop computers (Landler, 2002). Yet, many experts forecast a prosperous future when it comes to mobile Internet. It is expected that the number of worldwide subscribers to 3G would jump to 70 million by the end of the year 2005 from about 16 million at the end of 2004 (Racanelli, 2005). Also predicted is that by the year 2007, more than 60 percent of Americans will be using some form of wireless data (Young, 2002), with a revenue of $58.4 billion for the U.S. mobile commerce sector (Betts, 2001).

M-Commerce and Digital Entertainment Goods

Mobile commerce (hereafter m-commerce) is, literally, "mobile electronic commerce," as such businesses can take advantage of the wireless technologies and leverage the existing Internet infrastructure (Frolick, 2004). Thus, m-commerce activities encompass both content delivery (notification and reporting) and transactions (purchasing and data entry) on mobile devices (Leung and Antypas, 2001). Among all issues concerning m-commerce services, our research specifically examines the main factors that drive users to purchase digital entertainment goods on a portable mobile device.

Digital goods, or digital products, are knowledge-based information, or information goods, that can be digitized and transferred over networks. Information goods include a wide variety of products mostly first produced in digital format and either later printed on paper or used in their original digital formats (Choi et al., 1997). All recordable and digitally transferable products, such as music, software or news information are, therefore, digital goods. (Royer and Van Der Velden, 2003). Thus, digital goods are materially different from other tangible goods, mainly from the fact that they are shapeless and have economic lives of their own; once born, they need not to be reborn (McKenzie, 2003). Digital entertainment goods is a narrower term that represents music titles, picture and video files, and game software that can be downloaded on a terminal for the purpose of enjoyment. Recently, among various entertainment contents, game is considered to be one of the main features driving the market (Brodsky, 2002), while multimedia services such as MPEG video streaming are expected to unlock new revenue streams for the cellular operators (Chevillat and Schott, 2003). Also, the digital music delivery market has gone legitimate and is growing in its own right with the successful launch of various platforms, such as Napster, iTunes and Sony Connect. In Europe, iTunes alone has sold 5 million tracks in the first ten weeks of it going live, and T-Mobile and O2 have also started the mobile music bandwagon rolling with proprietary mobile music services on the basis that downloads over the Internet will soon extend across other delivery platforms (Jones, 2004).

Considering that most mobile Internet users are young in age, there is a high probability that entertainment contents will become prevalent in the m-commerce market. An exemplary case can be illustrated by NTT's DoCoMo data service. When NTT first started deploying their systems in 1997 under the name of DoPa packet transmission, the target market was focused on business customers. Later, by the time NTT upgraded their networks in 1999 and changed the service name to iMode wireless Internet, the company reassessed the target market and decided to concentrate instead on the young mass consumers (Fransman, 2002). Today, a majority of NTT's DoCoMo subscribers is consisted of young generation users especially interested in entertainment contents of the mobile Internet (Okazaki, 2004). Also, upon estimating South Korean consumers' preferences for the major CDMA2000 services, Kim (2005) found that two contents, video telephony and multimedia mobile Internet applications were highly valuated among subscribers, placing these services among the most anticipated mobile Internet applications of the future.

In light of such trends, cellular phones are becoming increasingly intelligent, especially with entertainment functions embedded in them. A recent appearance of camera phones that integrated digital cameras in cellular phones has shown great success as they turned out to be highly popular worldwide with a market boost from tens of millions already in use to an expected number of hundreds of millions in the following years (Crockett and Reinhardt, 2003; Drucker, 2003; Lewis, 2003). Moreover, with the development of highly efficient digital audio and video compression technology, such as MP3 and MPEG-4, the next generation cellular phones are anticipated to fully support audio- and video-on-demand (Fairlie, 2001; Dunn, 2002; Takahashi, 2002). In Japan, mobile phones are already being used as portable entertainment players, cameras, membership and loyalty cards, guidebooks, maps, tickets, watches, and devices for accessing everything from new to corporate databases (McClelland, 2004). The critical question lies on whether or not such digital entertainment goods provided wirelessly on handheld devices will enjoy worldwide proliferation, because the user interface on a mobile terminal, nevertheless, is less comfortable and less convenient for the user to control and to interact with the mobile services than it is with conventional computers (Figge, 2004). In today's technology-driven situation, customer usability and their future demands seem to be of only subordinate interest. However, the possibilities for profitable applications and services for success can only be secured with the knowledge of user needs. From this perspective, detailed examination of human nature, and understanding of consumers' cognitive and behavioral reactions is essential to gain knowledge about future market potentials (Gerstheimer and Lupp, 2004). Consequently, user acceptance and innovation diffusion have been two recurring issues in the discipline of telecommunication and information systems. Our study investigates and examines the critical factors that specifically instigate potential m-commerce users to positively perceive and accept this new technology. The theoretical basis of our arguments is presented in the following paragraphs.

Technology Acceptance, Social Influence, and Task-Technology Fit

Ever since mankind has been prospering, countless innovations took place in the form of new technologies that were either highly praised and adopted or neglected and rejected by the users of their era. Scholars have been pondering over a logical explanation of the success and failure of innovative ideas to identify the main drivers that cause the acceptance of novelties. In social science, there exist several theories that discuss the acceptance of new technologies by the social members. The Diffusion of Innovation theory (Rogers, 1983) provides a description of the antecedents that influence the adoption of innovations, and discusses the process of adoption. The Theory of Reasoned Action (Ajzen and Fishbein, 1975; 1980) presents a detailed model that links beliefs, attitude, subjective norm, intention, and behavior, while the Theory of Planned Behavior (Ajzen, 1985; 1989), adds a new antecedent, the perceived behavioral control, to the Theory of Reasoned Action. The Motivational Model (Davis et al., 1992) also provides two key constructs, extrinsic motivation and intrinsic motivation, that lead to user acceptance of a technology. Although these theories have effectively and comprehensively demonstrated social and psychological explanations for acceptance and use of different artifacts, they do not provide parsimonious approaches in testing and assessing the variables. The Technology Acceptance Model (TAM) and the Social Influence Model (SIM) offer simplified descriptions while maintaining the integrity of the constructs in explaining technology acceptance. In addition, the Task-Technology Fit (TTF) model sheds the light on the mechanism that stimulates utilization and enhances performance in using a new technology.

The Technology Acceptance Model (Davis, 1989) examines the key variables in the acceptance procedure of a new information technology. According to the theory, the intention to accept a new technology is determined by two beliefs, one being the perceived usefulness of using the technology, and the other, the perceived ease of use. Although the model has been redefined by numerous follow-up studies, which added further variables that lead to acceptance, the main precursors of acceptance, which include the perceived usefulness and perceived ease of use, have mostly remained inherent to the user.

The Social Influence Model of Technology Use (Fulk et al., 1990) states that individual's media perceptions and use are, in part, socially constructed. Media properties are posited to be subjective, that is, influenced to some degree by attitudes, statements, and behaviors of others. Such social factors are the individual's internalization of the reference group's subjective culture (Thompson et al., 1991). Therefore, although applicability and convenience of a medium are still considered to influence how individuals perceive and make use of it, these features are but a part of an equation that determines media perceptions and adoption.

The Task-Technology Fit model (Goodhue and Thompson, 1995) claims that the fit among task requirements, individual abilities, and the functionality and interface of the technology determine how well the users' needs are matched by the system, and as such is reflected on users' evaluative beliefs of task-technology fit. The model indicates that performance is affected by the level of correspondence between task and technology, and utilization is also associated with the fit level and performance. TTF has been broadly applied to any situation in which individuals use technology to accomplish specific tasks or fulfill certain needs.

This study approaches the issue of new technology acceptance by integrating the variables from the TTF and SIM in the TAM theory. Indeed, the process of acceptance of a new technology is not only influenced by some objective features or users' perception on usability, but also by socially shaped predispositions. Therefore, we contend that the level of goodness of fit between task and technology, and social influence as well as objective features of a technology needs to be equally examined to verify how an innovative technology is evaluated and accepted among its new users.

The suggestion that people are influenced by the collective expression of others is not new. In an article that examined the effect of poll results on other voters, Allport (1940) stated that:

> "We tend to behave as we see others behave, or, if we are feeling or acting in a given direction of our own accord, we tend to be swayed the more strongly if we see or hear a large number of others acting in the same direction… based more upon social influence and suggestion than upon rational decision."(p.250)

Also, Harvey Leibenstein (1950) described the impact of the "bandwagon effect" on product demand curves. According to Leibenstein, the bandwagon effect occurs when people's evaluation of a good increases after they observed others consuming the same product.

Social influence is especially applicable in the acceptance procedure of new communication technologies. Numerous studies demonstrated that new users intend to rely on social relations when deciding on the use of a new and unfamiliar device. Schmitz and Fulk (1991) empirically tested the SIM model in an actual setting through surveys, and found significant and direct effects of social influence from both co-workers and supervisors on the actual individual use of a new media. Another study by Kraut et al. (1998), which investigated the association between the amount of electronic network use and virtualization of a firm, showed that the use of interpersonal relationships for coordination was positively related to greater network use. While the literature of social influence as a key determinant of technology use will be discussed more in detail in later chapters, it is worth mentioning that only a small number of extant studies empirically tested the variable in accordance with the TAM model. This dissertation explores the extent of social influence as well as technological fit's effects on users' success of trials, perceptions, and intention in using a new technology, which is in our study, m-commerce.

Overview of the Dissertation and Research Questions

Most previous m-commerce studies have remained exploratory by focusing on exploiting the main values of the wireless Internet (Clarke III, 2001; Anckar and D'Incau, 2002; Lee et al., 2002), discovering key applications (Koh and Kim, 2000; Balasubramanian et al., 2002; Giaglis, 2003), presenting business strategies (Alanen and Autio, 2003; Barnes, 2003), and predicting the success of the medium (Hammond, 2001; Rowello, 2001; Siau et al., 2001). To date, only a handful amount of research examined the major factors that affect the acceptance of m-commerce, and little, if any, pursued the study from a theoretical perspective. Extant studies found that such factors, including perceived risk, complexity, compatibility (Kleijnen et al., 2003), privacy, reliability, cost, download time, usability (Coursaris et al., 2003), convenience (Magura, 2003) and simplicity (Haque, 2003) mostly influenced the adoption of mobile services.

The goal of this dissertation is to further develop the theory of TAM by integrating with key factors from the TTF and SIM models, and by exploring them in the m-commerce context to advance theoretical as well as practical implications. Also, this study provides a unified and parsimonious classification of the main drivers of m-commerce acceptance. Experiments are conducted to obtain control of the key variables and to observe causality. The results successfully contribute to the literature of TAM by clarifying the key factors for new technology acceptance, as well as to the literature of m-commerce by presenting a framework to assess the role of social influence and technological support in terms of consumers' perception and intention to purchase digital goods. The research questions for this study can be stated as follows:

General Research Question:

What are the main factors influencing the individual acceptance of mobile Internet services in mobile commerce dealing with entertainment applications such as music file downloads?

Specific Research Question 1:

How does task-technology fit of the navigational system in mobile commerce influence users' success of trials, perception, and intention of using mobile Internet services for entertainment purposes?

Specific Research Question 2:

How does social influence of significant other' word-of-mouth influence potential users' perception and intention to use mobile commerce for entertainment purposes?

Specific Research Question 3:

How does users' perception affect use intention in the context of m-commerce dealing with entertainment services?

This dissertation is organized into six chapters. This introductory chapter discusses the need to elaborate the theoretical framework of the TAM model by emphasizing the importance of social influence and task-technology fit as major antecedents, and presents m-commerce applications as a context of new technology. The next chapter provides an in-depth review of the theoretical and empirical literature on TAM, TTF, SIM theories and m-commerce Web navigation usability, and defines the key concepts along with the hypotheses tested in this study. Chapter 3 discusses the methods and procedures of data collection as well as the rationale for the experimental study used to examine the causal relations between the variables. Chapter 4 presents the results obtained from statistical computation and data examination employed throughout the preparation and analyses of the collected data. Final discussion of the outcome and findings is provided in Chapter 5, and Chapter 6 concludes the dissertation by stating the implications of the study, limitations stemming from conceptual caveats and drawbacks associated with the research design, and closing remarks.

CHAPTER 2

REVIEW OF THEORETICAL AND EMPIRICAL LITERATURE

This chapter examines the theoretical and empirical literature of the TAM model, SIM model, and TTF theory. Also, the context of m-commerce is defined, and concepts pertaining to this dissertation are described. The hypotheses to be tested in the next chapters will follow the discussions.

M-commerce Web Navigation

M-commerce relies on the usage of wireless devices, such as cellular phones or PDAs, from which commercial transactions are made through instantaneous application of information technology or transmission of data streams in places that were previously inaccessible (Raisinghani, 2002). Leading m-commerce services for consumers can be categorized into different sets of application that include travel, ticketing, banking, stock trading, news and sports, gambling, game and entertainment, and shopping (May, 2001).

However, the usability of these services heavily depends on the mobile device's screen size. "Usability" can be defined as the quality of a system with respect to ease of learning, ease of use, and user satisfaction (Rosson and Carroll, 2002). Although technological developments have enhanced the connection speed and image quality, the limited size of the small screens on cell phones or PDAs has impeded the display capacity of regular Web pages on these handsets (Tarasewich, 2003). Consequently, screen size affects usability. A study by Jones et al. (1999) demonstrated that users in "small screen" (640x480 pixels) environment showed lower effectiveness in completing search and retrieval tasks than those with a "large screen" (1074x768 pixels).

As an important building block for enabling Web site navigability on wireless devices, the Wireless Application Protocol (WAP) has now become a globally-accepted standard (Ralph and Aghvami, 2001), but is required a new technique for user interface design to minimize user interaction during input and output (Frick, 2000). Chittaro and Cin (2001) tested the usability of the WAP interface with novice users. The subjects evaluated four different types of interface, (1) a navigation using links (2) a list of links, (3) action screens and (4) selection screens, and reported better performance and higher perceived ease of use in the first two types of interface, that is, the link-enabled navigations. The study confirmed the fact that the hyperlink function is as effective in mobile commerce as it is in conventional Internet navigation.

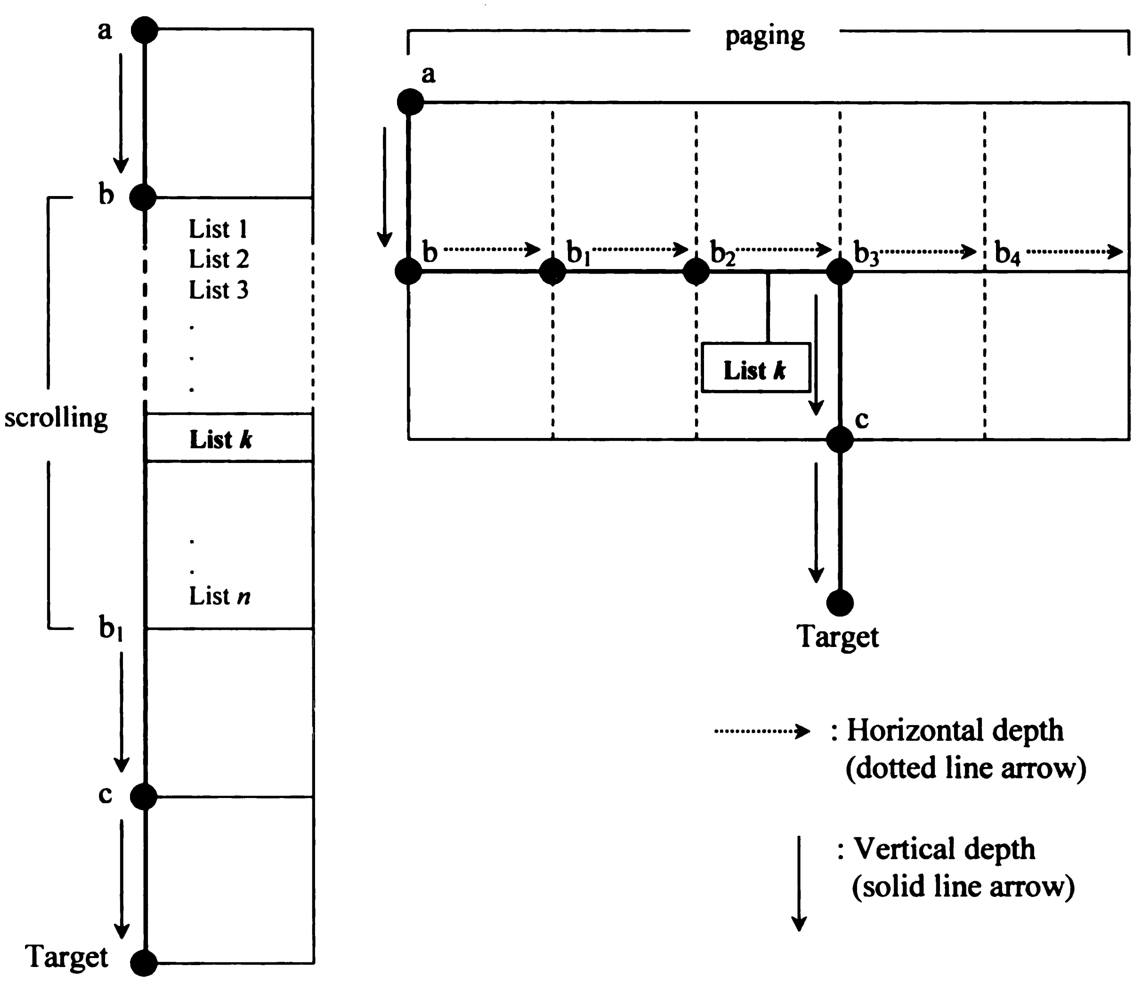
The usability of small handheld devices also depends on the hierarchical menu structure. The "hierarchy" of menus in mobile Internet refers to the arrangement and display method of Web page procedure. Henneman and Rouse (1984) argued that one of the most critical characteristics that must be considered in the hierarchical menu design is the trade-off between depth and breadth of menu structure. "Depth" can be defined as the number of levels in the hierarchy, while "breadth" can be explained by the number of options per menu panel (Paap and Cooke, 1997). Figure 1 depicts the difference between the horizontal-depth navigation and vertical-depth navigation. In essence, the horizontal-depth, or depth, refers to the number of sub-menus, whereas the vertical depth, or breadth, refers to the length of the list on a single menu. The following statement explains the steps that a user needs to take in both horizontal- and vertical-depth navigations to reach a target:

> "The user starts searching information from the top level (point *a*) and moves down to a sub-level (*b*) until encountering a list of street names. If there are *n* street names on the list, there may be several ways to present the whole list on the screen, such as providing *n* street names within one page, or dividing the list into several pages. In the former case, the user has to find a certain street (*list k*) by scrolling down the long list. In the latter case, the user has to move from the first page to the third page containing *'list k'* ($b \rightarrow b_1 \rightarrow b_2$), then on page b_2 (s)he needs to go down to *'c'* to reach the *'Target'* information." (Chae and Kim, 2003)

Through an experimental study, Chae and Kim (2003) demonstrated that as depth increased, the performance of users using mobile devices decreased. They also found that user satisfaction was significantly affected by depth. However, the results showed higher user preference of four-depth design over one- and six-depth designs.

Concurring with Chae and Kim's study, the current research applies the horizontal-depth design as a type of navigation in m-commerce. Additionally, an interactive navigation will also be considered. The interactivity has been validated to be an efficient method of information retrieval (Benoit, 2002; Lin et al., 2003), as well as a driver of online consumers' intention to purchase and revisit (Kuk and Yeung, 2002). Although there exist numerous ways to implement interactivity, for the purpose of executing the file searching and retrieving function, a search box was created and employed in the study. On this search box, users are told to type the name of the file to be found. A 'search' button is displayed next to the search box so that when users click on it, the screen shows a list of files matching the letters typed in the box. The users are then able to choose and click on a file name hyperlink in the window.

Figure 1: Horizontal-Depth versus Vertical-Depth (Adopted from Chae and Kim, 2003)



Technology Acceptance Model (TAM)

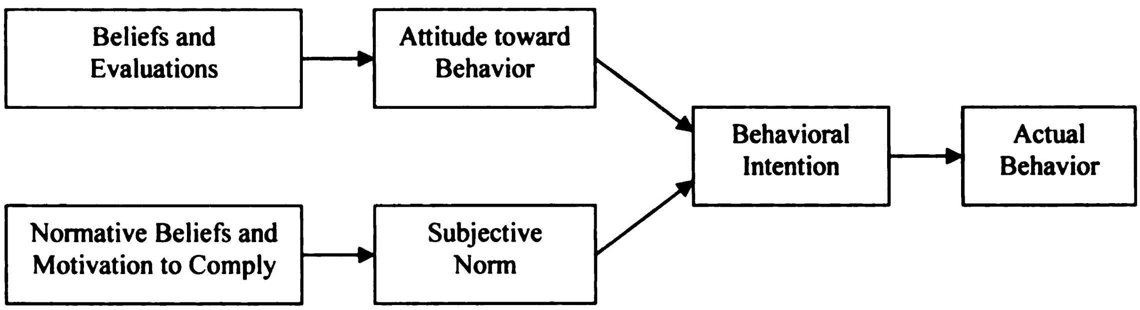
The Technology Acceptance Model (TAM) (Davis, 1989; Adams et al., 1992) suggests that two main factors, perceived usefulness and perceived ease of use of a new technology, lead to its acceptance and actual usage. According to TAM, the intention to voluntarily accept, that is to use, a new technology is determined by two beliefs dealing with (1) the perceived usefulness of using the technology and (2) the perceived ease of use of it. Perceived usefulness is a measure of the individual's subjective assessment of the utility offered by the new technology in a specific task-oriented context, and perceived ease of use is and indicator of the cognitive effort needed to learn and to utilize the new technology.

> "The goal of TAM is to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behaviour across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified." (Davis et al. 1989, p.985)

A key purpose of TAM, therefore, is to provide a basis for tracing the impact of internal factors on intentions and usage. TAM is formulated in an attempt to achieve these goals by identifying a small number of fundamental variables suggested by previous research dealing with cognitive and affective determinants of IT acceptance (Al-Gahtani and King, 1999).

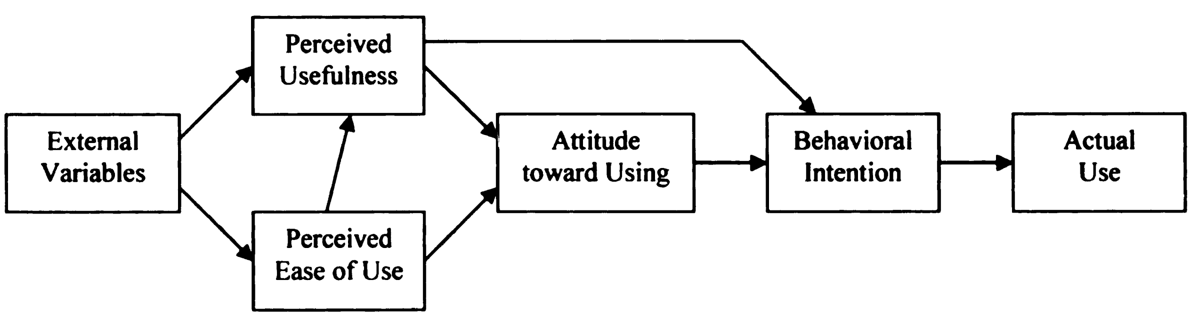
TAM's theoretical foundation comes from the Theory of Reasoned Action (TRA) by Ajzen and Fishbein (1975; 1980; Sheppard et al., 1988). TRA assumes that behavior is determined by intention, which is, consecutively, influenced by attitude toward the behavior and subjective norm. Attitude is shaped by beliefs (perceived consequences of the act) and evaluations of outcomes, while subjective norm is affected by normative beliefs (perceived significant others' preferences) and motivation to comply (see Figure 2 below).

Figure 2: Theory of Reasoned Action (Fishbein and Ajzen, 1975)



TRA's belief-attitude-intention-behavior relationship yielded to the formation of TAM, which applies a more parsimonious approach of framing the exogenous variables. Perceived usefulness and perceived ease of use are the two drivers originally deemed to be the most important factors in acceptance of a new technology (see Figure 3 below).

Figure 3: Technology Acceptance Model (Davis et al., 1989)



The causal link between perceived ease of use and perceived usefulness is not only argued in Davis' model but also confirmed by numerous studies. Both Mathieson (1991) and Szajna (1996) showed that ease of use account for a significant amount of the variance of perceived usefulness. Similar findings have been reported by Thompson et al. (1991), Straub et al. (1995), Igbaria et al. (1997), and Gefen et al. (2003). They suggest that, while perceived ease of use and perceived usefulness influence use intention and usage, perceived ease of use is an antecedent of perceived usefulness as well.

Previous TAM Studies

For more than a decade, a large number of studies have contributed to the literature of TAM. While a majority of the literature introduced new variables by combining TAM with other models, some other portion tested the model in different contexts and compared the model with other theories to assess the main factors of technology acceptance.

Mathieson (1991) compared TAM with the Theory of Planned Behavior (TPB) in an experimental study that employed using new computer programs. He found that both theories predicted intention to use fairly well, but TAM showed a slight empirical advantage. Taylor and Todd (1995) tested a model that combined TAM and TPB, called the decomposed TPB, and found that it provided better explanation of the variance in usage than TAM. The same authors elaborated their findings and presented a new model, Augmented TAM, encompassing a new variable: perceived behavioral control (Taylor and Todd, 1995). In another study, Mathieson et al. (2001) also used TPB variables to form a model of Extended TAM with an added predictor of perceived user resources.

According to the authors, the "perceived resources" refers to the extent an individual believes that he or she has the personal and organizational resources needed to use an information system. They found empirical evidence that supported the Extended TAM's contention that perceived resources affect an individual's intention to use an information system.

TAM has also been tested in the context of electronic commerce. Geffen et al. (2003) advanced a new model of technology acceptance by incorporating the trust factor in TAM. This Trust and TAM determinants were tested on consumers' shopping experiences through electronic vendors' Web sites. The results of the study showed that consumer trust is as important to online consumers as TAM's antecedents. Similar models of trust in TAM studies were conducted by other scholars. Pavlou (2001) successfully incorporated two additional factors, trust and perceived risk, in testing consumers' intention to adopt e-commerce. Also, Dahlberg et al. (2003) implemented a new model of Trust Enhanced TAM, and found that trust was an important predictor of intent to use in the mobile payment context.

While the initial TAM underwent a series of model extension in numerous studies, a more recent trend involves the elaboration of TAM model. Venkatesh et al. (2002) proposed an integrated model of TAM and Motivational Model, where user acceptance enablers were observed as predictors of perceived ease of use, perceived usefulness, and intrinsic motivations. This integrated model was tested in an employee-training environment through longitudinal data collection and analysis. The results supported the importance of intrinsic motivational factors in the process of technology acceptance in organizations. Another elaborate model of TAM by Venkatesh and Davis

(2000) was TAM2, a new version that includes subjective norm as one of the main determinants. In this new model, the subjective norm, which was a key predictor of behavioral intention in TRA, is defined as a "person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein and Ajzen, 1975). As the construct represents a crucial aspect of social influence, the implication of TAM2 clearly indicates that societal factors are equally important in the acceptance process of a new technology.

To date, two comprehensive studies provide a general and detailed literature review of TAM. Lee et al. (2003) explicitly organized most of extant TAM studies by chronological progress and findings, and presented a discussion on the model's limitations through interviews with major researchers in the field. Venkatesh et al. (2003) provided as well an almost complete list of TAM literature. However, the authors formulated a Unified Theory of Acceptance and Use of Technology (UTAUT) through revision of eight salient models of extended and elaborated TAM. Empirical evaluation of the new model gave the authors validated results that supported the integrity of UTAUT.

Concurring with the TAM theory, it is predicted that the perception of the new technology's ease of use will show a positive relationship with the perceived usefulness, hence the following hypothesis:

H1: Perceived ease of use will be positively related to perceived usefulness.

Also, since the TAM model theorizes a positive effect of these perceptions on use intention, we hypothesized that perceived ease of use and perceived usefulness will positively influence the subjects' willingness to reuse the new technology:

H2: Perceived ease of use will have a positive effect on use intention.

H3: Perceived usefulness will have a positive effect on use intention.

Task-Technology Fit (TTF) Theory

The Task-Technology Fit (TTF) Theory (Goodhue, 1995; Goodhue and Thompson, 1995) states that the correspondence between information systems functionality and task requirements leads to positive user evaluations, higher utilization, and positive performance impacts. The essence of TTF comes from Technology-to-Performance Chain (TPC), as depicted in Figure 4, which asserts that for an information technology to have a positive impact on individual performance, the technology must be a good fit with the task. According to Goodhue (1995), in the context of information systems research, *technology* refers to computer systems and user support services, while *tasks* are defined as the actions carried out by individuals in turning inputs into outputs. Also, the model of TTF emphasizes the importance of user evaluations. Users will give evaluations based on the extent to which systems meet their needs and abilities. Figure 5 represents the model of Task-Technology Fit and User Evaluations. The heart of the TTF model is the assumption that information systems give value by being instrumental in some tasks and that users will reflect this in their evaluations of the systems (Goodhue, 1998). Therefore, the evaluations from users are the key determinants of fit between task and technology.

Figure 4: The Technology-to-Performance Chain (Goodhue and Thompson, 1995)

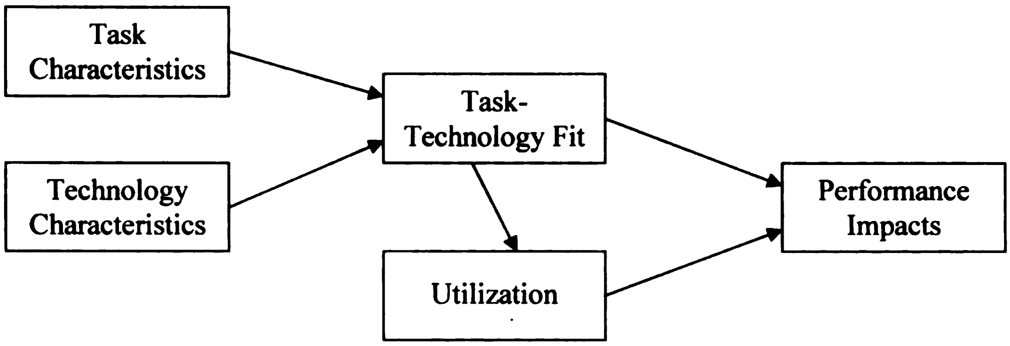
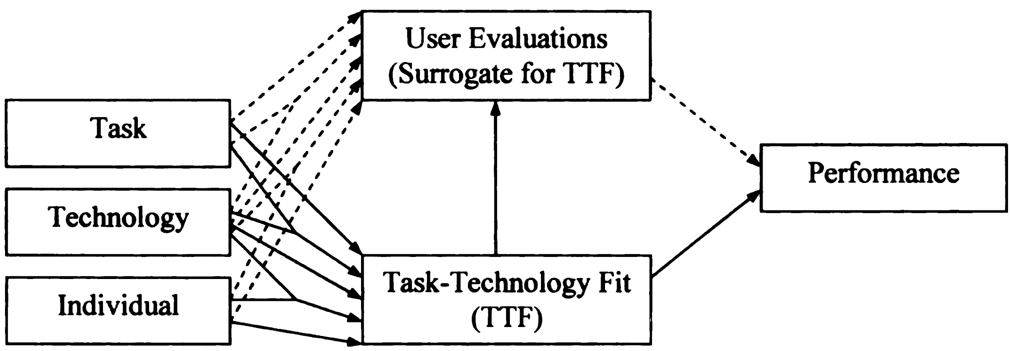


Figure 5: Model of Task-Technology Fit and User Evaluations (Goodhue, 1995)



Previous TTF Studies

TTF shares some important similarity with organizational structural contingency theories. One of the key questions of contingency theories is how task technology influences the information-processing requirements of an organizational unit (Keller, 1994). These theories involve fit measures of tasks at the organizational level, that is an organization's structure and its organizational context in which the technology is used (Van de Ven and Drazin, 1985). For instance, information processing has been described to be an integral concept in models that tested how organizations can match different technologies to the design and structure of units in order to achieve high unit performance (Tushman and Nadler, 1978; Daft and Lengel, 1984; Cohen and Levinthal, 1990).

However, TTF is more concerned about individual level fit of task and technology. TTF can be defined as "the degree to which technology assists an individual in performing his or her portfolio of tasks" (Goodhue, 1997). Indeed, most extant TTF studies examined individual users' performance and perceptions of different IT use in various contexts. Goodhue (1995) tested the TTF model in individual work-related computer use, and found that users can successfully evaluate task-technology fit by accurately reflecting differences in the underlying systems and services provided to them. Also, Goodhue and Thompson (1995) explored the effects of task-technology fit on performance and concluded that for an information technology to have a positive impact on individual performance, it must match the individual needs and task characteristics. Ferratt and Vlahos (1998) investigated the managerial decision making support of computer-based information systems from the perspective of TTF, and found that managers value information systems highly for resource allocation, evaluating alternatives, identifying problems, ranking alternatives, and short-term decision making.

Some group level studies of TTF were also pursued. Massey et al. (Massey et al., 2001) explicitly observed how cultural variability affects the difficulty with which global virtual teams communicate, and suggested that establishing norms of behavior regarding communication task-technology will enhance the performance of virtual teams separated by space, time, and culture. Several scholars also tested the effectiveness of Group Support Systems (GSS). Zigurs and Buckland (1998) examined the relationship between attributes of group task complexity and group performance, while Shirani et al. (Shirani et al., 1999) compared the quality of works performed by groups with synchronous versus asynchronous communication technology. Murthy and Kerr (2000) discovered that group members performed significantly better when communicating face-to-face for problem-solving tasks and when communicating via the GSS for the idea generation tasks.

The theory of TTF has been tested in conjunction with other theories as well. Lim and Benbasat (2000) conducted a TTF model test in accordance with the information richness theory. They developed and successfully tested their Task-Representation Fit Model that explains how the multimedia representation is perceived as more useful than the text-based representation in the context of individual decision makers utilizing organizational data. In other papers, Dishaw and Strong (1999), Dishaw et al. (2002), and Klopping and McKinney (2004) extended the model by integrating TTF with TAM constructs. The introduction of the TTF variable in TAM as an antecedent of perceived ease of use and perceived usefulness is worth emphasizing since it explores the fit between task and technology as a determinant of users' perceptions. This argument concurs with that of Mathieson and Keil (1998) who claimed that the perceived ease of use can be a function of task-technology fit as does the perceived usefulness. Indeed, the level of task-technology fit is quite likely to affect user's perceptions and intention to use a new technology. Pertaining to the TTF constructs and predicted effects of TTF on TAM, the following hypotheses are presented:

H4: There will be a main effect of TTF on users' success of trials, perceptions and use intention of the new technology.

H4a: There will be a main effect of TTF on users' success of trials.

H4b: There will be a main effect of TTF on user's perception of TTF.

H4c: There will be a main effect of TTF on perceived ease of use.

H4d: There will be a main effect of TTF on perceived usefulness.

H4e: There will be a main effect of TTF on use intention.

Social Influence Model (SIM)

The term of social influence is highly comprehensive and complex. Social influence can be defined as "the way in which one or more people alter the attitudes or the behavior of others" (Peterson, 1997). Therefore social influence encompasses every aspect of social exchange between two or more individuals sharing one or more common social boundaries. The social exchange theory (Homans, 1958; Ekeh, 1974; Blau, 1987) indicates that individuals involve in interpersonal and mutual interactions for the sake of reward, but the benefits contained in social exchange do not have an exact price in terms of a single quantitative medium of exchange, and the nature of the return cannot be bargained about. Such interactions among social members trigger collective conscience, because each individual seeks to fit him(her)self into the structuralism, or normative rule that regulates behavior, of the society (Durkheim, 1958; Levi-Strauss, 1969). By the same token, an inexperienced individual who observes a new technology and gets exposed to his (her) peers' opinions about the quality, efficiency, and their willingness to use might as well share similar beliefs and intention toward that novelty.

The Social Influence Model of Technology Use (Fulk et al., 1990; Schmitz and Fulk, 1991) suggests that media choice and use behavior occurs in a very social world, where the users' perceptions are subjective and socially constructed. Thus, although these media are evaluated in some degree by objective features, they are also substantially determined by the attitudes, statements, and behaviors of coworkers.

Social Influence through Word-Of-Mouth Messages

The word-of-mouth (WOM) messages expressed in face-to-face communication have been considered as highly persuasive means for molding and changing individual opinion, especially when the communicator is a peer or someone who share similar interests in similar environments. Indeed, peers often exchange ideas through expressing overt statements or by hinting social cues. Riesman (1952) argued that American society is moving toward an orientation in which both the values and styles of behavior are learned not from the predecessors or ancestors, but from peers such as tutors, friends, colleagues, and family members. Studies of individual technology use have also examined the effect of WOM messages, which turned out to be an important factor influencing the decision making process. Meuter et al. (2003) explored the consumers' usage pattern of self-service technologies and found that those with high levels of technology anxiety were more likely to participate in positive WOM interactions with other consumers who had had an initially satisfying technology experience. In another study that tested the Social Judgment Analysis (SJA) to identify the information judgment preferences held by professional groups (Stefl-Mabry, 2003), the WOM messages were found to be one of the most important factors for user satisfaction of information. Therefore, it is posited that such WOM messages expressed by peers play an important role as socially significant influence regarding the decision making of an individual in shaping first impressions toward a newly introduced technology.

TAM and Social Influence

While in the initial TAM, only two perceptual factors were suggested to affect technology acceptance, several scholars have been suggesting that social influence should equally be reconsidered as a main determinant of the model. As presented previously, a study on TAM2 corroborated that the subjective norm is a crucial social influence variable that needs to be incorporated in the model. "Subjective norms" has been considered to best represent social influence, especially in workplaces, and was validated by a number of elaborated TAM studies (Jasperson et al., 1999; Malhotra and Galletta, 1999; Venkatesh and Morris, 2000; Lee et al., 2001). In a more recent study, Hsu and Lu (2004) reported that social norms, attitude, and flow experience explain about 80% of online game playing. Nevertheless, since the concept of subjective norm implies a situation where the use of a certain technology is more ore less compulsive, that is, in a mandatory context, other researchers attempted to measure social influence in a more voluntary context. Thompson et al. (1991) tested the effect of social factors on personal computing, and confirmed that there exist positive relations between perceived influence and actual utilization.

Since most social influence studies employed a self-reported or indirect data to estimate the level of social influence on the research participants, there is a need to call for a more delicate method of manipulating the construct to evaluate its directionality and magnitude. An interesting experimental research pursued by Galletta et al. (1995) effectively controlled and manipulated social factors in software learning environment by introducing confederates in their experiment site. In this study, the trained "fake" participants joined the "real" subjects and acted as being knowledgeable about the software in question during the experimental sessions. Furthermore, through word-of-mouth communication, they expressed either favorable or unfavorable opinions to the other subjects. Results of the study revealed that social influence through word-on-mouth communication was a significant determinant of attitudes, behavior, and performance.

Although the research design and data collection procedure of this dissertation will be described with more details in the next chapter, it is worth mentioning that the current study will take Galletta et al.'s approach as an exemplary designing method and implement the use of confederates to induce social influence through prearranged WOM messages. It is posited that regardless of the actual TTF of the new medium, positively influenced subjects will show positive perceptions and positive intention to use, while negatively influenced subjects will exhibit less favorable perceptions and use intent. Neutrally influenced subjects are also predicted to show lower degree of perceptions and use intent than the positive group's subjects, but higher scores than the negatively influenced ones. Therefore, in an identical level of TTF situation, each of the three conditions' perceptive and intentional outcomes regarding the new technology is likely to vary according to the direction of social influence. The hypotheses concerning these main effects of social influence are stated as follows:

H5: There will be a main effect of social influence on users' perceptions and use intention of the new technology.

H5a: There will be a main effect of social influence on perceived TTF.

H5b: There will be a main effect of social influence on perceived ease of use.

H5c: There will be a main effect of social influence on perceived usefulness.

H5d: There will be a main effect of social influence on use intention.

Since we hypothesized that TTF and social influence form the key external variables for the TAM theory that are considered to influence the perceived ease of use, perceived usefulness and use intent, it is also highly likely that these two factors interact with each other to emphasize the effects on users' perceptions and intention. In other words, social influence may as well magnify the effect of TTF on the individuals' perceptions and use intention of a new technology. Thus the hypotheses concerning the interaction effects of social influence and TTF can be stated as follows:

H6: There will be an interaction effect between social influence and TTF on users' perceptions and use intent.

H6a: There will be an interaction effect between social influence and task-technology fit on users' perception of TTF.

H6b: There will be an interaction effect between social influence and task-technology fit on perceived ease of use.

H6c: There will be an interaction effect between social influence and task-technology fit on perceived usefulness.

H6d: There will be an interaction effect between social influence and task-technology fit on use intent.

These relationships are summarized in Figure 6 as a variance research model that classifies the variables into three categories: manipulations, cognitive variables, and conative variables. Manipulations include the independent variables that directly affect the cognitive and conative reactions, while the cognitive variables consist of all the perceptive measures regarding TTF, EOU, and usefulness. Conative variables comprise the outcomes concerning the actual success of trials, and individual willingness to further use the system tested.

Process Research Model

The predictions derived from TTF, SIM, and TAM models can also be stated in terms of a process chain, where the relationships among the variables are explained through causal links. Such a process model is an extension of the TAM model, as well as an alternative way to consider the associations among the social influence factor, TTF factor, and other technology acceptance drivers. Our process model places social influence as a moderating variable based on the assumption that it could intensify the effect of TTF on perceptions. Also, because TTF is a dichotomous variable, a surrogate for TTF, namely success of trials, was introduced as an independent variable that represents a key external factor in TAM model. As previously described, TTF theorizes that the level of fit between task and technology affects utilization (Goodhue and Thompson, 1995), which allowed us to formulate the following hypotheses:

H7: The degree of a trial's success in completing a task with a new technology will be positively associated with the users' perception of TTF.

H8: Success of trials will be positively related to perceived ease-of-use.

H9: Success of trials will be positively related to perceived usefulness.

Also, perceived TTF, which is one of the many dimensions of TTF evaluation, is hypothesized to have a positive relation with other perceptive variables of TAM. We employed the term "perceived TTF" instead of "TTF evaluation" because the latter encompasses numerous types of cognitive measures, such as *quality*, *authorization*, *ease of use*, *production timeliness*, *system reliability*, *relationship with users*, and *locatability* (Goodhue, 1998). Since the TAM variables overlap with the dimensions of *ease of use* and *relationship with users*, implementing all of these measures would be redundant and recursive to the proposed model. Thus the locatability dimension was chosen to represent the concept of perceived TTF. The hypotheses regarding perceived TTF are stated as follows:

H10: Users' perception of TTF will be positively associated with perceived ease-of-use.

H11: Users' perception of TTF will be positively associated with perceived usefulness.

As was the case with the variance model, the effects of perceived ease of use and perceived usefulness on use intent will also be tested in this process model. Pertaining to the TAM literature (Davis, 1989), the following statements are the same hypotheses as presented previously.

H1: Perceived ease of use will be positively related to perceived usefulness.

H2: Perceived ease of use will have a positive effect on use intention.

H3: Perceived usefulness will have a positive effect on use intention.

Since social influence is expected to interact with TTF in this variance model, instead of viewing it as another independent variable, we believe that it contains a trait for moderating the effect of TTF on the perceptive outcomes. Therefore, it is hypothesized that social influence will affect the relationship between success of trials and the three perception-related variables.

H12: The effect of the trials' success on perceived TTF will be moderated by social influence, such that the relationship will be stronger for positively influenced users, moderate for neutrally influenced users, and weaker for negatively influenced users.

H13: The effect of the trials' success on perceived ease-of-use will be moderated by social influence, such that the relationship will be stronger for positively influenced users, moderate for neutrally influenced users, and weaker for negatively influenced users.

H14: The effect of the trials' success on perceived usefulness will be moderated by social influence, such that the relationship will be stronger for positively influenced users, moderate for neutrally influenced users, and weaker for negatively influenced users.

Chapter Summary

The Technology Acceptance Model (TAM) has been receiving great attention since its first appearance. Numerous studies contributed to the model's extension and modification, including those that employed social factors. Since the Social Influence Model (SIM) literature had already been discussing new media use behaviors, while the Task-Technology Fit (TTF) model attempted to account for the factors enhancing utilization and performance of new technology users, the current study combines these three models in assessing the antecedents that trigger new technology acceptance in a mobile commerce context. Figure 6 illustrates a variance research model, while Figure 7 depicts a process research model showing the relationships between the key variables in process chains. All arrows denote the hypotheses to be tested in the current research. The following chapter discusses the empirical portion of this dissertation by precisely describing the methodological procedures and explaining the measures taken for data analyses and model testing.

Figure 6: Proposed Variance Model of the Study

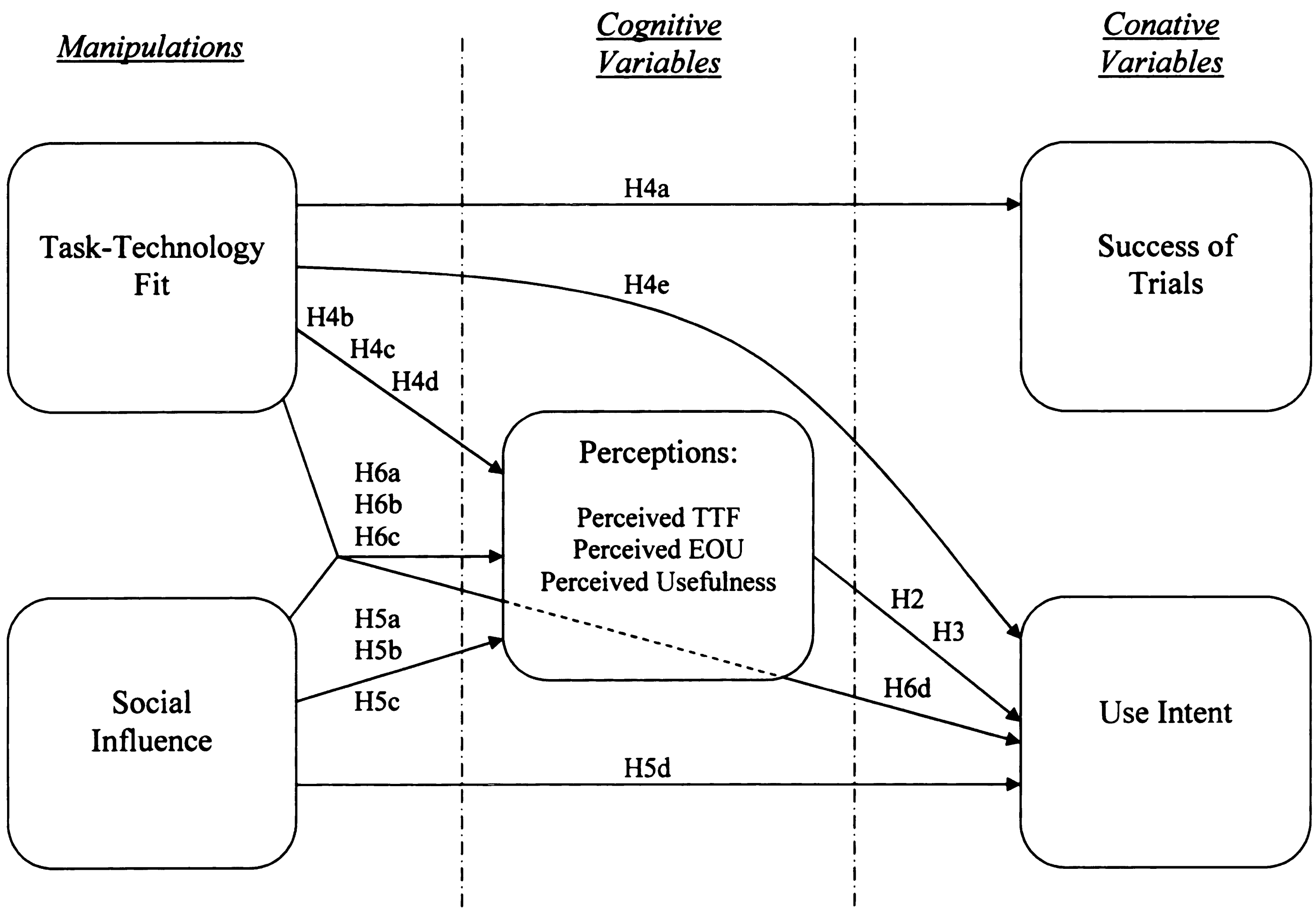
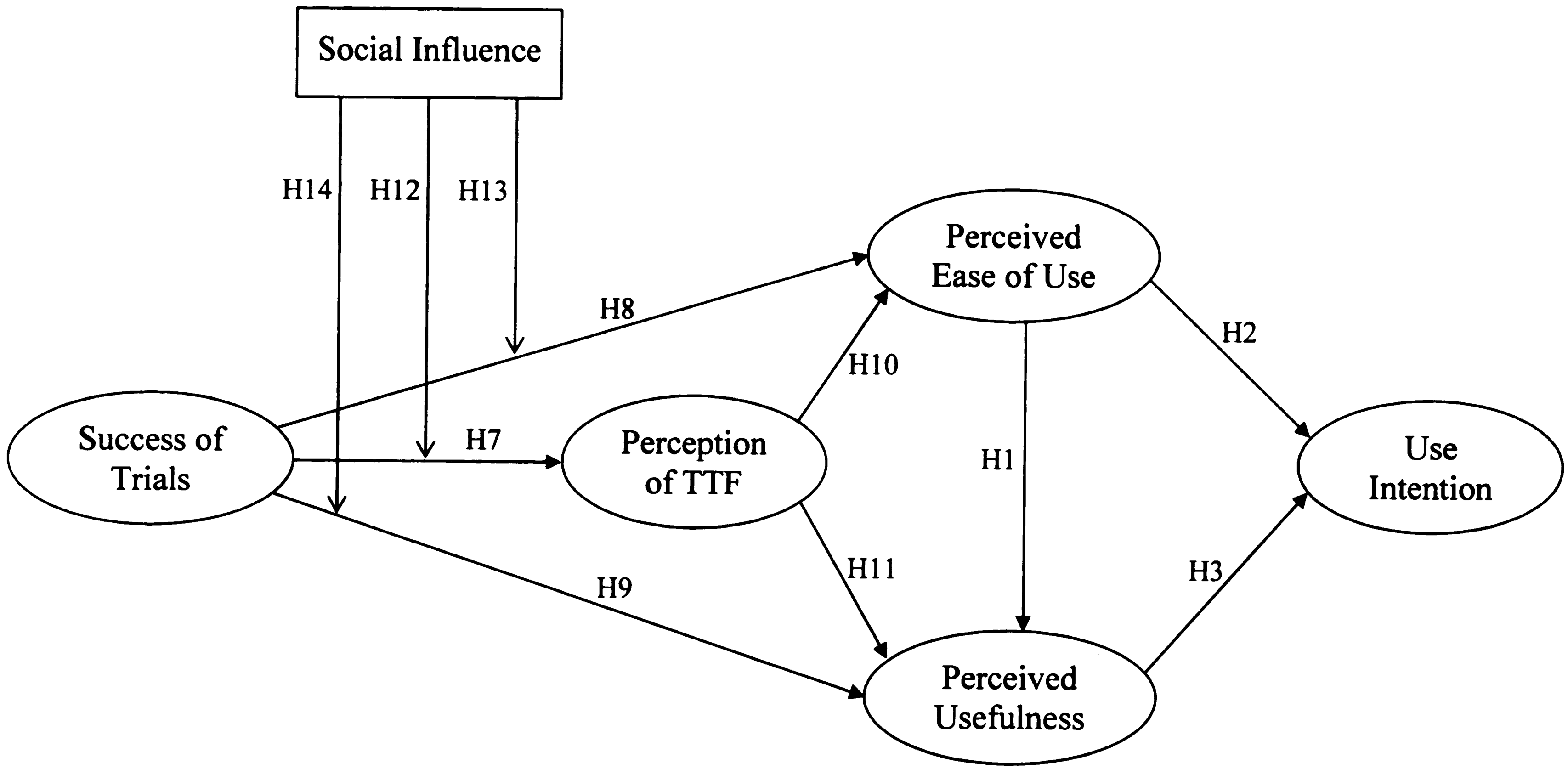


Figure 7: Proposed Process Model of the Study



CHAPTER 3

METHODS AND PROCEDURES

This chapter describes the research methods and procedures used in data collection process for the current study. As indicated in previous chapters, since the objective of the research is to test the causal relationships among variables from the TAM, TTF, and SIM model, data were collected in an experimental setting to control for unwanted intervening factors and observe the relations among the independent, mediating, moderating, and dependent variables.

Research Design

There exist two treatments in this research: (1) three different social influences through word-of-mouth messages (positive, negative, and neutral – control), and (2) two contrasting fits of technology with tasks (good fit and poor fit). A three-by-two (3x2) between-subjects factorial design was employed to test the hypotheses, with task-technology fit as the independent variable, and social influence as the moderating variable. A total number of 210 subjects participated in the study from which 37 participants were assigned in positive/good condition, 37 in positive/poor condition, 32 in neutral/good condition, 32 in neutral/poor condition, 36 in negative/good condition, and 36 in negative/poor condition. Figure 8 illustrates the conditions and the number of participants for each treatment group.

Figure 8: 3x2 Between-Subjects Factorial Design

Task-Technology Fit		Social Influence: Positive	Control	Negative
	Good Fit	37	32	36
	Poor Fit	37	32	36

The fact that there was a limited number of PDAs and that each participant needed to be individually trained and socially influenced, without the presence of other participants, made the data collection procedure require no more than one participating subject at a time during the experiment. Therefore every subject was individually and independently assigned to a treatment, tested, and asked to complete the questionnaires at the location of experiment.

Stimuli

As previously mentioned, we tested the effects of two treatments, task-technology fit and social influence, on users' success of trail, perceptions, and use intent in an experimental setting. The following paragraphs thoroughly explain how the stimuli were controlled to differentiate one treatment from another.

Task-Technology Fit Stimuli

In order to test the effect of task-technology fit on perception and technology acceptance, we built two similar Web sites that pretended selling MP3 format music files as products. Music titles were chosen from the researcher's personal collection of compact discs (CDs), and converted into MP3 file format to make it transferable through electronic networks. These Web sites were temporarily created to represent seemingly commercial MP3 online vendors that enable music search and direct download from the site. However, the two Web vendors employed different interface for searching and finding music files, and participants were asked to perform specific tasks, i.e. find and download specific songs, that either fitted well or poorly with the interface. No MP3 files were actually offered to the participants, and all files were discarded from the system when the entire experiment was over. The optical resolution of the Web pages were narrow enough (320 horizontal pixels) to be represented on PDA screens. Also, both sites contained the same list of music files downloadable on the handheld devices.

The first Web site, which was named *MP3Topia.Com*, featured an interactive system, where a user was first asked to type a part or the entire name of the artist, leading to a matching list of names. Then, when a name was clicked, the screen displayed another search window asking the user to type the title of the song. The user was able to choose and click any title from the list whenever (s)he sees the one (s)he was seeking. The next Web page displayed all information of the song, with a button that let the user confirm the download as a final step. During the download process, a status bar would appear and indicate how much the MP3 file was being downloaded on the device. Finally, the last page would display a message verifying that the file was successfully transmitted on the device.

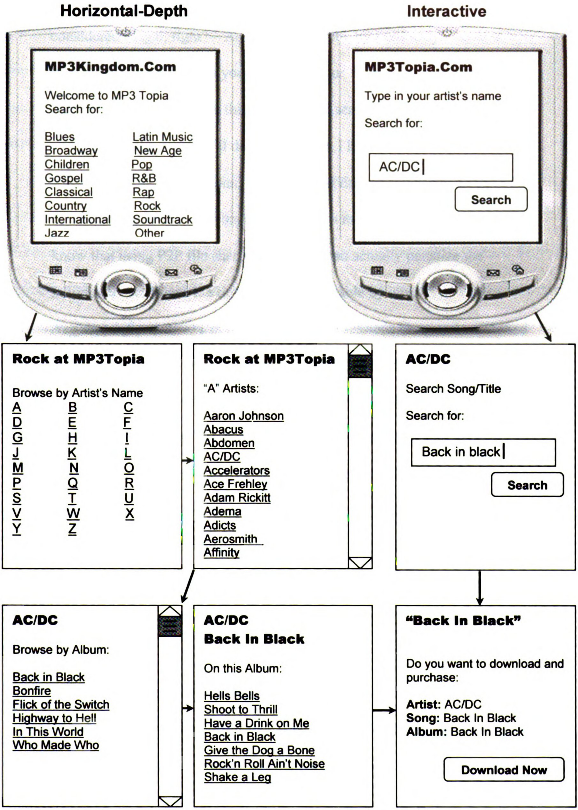
The second Web site, called *MP3Kingdom.Com*, featured horizontal-depth Web navigation, that is, a menu-by-menu navigation technique. For instance, if a user was searching for the song "Yesterday" by "The Beatles" from the album "Help!", (s)he would first require to click on the "Rock" genre, choose "Beatles" in the list of artists, choose “Help!” in the list of albums, and then choose “Yesterday” in the list of songs. The confirming, downloading, and verifying pages were analogous to those of *MP3Topia.com*. Both Web sites were created on an Internet server, and the contents were wirelessly uploaded to the PDA through 802.11b wireless LAN (Wi-Fi) connection. Figure 9 illustrates the navigation processes for *MP3Kingdom* and *MP3Topia*. Actual picture samples of the two systems are in Appendix 6

Task-technology fit was controlled by providing subjects either with tasks that matched the navigational characteristic of the Web site or with tasks that did not exactly correspond to the navigational characteristic of the Web site. More specifically, subjects in the good fit group were required to find and download any five MP3 songs of a particular album from a specific artist from the horizontal-depth navigation Web site, *MP3Kingdom.com*. Later, they were once again asked to find and download a specific song from a specific artist using the interactive navigation Web site, *MP3Topia.com*. On the other hand, subjects in the poor fit group were asked to seek and download any five songs from a specific artist’s album by using the interactive navigation, *MP3Topia*, and later find a specific song using the horizontal-depth Web site, *MP3Kingdom*. Since the interactive Web navigation (*MP3Topia*) does not provide any information of the album until a song is chosen, the user would be compelled to tap any song in the list and verify if the song is from the album required to find. If not, she would go back to the song search page, and choose other songs repeatedly until five songs are found. By the same token, to search a specific song in the horizontal-depth Web navigation (*MP3Kingdom*), the user would need to look into all albums of an artist to finally find and download the required song. Such arbitrary manipulations of Web site interface and task assignment has allowed us to effectively manipulate task-technology fit in mobile Internet use.

Social Influence Stimuli

Social influence was controlled through word-of-mouth messages expressed by the experiment trainer, who, at the same time, was a confederate for the experiment. Prior to perform the actual tasks, all subjects were required to go through a training session in a separate location where a trainer instructed them on using the PDA, connecting wirelessly to the online system, and searching and finding the songs from the Web sites. During the instruction, the trainer casually but clearly conveyed his opinion about using wireless Internet on mobile devices and downloading MP3 files. The subjects were ignorant that his expressions had been planned and scripted prior hand, and were arbitrarily exposed to either positive or negative messages. Those who were randomly assigned to the positive social influence group were exposed to positive expressions, while those who were randomly assigned to negative social influence group heard negative expressions coming from the trainer. For the consistency of social influence, the same trainer continually instructed all subjects and expressed unvarying positive word-of-mouth messages to every positively influenced group subjects or the same negative messages to each negatively influenced group subjects. As scripted, the trainer spoke the following messages to the positively and negatively influenced participants. The entire script for the trainer on instructing and influencing the subjects can be found in Appendix 2.

Figure 9: An Example of Horizontal-Depth Navigation and Interactive Web Navigation



Positive Influence: "Isn't this cool? Of course, you might be able to download songs for free by using Kazaa or Morpheus, but that is now considered illegal, right? And you don't actually need to synchronize with your computer to put your music on your PDA. I wonder if they are planning to commercialize this type of MP3 service, because if they do, and if I have the device, I'll definitely use it. I heard there exist similar services abroad, like in Japan, Australia, and Europe. They can actually download songs on cell phones and use them as MP3 players! You may know that using P2P file sharing programs can actually penalize the individual users since it's now legally punishable by law."

Negative Influence: "I'm doing the training sessions because I was asked to, but personally, I don't think this will work commercially. You can buy MP3 players for a fraction of the price of a PDA, and you can download songs for free through any P2P file sharing program, such as Kazaa or Morpheus. I heard that there exist such services in overseas, like in Japan and Europe, but it seems that they are not quite popular. Downloading is fast here because we're using a wireless LAN, but if we were using a cellular technology, the process will take so much more time. I guess this will end up being useless."

Our assumption on the effects of such word-of-mouth messages is that those who were exposed to negative expressions would be sufficiently socially influenced in a negative manner, while those exposed to positive expressions would be amply positively affected. As for the control group subjects, instead of going through a trainer for the training session, they were directly led to the experiment administrator to receive basic instructions without any affective statements, and immediately begin the trials at the same location.

Sampling

Samples were drawn from a population of college undergraduate students enrolled in telecommunication, communication, or advertising classes at a major Midwestern university. Subjects were gathered through announcements in the classrooms during a period of two academic semesters in the year 2004. To recruit the students, we contacted the instructors to obtain permission to come to their class and ask for participation. When permission was granted, we advertised, without telling the real purpose, the subject matter of the experiment, the location for the trials, and informed that a Web page had been posted, on which those who would be interested can sign up their names and e-mail addresses, and choose a time slot desired. The instructors have agreed on offering extra credits for the course to the participating students in order to encourage participation. As a result, a total of 210 students were recruited and randomly assigned to one of the six treatment group conditions.

Procedure

Upon entering the experimental site, each participant first completed a consent form of voluntary participation and then received basic instructions on using a PDA for Web search. While performing the training session, the trainer casually expressed negative or positive opinion on using such a new technology for searching, purchasing and downloading MP3 files on the mobile devices. To prevent any potential suspicion that might arise among the subjects, the training area was located in a separate room situated at a certain distance from the experimental site. The trainer was a Caucasian male graduate student who could speak to the participants with a seemingly expert impression. After the training session, the subject went to the experiment site, and following a strict protocol, he or she was asked to find and download MP3 files from the Web sites on the PDA. There were a total of two tasks to complete, each of which consisting of two subtasks; two using a horizontal-depth navigation Web site (*MP3Kingdom*), and two on the interactive Web site (*MP3Topia*). Each task was separately described on a paper sheet so that the participants could not know in advance the subsequent tasks (see appendix 3). Every participant was allowed to freely listen to the music or browse on the Web page when a task was over. The search time, number of retraced Web pages, and number of correct downloads were automatically and objectively monitored and collected on a database computer file. After each set of tasks, a short questionnaire designed to record the subjects' evaluation, perceptions, and purchase intention was provided to measure their perceptive responses regarding searching and purchasing MP3 files on mobile devices. Thus, a total of two questionnaires were handed out to the participants. After ending the experimental session, the subjects were debriefed and dismissed. Each trial, from training to completing the questionnaires, lasted between 20 to 30 minutes, depending on the condition to which the student was assigned, and the personal ability of using an browsing the Web on a PDA.

Measurement

Measurement is the first building block of science, and this fact applies to both physical and social sciences. However, in social science, not all measures can be observed systematically. Cognitive reactions, such as affection (attitude), belief, or impression (perception) need to be measured subjectively and in some degrees equivocally from the individual's point of view. Yet, this characteristic of measurement is by no means unique to social science, and thus it must be recognized that all measurements are arbitrary at base (Babbie, 1998). Therefore, in social science, where most phenomena are assessed with hypothetical constructs not directly observable, such variables must be measured through inference (Emmert, 1989).

Most hypotheses of this study, except for those concerning success of trials, deal with perceptive measures of evaluation, perception, and intention. An individual's perception is a function of his past history, his state of the moment he is viewing the stimulus and the value of the object to the individual (Schiff, 1970). Attitudes conceptually differ from other such states of readiness in that they predispose people to respond in a preferential manner (Emmert, 1989), they are implicit processes having reciprocally antagonistic properties and varying in intensity (Osgood et al., 1970), and they tend to be kept more internally consistent without occurring at the spur of the moment (Schiff, 1970). Because our study involves introducing and varying stimuli by applying experimental treatments to the subjects, the concept of perception would correspond better than attitude to the cognitive reactions measured in regard to the device that has been tested.

Although there exist numerous scale construction methods, for the sake of measuring these perceptive variables, seven-point Likert scale questionnaire items were created. The Likert method is based on the assumption that the overall score based on responses to the many items that seem to reflect the variable under consideration provides a reasonably good measure of the variable (Babbie, 1998). While other scaling methods, such as Bogardus Social Distance, Thurstone, or Guttman prove to be equally, if not more, effective measures of perceptive responses, the process of item creation may present a tremendous cost in terms of time and effort to the researchers. Also, the Semantic Differential Scaling was exempted from scale creation. This method is considered to better approach attitude measurement since it represents a general procedure for assessing affective responses (Heise, 1970).

Multiple Item Measures

The process of operationalization of the constructs yielded to a multiple-item measure of the variables to be tested. Although single-item measures should not be judged as being less effective than multiple-item scales in providing reliable measure of relatively complex constructs (Loo, 2002), in social science, a consensus is established that the latter provides elaborate reflection of the rather abstract perceptive constructs. In fact, when studying the TTF effect on utilization, Goodhue and Thompson (1995) questioned 662 subjects about using information systems and obtained high reliability estimates for each factor in the TTF dimension. For instance, they found Cronbach's alpha values of .84 for quality, .75 for locatability, .74 for ease of use/training, and .88 for relationship with users. Each factor had at least two items indicating the construct to be measured. Also, in a TAM study, Davis et al. (1989) showed that a two-item behavioral intention scale obtained a Cronbach alpha reliability of .84 and .90 at time 1 and time 2 in their study, while a four-item usefulness scale achieved a reliability of .95 and .92, and a four-item ease of use scale obtained reliability coefficients of .91 and .92, respectively.

We also adopted the multiple-item measure for the sake of the structural equation model (SEM) testing. In SEM, all concepts correspond to latent variables, and the observed variables indicate their latent variables. Latent variables are unobserved variables implied by the covariances among two or more indicators (Hoyle, 1995). Although observed, or manifest, variables of a latent variable may contain random or systematic measurement errors, it is granted that such multiple-item scales are most suitable for indirect measurement of abstract latent variables, such as intelligence, social class or expectations (Bollen, 1989).

Data Collection Instruments

The questionnaire items were carefully chosen from the TAM, SIM and TTF literature. Some wordings of these items have been slightly modified for the purpose of m-commerce study. A total of eighty-six (86) items were formulated to measure the perceived ease of usability, perceived usefulness, perceived social influence, enjoyment, purchase intention, trainer's communication styles, demographic data, prior experience, and self-efficacy (see Appendix 1). Questions concerning the trainer's communication styles were excerpted from the discipline of interpersonal communication. Especially, the dominant Communication Styles Measures (Rubin et al., 1994) were taken into consideration to statistically control, if necessary, for the variance among leaders' subjective characteristics. In addition to the self-reported questionnaire, success of trials was measured by the search time, number of retraced Web pages it took to find the targeted files, and the number of correct files found and downloaded. The following paragraphs specifically address the items put on the questionnaires and the trial data for the measurement of the dependent variables. The actual statements of the questionnaire and their corresponding construct are illustrated later in Table 1.

Perceived Task-Technology Fit

Task-technology fit is defined as "the degree to which a technology assists in individual in performing his or her portfolio of tasks… [it] is the correspondence between task requirements, individual abilities, and the functionality of the technology" (Goodhue and Thompson, 1995). As previously described, Task-technology fit was arbitrarily manipulated by dividing the treatments into two experimental groups to which subjects were randomly assigned prior to participation. However, since we did not maneuver the actual task completion sequence for each participant, the extent to which a person feels how well the technology supports the task would be different in many cases. Therefore it is obvious that a measure that reflects their evaluation of the fit between the task and the technology is required. Such appliance of user evaluations as surrogates for task-technology fit has been commonly supported in the TTF literature (Goodhue, 1995). According to Goodhue (1998), various perceptive constructs are cited to reflect the concept of TTF. Among the listed ones, accuracy, compatibility, rightness of data, rightness of level of detail, locatability, accessibility, flexibility, meaning, assistance, ease of use, system reliability, currency, training, authorization, presentation, and confusion were deemed as indicators of task-technology fit. Seemingly, the level of technology fit can be measured in multiple aspects through a collection of diverse sub-constructs. In this study, this concept is measured in terms of rightness of features, support, and general fit between the functions and the specific tasks. Each item was measured on a seven-point scale, in which a score of one (1) would indicate a strong disagreement, a four (4) signifying a neutral state, and a seven (7) suggesting a strong agreement to the corresponding statement. While it is arguable that some other constructs reflecting TTF could also be considered, these were excluded from the list of questionnaire items because the current study specifically examines file searching functions of a mobile device's Web interface. Moreover, since the constructs of ease of use and usefulness of the system are the key determinants of the Task Acceptance Model, items for these constructs would be more appropriate to be treated as indicators of perceptive measures rather than the perception of TTF.

Perceived Ease of Use

One of the main variables in the TAM model is the perceived ease of use (PEOU) of the system. The perceived ease of use can be defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989). Following numerous previous studies in TAM literature (Davis et al., 1989; Malhotra and Galletta, 1999; Venkatesh et al., 2002; Klopping and McKinney, 2004; Saade and Bahli, 2005), for our research the perceived ease of use was measured with items indicating the subjects' sense of time consumption in accomplishing the task, learning of the device, and overall easiness. As with the case of perceived TTF construct, each of the above items was measured on a seven-point scale, with one (1) implying a strong disagreement, a four (4) suggesting a neutral state, and a seven (7) indicating a strong agreement to the corresponding statement.

Perceived Usefulness

Another key variable in the TAM literature is perceived usefulness (PU) of the technology. Perceived usefulness is, by definition, "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989). In our study, this construct was assessed with questionnaire items suggesting the usefulness in searching and locating files, appropriateness of use, and general usefulness of the interface. Again, every statement was set on a seven-point scale measure: a strong disagreement for a score of one (1), a neutral state for a score of four (4), and a strong agreement for a score of seven (7).

Use Intent

According to TAM, intention to use, or use intent (UI), of a new technology is determined by PEOU and PU, and also leads to the actual behavior (usage). Therefore, this variable has been vastly treated as a mediating variable rather than a dependent one. However, one stream of technology acceptance research focuses on individual acceptance of technology by using intention as a dependent variable (Compeau and Higgins, 1995). Though the role of intention as a predictor of usage is crucial and has been well-founded (Sheppard et al., 1988; Ajzen, 1991; Taylor and Todd, 1995), our research implements an introduction of a new system and service that are yet hardly practiced in today's information technology market. The fact that there is limitation of collectable data in our study, and that the path between intention and usage had been confirmed by numerous extant studies (Venkatesh et al., 2003) yielded us to drop the measurement of actual usage, resulting in confining the research model to use intent as a dependent variable. The following statements represent five questionnaire items that were included in the surveys. By the same token as the perceptive measures, each item was assessed on a seven-point scale, in which a score of one (1) would indicate a very low intention, whereas a seven (7) a very high likeliness to use the service.

Success of Trials

Success of trials is an initial performance measure, which reflects how easily and well a user utilizes the technology (Goodhue and Thompson, 1995). However, performance is associated with a user's overall ability to accomplish certain given tasks, and encompass an idea of continuity beyond the effectiveness of an initial usage. Since our study introduces new systems and services not frequently used by the participants, it is believed that success of initial trial of the new technology would better describe our variable than the word "performance."

Success is an objective measure assessed with various tools of measurement evaluating task accomplishment. Since one can apply various criteria to analyze the degree and quality of success in task-completion, a multiple-item approach, rather than single-item, would be appropriate. Unlike the self-reported perceptive constructs, which were interpreted with survey question items, measures of successful use were collected by employing an automated computer data collection program that monitored the sequence of activities and stored it on a Web-based database file. When a subject began searching and navigating the Web site, the database file started recording the time it took, the number of Web pages the person went through, and the number of correct files found until all the downloads were confirmed. The subject was not aware of the monitoring process, nor was she told how well she did on the tasks. Thus three indicators, namely, time, number of pages, and number of correct files, were measured to determine success of trials.

Reliability Test

Prior to analyzing the collected data to examine the results, a reliability test was run to verify the authenticity of the measures to their respective constructs. Reliability, which is often estimated by Cronbach's alpha values, indicates the extent to which measurements are repeatable (Nunnally and Durham, 1975), or have a relatively high component of true score and relatively low component of random error (Carmines and Zeller, 1979). Since the number of items for the key constructs of the study range from three to eight, problems concerning their internal consistency might be critical if some dimensions fail to correctly indicate the corresponding variable.

Results show that at Trial 1, which is immediately after the completion of the first set of tasks, the reliability test of all five items measuring Perceived TTF yielded a Cronbach's alpha value of .949. Also, the reliability estimate of the eight items for Perceived EOU at Trial 1 proved to be .930, while the value of five measures for Perceived Usefulness was .948. As for the intention to use, also indicated by five items, we found a value of .948, and for the dimension of success of trials, which had three measures, the Cronbach's alpha showed .680. Quite similar findings were obtained for the measures at Trial 2, i.e. after the second set of tasks. At Trial 2, Perceived TTF measures indicated an alpha value of .973, Perceived EOU showed a value of .964, Perceived Usefulness revealed .937, intention to use exhibited .949, and success of trials generated a Cronbach's alpha of .755.

Exploratory Factor Analysis (EFA)

Although the above reliability indices confirm that the measures for each variable are internally consistent, a contention suggesting that some indicators would denote equally high coefficient values toward other unintended constructs may arise. To verify whether there exist cross loadings among the perceptive items, we executed an exploratory factor analysis (EFA) for the indicators of the cognitive variables, i.e. Perceived TTF, Perceived EOU, and Perceived Usefulness. Varimax rotation (Kaiser, 1958) of the three factors yielded EFA results suggesting that, indeed, some items proposed for perception measures were highly related to items planned for evaluative measures, and vice-versa (see Table 2 & 3). By eliminating the potentially problematic measures, cleaner groupings emerged as items originally projected to reflect their relevant variables were less associated to others (Table 4 & 5). Statistical analysis software, SPSS version 11.0, was implemented to compute the estimates.

Table 1: Questionnaire Items

Construct & Item		Questionnaire Statement
TTF Evaluation	Features	The interface has the exact features for me to carry out the tasks
	Task Fit	The interface fits well with the tasks I was required to perform
	Support	The interface fully supports the purpose of the tasks
	Lack Features	It was difficult to complete the tasks because some features were not available
	General Fit	In general, the interface had functionalities that corresponded to the tasks
Perceived Ease-Of-Use	Task Difficult	The tasks I performed were difficult
	Interaction Clear	My interaction with the interface was clear and understandable
	Skillful	I quickly became skillful at using this interface
	Learning Easy	Learning how to fully use the interface was easy for me
	Interface Find	It was easy to get the interface search and find what I was looking for
	Too Much Time	It took too much time to find the file I was seeking through the interface
	Complicated	The interface was so complicated, it was difficult to understand what to do
	General EOU	In general, the interface was easy to use
Perceived Usefulness	Useful Search	The interface would be useful for any type of file search
	Improve Ability	This Web site would improve my ability to locate other music files
	Useless	I think the interface is useless for locating music files
	Appropriate Use	This was an appropriate use of a Web site interface on the PDA
	Generally Useful	Generally, I find the interface useful
Use Intention	Public Place	If you were in an airport with a mobile device, what would be the probability that you consider buying songs through such services?
	Home	If you were at home with the device, what would be the probability that you consider buying songs through such services?
	Outdoors	If you were relaxing on the beach with the device, what would be the probability that you consider buying songs through such services?
	Present	If you had to decide whether or not to buy the songs using this technology at this moment, how likely is it for you to make the purchase?
	Future	In the future, if you had access to similar services on mobile devices, how likely is it for you to buy music?

Table 2: Rotated Component Matrix of Perceptive Items at Trial 1

	Loadings		
Item	Factor 1	Factor 2	Factor 3
Features (TTF1)		.595	
Task fit (TTF2)		.603	
Support (TTF3)	.576	.549	
Lack features (TTF4)		.506	.527
General fit (TTF5)	.618		
Task difficult (PEU1)	.581		
Interaction clear (PEU2)	.861		
Skillful (PEU3)	.892		
Learning easy (PEU4)	.901		
Interface find (PEU5)	.599	.558	
Too much time (PEU6)			.879
Complicated (PEU7)	.784		
General EOU (PEU8)	.771		
Useful file search (PU1)		.780	
Improve ability (PU2)		.705	
Useless (PU3)		.809	
Appropriate use (PU4)	.514	.706	
General useful (PU5)	.648	.609	

(Rotation Method: Varimax with Kaiser Normalization)
(Values under .50 omitted)

Table 3: Rotated Component Matrix of Perceptive Items at Trial 2

	Loadings		
Item	Factor 1	Factor 2	Factor 3
Features (TTF1)		.646	
Task fit (TTF2)	.607	.661	
Support (TTF3)		.695	
Lack features (TTF4)	.628	.622	
General fit (TTF5)	.647	.641	
Task difficult (PEU1)			.825
Interaction clear (PEU2)	.799		
Skillful (PEU3)	.836		
Learning easy (PEU4)	.841		
Interface find (PEU5)	.621		
Too much time (PEU6)		.681	
Complicated (PEU7)	.640		
General EOU (PEU8)	.767		
Useful file search (PU1)		.808	
Improve ability (PU2)		.773	
Useless (PU3)		.627	
Appropriate use (PU4)		.722	
General useful (PU5)	.672	.611	

(Rotation Method: Varimax with Kaiser Normalization)
(Values under .60 omitted)

Table 4: Rotated Component Matrix at Trial 1 (after elimination of problematic items)

Item	Loadings Factor 1	 Factor 2	 Factor 3
Features (TTF1)		.775	
Task Fit (TTF2)		.782	
Support (TTF3)		.750	
Interaction Clear (PEU2)	.839		
Skillful (PEU3)	.867		
Learning Easy (PEU4)	.889		
Useful File Search (PU1)			.771
Improve Ability (PU2)			.838
Appropriate Use (PU4)			.682

Rotation Method: Varimax with Kaiser Normalization)
(Values under .60 omitted)

Table 5: Rotated Component Matrix at Trial 2 (after elimination of problematic items)

Item	Loadings Factor 1	 Factor 2	 Factor 3
Features (TTF1)			.728
Task Fit (TTF2)			.683
Support (TTF3)			.633
Interaction Clear (PEU2)	.782		
Skillful (PEU3)	.853		
Learning Easy (PEU4)	.848		
Useful File Search (PU1)		.711	
Improve Ability (PU2)		.757	
Appropriate Use (PU4)		.806	

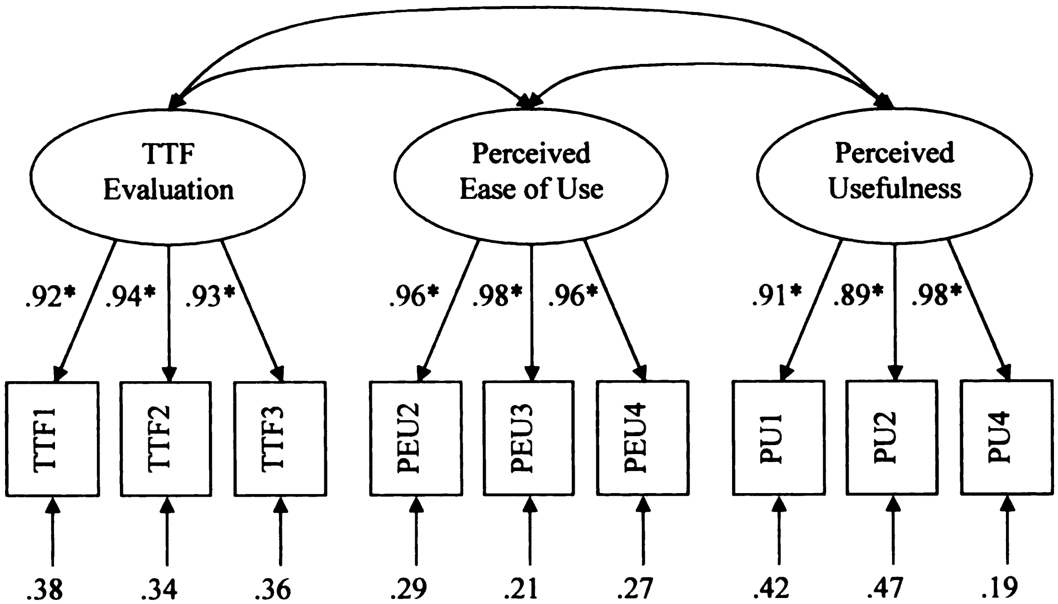
(Rotation Method: Varimax with Kaiser Normalization)
(Values under .60 omitted)

Confirmatory Factor Analysis (CFA)

Since measures of all three cognitive variables, that is Perceived TTF, Perceived EOU, and Perceived Usefulness, were theoretically and empirically supported to show construct validity (Davis, 1989; Goodhue, 1998; Venkatesh and Davis, 2000; Klopping and McKinney, 2004), a confirmatory factor analysis (CFA) was performed to corroborate the literature findings concerning these constructs. Structural equation modeling (SEM) was run on EQS version 6.1 to perform the computation for the CFA of the model of perceptive measurements. The CFA tests the construct validity of the factor loadings to the latent variables. Figure 10 and 11 illustrate the CFA models with all factor loadings indicating unidimensionality

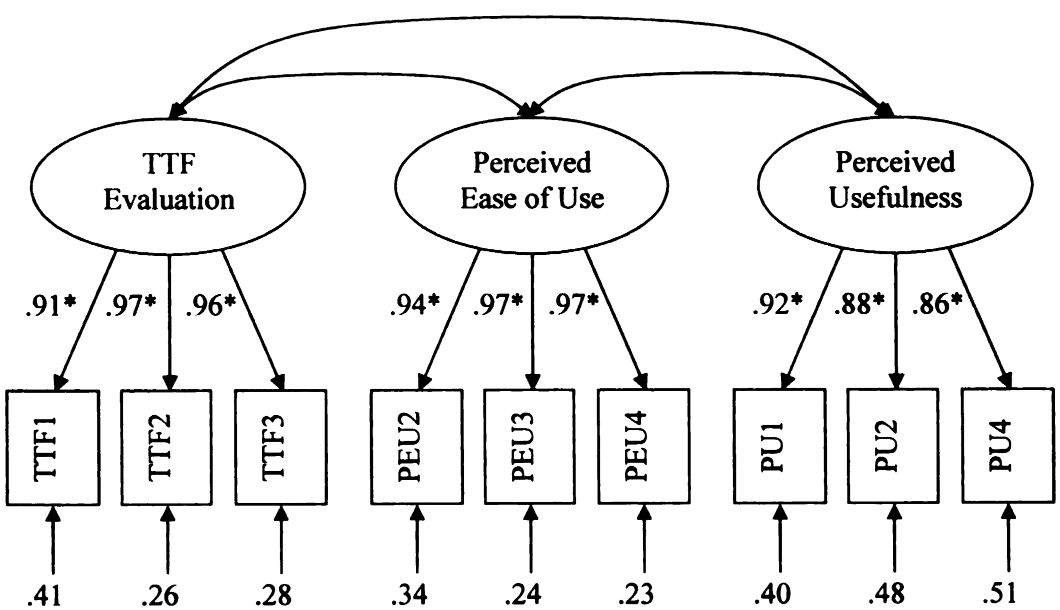
Results show that both CFA models proved to be well-fitting. As for the Trial 1 CFA model (Figure 10)goodness of fit measures indicated that Bentler and Bonett's (1980) Normed Fit Index (NFI) was .973, Bentler and Bonett's Nonnormed Fit Index (BFI) showed .972, and the Comparative Fit Index (CFI) (Bentler, 1988) was .981, while the Goodness-of-Fit Index (GFI) measured .922, and the Adjusted Goodness-of-Fit Index (AGFI) (Joreskog and Sorbom, 1984) estimated a value of .854. Since 0.90 is generally considered to be the threshold value for these fit indices, such highly significant values clearly indicate that the analysis proved support for the model. Also, although the Chi-square (χ^2) value was 75.829 based on 24 degrees of freedom (df), lending a probability value of less than 0.001 (meaning that the model is significantly different from the predicted population), the Root Mean Square of Approximation (RMSEA) index (Steiger, 1989; Browne and Mels, 1990) at .102 supported a reasonably good fit as well.

Figure 10: CFA Model for Perceptive Measures at Trial 1



(* based on test statistics, all factor loadings significant at p<.001)

Figure 11: CFA Model for Perceptive Measures at Trial 2



(* based on test statistics, all factor loadings significant at p<.001)

The Trial 2 CFA model (Figure 11) equally confirmed the construct validity of the variables by generating an NFI value of .979, a BFI of 982, a CFI of .988, a GFI of .943, an AGFI of .892, and an RMSEA of .081. The Chi-square estimate marked 56.878 on 24 degrees of freedom. The reason for the drop in index value of the AGFI can be explained by the nature of this measure. Because the AGFI adjusts for the degrees of freedom of a model relative to the number of variables, it rewards simpler models with fewer parameters (Bollen, 1989). Shown below, Table 6 arranges all fit indices for both CFA models.

Table 6: Fit Indices for CFA Models of Cognitive Measures at Trial 1 and Trial 2

	Indices	
Fit Measure	Trial 1 CFA	Trial 2 CFA
NFI	.973	.979
BFI	.972	.982
CFI	.981	.988
GFI	.922	.943
AGFI	.854	.892
RMSEA	.102	.081
χ^2 (df)	75.829 (24)	56.878 (24)

Measures selected, we repeated the reliability tests of the variables without the items dropped. Measures of success of trials underwent revision as well, and an item showing weaker overall correlation within the construct was eliminated. Specifically, the number of correct files found during the task completion was removed. Since the requirement of the tasks involving finding and downloading particular music files was not tortuous, most participants somehow managed to successfully complete the tasks regardless of the number of pages or time it took to locate them. Only 27 out of 105 subjects in the poor-fit groups had one or more incorrect downloads at Trial 1, and merely 5 out of 105 chose wrong files at Trial 2 (in the good-fit groups, all subjects but one person downloaded incorrect titles). Also, among the 27 underachieved subjects, just 5 showed error rates of 50% or more. At Trial 1, the Pearson's *r* correlation between number of correct files and search time was .073 ($r^2 = .0054$) and for the number of pages, the *r* value was .011 ($r^2 = .0001$). Therefore, it is assumed that, in our study, the number of correct music files fails to adequately indicate the degree of a trial's success.

After the reliability tests were rerun, the initial values were compared with the fixed values. Cronbach's alphas showed minimal changes for all cognitive and readiness dimensions, namely TTF evaluation, perceived ease of use and usefulness, and use intention, while in the case of success of trials, the alpha value increased by almost 0.3 to show .955 at Trial 1. The initial and the reassessed reliability estimates are presented on the following Table 7.

Table 7: A Comparison of Cronbach's Alphas between the Initial and Selected Items

	Reliability Estimates			
Construct	Trial 1 Without Dropping Items	Trial 2 Without Dropping items	Trial 1 After Dropping items	Trial 2 After Dropping items
TTF Evaluation	.949	.973	.953	.961
Perceived EOU	.930	.964	.977	.973
Perceived U	.948	.937	.948	.912
Use Intent (no item dropped)	.948	.949	.948	.949
Success of Trials	.680	.755	.955	.746

Other Measures

Other measures include: demographic data, prior experience, enjoyment, trainer's communication style, self-efficacy, and familiarity with the task object. Although these variables were not reflected on the research questions and hypotheses as being critical antecedents of technology acceptance, they are taken into consideration to control for potential intervening factors.

Demographic Data

Since our research involved experimental studies with mostly undergraduates, the data collected were restricted within the college level students. Although no significant results were assumed from the demographics of the participants, items were included in the questionnaires to collect the subjects' information on their gender, age, major, and year in college.

Prior Experience

Measures of prior experience with electronic media were also gathered. Specifically, subjects were asked to indicate the amount of time they have been spending daily on the Internet, and whether or not they had ever used any peer-to-peer (P2P) file sharing programs, cell phones, personal data assistants (PDAs), and/or MP3 players. Those who gave positive responses regarding their media usage experience were also asked to provide the length of time they had used them in terms of months and years.

Enjoyment

Enjoyment is an abstract term that can be explained by the state of having pleasure or keen satisfaction from an act or object. Previous electronic commerce and TAM studies cite enjoyment as one of important factors that leads to satisfaction and usage of online shopping systems (Li et al., 2001; Goldsmith and Goldsmith, 2002; Katerattanakul, 2002; Van Dolen and De Ruyter, 2002). Contradictions to such claims state that goal-oriented motives are more common among online shoppers than are experiential motives, and therefore, shopping is planned ahead hardly with any impulse purchases, such that freedom of control is considered to be more important than fun factors (Wolfinbarger and Gilly, 2001). Since our study involves experimental sessions, which are mandatory rather than voluntary to the participants, we concur with this argument, and omitted enjoyment from the model's key variables. However, a series of five items were included in the questionnaire to test the presence of this factor.

Trainer's Communication Style

Social influence through the words-of-mouth of the trainer is one of the crucial determinants in our model. However, since a subject's impression on the trainer's communication style is likely vary from person to person, it is deemed that not all participants would be heavily influenced by the trainer's messages. For this matter, the dominant Communication Styles Measures (Rubin et al., 1994) were recorded on a six-item dimension.

Self-Efficacy

Self-efficacy is another factor that could affect a user's perception on using a new technology. Based on the social cognitive theory (Bandura, 1982), self-efficacy is defined as the belief that one has the capability to perform a particular behavior. To date, empirical studies on TAM and self-efficacy have been abundant yet contradicting. For instance, while Igbaria and Livari (1995) found strong support for direct and indirect effects of self-efficacy on users' perceptions in using computers, Chau (2001) contended that self-efficacy shows negative or minor effects on perceptive variables. Although we followed Chau's findings and assumed no critical effects of self-efficacy on users' perception and use intent of a new technology, measures concerning users' self-awareness and evaluation of personal capabilities have been put into consideration to verify potential effects of this factor.

Familiarity with the Task Object

Familiarity with the task object can play an important role in users' success in achieving certain tasks. Because of the mandatory nature of the tasks in our experiment, which requested all participants to find and download specific music titles from the designated Web sites, it is believed that those who coincidentally had previous knowledge and profound interests in the musicians or songs we specified would demonstrate high level of success in locating the required music titles. Although familiarity might also concern perception and use intent of new media, this variable only relate to individual recognition of the artists, albums, and songs in question by measuring familiarity on a seven-point scale ranging from *"don't know at all"* to *"know very well."*

Manipulation Check

A *t*-test was performed to examine whether the participants in the social influence treatment groups differed from each other in terms of levels of trainer credibility. The indicators of the trainer's communication style included measures of the trainer's persuasiveness, trustworthiness, and perceived trainer knowledge. However, items indicating the degree of positively or negatively perceived messages were not taken. We believe that the two types of experimental treatments, termed as *positive* and *negative*, delivered enough favorable or unfavorable (according to the SI group the subject was assigned) WOM messages just as the research pursued by Galletta et al. (1995) proved to be effective when training the end-users on a new computer software. In their study, a confederate acted to perform three unsanctioned outbursts during the training sessions to express his appreciation or disapproval of the software to socially influence the other participants.

As expected, the *t*-test indicated that there were no significant differences between the two groups in terms of persuasiveness ($t = 0.385$, $p > .05$), trustworthiness ($t = 1.827$, $p > .05$), and perceived trainer knowledge ($t = 1.894$, $p > .05$). The results, as illustrated in Table 8, show that both groups were above the 5-point (for persuasiveness) and 6-point (for trustworthiness and perceived trainer knowledge) in the scale, indicating high credibility.

Table 8: Manipulation Check of Trainer Credibility

Measure	Group (N)	Mean	St. Dev.	*t*	df	p
Trainer is Persuasive	Neg. (72)	5.22	1.746	0.385	207	.701
	Pos. (74)	5.34	1.682			
Trainer is Trustworthy	Neg. (72)	6.11	1.069	1.827	207	.069
	Pos. (74)	6.39	0.737			
Trainer is Knowledgeable	Neg. (72)	6.28	0.938	1.894	207	.060
	Pos. (74)	6.53	0.602			

Chapter Summary

In this chapter we described the process of data collection methods, and provided the rationale for choosing certain measures for testing the hypotheses. Issues and procedures applied in gathering and measuring the key factors were explained and construed. The following chapter discusses the results of data analyses from the 210 subjects who participated in our experiment. Accordingly, the proposed model of SIM and TTF in TAM is revised and adjusted for an overall better fit.

CHAPTER 4

RESULTS

The current chapter illustrates the quantitative data obtained from the experiments and reports the results analyzed with statistical methods. As for the data analysis methods, analysis of variance (ANOVA) multivariate analysis of variance (MANOVA), and structural equation modeling (SEM) had been employed. Since data integrity checks were provided in the previous chapter, we first begin with an outline of the descriptive statistics by examining the composition of the participants, and then describe the outcomes from hypotheses testing. The model is reassessed and revised to create a final model.

Descriptive Statistics

As explained in the preceding chapter, a total of 210 subjects participated in the experiments. As suggested by Wimmer and Dominick (1997), every subject was randomly assigned to one of the six treatment groups to allocate 36 participants in poor-fit/negative condition, another 36 in good-fit/positive condition, 32 in poor-fit/neutral condition, 32 in good-fit/neutral condition, 37 in poor-fit/positive condition, and 37 in good-fit/positive condition. Among them, 144 were male (68.6%) and 66 were female (31.4%) college students, and the average age of the subject was 21.21 years old with a median of 21. Also, a majority was majoring Telecommunication (151 students, 71.9%), followed by Advertising (22 students, 10.5%), Computer Science (6 students, 2.9%), Communication (4 students, 1.9%), and other majors (27 students, 12.8%). Students in their freshman year counted only 3 (1.4%), while sophomores were 36 (17.2%), juniors 92 (43.8%), seniors 76 (36.2%), and 3 graduate students (1.4%).

The mean value of daily Internet use time was 251.32 minutes (4 hours, 11 minutes and 20 seconds) per day, with a median of 210 minutes (3.5 hours). When asked whether or not they ever had or currently use a mobile device, 205 subjects (97.6%) gave a positive response about cell phones, while 81 (38.6%) agreed with ever owning an MP3 player, and 58 (27.6%) responded positively about having a PDA. Regarding the use of a P2P file-sharing program, a large number (190 respondents, 90.5%) reported having ever used it. Table 9 partially illustrates these basic descriptive statistics in an organized manner.

<u>*Table 9*</u>: Study Participants' Descriptive Statistics Summary

	Male =144 (68.6%)		Female = 66 (31.4%)	
	Yes	No	Yes	No
Cell Phone	139 (96.5%)	5 (3.5%)	66 (100%)	0 (0%)
MP3 Player	59 (41.0%)	85 (59.0%)	22 (33.3%)	44 (66.7%)
PDA	47 (32.6%)	97 (67.4%)	11 (16.7%)	55 (83.3%)
P2P File-sharing	133 (92.4%)	11 (7.6%)	9 (13.6%)	57 (86.4%)
Freshmen = 3 (1.4%)	3 (100%)		0 (0%)	
Sophomores = 36 (17.2%)	19 (52.8%)		17 (47.2%)	
Juniors = 92 (43.8%)	70 (76.1%)		22 (23.9%)	
Seniors = 76 (36.2%)	51 (67.1%)		25 (32.9%)	
Graduates = 3 (1.4%)	1 (33.3%)		2 (66.7%)	

Average age of subjects: 21.21 yrs.

Daily average Internet use time: 4 hrs. 11 min. 20 sec.

Hypothesis Testing

The purpose of testing the hypotheses is to verify the relationships among the variables and observe whether or not the effects were present as predicted earlier in the dissertation. The ultimate goal, however, is to make inferences about the beliefs and behavior of the subjects who have not been tested in the experiment (Keppel, 1991). Thus, data analyses must show statistical power, which indicates the probability that a statistical test of a null hypothesis will result in the conclusion that the phenomenon under study actually exists (Cohen, 1988). For this matter, we employed a series of statistical tests, including ANOVA, MANOVA, and SEM to corroborate the expected results from the pursued study.

Analysis of Variance (ANOVA)

The research design of the current study implied that the acceptance of a new technology is influenced mainly by task-technology fit and social influence. The anticipated relationships between the independent variables and dependent variables state that there will be a main effect of task-technology fit (TTF) on users' success of trials, perceptions and use intention of the new technology (Hypothesis 4), and a main effect of social influence (SI) on users' perceptions and use intention of the new technology (Hypothesis 5). Corresponding to these hypotheses, a three-by-two (3x2) two-factor between subjects factorial design was adopted, and data gathered were first analyzed with the method of one-way multi-factor analysis of variance (ANOVA) using SPSS version 11.0.

Main Effect of TTF on Success of Trials

As explained in the previous chapter, success of trials was determined by the number of Web pages and time it took for a user to find all required files for the given tasks. Data analysis results clearly indicate that there is a significant treatment effect of TTF on the success of trials at Trial 1, i.e. after the completion of the first set of tasks. The number of Web pages browsed averaged (M) 72.46 for the case of the good-fit groups, whereas the poor-fit groups' subjects went through (M) 180.26 pages (F=756.632, p<.001). Similar findings were observed during the second set of tasks, or at Trial 2, when the good-fit groups searched through (M) 16.87 Web pages, the poor-fit groups had to navigate through (M) 29.08 pages (F=69.086, p<.001).

Time was also an indicator that showed significant differences between the two TTF groups. At Trial 1, each subject of the good-fit groups took an average of (M) 419.32 seconds (almost 7 minutes) to complete the first set of tasks, while the poor-fit groups' users spent (M) 1034.52 seconds, or approximately 17 minutes and 15 seconds (F=535.913, p<.001). Also, at Trial 2, the good-fit groups showed a mean score of 132.36 seconds (2 minutes and 12 seconds), and the poor-fit groups spent (M) 182.34 seconds, or 3 minutes and 2 seconds (F=21.494, p<.001). Therefore, Hypothesis 4a (there will be a main effect of TTF on users' success of trials) was successfully supported.

Main Effect of TTF on Perceived TTF

For the sake of the ANOVA method, we took the average score of the three perceptive items for "features," "task-fit," and "support." Our findings suggest that there is a significant treatment effect of TTF on users' evaluation with a mean score of

(_M_) 3.254 for the poor-fit group, and (_M_) 6.165 for the good-fit group (F=333.232, p<.001). Similar outcomes were generated when we compared the evaluated TTF at Trial 2, with a mean score of (_M_) 4.118 for the poor-fit group, and (_M_) 6.200 for the good-fit group (F=156.869, p<.001). Thus, Hypothesis 4b (there will be a main effect of TTF on users' TTF perception) was supported.

Main Effect of TTF on Perceived Ease of Use

By the same token as the perceived TTF, we took an average score of the three items measuring perceived ease of use, namely "clear interaction," "become skillful," and "easy learning," and checked the significance of score difference. The ANOVA results indicate a significant main effect on Perceived EOU at both Trial 1 and Trial 2. At Trial 1, the mean score of perceived ease of use of the poor-fit group was (_M_) 4.400, while that of the good-fit group was (_M_) 6.610 (F=194.186, p<.001). At Trial 2, the same measures scored (_M_) 4.622 and (_M_) 6.489 for the poor-fit and good-fit groups, respectively (F=110.011, p<.001). We concluded that Hypothesis 4c (There will be a main effect of TTF on perceived EOU) was indeed supported.

Main Effect of TTF on Perceived Usefulness

The ANOVA test also supported the main effect of TTF on perceived usefulness. Again, by taking the average of the three perceived usefulness measures, poor-fit group scores were compared with the good-fit group. The mean score of the poor-fit group at Trial 1 showed (_M_) 3.362, and that of the good-fit group showed (_M_) 5.746 (F=272.511, p<.001). Also at Trial 2, the poor-fit group's mean score was (_M_) 3.911, and the good-fit group marked (M) 6.016 (F=166.698, p<.001). Therefore, Hypothesis 4d (There will be a main effect of TTF on perceived usefulness) was supported as well.

Main Effect of TTF on Use Intention

With the single-itemized use intent measures, another ANOVA test was conducted, resulting in significant difference between the poor-fit and good-fit groups. The scores at Trial 1 indicated (M) 3.149 and 4.921 for the poor-fit and good-fit groups, respectively (F=126.002, p<.001), while at Trial 2, they showed (M) 3.212 and (M) 5.044 (F=126.420, p<.001). The assumption of null hypothesis for Hypothesis 4e (There will be a main effect of TTF on use intention) was once again rejected.

Main Effect of Social Influence on Perceived TTF

Since social influence was another crucial independent variable in our research model, the treatment effect of this factor on users' perception of TTF was also analyzed. The ANOVA results show that at Trial 1, the negative group scored (M) 4.194, the control group (M) 4.542, and the positive group (M) 5.356 (F=19.405, p<.001), while at Trial 2, the scores were (Ms) 4.607, 4.953, and 5.874 for each of the three respective groups (F=21.533, p<.001).

Although the observed *F* values suggest significant difference among the three socially influenced groups, there is no indication whether the differences are significant between two specific groups (e.g. negative and neutral groups). We therefore ran contrast tests involving only two of the three groups, and obtained evidence that, indeed, there existed no statistical differences for the case between the negative versus neutral groups

(Trial1: F=3.059, p>.05; Trial2: F= 2.806, p>.05), whereas the difference between the neutral and positive groups was still significant (Trial1: F=17.040, p<.001; Trial2: F=20.044, p<.001). Thus, Hypothesis 5a (there will be a main effect of social influence on users' perceived TTF) was partially supported for the case of positively influenced groups.

Main Effect of Social Influence on Perceived Ease of Use

The main effect of Social Influence on perceived EOU was also tested with the mean values of the three groups. At Trial 1, the each of the three groups scored (Ms) 5.222, 4.938, and 6.270 for the negative, neutral, and positive conditions, respectively (F=20.406, p<.001). As for Trial 2, these scores showed (Ms) 5.259, 5.130, and 6.212 (F=14.962, p<.001). However, when contrast tests were conducted, only the differences between the positive and neutral groups (Trial1: F=46.186, p<.001; Trial2: F=24.138, p<.001), and positive and negative groups (Trial1: F=30.371, p<.001; Trial2: F=19.909, p<.001) showed statistical significance. The neutral and negative groups failed to provide statistically significant differences regarding the perceived ease of use (Trial1: F=2.082, p>.05; Trial2: F=0.340, p>.05). Hypothesis 5b (There will be a main effect of social influence on perceived EOU) was again partially supported within the constraint of positively influenced groups.

Main Effect of Social Influence on Perceived Usefulness

As for the treatment effect of social influence on perceived usefulness, data analysis results evidenced statistical differences among all three groups. The negative group showed a mean score of (*M*) 3.699, the neutral group (*M*) 4.589, and the positive group (*M*) 5.356 at Trial 1 (F=45.788, p<.001), while at Trial 2, the three groups averaged (*M*s) 4.421, 4.823, and 5.613, respectively (F=19.213, p<.001). When compared by contrast tests, the usefulness-perceptive measures of the negatively influenced groups were significantly lower than those of the neutrally influenced groups (Trial1: F=24.681, p<.001; Trial2: F=3.916, p<.05), and the scores of the positive groups were significantly higher than the control groups (Trial1: F=18.456, p<.001; Trial2: F=15.343, p<.001). Hypothesis 5c (there will be a main effect of social influence on perceived usefulness) was fully supported.

Main Effect of Social Influence on Use Intent

The mean score differences among the groups showed statistical significance in terms of users' behavioral intention. The mean scores of the negative group indicated (*M*s) 2.838 and 2.801, those of the control group showed (*M*s) 3.912 and 4.073, and those of the positive group were (*M*s) 5.306 and 5.469 at Trial 1 (F=85.565, p<.001) and Trial 2 (F=93.284, p<.001), respectively. Contrast tests also proved that these mean values were improbably similar even when only negative and neutral conditions were compare (Trial1: F=29.866, p<.001; Trial2: F=39.338, p<.001), and when neutral and positive conditions were contrasted (Trial1: F=51.065, p<.001; Trial2: F=47.969, p<.001) Social influence's main effect on new technology use intention, as predicted by Hypothesis 5d, was thus statistically fully supported. Figures 12 – 23 represent the mean values of the perceptive and intention measures at Trial 1 and Trial 2 of the experiment. Also, the ANOVA test results are summarized in Table 10 below.

C
C
C
vs
Ne

Table 10: ANOVA Summary

	PTTF		PEU		PU		UINT	
	T1	T2	T1	T2	T1	T2	T1	T2
Poor-Fit Groups' *M* (*S*)	3.25 (1.63)	4.12 (1.73)	4.40 (1.91)	4.62 (1.97)	3.36 (1.49)	3.91 (1.60)	3.15 (1.53)	3.21 (1.62)
Good-Fit Groups' *M* (*S*)	6.17 (0.92)	6.20 (0.94)	6.61 (0.66)	6.49 (0.72)	5.75 (1.10)	6.02 (1.00)	4.92 (1.56)	5.04 (1.63)
Main Effect of TTF	F=333.2 p<001	F=156.9 p<001	F=194.2 p<001	F=110.0 p<001	F=272.5 p<001	F=166.7 p<001	F=126.0 p<001	F=126.4 p<001
Negative Groups' *M* (*S*)	4.19 (1.93)	4.61 (1.75)	5.22 (1.92)	5.26 (1.89)	3.70 (1.52)	4.42 (1.67)	2.84 (1.51)	2.80 (1.62)
Neutral Groups' *M* (*S*)	4.54 (2.27)	4.95 (2.04)	4.94 (2.18)	5.13 (2.05)	4.59 (2.00)	4.82 (1.90)	3.91 (1.47)	4.07 (1.52)
Positive Groups' *M* (*S*)	5.36 (1.52)	5.87 (1.11)	6.27 (0.82)	6.21 (0.97)	5.36 (1.37)	5.61 (1.31)	5.31 (1.37)	5.47 (1.34)
Main Effect of SI	F=19.4 p<001	F=21.5 p<001	F=20.4 p<001	F=15.0 p<001	F=45.8 p<001	F=19.2 p<001	F=85.6 p<001	F=93.3 p<001
Negative vs. Neutral	F=3.1 p>.05 *n.s.*	F=2.8 p>.05 *n.s.*	F=2.1 p>.05 *n.s.*	F=0.3 p>.05 *n.s.*	F=24.7 p<001	F=3.9 p<05	F=29.9 p<001	F=39.3 p<001
Neutral vs. Positive	F=17.0 p<001	F=20.0 p<001	F=46.2 p<001	F=24.1 p<001	F=18.5 p<001	F=15.3 p<001	F=51.1 p<001	F=48.0 p<001

Figure 12: Number of Web Pages Browsed at Trial 1

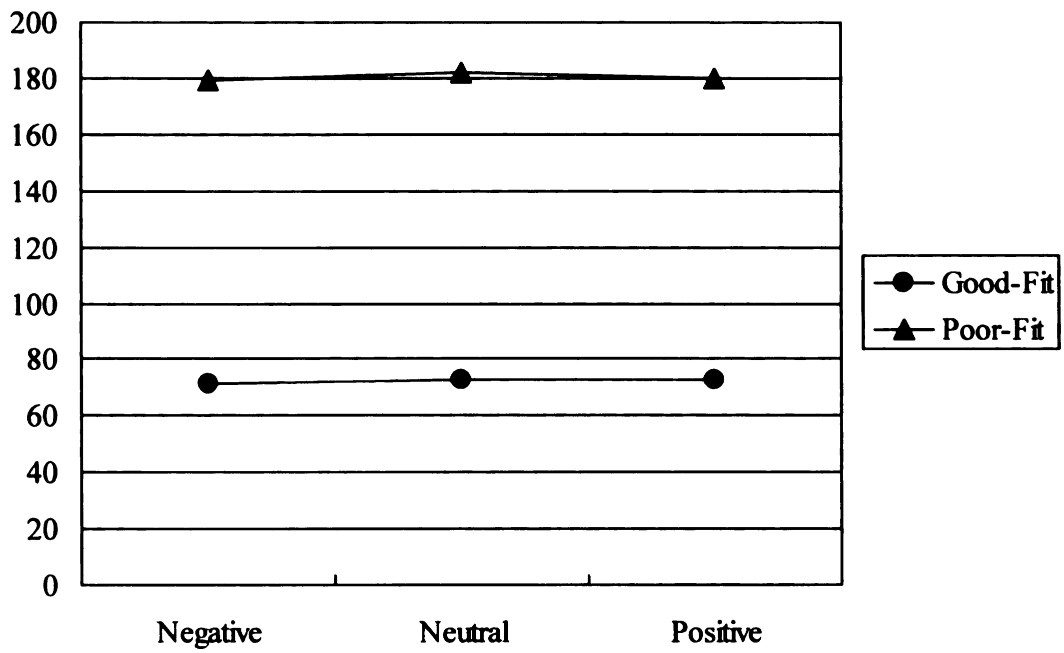


Figure 13: Number of Web Pages Browsed at Trial 2

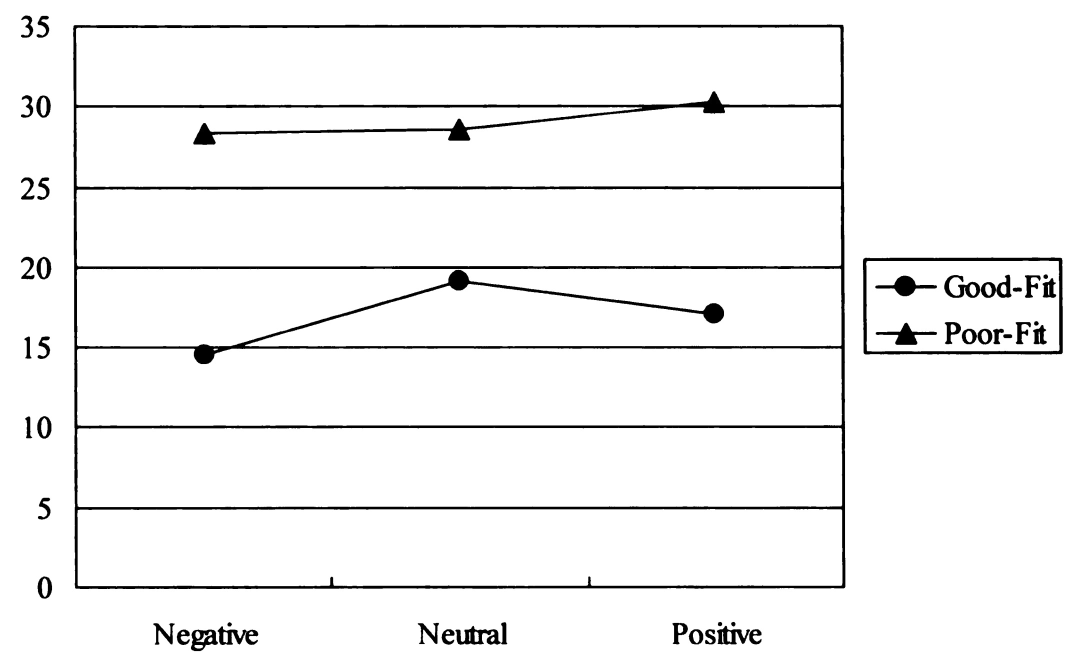


Figure 14: Time Spent at Trial 1

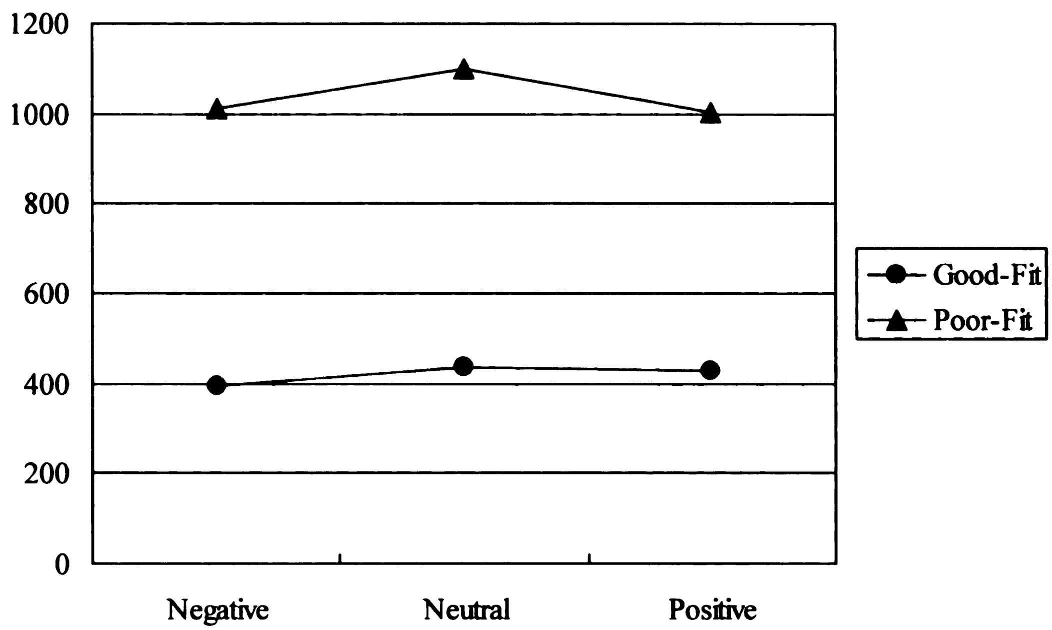


Figure 15: Time Spent at Trial 2

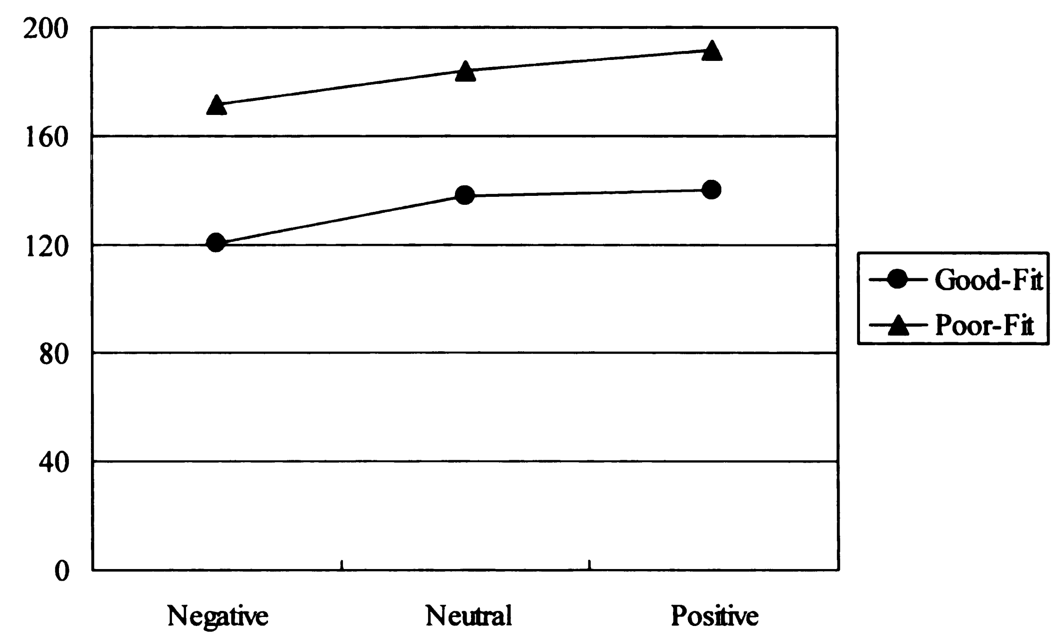


Figure 16: Perceived TTF at Trial 1

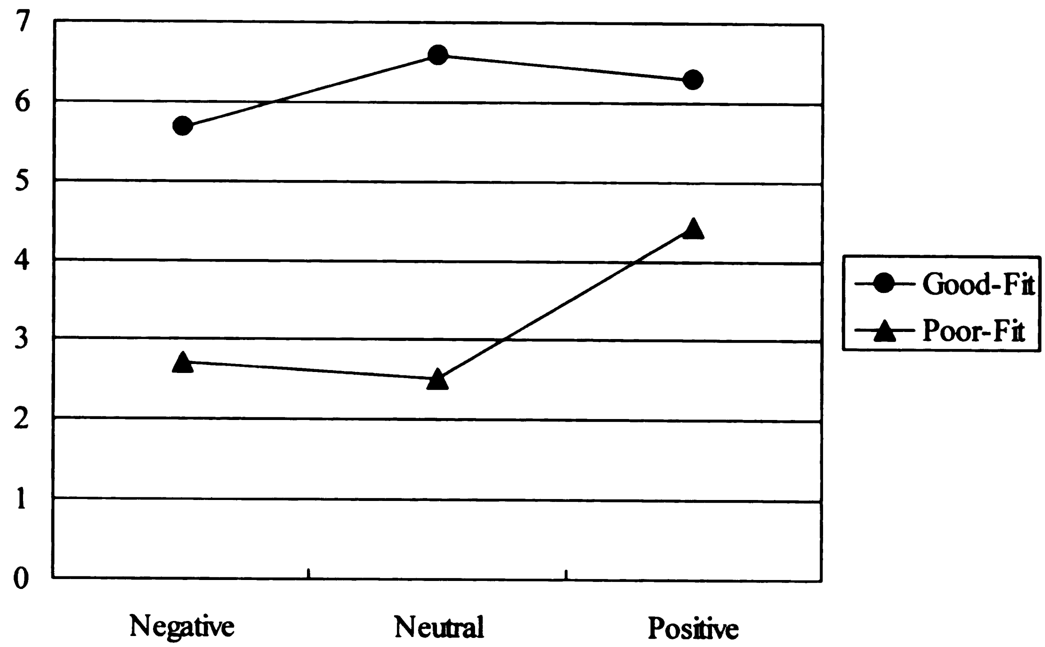


Figure 17: Perceived TTF at Trial 2

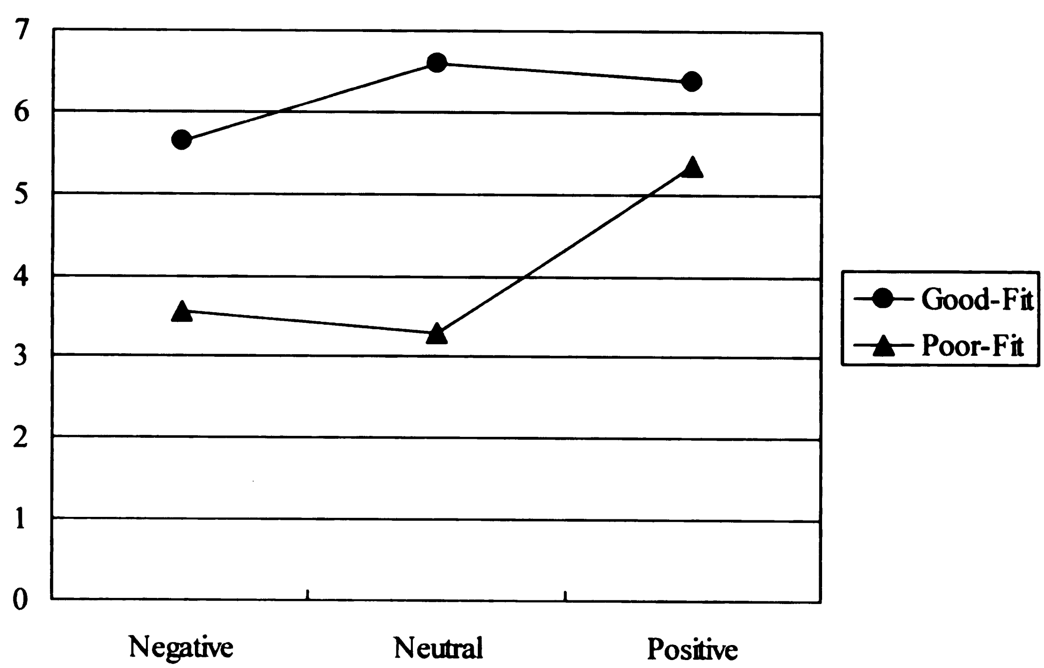


Figure 18: Perceived EOU at Trial 1

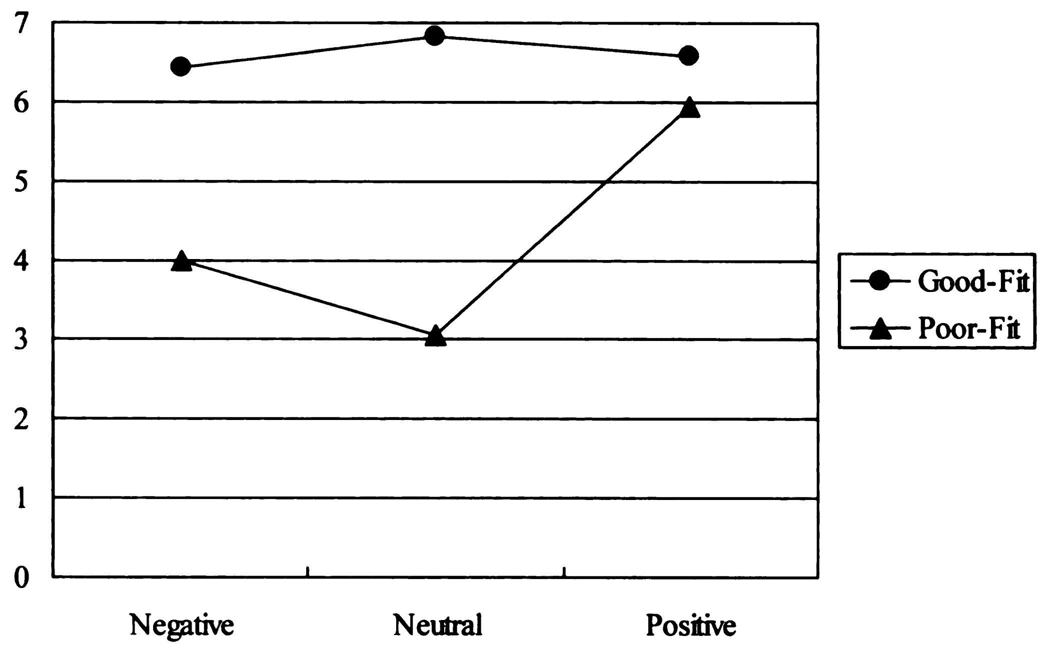


Figure 19: Perceived EOU at Trial 2

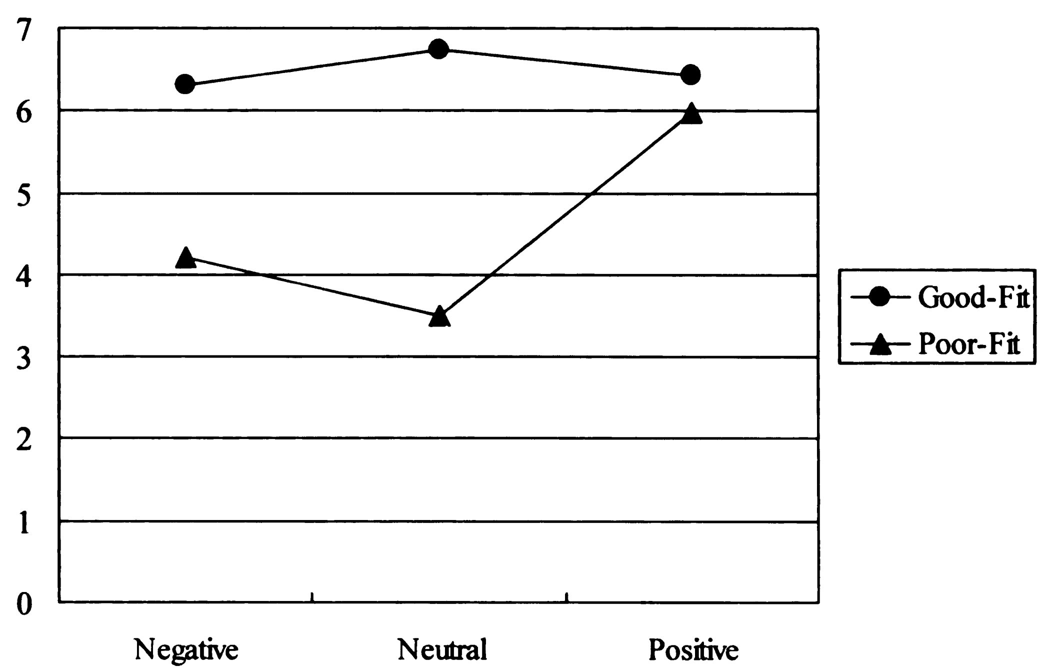


Figure 20: Perceived Usefulness at Trial 1

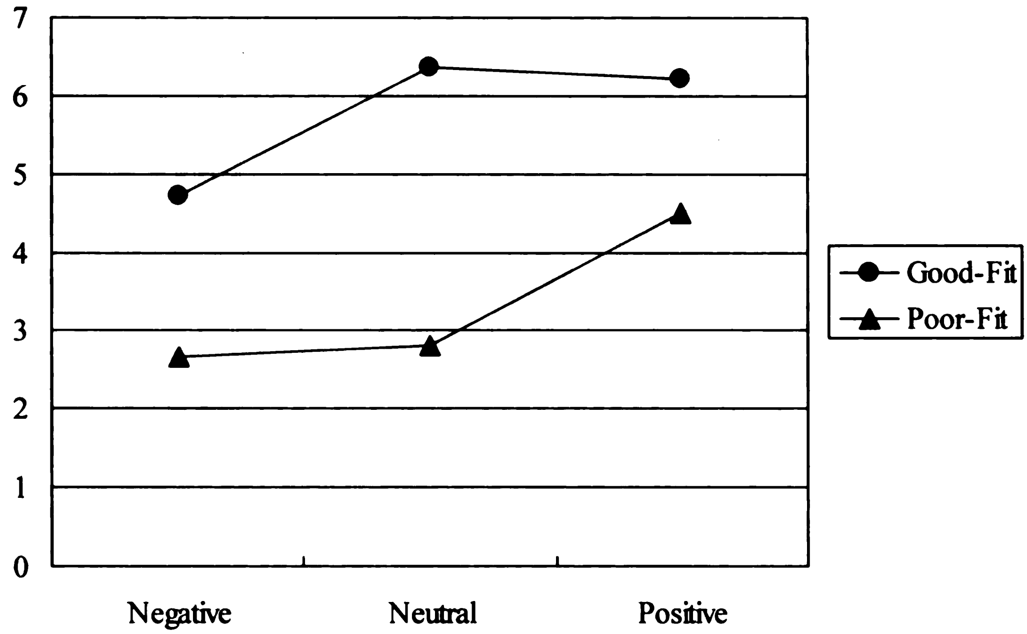


Figure 21: Perceived Usefulness at Trial 2

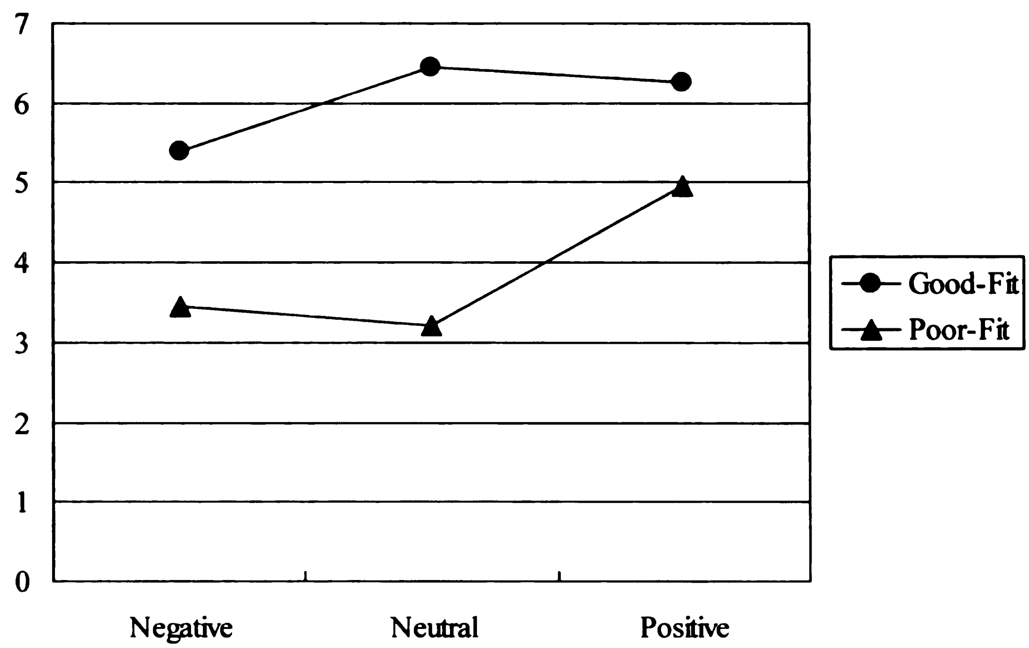


Figure 22: Use Intention at Trial 1

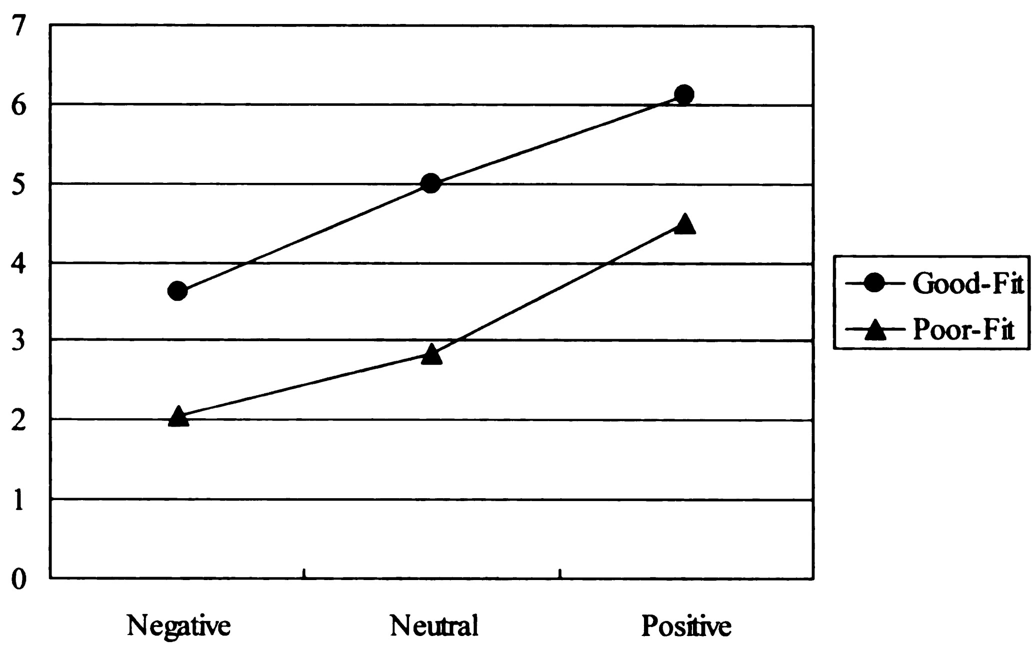
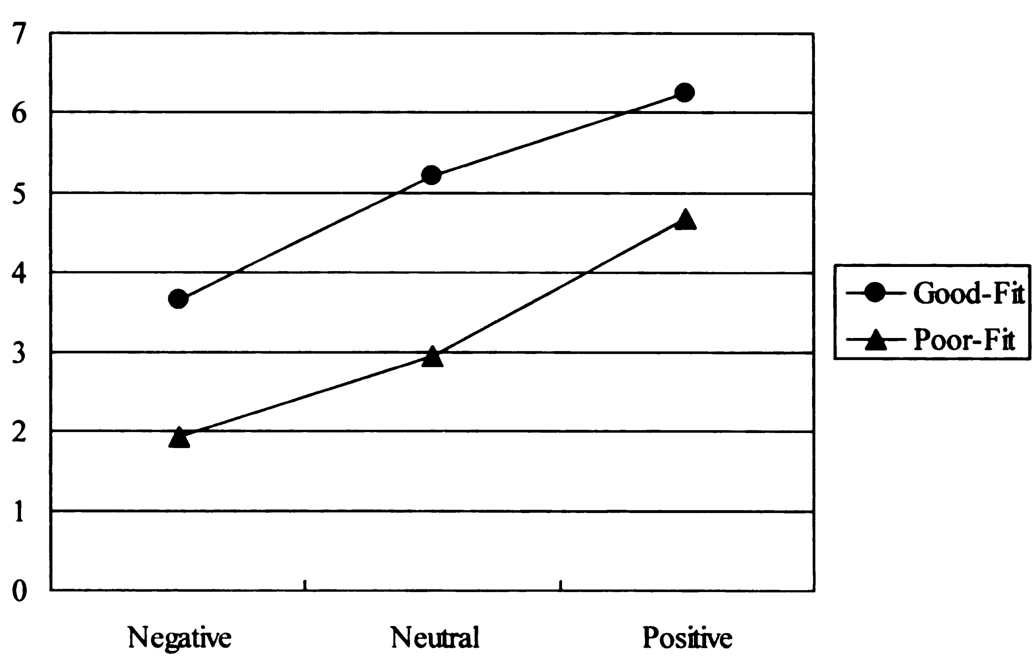


Figure 23: Use Intention at Trial 2



Multivariate Analysis of Variance (MANOVA)

Along with the main effects of the independent variables, we anticipated an interaction effect between TTF and social influence, the two key determinants of our study. An interaction is observed when the simple effects of one independent variable are not equal at all levels of another independent variable, thus making the effects of one of the independent variables to be conditionally related to the levels of the second independent variable (Keppel, 1991). The ANOVA results demonstrated the presence of the main effects of TTF and social influence. However, evidence was not provided regarding the difference of amount of variation in users' perception and reaction along the TTF levels in regard to the social influence levels. In other words, we suspected that the strength of the main effect of social influence would be different according to the TTF levels, and vice-versa. Such interaction effects on users' perceptions, and use intention were predicted in Hypothesis 5. A multivariate analysis of variance (MANOVA) was conducted on SPSS 11.0 to test the hypothesis and verify if the data were meaningful.

Interaction Effect of TTF and Social Influence on Perceived TTF

To verify whether there is an overall interaction effect between the treatments, an omnibus ANOVA was initially performed. The outcome showed that there exists significant interaction effect between TTF and social influence factors at both Trial 1 (F=15.55, p<.001) and Trial 2 (F=15.30, p<.001). However, since this result fails to indicate any particular differences between any two specific social influence treatment groups, an interaction contrast test was then pursued to observe and analyze each of the relations more closely. Through a MANOVA test, first we performed an interaction effect analysis with the negative and neutral groups in contrast. The observed *F* values at both Trial 1 ($\underline{F}$=7.672, p<.01) and Trial 2 ($\underline{F}$=8.667, p<.01) indicate a clear interaction effect between TTF and social influence in the case of negative and neutral treatments. Next, the interaction effect was analyzed for the neutral and positive groups. The significance tests once again suggested that both at Trial 1 ($\underline{F}$=31.036, p<.001) and Trial 2 ($\underline{F}$=30.592, p<.001), the average TTF perception score difference between the good-fit group and poor-fit group is not the same when users are socially influenced in different ways. Hypothesis 6a (there will be an interaction effect between social influence and task-technology fit on users' perception of TTF) was therefore not rejected.

Interaction Effect of TTF and Social Influence on Perceived EOU

As with the analyses of interaction effect on perceived TTF, the average scores to be measured were replaced with users' perceived ease of use and a MANOVA for the two treatments was performed. Since the omnibus *F* test provided evidence for a significant interaction effect (Trial 1: $\underline{F}$=32.62, p<.001; Trial 2: $\underline{F}$=20.36, p<.001), we proceeded with the interaction contrast effect test to isolate and compared two of the three social influence treatments. Again, an interaction contrast effect between the poor-fit and neutral groups was confirmed (Trial 1: $\underline{F}$=11.290, p<.005; Trial 2: $\underline{F}$=6.703, p<.05), as well as the interaction contrast effect between neutral groups and positive groups (Trial 1: $\underline{F}$=64.096, p<.001; Trial 2: $\underline{F}$=39.879, p<.001). Hypothesis 6b (there will be an interaction effect between social influence and task-technology fit on perceived ease of use) was also retained.

Interaction Effect of TTF and Social Influence on Perceived Usefulness

By the same token as the above methods, the omnibus *F* test for perceived usefulness provided a significant overall interaction effect of TTF and social influence (Trial 1: F=14.83, $p<.001$; Trial 2: F=11.91, $p<.001$). The interaction contrast tests also generated statistically significant differences of perceived usefulness variation for both negative versus neutral group case (Trial 1: F=17.539, $p<.001$; Trial 2: F=9.878, $p<.005$), and neutral versus positive group case (Trial 1: F=26.801, $p<.001$; Trial 2: F=23.377, $p<.001$). The results, therefore, successfully supported Hypothesis 6c, which predicted an interaction effect between social influence and task-technology fit on perceived usefulness.

Interaction Effect of TTF and Social Influence on Use Intention

MANOVA tests also analyzed the interaction effect of the treatments on new technology use intention. However, similar outcomes as of the perceptive measures were not found for the case of this variable. Omnibus *F* tests failed to endorse the presence of the interaction effect at both Trial 1 (F=1.31, $p>.05$) and Trial 2 (F=1.53, $p>.05$). Although it is needless to illustrate further interaction contrast tests, the results reaffirmed the absence of treatment interactions when it comes to the subjects' intention to use, as change in the negative group was not significantly different from that of the positive group (Trial 1: F=0.01, $p>.05$; Trial 2: F=0.176, $p>.05$), and the average scores of negative group and neutral group showed no statistical difference in change of intention measures with the positive group for different TTF conditions (Trial 1: F=0.564, $p>.05$; Trial 2: F=1.538, $p>.05$). Thus, Hypothesis 6d (there will be an interaction effect between social influence and task-technology fit on use intent) failed to reject null hypothesis. The following Table 11 summarizes the MANOVA results of the interaction effect tests.

Table 11: Summary of Interaction Effect Tests from MANOVA

		Trial 1		Trial 2	
		F value	Sig.(2-tailed)	*F* value	Sig.(2-tailed)
Evaluated TTF (H6a)	Omnibus *F*	15.55	p<.001	15.30	p<.001
	Cont. "–"vs. "Ø"	7.67	p<.01	8.67	p<.01
	Cont. "Ø"vs. "+"	31.04	p<.001	30.59	p<.001
PEOU (H6b)	Omnibus *F*	32.62	p<.001	20.36	p<.001
	Cont. "–"vs. "Ø"	11.29	p<.005	6.70	p<.05
	Cont. "Ø"vs. "+"	64.10	p<.001	39.88	p<.001
PU (H6c)	Omnibus *F*	14.83	p<.001	11.91	p<.001
	Cont. "–"vs. "Ø"	17.54	p<.001	9.88	p<.005
	Cont. "Ø"vs. "+"	26.80	p<.001	23.38	p<.001
UINT (H6d)	Omnibus *F*	1.31	p>.05; *n.s.*	1.53	p>.05; *n.s.*
	Cont. "–"vs. "+"	0.01	p>.05; *n.s.*	0.176	p>.05; *n.s.*
	"–" & "Ø" vs. "+"	0.564	p>.05; *n.s.*	1.538	p>.05; *n.s.*

Repeated Measures

Since the study incorporated two trials that were performed successively by the participants, a repeated measure analysis of the outcomes is needed to verify whether or not there exists a type of 'comforting' effect during continual testing. A repeated measure MANOVA test was performed to examine the main effect of successive trial sessions on each dimension of perception and use intention. Also, the test explored the interaction effects between trials and TTF, as well as trials and SI. Results from repeated measure MANOVA indicate that for perceived TTF there is a significant comforting effect after the first trial (F=35.66, p<.001). It has been also revealed that there is a significant interaction effect of trials and TTF on perceived TTF (F=30.42, p<001). Looking at the mean score changes, it is noticeable that the poor-fit group subjects expressed higher TTF perception scores at the second trial, compared to the first trial (See Figure 24). However, no significant trials by SI effect was observed (F=0.23, p>.05).

A similar result was seen for the case of the interaction effect between trials and TTF on perceived EOU (F=6.27, p<.05). Yet, there was no significant main effect of trials on perceive EOU (F=0.66, p>.05), and no significant interaction effect either of trials and SI (F=1.06 p>.05), as depicted in Figure 25. When the repeated trials' effect on perceived usefulness was tested, a significant main effect (F=35.05, p<.001) as well as a significant trials by TTF interaction effect (F=4.19, p<.05), and trials by SI interaction effect (F=5.50, p<.01) emerged. Subjects, it seems, tend to perceive the mobile music download service more useful over a repeated trial sessions; and the increase was even higher in the case of the poor-fit and negatively influenced conditions (Figures 26 and 27).

As for the case of use intent, a significant main effect of trials was detected (F=6.46, p<.05), as well as an interaction effect between trials and SI (F=3.17, p<.05). However, no significance was found for the interaction effect between trials and TTF (F=0.69, p>.05). Figure 28 shows the repeated measure effect of trials in accordance to different social influences. These findings are summarized in Table 12 below.

Although most of the repeated trial sessions' effects proved to be significant, with results indicating that there exists a "comforting" factor after the subjects initially experience the new system, it is still arguable that such effects might have been driven by the difference of the load of the tasks between the two trials. Since the first set of tasks required finding and downloading a total of ten songs, the amount of time and number of Web pages it took to finish the first trial were highly different from those of the second trial, in which subjects were asked to find and download no more than two music titles (See difference between Figures 12 and 13, and Figures 14 and 15). Therefore, it is questionable that an intervening factor, namely task load, could have affected the change in perceptive measures among the participants who went through both trials continually. Moreover, by eyeballing the histograms in Figures 24, 25, 26, 27 and 28, it is obvious that the shifts are still minimal and no perceptive or intentional shifts exceed more than one point in the overall seven-point measure scale. An in-depth discussion and interpretation of the repeated measure results will be provided in Chapter 5.

Figure 24: Repeated Measure Effect of Trials and TTF on Perceived TTF

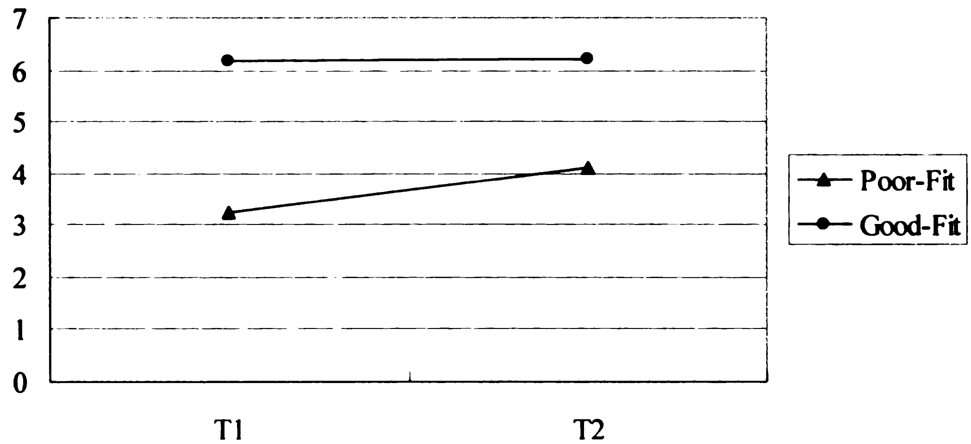


Figure 25: Repeated Measure Effect of Trials and TTF on Perceived EOU

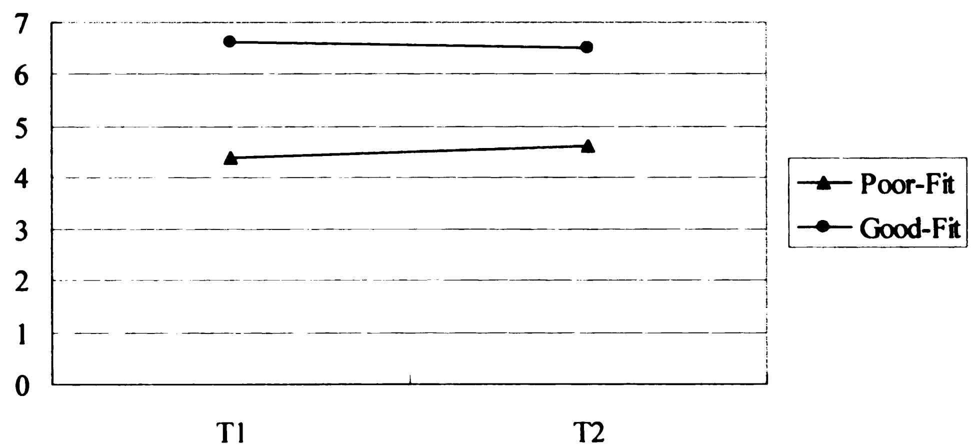


Figure 26: Repeated Measure Effect of Trials and TTF on Perceived Usefulness

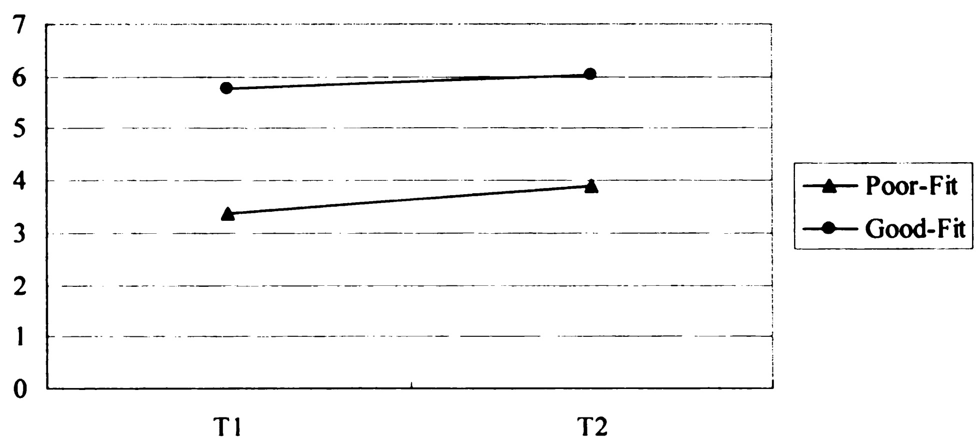


Figure 27: Repeated Measure Effect of Trials and SI on Perceived Usefulness

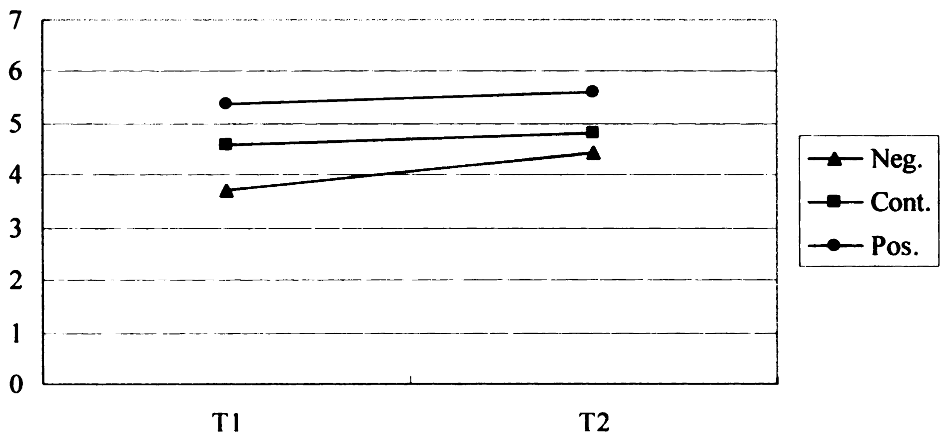


Figure 28: Repeated Measure Effect of Trials and SI on Use Intent

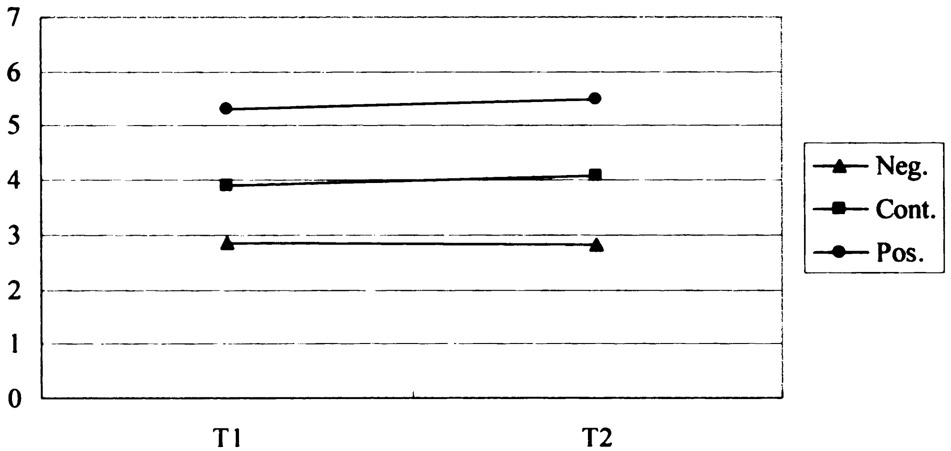


Table 12: MANOVA Results for Repeated Measures Effects of Trials

Variable	Trials		Trials x TTF		Trials x SI	
	F	Sig.	*F*	Sig.	*F*	Sig.
PTTF	35.66	p<.001	30.42	p<.001	0.23	p>.05 *(n.s.)*
PEOU	0.66	p>.05 *(n.s.)*	6.27	p<.05	1.06	p>.05 *(n.s.)*
PU	35.05	p<.001	4.19	p<.05	5.50	p<.01
UINT	6.46	p<.05	0.69	p>.05 *(n.s.)*	3.17	p<.05

Structural Equation Model Testing

To test the hypothesized process model of this study, which was illustrated in Chapter 2, Figure 7, we applied SEM using EQS version 6.1 and investigated the effects expected by the hypotheses. It is believed that the structural equation modeling (SEM) approach has several advantages over traditional analyses even when it comes to experimental studies. Bagozzi and Yi (1989) state that the SEM procedures do not involve the restrictive assumption of homogeneity in variances of the dependent variables across groups, and therefore can handle cases in which homogeneity assumptions are violated. This approach also provides a way to correct for measurement error in the measures of variables, reducing the likelihood of making type II errors. Another advantage of SEM is that it allows for a more complete modeling of theoretical relations, whereas traditional analyses are limited to associations among individual items.

Whit this in mind, a Multiple-group SEM (MSEM) analysis approach was performed. Figure 29 represents the results of a three-group between-subjects model test for positively, neutrally, and negatively influenced groups at Trial 1 of the experiment, while Figure 30 shows the outcomes of the same model tested at Trial 2. Since each of the path coefficients designate a hypothesis, the significance levels of the parameter estimates indicate either support or rejection of the corresponding predictions. In general, both models proved to be good fits as, for the Trial 1 model, Bentler and Bonett's (1980) Normed Fit Index (NFI) showed .913, Bentler and Bonett's Nonnormed Fit Index (BFI) showed .950, and the Comparative Fit Index (CFI) (Bentler, 1988) indicated .962. However, the Goodness-of-Fit Index (GFI) was a little below the suggested value with .818, and the Adjusted Goodness-of-Fit Index (AGFI) (Joreskog and Sorbom, 1984) was also moderate at .727. Yet, the Root Mean Square of Approximation (RMSEA) index (Steiger, 1989; Browne and Mels, 1990) was satisfactory at .058, overall supporting a reasonably good fit of the proposed model. As for the Trial 2 model, the NFI denoted a fit value of .903, the BFI a .946, the CFI a .958, the GFI a .823, the AGFI a .734, and the RMSEA a .056, reporting a reasonably good fit as well. The models' goodness-of-fit indices are summarized in Table 13.

The Effects of the Moderating Variable

MSEM analysis also enables the statistical examination of the moderating variable through Lagrangian Multiplier (LM) and Likelihood Ratio (LR) tests (Bollen, 1989; Scott-Lennox and Lennox, 1995) to examine whether the parameter estimate between each perception measure and success of trials differs across the three different social influences. These techniques are advantageous, since they allow for controlling the measurement errors, while estimating the path coefficients with less bias (Matsuno and Mentzer, 2000). Hypotheses 12, 13, and 14 projected a moderating effect of social influence on the relationship between the success of trials and the perceptive variables. Both LM and LR tests were performed to statistically verify whether there exist significant differences between these path coefficients.

Lagrangian Multiplier (LM) Test

The LM test compares the fit of restrictive to less restrictive models. When a structural model fails to adequately fit the sample data, it may suggest that certain fixed parameters or constraints need to be released to produce better fit. The LM test evaluates the statistical necessity of the restrictions, based on the calculations that can be obtained on the restricted model alone (Bentler, 1995). Though the method was developed in a single-group context, where model fit improvement is suggested through relieving specific restricted paths, it has been also adopted to verify the viability of the equally constrained paths across groups in multi-sample analysis. Therefore, if the paths to be tested are equally constrained in a MSEM, the LM test will try to fit the constraints into the model and indicate if any of the constraints are invalid. If a constraint is invalid, a significant difference of chi-square values is shown on that path between groups.

EQS 6.1 was used to run the LM tests. First, we assumed equality of the parameters to be estimated (i.e. a null case) by constraining the paths between success of trials and perceived EOU measures. More specifically, we set the Trial-Perceived EOU estimate value of the positively influenced group to be equal to that of the control group. We then set equality to the path in the case of the control versus negatively influenced group, and also to that for the positive versus negative groups. LM test results showed that, at Trial 1, two constraints, those including positive conditions, needed to be released with chi-square values showing 16.825 ($p<.001$), 2.170 ($p>.05$), and 17.746 ($p<.001$) for the positive-control, control-negative, and positive-negative respectively, which suggests that there exist some significant cross-group differences for the path coefficients between Trial and Perceived EOU. Since the standardized coefficients of this relationship were .34 for the positive group, .09 for the control group, and -.004 for the negative group, Hypothesis 13 was partially supported. However, an examination of LM tests at Trial 2 showed that all three groups were equal when it comes to the correlation between Trial and Perceived EOU (chi-squares of 2.582, $p>.05$ for positive-control; 2.117, $p>.05$ for control-negative; and 2.792 p>.05 for positive-control). Thus, Hypothesis 13 was only partially supported.

By the same token, the constrained paths between Trial and Perceived TTF were examined. At Trial 1, the chi-square tests yielded a value of 32.170 ($p<.001$), 8.516 ($p<.01$), and 10.060 ($p<.01$) for positive-control, control-negative, and positive-negative comparisons, respectively. However, with the control group's path showing the highest estimate, Hypothesis 12 was rejected. Similar results came out at Trial 2, as the chi-squares indicated 1.939 ($p>.05$) for positive-control, 0.533 ($p>.05$) for control-negative, and 13.015 ($p<.001$) for positive-negative comparisons, with a stronger correlation for the case of the negatively influenced group.

The LM test also failed to reject the constrained paths between Trial and Perceived Usefulness for the case of positive-control comparison both at Trial 1 (0.025, $p>.05$ for positive-control; 0.176, $p>.05$ for control-negative; and 0.197, $p>.05$ for positive-negative comparisons) and Trial 2 (0.369, $p>.05$ for positive-control; 0.106, $p>.05$ for control-negative; and 0.68, $p>.05$ for positive-negative comparisons), resulting in a null case for Hypothesis 14.

Likelihood Ratio (LR) Test

Also known as chi-square difference test, the LR test uses a statistic which has a limiting chi-square distribution when the restrictive model is valid. The degree of freedom (*df*) is referred to the difference in the *df* for the two models, and the usual chi-square estimators for the restricted and unrestricted models are compared. Since the MSEM produces one set of fit indices with a chi-square value, when all the constraints are held for the parameters to be estimated, the outcome would indicate a “null” case, because this assumes the equality of those paths. As the constraints are released, the indices will improve, indicating which paths are different, and enabling the examination of the moderator’s effects.

For our study, the LR test was conducted for a pairwise comparison of the restricted and free path coefficients between Trial and perceptive measures across the three social influences. First, a pairwise comparison was done by observing the chi-square differences between two models, in which one model constrained all three paths to be equal, while the other model was left with free parameters. The resulting chi-squares were compared to observe whether the equality constraint model produced a better fit than the free model or vice-versa. For the Trial-Perceived EOU estimate, when unconstrained, the model at Trial 1 produced a chi-square value of 353.802 with a df of 210, whereas when all three conditions were equally constrained, the chi-square increased by 10.872 (364.674) with a difference of *df* of 2 (212). Since this chi-square value is statistically significant ($p<.01$), it is highly unlikely that the restrictive model is correct. Therefore we continued to compare the chi-square differences of the constrained versus unconstrained models across two specific groups. The positive versus control conditions were significantly different ($p<.01$), as the chi-square difference between the models with unconstrained and constrained paths showed 10.777 (364.579) at 1 *df*. Positive and negative groups were not equal either as the chi-square difference was 12.347 (366.149) at 1 *df* ($p<.001$). However, the control versus negative condition comparison suggested that the path was not significantly different across these two groups ($p>.05$) with a chi-square of 354.801 (difference of 0.999) at 211 *df* (difference of

1). Null hypothesis was retained for the case of control-negative group comparison. The unconstrained and constrained Trial-Perceived EOU estimates comparison at Trial 2 delivered a chi-square value difference of 2.468 (350.501 – 348.033) at 2 *df* (212 – 210), which had no statistical significance (p>.05). Thus the Trial-Perceived EOU path in the Trial 2 model failed to significantly differ across the three social influence conditions. Hypothesis 13 was therefore only partially supported for the case of the positive influence.

By the same token, we tested the moderating effect of social influence on the Trial-Perceived TTF path coefficient. Once again, LR tests were conducted and for the Trial 1 model, we found a significant difference between the constrained and free paths across all three groups (chi-square of 387.787 at 210 *df*, difference of 33.985 at 2 *df*, p<.001). Each comparison for a pair of groups proved significant difference as well (positive = control groups' chi-square 387.634 at 211 *df*, difference of 33.832 at 1 *df*, p<.001; control = negative groups' chi-square 361.355 at 211 *df*, difference of 7.553 at 1 *df*, p<.01; and positive = negative groups' chi-square 361.032 at 211 *df*, difference of 7.23 at 1 *df*, p<.01). However, these findings indicate that the control group's coefficient is the strongest, while that of the positive group is the weakest, contradicting our Hypothesis 12, which predicted a higher term of correlation for the positive group. Similar results were found in the Trial 2 model, where the negative groups' path showed a significantly stronger coefficient that that of the positive group and control group. This time, the chi-square difference tests generated a 363.163 (212 *df*) when the Trial-Perceived TTF parameter was constrained to be equal across all three conditions, yielding a chi-square difference of 15.13 at *df* of 2 (p<.001) compared to the free model's chi-square value of 348.033 at 210 *df*. While the positive and control groups' path coefficients did not significantly differ from each other (350.144, chi-square difference of 2.111 at 1 *df*, $p>.05$), and those of control and negative were equal as well (349.409, chi-square difference of 1.376 at 1 *df*, $p>.05$), only the equality assumption between positive and negative groups was statistically refuted (362.453, chi-square increase of 14.42 at 1 *df*, $p<.001$). Yet, as the negative group's Trial-Perceived TTF estimate showed the strongest correlation at Trial 2, Hypothesis 12 was once more not supported by our data.

Since Hypothesis 14 predicted a moderating effect of social influence on the estimator of Trial-Perceived Usefulness relationship, the chi-square differences were also tested though LR tests. Results showed that for both paths in Trial 1 and Trial 2 models, equally constrained (null) cases generated better fits, with a chi-square difference of 0.418 at 2 *df* ($p>.05$, with the constrained model's chi-square of 354.220, 212 *df*) when we assumed equality across all three groups at Trial 1, and a chi-square difference of 0.013 at 2 *df* ($p>.05$, with the constrained model's chi-square of 348.046, 212 *df*) when the three groups' paths were constrained in Trial 2 model. No further pairwise analyses were needed in this case, since the generic null hypothesis was supported in both models.

Although it seems redundant to perform two different data analyses to test the moderating effect of social influence, discovering that both LM and LR tests produced identical results provided us with higher confidence in presenting and discussing the outcomes and implications. The LM and LR findings are summarized in Table 15 at the end of this Chapter.

Chapter Summary

The data analysis results confirm that Hypotheses 3, 4, 5, 6 (a, b, and c), 7, 10 and 11 are retained, while Hypotheses 8 and 13 are partially supported, and Hypotheses 1, 2, 6d, 9, 12 and 14 are rejected. According to the results, it seems that people's successful trial in using a new technology positively influences their perception of TTF (H7). This perceived TTF subsequently affects their perception of the device's ease-of-use (H10) and usefulness (H11), which leads to the intention to use the technology. The positive correlation between success of trials and perceived ease of use (H8) was only present when subjects were positively influenced by the trainer (H12). However, when the subjects were negatively or neutrally influenced prior to participate in the study, their trials' success level did not affect their perception of ease of use. Also, the measure of success of trials showed no relation with the level of perceived usefulness (H9). However, since perceived TTF was highly associated with perceived ease of use and perceived usefulness, the relation between success of trials and perception of a technology's easiness and usefulness was mediated by perceived TTF. An interesting finding from the model analysis is the absence of the link between perceived ease of use and perceived usefulness (H1). While most of the previous TAM studies contend that perceived ease of use positively influences perceived usefulness, our data failed to reject the null hypothesis for the relation between these two factors. It appears that the notion of easiness or convenience does not always concede the feeling of usefulness to the users of a new technology. The perception of usefulness had a positive effect on the willingness to use a new technology (H3), whereas in most cases, the level of perceived ease of use failed to directly influence the use intent. Interestingly, the relation between use intent and perceived ease of use appeared to be partially moderated by social influence, since the effect was only significant when subjects were positively introduced to a new technology. The detailed discussion on the implications of the findings is presented in the following Chapter 5.

Figure 29: MSEM Results for Positively (P), Neutrally (C) and Negatively (N) Influenced Groups at Trial 1

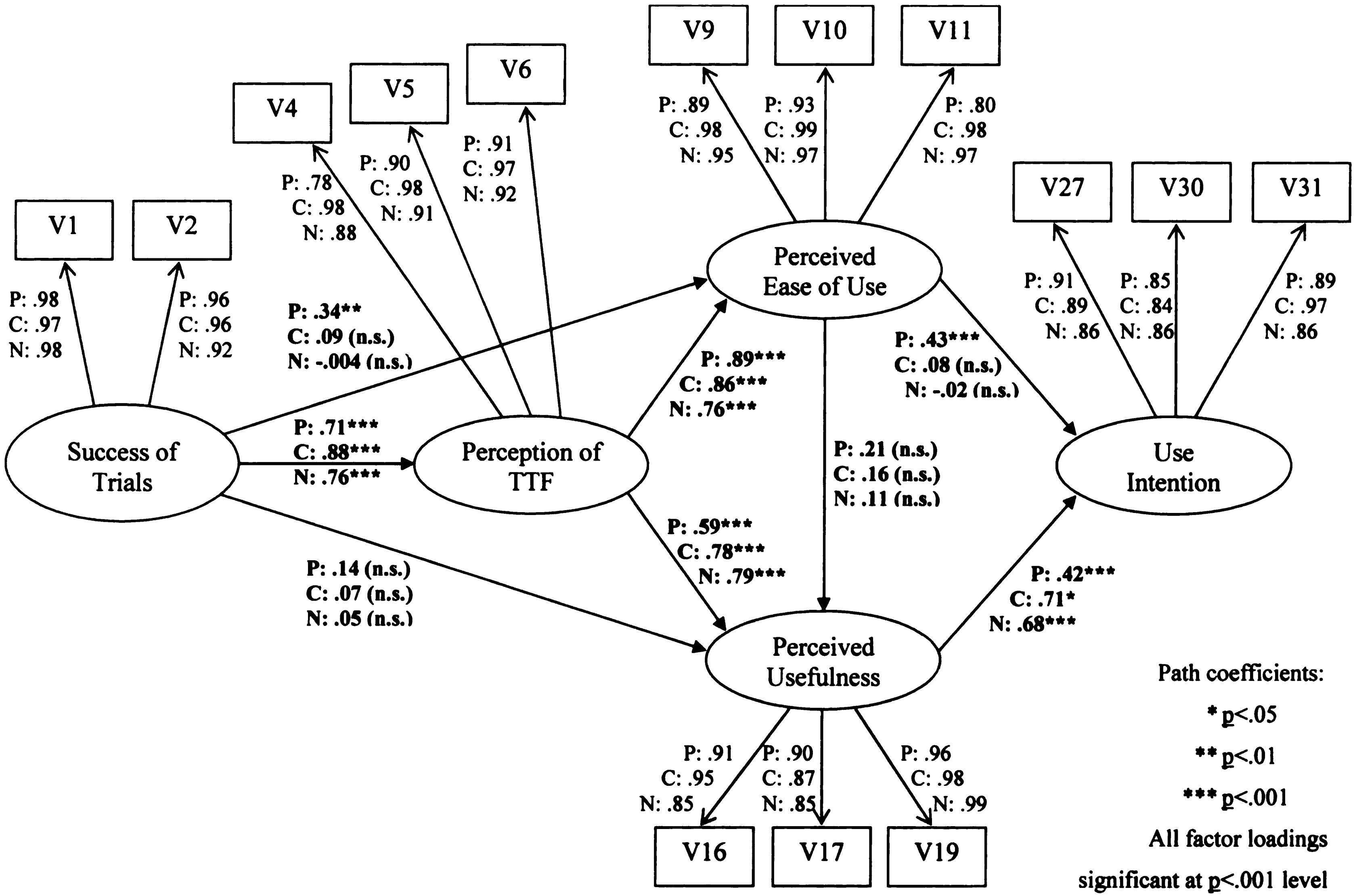


Figure 30: MSEM Results for Positively (P), Neutrally (C) and Negatively (N) Influenced Groups at Trial 2

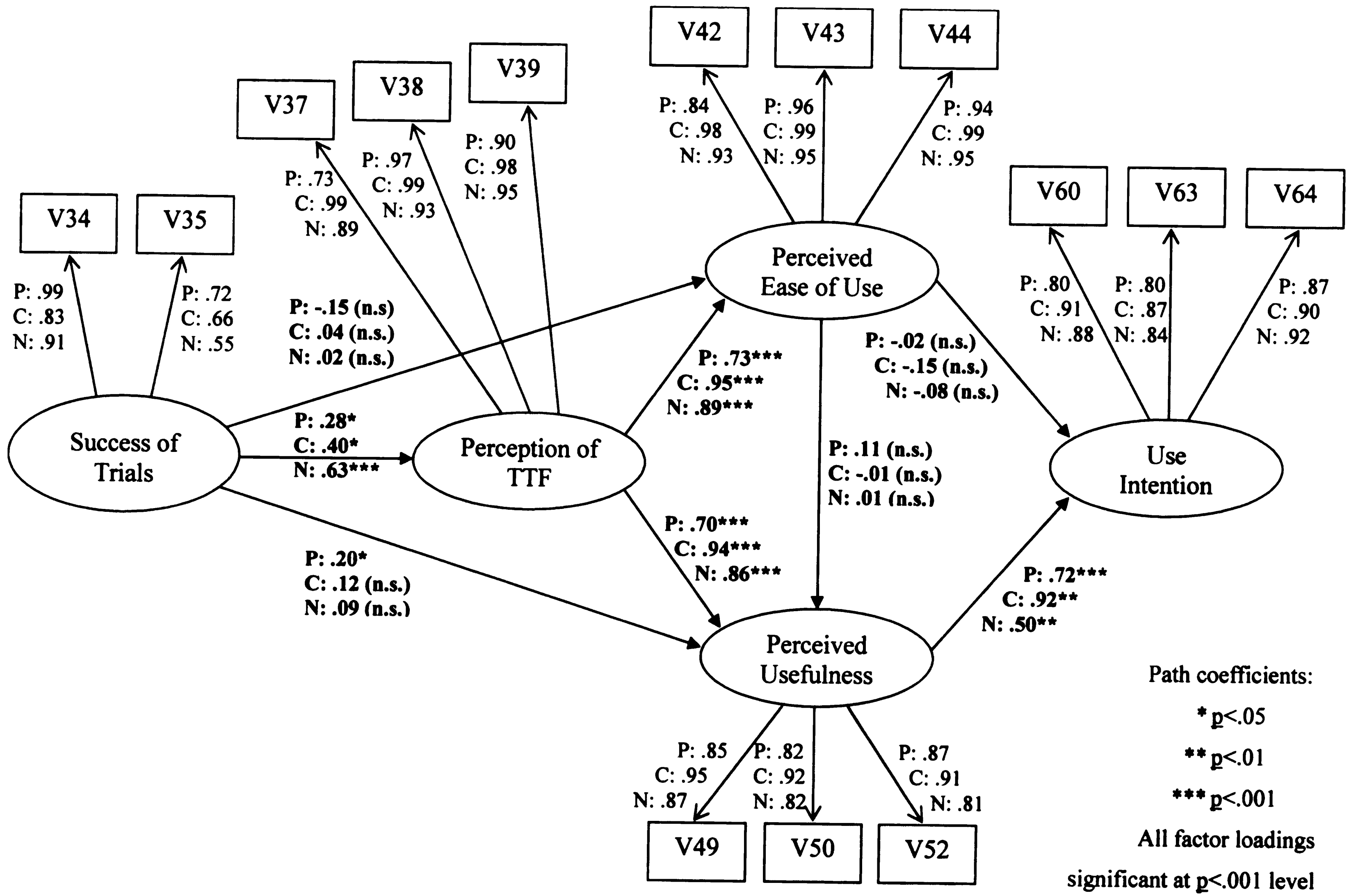


Table 13: Goodness-of-fit Summary for the Three-Group Structural Equation Models

Fit Measure	Indices	
	Trial 1 SEM	Trial 2 SEM
NFI	.913	.903
BFI	.950	.946
CFI	.962	.958
GFI	.818	.823
AGFI	.727	.734
RMSEA	.058	.056
χ^2 (df)	353.802 (210)	348.033 (210)

Table 14: Summary of Path Coefficients in Trial 1 and Trial 2 Models

Path Coefficient (γs and βs)		Trial 1			Trial 2		
Starting Variable	Ending Variable	Pos.	Cont.	Neg.	Pos.	Cont.	Neg.
Success of Trials	Perceived TTF	.71***	.88***	.76***	.28*	.40*	.63***
Success of Trials	Perceived EOU	.34**	.09	-.004	-.15	.04	.02
Success of Trials	Perceived Useful.	.14	.07	.05	.20*	.12	.09
Perceived TTF	Perceived EOU	.89***	.86***	.76***	.73***	.95***	.89***
Perceived TTF	Perceived Useful.	.59***	.78***	.79***	.70***	.94***	.86***
Perceived EOU	Perceived Useful.	.21	.16	.11	.11	-.01	.01
Perceived EOU	Use Intention	.43***	.08	.02	-.02	-.15	-.08
Perceived Useful.	Use Intention	.42***	.71*	.68***	.72***	.92**	.50**
*p<.05 ; **p<.01 ; **p<.001 ; all other parameters non significant at p>.05							

Table 15: LM and LR Tests' Results Summary

Hypo.	Cont.	Model	LM Test Statistics	LR Test - χ^2 Difference	H Support
H12: Moderating Effect of SI on Trial Success – Perceived TTF	P=C=N	T1	N/A	χ^2: 33.985, 2 *df* (p<.001)	H12 rejected in T1 model: P(.71) < N(.76) < C(.88)
		T2	N/A	χ^2: 15.13, *df*: 2 (p<.001)	
	P=C	T1	χ^2: 32.170 (p<.001)	χ^2: 33.832, *df*: 1 (p<.001)	
		T2	χ^2: 1.939 (p>.05)	χ^2: 2.111, *df*: 1 (p>.05)	
	C=N	T1	χ^2: 8.516 (p<.01)	χ^2: 7.553, *df*: 1 (p<.01)	H12 rejected in T2 model: P(.28) = C(.40) C(.40) = N(.63) P(.28) < N(.63)
		T2	χ^2: 0.533 (p>.05)	χ^2: 1.376, *df*: 1 (p>.05)	
	P=N	T1	χ^2: 10.060 (p<.01)	χ^2: 7.23, *df*: 1 (p<.01)	
		T2	χ^2: 13.015 (p<.001)	χ^2: 14.42, *df*: 1 (p<.001)	
H13: Moderating Effect of SI on Trial Success – Perceived EOU	P=C=N	T1	N/A	χ^2: 10.872, *df*: 2 (p<.01)	H13 partially supported in T1 model: N(.004) = C(.09) < P(.34)
		T2	N/A	χ^2: 2.468, *df*: 2 (p>.05)	
	P=C	T1	χ^2: 16.825 (p<.001)	χ^2: 10.777, *df*: 1 (p<.01)	
		T2	χ^2: 2.582, (p>.05)	χ^2: 2.463, *df*: 1 (p>.05)	
	C=N	T1	χ^2: 2.170 (p>.05)	χ^2: 0.999, *df*: 1 (p>.05)	H0 retained for H13 in T2 model: P(-.15) = C(.04) = N(.02)
		T2	χ^2: 2.117, (p>.05)	χ^2: 0.209, *df*: 1 (p>.05)	
	P=N	T1	χ^2: 17.746 (p<.001)	χ^2: 12.347, 1 *df* (p<.001)	
		T2	χ^2: 2.792 (p>.05)	χ^2: 0.051, 1 *df* (p>.05)	
H14: Moderating Effect of SI on Trial Success – Perceived Usefulness	P=C=N	T1	N/A	χ^2: 0.418, *df*: 2 (p>.05)	H0 retained for H14 in T1 model: P(.14) = C(.07) = N(.05)
		T2	N/A	χ^2: 0.013, *df*: 2 (p>.05)	
	P=C	T1	χ^2: 0.025, (p>.05)	χ^2: 0.089, *df*: 1 (p>.05)	
		T2	χ^2: 0.369, (p>.05)	χ^2: 0.011, *df*: 1 (p>.05)	
	C=N	T1	χ^2: 0.176, (p>.05)	χ^2: 0.102, *df*: 1 (p>.05)	H0 retained for H14 in T2 model: P(.20) = C(.12) = N(.09)
		T2	χ^2: 0.106, (p>.05)	χ^2: 0.001, *df*: 1 (p>.05)	
	P=N	T1	χ^2: 0.197, (p>.05)	χ^2: 0.415, *df*: 1 (p>.05)	
		T2	χ^2: 0.68, (p>.05)	χ^2: 0.002, *df*: 1 (p>.05)	

CHAPTER 5

DISCUSSION

The main goal of our research was to investigate the key factors of technology acceptance within the context of m-commerce. Most of the findings from the analyzed data agree with previous work that examined the adoption of new information systems, with a few exceptions. The current chapter discusses the implications of the results by addressing each particular hypothesis, explaining the situational circumstances of our experiments, and providing insight into the very meaning of the outcomes.

Experimental Study

A major advantage of implementing experimental designs is that researchers have control over the subjects' values on factors that can influence the variable of interest in the study (Agresti and Finlay, 1997). Thus, through experiments, effects can be maximized and causalities are better observed. To exploit and compare the effects of the degree of fit between task and technology, and social influence through the WOM of a trainer, we recruited over 200 college students, mostly undergraduate, and gave each of them a PDA wirelessly connected to the Internet. Since we randomized the process of subject assignment to one of the six preset conditions, it was not possible to control for their gender, college grade, or prior experience, and therefore, these variables were not considered as the main factors to test the hypotheses. One-third of the sample constituted of male student, and a majority of the participants were newly introduced to a PDA at the time of their participation (see Table 9). During the experiment, we assigned each subject two sets of tasks to be completed at the location of the trial, and thus collected two data sets (Trial 1 and Trial 2). The objective for employing a repeated data collection method was mainly to obtain a robust explanation of the main factors driving technology acceptance. Also, since we created two different Web sites, the appearance or navigational characteristics of a particular site had to be controlled to prevent interference with a subject's impression or personal preference of a specific mobile Internet search system.

Repeated Measures

The research design incorporating successive trials necessitates a test of repeated measures. Although the repeated measure results indicate that there is a high probability of learning, or "comforting" effect of the device between Trial 1 and Trial 2, we believe that such an effect might have been caused by the difference of the tasks' load between the two trials. The first set of tasks involved searching, finding, and downloading a total of ten songs that required more than 17 minutes and 180 Web pages in average to complete for the poor-fit groups' subjects, while the second set of tasks, which needed just two music files to find, took only about 3 minutes and 29 Web pages to browse. Moreover, since the Web sites' navigational interface was different for each trial (if the first trial was completed on a horizontal-depth navigation, the second trial switched to an interactive interface), learning effects had a small chance to occur. Also, not all perceptive measures increased after Trial 1. For instance, perceived EOU slightly (but not significantly) decreased among the good-fit group subjects (Trial 1's $\underline{M}$=6.61 vs. Trial 2's

$\underline{M}$=6.49), without any significant main effect of trials. The outcomes were not consistent either, as the interaction effects between trials and TTF were observed on perceived TTF, perceived EOU and perceived usefulness, while the interaction effects between trials and SI were only verified on perceived usefulness and use intent. Therefore, although the repeated measure tests indicated the existence of a "comforting" effect, we contend that such an effect could have been absent if the second trial carried the same amount of task load as the first trial.

Task-Technology Fit in Mobile Commerce

The mobile access technologies through which wireless users connect to a network are the foundation for high quality m-commerce services (Maitland, 2004). Since m-commerce rely on advances in middleware technologies, systems, and services (Lee and Ke, 2001), an important issue regarding its adoption involves the correspondence between the systems designed by the service providers and the contents of the mobile services. A well-matched system to the characteristics of the needs is, without any doubt, likely to evoke successful trial and positive reactions from the users.

Effect of TTF on Success of Trials

One of the main m-commerce technology acceptance drivers we tested in this study is the fit between task and technology. TTF is a function of task requirements, individual abilities, and the functionality and interface of the technology (Goodhue, 1997). Therefore, if a specific technology fits the task requirements, its users are expected to show higher trial success than those using a system that fails to match the specific job characteristics. Although success is a multifaceted concept that implies multiple dimensions, such as quality and perfection of the accomplishment, or quantity and size of the outcome, our study considered two objective measures quantifiable in numbers: time and Web pages it takes to achieve the tasks. As evidenced by numerous previous TTF studies (e.g. Keller, 1994; Goodhue, 1995; D'Ambra and Wilson, 2004; Staples and Seddon, 2004), the ANOVA results support with high significance the fact that TTF is highly correlated with success of trials both in terms of time and number of Web pages (H4a). Therefore, a well-matched TTF significantly differ from a poor-matched TTF in number of procedures through which a user undergoes when using an m-commerce service. These results also indicate that success of trials measured in terms of time and Web pages offers effective manipulation checks on the control of TTF in our experimental study. Thus, success of trials represents an objective assessment of TTF that was widely deemed as measurable only through users' TTF evaluation.

Effect of TTF on Perception and Intention to Use

With Hypothesis 4a strongly supported by the data, it has become obvious that success of trials reflects the extent of task-technology fit adequacy. However, one of the main questions of our study entailed the relation between TTF and technology acceptance. The TAM literature presents external variables, such as system usability, to have an impact on perceptions (Venkatesh and Davis, 1996). Yet, little has been empirically shown as to represent the antecedents of perceived ease of use and perceived usefulness. We denote that TTF can represent an objective construct for these exogenous variables causing variance of perception in technology acceptance. Since the TAM theory suggests that positive perception of EOU and usefulness leads to high intention to use, our predictions stated that a well-fit TTF would associate with positively perceived TTF (H4b), perceived ease-of-use (H4c), perceived usefulness (H4d), and high willingness to use the new technology (H4e). The results supported our proposed statements, thus confirming the strong correlations both between TTF and perception, and between TTF and use intention. From these results, it can be inferred that TTF provides a solid ground for controlling and measuring the external factors of system usability. The major implication of such findings is that TTF not only increases the level of success of a new system's trial, but also positively enhances the users' perceptions on TTF, EOU, usefulness, and their intention to use. Since the latest small mobile devices increasingly need to simultaneously fulfill two features, namely simplicity and functionality, the importance of a user interface that meets the functional expectation by maintaining the conciseness of the system can never be overemphasized.

Technology Acceptance Factors: Implications of the Process Model Test Results

As the main effects of TTF were supported, a question remains on whether or not there are causal chains among the variables. Again, the TAM literature specifies two key factors of technology acceptance as perceived usefulness and perceived ease of use, and since success of trials was an objective reflection of TTF, we examined whether the effect of success of trials directly links to each individual dimension of perception. The paths to be tested were: (1) the association between success of trials and perceived TTF, (2) the association between success of trials and perceived ease of use, and (3) the association between success of trials and perceived usefulness. Additionally, the relationship between perceived ease of use and perceived usefulness was examined, and the links to the use intent variable were analyzed.

Implications of the MSEM Results

According to the MSEM analyses, the direct and positive relationship between success of trials and perceived TTF (H7) was supported. However, *ceteris paribus*, the direct links from success of trials to perceived ease of use (H8) and perceived usefulness (H9) were not observed. Instead, these relations seemed to be mediated by perceived TTF, which in turn, showed significant positive correlations with both perceived ease of use (H10) and perceived usefulness (H11). The implications of our findings state that system usability can be represented in terms of TTF level, which comprises trials' success, and consequently causes perception on the goodness of TTF. Therefore, based on the MSEM results, it can be inferred that the links of a trial's success on perceived ease of use and usefulness are not straight, but rather indirect. People tend to perceive new mobile devices and services easy to use and useful only when they consent to the fact that the new technology highly supports the expected functions. Thus, from a practical point of view, it is suggested that mobile system developers are constantly aware of the needs of the potential users when implementing a new service in the market.

Effect of Perceived Ease of Use on Perceived Usefulness

Equally, if not more, interesting finding in our model is that the relation between perceived ease of use and perceived usefulness (H1) was absent. Although it is not common, similar results are reported by numerous TAM studies (Lee et al., 2003). For example, Bjorn et al. were compelled to abandon the correlation between perceived ease of use and perceived usefulness after pursuing an in-depth qualitative research on technology acceptance of Groupware in virtual learning teams. Also, in a study of implementation of an IT training program to inform mid-career employees, Neville and Fitzgerald (2002) found that perceived ease of use is not necessarily a precursor of perceived usefulness, but instead, high perception of usefulness can supercede the importance of perceived ease of use. Our data analysis results concur with those findings, implying the disparity of the feeling of easiness from the perception of usefulness.

Effect of Perception on Use Intent

Another interesting finding indicates that the behavioral intention is only influenced by perceived usefulness (H3), and not by perceived ease of use (H2). Also claimed in many extant studies is the argument that users' readiness to accept a new technology does not require the attribute of perceived convenience (Lee et al., 2003). An exemplary study is reported by Szajna (1996) in which she performed a longitudinal research on the procedure of the adoption of an electronic mail system. In her paper, she contends that only perceived usefulness leads to use intention, while ease of use is identified as a dependent measure of experience. Koufaris (2002) also found that perceived ease of use of a Web store failed to correlate with the customers' intention to return to the same site. It is therefore arguable that the extent to which users find a new system to be easy does not fully guarantee their willingness to continue using it.

Social Influence in Technology Acceptance

Main Effects of Social Influence

Social influence is an independent variable in the variance model and a moderating variable in the process model. In the two-way ANOVA and MANOVA results, social influence proved to be a critical independent factor that generated a significant treatment effect on users' perception and use intention (H5). However, the effect was partially present when it came to two perceptive variables: perceived TTF (H5a) and perceived EOU (H5b). According to the findings, the effect of social influence was not observed when the mean values of these two perceptive measures were compared between the negatively influenced group and the control group. Only the positively influenced subjects showed significantly higher perceptive and intentional scores than the negative and neutral groups. These findings suggests that positive social influence is indispensable to positively affect perceived TTF and ease of use, regardless of the actual degree of fit between task and technology.

When it comes to perceived usefulness (H5c) and use intent (H5d), all three social influences were significant determinants, implying that perceiving a device or a system to be useful highly depends on the opinion of significant others. This certainly can be explained by the nature of the process by which an individual agrees with his(her) peers on the usefulness of a new device. The opinion of significant others about a new device's usefulness is very likely to be acquired through social exchange. By the same token, the willingness to use a specific system or service is also highly dependent on significant others' opinions, especially regarding a new and unknown technology, and more specifically in the case of young college students, who tend to freely exchange and share personal interests more so than the older generation. Therefore, our experimental setting, which was established in a collegiate environment, turned out to be an advantageous location, if not ideal, for testing the effect of social influence on technology acceptance.

Interaction Effects between Social Influence and Task-Technology Fit

Interaction effects between social influence and TTF were observed in all three perceptive factors of technology acceptance. In other words, the difference of perception shift between poor TTF and good TTF among the neutrally influenced individuals was greater than those of the positively influenced and negatively influenced people. Since the subjects in neutral influence condition formed a control group without any affective messages addressed to them, a difference in the goodness of TTF was highly likely to orient them to a more extreme direction, be it positive or negative, than those who were previously exposed to the opinion of another social member. Thus, the survey results showed clear and significant interaction effects of social influence and TTF on perceived TTF (H6a), perceived EOU (H6b), and perceived usefulness (H6c). Social influence proved to be an effective method to form a less dispersed cognitive responses among the users of a newly-introduced technology.

Quite interestingly, however, this interaction effect was absent in the case of use intent measures (H6d). Put it differently, the difference of use intent levels between good-fit and poor-fit of the technology to the task was practically the same in all three social influence conditions. This result indicates that when combined, each of the objective (TTF) and subjective (social influence) factors can add up to each other's effect and mount to the highest degree of willingness. Yet, no factor causes the increase or decrease of intensity of another factor's effect, and the changes appear parallel on a scatter plot (see Figures 22 and 23). A key suggestion to the m-commerce practitioners according to theses findings underscore the use of a social influence strategy when they seek to diffuse the medium in the potential market. Because each individual hardly has complete information on any new medium, media choice often occur through cognitions of other people's opinions rather than through personal learning of media attributes. Indeed,

> "[m]edia perceptions are determined to some degree by objective features… However, they are also determined to a substantial degree by the attitudes, statements, and behaviors of coworkers." (Fulk et al., 1990)
>
> "Social interaction in the workplace shapes the creation of shared meanings and … these shared definitions provide an important basis for shared patterns of media selection." (Schmitz and Fulk, 1991)

Moderating Effect of Social Influence

From our MSEM analyses that tested the process model, social influence showed little significance as a moderating factor. Its predicted effect on the relation between success of trials and perceived TTF (H12) was not consistent at Trial 1 and Trial 2, and practically absent in the relation between success of trials and perceived usefulness (H14). The only prediction that was observed from the model testing was its moderating effect on the relation between success of trials and perceived ease of use (H13) at Trial 1. The positive effect of successful trials on perceived ease of use was significant only for the positively influenced group, whereas the control and negative groups showed no effect of trials' success whatsoever on ease of use. These results suggest that users' perception on a new technology's traits is little dependent on social influence, but rather strongly associated with its goodness of fit between task and technology.

A surprising result, though, is found in the relation between usefulness perception and use intent. At Trial1, the negative and neutral groups generated a standardized path coefficient of .70 and .69, respectively, while the positive group showed a weaker effect of .40. Also at Trial 2, the parameter estimates of negative and neutral groups were .71 and .86, whereas the positive group's coefficient was lower at .49. It can be inferred, according to these numbers, that the moderating effect of social influence is affecting the relation between perceived usefulness and use intention of a user such that the relationship is stronger for negatively and neutrally influenced users, and weaker for positively influenced users. The implication of such finding is that negatively and neutrally influenced individuals would rely on their perception of the system's usefulness when deciding whether or not they want to use the new technology, while positively influenced individuals tend to have an overall high intent to use the system, and therefore their perception of usefulness would have a lesser impact on their intention to use. This result once again emphasizes the importance of positive social influence from peers or significant others in forming the willingness to use a certain new technology.

Chapter Summary

The current chapter inspected the data analysis results and explained the implications of the findings. The ANOVA and MANOVA results supported the main effects of TTF and social influence on technology acceptance, and confirmed the interaction effect of these two independent variables on users' perception. However, no interaction effect was found on the users' willingness to further use our tested mobile system. Instead, TTF and social influence proved to be both independently important in leveraging use intention. The process model's MSEM analysis results showed significant support for an indirect effect of success of trials on perceived ease of use and usefulness, while only perceived usefulness was statistically proven to impact use intent. Meanwhile, only a positive social influence was found to partially moderate the relation between success of trials and perceived ease of use. Overall, regardless of the goodness of fit between task and technology, we identified that positive social influence is a crucial factor in increasing potential users' willingness to adopt a particular technology.

In the next chapter we provide a summary of this dissertation, present the managerial implications of findings for the m-commerce practitioners, exploit the limitations of the current study, discuss the issues concerning future studies, and conclude the dissertation with closing remarks.

CHAPTER 6

SUMMARY AND CONCLUSIONS

The current study entails theoretical improvement of the literature of the TAM, TTF, and SIM within the discipline of telecommunication, as well as practical contribution in the domain of business-to-consumer m-commerce. The empirical results obtained from the experimental data provide a solid foundation for an insightful understanding of the factors driving technology acceptance, and an oriented suggestion for practitioners and marketers of mobile Internet services. We believe that, however, this dissertation has its limitations which should not be disregarded but rather addressed with humble acknowledgement. This chapter concludes our dissertation by providing a summary of the study, presenting the limitations and directions for future studies, and discussing the managerial implications of the current study.

Summary of the Study

During the last few years, high-speed 3G mobile technologies have been proliferating rapidly, signaling prospects for the mobile Internet (Racanelli, 2005). Although m-commerce is still in its infancy, some foreign markets, including Japan and South Korea, are already experiencing soaring increase of mobile Internet subscribers (Minges, 2005), with high demands of multimedia services over the mobile devices (Kim, 2005). However, such great expectation is only an anticipation of the marketers in mobile telecommunication industry, and while the projected numbers are not fully guaranteed to be attained, there still exist controversies regarding the future of mobile Internet and m-commerce. After an extensive review of the m-commerce literature, we found that little has been studied on the factors that drive the users' acceptance of this new technology. This dissertation specifically examines the main factors that drive technology acceptance by testing the effects of TTF and social influence on the TAM model's variables in the context of m-commerce.

We started by construing today's situation of mobile commerce and identifying crucial acceptance factors to raise theoretical questions in the discipline of telecommunication. Thus we generated the following research questions:

What are the main factors influencing the individual acceptance of mobile Internet services in mobile commerce dealing with entertainment applications such as music file downloads?

Three theoretical paradigms that were selected to formulate our research model are as follows: The Task-Technology Fit (TTF) Theory, Social Influence Model (SIM), and Technology Acceptance Model (TAM). By adopting variables from the TTF and SIM to the TAM, our hypotheses predicted the following relations:

H1: Perceived ease of use will be positively related to perceived usefulness.

H2: Perceived ease of use will have a positive effect on use intention.

H3: Perceived usefulness will have a positive effect on use intention.

H4: There will be a main effect of task-technology fit on the success of triasl, users' perceptions and use intention of the new technology.

H5: There will be a main effect of social influence on users' perceptions and use intention of the new technology.

H6: There will be an interaction effect between social influence and task-technology fit on users' perceptions and intention.

H7: The degree of a trial's success in achieving a task with a new technology will be positively associated with the users' perception of TTF.

H8: Success of trials will be positively related to perceived ease-of-use.

H9: Success of trials will be positively related to perceived usefulness.

H10: Users' perception of TTF will be positively associated with perceived ease-of-use.

H11: Users' perception of TTF will be positively associated with perceived usefulness.

H12: The effect of the trials' success on perceived TTF will be moderated by social influence, such that the relationship will be stronger for positively influenced users, moderate for neutrally influenced users, and weaker for negatively influenced users.

H13: The effect of the trials' success on perceived ease-of-use will be moderated by social influence, such that the relationship will be stronger for positively influenced users, moderate for neutrally influenced users, and weaker for negatively influenced users.

H14: The effect of the trials' success on perceived usefulness will be moderated by social influence, such that the relationship will be stronger for positively influenced users, moderate for neutrally influenced users, and weaker for negatively influenced users.

An experimental setting was conceived to artificially create a 3x2 (positive/neutral/negative social influence by good/poor task-technology fit) between-subjects factorial design, in which subjects were randomly assigned to one of six conditions. After the participants were introduced and instructed on the method of using a PDA, data were collected over two experimental sessions (Trial 1 and Trial 2), each of which requested a set of tasks to complete (to find and download the required MP3 music titles) using a specific type of mobile Internet navigation interface system. Two different Web sites were created for this purpose. The time and number of Web pages it took for a user to complete a task were monitored to measure the level of success of the trials. Also, two separate questionnaires were handed out to measure the subjects' perceptive responses. When data collection was finished, a total of 210 college students participated in the study.

Data analyses were performed by employing two-way ANOVA and MANOVA, and Multiple group Structural Equation Modeling (MSEM) tests. The results showed full support for H3, H4, H5, H7, H10 and H11, partial support for H6, H8 and H13, and no significant support for H1, H2, H9, H12 and H14. Based on these findings the followings could be inferred: First, positive social influence was crucial in forming positive perception on a new technology and high intention to use it, and when combined with appropriate goodness of fit between task and technology, the effect on use intent would maximize. Second, although task-technology fit impacts the users' success of trials in finding music titles, it does not directly affect their perceived ease of use and perceived usefulness, but rather has an indirect effect through perceived TTF. Third, perceived ease of use has almost no effect on perceived usefulness and use intent, but instead, perceived usefulness was found to significantly associate with users' willingness to use a new technology. These findings suggest that as much as TTF plays an important role in shaping and changing users' perception on new mobile technologies, social influence is equally, if not more, influential when it comes to the decisions of these new users toward an intention to actually use them.

Managerial Implications

This dissertation finds strong support for the extended model of TAM with TTF and SI factors for the use of m-commerce. In other words, we found that the external variable that was presented as a rather abstract construct in TAM can be efficiently measured by TTF and SI. This yields to several suggestions for the m-commerce practitioners and marketers. First, the importance of a navigational interface system appropriate to the purpose of a service should be emphasized. Since mobile devices have limited screen capacity to display all functions and contents of a Web store, businesses should actively seek ways to improve the fit of their systems by constantly revising and researching the functionality of navigational interfaces adequate to the needs of the users. Second, in doing so, the developers should mainly consider improving the level of usefulness of their services, and by a lesser degree, enhance the easiness of browsing. Third, marketers must recognize that consumers of new telecommunication technologies, especially those from the young generation, are prone to continually exchange information with each other and listen to the opinions of early adopters. Therefore, to approach this potentially huge market and gain success, the opinion leaders should be the first to be identified and persuaded.

Limitations and Directions for Future Studies

As it is the case with all studies, this dissertation should be interpreted with regards to the limitations inherent in the study. The first limitation relates to the methodological practice of using college students as subjects in behavioral experiments, which has been widely criticized in the field of social sciences. For more than half a century, numerous scholars expressed concerns over the validity of results generated in this manner, including McNemar (1946), who argued that researchers tend to over-rely on findings derived from the study of the "behavior of sophomores," Enis et al. (1972), who reported that students were studied in more than one-half of the consumer behavior articles, Cunningham et al. (1974), who suggested that students are not equal to the household consumers, Morgan (Morgan, 1979), who questioned the value of students as role-players because they could not anticipate the reactions of the typical consumers, and more recently, Winer (1999), who expressed skepticism about experimental studies' external validity. Although we agree that a selection of student samples is problematic to represent a specific set of "real" people, we argue that the purpose of experimental designs is to isolate and emphasize the treatment effects to observe the reactions of the individual participants, and therefore, students should be no less real than regular people. As claimed by Lynch (1999), just as in the laboratory, the real world varies in background facets of subject characteristics, setting, context, relevant "history," and time. Moreover, since young generation markets constitute the majority and target consumers of wireless and mobile Internet (Okazaki, 2004), the findings from our experimental sample of young undergraduate college students has the external validity of *generalizability across* (Cook and Campbell, 1979) this specific population. However, concerns might arise for the small number of subjects (N=210) to perform MSEM analyses, since our study implemented a multiple-group approach, allowing only about 70 subjects in each social influence group. Some insignificance of path coefficients might have been caused by the small sample size, and therefore, we suggest a larger sample size for future studies employing a MSEM analyses with experimental designs.

Another method-related issue in our experimental study is the lack of actual manipulation checks of the social influence. Although the measures for the trainer's communication styles allowed the subjects to evaluate the credibility of the trainer, we omitted to verify whether the positively influenced group significantly differed from the negatively influenced group in terms of perceived favorability of the WOM messages. Also, some students with an already strongly established opinion toward m-commerce and mobile devices might have felt uneasiness listening to the partiality of the expressions cued by the trainer. Such manipulation check measures should not be overlooked in other studies that test the effect of WOM social influences

The second limitation is the use of a trainer as confederate to practice social influence on the subjects through word-of-mouth messages. Most social influence studies, including those associated with TAM, measure social influence in terms of social or subjective norms. Subjective norms can be described as the degree to which an individual believes that people who are important to him think he should perform the behavior in question (Ajzen and Fishbein, 1975). Such socially-established norms are found to have both short- and long-term effects on people's acceptance of a new technology (Taylor and Todd, 1995; Venkatesh and Davis, 2000; Venkatesh and Morris, 2000). Although our method introduced a seemingly expert trainer to the subjects, it is not exactly known whether they value his messages with the same importance as those of their peers or significant others. Therefore, the effect of such word-of-mouth messages expressed by an unknown person should be considered to have a short-term impact rather than a long-term effect on their eventual perception and decision on using the new system.

The third limitation of this study involves the lack of actual usage measurement. Use intent is a mere indication of readiness or willingness to use, which does not necessarily trigger real-life usage. In fact more than 80% of TAM-related studies omitted to verify the link between behavioral intention and actual behavior (Lee et al., 2003). Since our study tested a system that is currently not offered by m-commerce service providers, the unavailability of measures of usage was a major hindrance we could not overcome in our experimental design. Perhaps a follow-up survey on each participant's m-commerce usage after the launch of similar services in the mobile market would serve as an examination of the relation between use intent and actual use.

Fourth, the context of m-commerce can not be applied to all new technological devices. Especially, social influence, which is one of the key independent variables, may as well be a less important factor when it comes to a totally different technology. Thus, the findings of this study should be addressed with careful consideration of the products' characteristics if one wished to apply our extended model to explain a new system irrelevant to the mobile Internet.

In light of the above limitations, we recommend that future studies of m-commerce acceptance consider conducting a more robust research with "real" people, by assessing highly interpretable and controllable social influence, checked for the manipulation effects, with a complete data on actual usage of the new technology, and a larger sample size if MSEM analyses are to be performed. Also, a suggestion for another interesting research idea relating to social influence beyond the WOM messages is a study of the effect of Web vendors' list of recommendation systems. Since most of today's online stores, such as iTunes and Amazon.com, sort popular items by product categories through data mining techniques and show a list of recommended titles to the online customers by indicating such statements as: "*Customers who bought this product also bought:...*", these mediated social influences could significantly affect the consumers' perception of usefulness, intention to purchase, and actual buying behavior of the listed products. If the results were to generate significant social effects of these messages, interesting findings of the impact of a non-face-to-face and asynchronous computer-mediated interaction might as well suggest for exciting theoretical and practical implications in the discipline of information systems studies.

Conclusion

This dissertation attempts to identify and examine the main factors driving the acceptance of new technology of m-commerce. For this purpose, the TTF and SIM variables have been integrated into the TAM theory and successfully tested through experimental processes. While a number of factors have been considered and analyzed to prove our predicted causal relations, the fact that the current study did not contemplate all possible factors should not be neglected. We deem, however, that the selection of variables was theoretically adequate, and the results valid in many aspects.

M-commerce represents the convergence of the Internet and the mobile technology, which, through mobile devices, has added a dimension to e-commerce. M-commerce is forecasted to continue to grow and show a significant impact on the global business environment. This study provides theoretical and practical implications for both scholars and practitioners of m-commerce. As the technological advances in mobile communication and data transmission is likely to stimulate new types of services, further investigation on the drivers of diffusion and adoption of the new technology would be needed to improve the model of technology acceptance.

APPENDIX 1: QUESTIONNAIRES

Questionnaire 1 (completed by the participants after the first set of tasks)

		Strongly Disagree			Neutral			Strongly Agree
1	The tasks I performed were difficult.	1	2	3	4	5	6	7
2	The interface has the exact features for me to carry out the tasks.	1	2	3	4	5	6	7
3	The interface fits well with the tasks I was required to perform.	1	2	3	4	5	6	7
4	The interface fully supports the purpose of the tasks.	1	2	3	4	5	6	7
5	It was difficult to complete the tasks because some features were not available.	1	2	3	4	5	6	7
6	In general, the interface had functionalities that corresponded to the tasks.	1	2	3	4	5	6	7
7	My interaction with the interface was clear and understandable.	1	2	3	4	5	6	7
8	I quickly became skillful at using this interface.	1	2	3	4	5	6	7
9	Learning how to fully use the interface was easy for me.	1	2	3	4	5	6	7
10	It was easy to get the interface search and find what I was looking for.	1	2	3	4	5	6	7
11	It took too much time to find the file I was seeking through the interface.	1	2	3	4	5	6	7
12	The interface was so complicated, it was difficult to understand what to do.	1	2	3	4	5	6	7
13	In general, the interface was easy to use.	1	2	3	4	5	6	7
14	The interface would be useful for any type of file search.	1	2	3	4	5	6	7
15	This Web site would improve my ability to locate other music files.	1	2	3	4	5	6	7
16	I think the interface is useless for locating music files.	1	2	3	4	5	6	7
17	This was an appropriate use of a Web site interface on the PDA.	1	2	3	4	5	6	7
18	Generally, I find the interface useful.	1	2	3	4	5	6	7

		Strongly Disagree			Neutral			Strongly Agree
19	Using the interface was enjoyable.	1	2	3	4	5	6	7
20	The actual process of searching with the interface was pleasant.	1	2	3	4	5	6	7
21	I had fun using the interface on a PDA.	1	2	3	4	5	6	7
22	I find the interface exciting.	1	2	3	4	5	6	7
23	The interface was so boring, I felt annoyed while using it.	1	2	3	4	5	6	7
24	This type of service will become popular in the future.	1	2	3	4	5	6	7

		Very Low			Neutral			Very High
25	If you were in an airport with a mobile device, what would be the probability that you consider buying songs through such services?	1	2	3	4	5	6	7
26	If you were at home with the device, what would be the probability that you consider buying songs through such services?	1	2	3	4	5	6	7
27	If you were relaxing on the beach with the device, what would be the probability that you consider buying songs through such services?	1	2	3	4	5	6	7
28	If you had to decide whether or not to buy the songs using this technology at this moment, how likely is it for you to make the purchase?	1	2	3	4	5	6	7
29	In the future, if you had access to similar services on mobile devices, how likely is it for you to buy music?	1	2	3	4	5	6	7

		Don't know at all						Know very well
30	How familiar are you with the **artist** of the **first task** whose song you had to find? ***(Counting Crows)***	1	2	3	4	5	6	7
31	How familiar are you with the **song** of the **first task**? ***("This Desert Life")***	1	2	3	4	5	6	7
32	How familiar are you with the **artist** of the **second task** whose song you had to find? ***(Urban Knights)***	1	2	3	4	5	6	7
33	How familiar are you with the **song** of the **second task**? ***("Urban Knights V")***	1	2	3	4	5	6	7

Survey 1 Completed.

Please return this form to the experiment administrator.

Questionnaire 2 (completed after the second set of tasks)

		Strongly Disagree			Neutral			Strongly Agree
34	The tasks I performed were difficult.	1	2	3	4	5	6	7
35	The interface has the exact features for me to carry out the tasks.	1	2	3	4	5	6	7
36	The interface fits well with the tasks I was required to perform.	1	2	3	4	5	6	7
37	The interface fully supports the purpose of the tasks.	1	2	3	4	5	6	7
38	It was difficult to complete the tasks because some features were not available.	1	2	3	4	5	6	7
39	In general, the interface had functionalities that corresponded to the tasks.	1	2	3	4	5	6	7
40	My interaction with the interface was clear and understandable.	1	2	3	4	5	6	7
41	I quickly became skillful at using this interface.	1	2	3	4	5	6	7
42	Learning how to fully use the interface was easy for me.	1	2	3	4	5	6	7
43	It was easy to get the interface search and find what I was looking for.	1	2	3	4	5	6	7
44	It took too much time to find the file I was seeking through the interface.	1	2	3	4	5	6	7
45	The interface was so complicated, it was difficult to understand what to do.	1	2	3	4	5	6	7
46	In general, the interface was easy to use.	1	2	3	4	5	6	7
47	The interface would be useful for any type of file search.	1	2	3	4	5	6	7
48	This Web site would improve my ability to locate other music files.	1	2	3	4	5	6	7
49	I think the interface is useless for locating music files.	1	2	3	4	5	6	7
50	This was an appropriate use of a Web site interface on the PDA.	1	2	3	4	5	6	7
51	Generally, I find the interface useful.	1	2	3	4	5	6	7

		Strongly Disagree			Neutral			Strongly Agree
52	Using the interface was enjoyable.	1	2	3	4	5	6	7
53	The actual process of searching with the interface was pleasant.	1	2	3	4	5	6	7
54	I had fun using the interface on a PDA.	1	2	3	4	5	6	7
55	I find the interface exciting.	1	2	3	4	5	6	7
56	The interface was so boring, I felt annoyed while using it.	1	2	3	4	5	6	7
57	This type of service will become popular in the future.	1	2	3	4	5	6	7

		Very Low			Neutral			Very High
58	If you were in an airport with a mobile device, what would be the probability that you consider buying songs through such services?	1	2	3	4	5	6	7
59	If you were at home with the device, what would be the probability that you consider buying songs through such services?	1	2	3	4	5	6	7
60	If you were relaxing on the beach with the device, what would be the probability that you consider buying songs through such services?	1	2	3	4	5	6	7
61	If you had to decide whether or not to buy the songs using this technology at this moment, how likely is it for you to make the purchase?	1	2	3	4	5	6	7
62	In the future, if you had access to similar services on mobile devices, how likely is it for you to buy music?	1	2	3	4	5	6	7

		Don't know at all						Know very well
63	How familiar are you with the **artist** of the **first task** whose song you had to find? ***(Gerald Levert)***	1	2	3	4	5	6	7
64	How familiar are you with the **song** of the **first task**? ***("Awesome")***	1	2	3	4	5	6	7
65	How familiar are you with the **artist** of the **second task** whose song you had to find? ***(Nickelback)***	1	2	3	4	5	6	7
66	How familiar are you with the **song** of the **second task**? ***("Someday")***	1	2	3	4	5	6	7

		Strongly Disagree			Neutral			Strongly Agree
67	The instruction I received during the training session was sufficient for the tasks.	1	2	3	4	5	6	7
68	The trainer was friendly.	1	2	3	4	5	6	7
69	The trainer was persuasive.	1	2	3	4	5	6	7
70	The trainer was trustworthy.	1	2	3	4	5	6	7
71	The trainer was knowledgeable.	1	2	3	4	5	6	7
72	In general, the trainer did a good job.	1	2	3	4	5	6	7

73. Gender: (1) Male _____ (2) Female_____

74. Age: ________

75. Major: ______________________

76. What is your year in college?

(1) Freshman _____ (2) Sophomore _____ (3) Junior _____ (4) Senior _____

(5) Other (*please specify*) _________________

77. Please indicate the amount of time you spend on ***an average per day*** using the Internet:

____________ hours, ___________ minutes a day.

78. Are you using, or did you ever use, any peer-to-peer (P2P) file sharing application? (for example, Napster, Kazaa, Morpheus, iMesh, Soribada etc...)

(1)Yes____ (2)No____

If yes, how long have you used a P2P program? ______years, _______months

79. Do you have, or did you ever have, a cell phone? (1)Yes____ (2)No____

If yes, for how long have you used a cell phone? ______years, _______months

80. Do you have, or ever had, a PDA? (1)Yes_____ (2)No_____

If yes, for how long have you used a PDA? ______years, _______months

81. Do you have, or ever had, a portable MP3 player? (1)Yes_____ (2)No_____

If yes, for how long have you used an MP3 player? ______years, ______months

		Strongly Disagree			Neutral			Strongly Agree
82	How do you rate your skill in manipulating electronic devices?	1	2	3	4	5	6	7
83	How experienced are you in using the Internet?	1	2	3	4	5	6	7
84	How do you rate your computing ability?	1	2	3	4	5	6	7
85	How do you rate your interests in new technologies?	1	2	3	4	5	6	7
86	How skilled are you in using a PDA?	1	2	3	4	5	6	7

End of Survey 2.

Please return this form to the experiment administrator.

Thank you for participating!

APPENDIX 2: TRAINER'S SCRIPT

Hello, and welcome to the PDA study.

I'm ________, I will show you how to use the PDA and which Web sites you will browse during the experiment.

First, I'd like you to read and sign this consent form. *(Give the subject a consent form to sign)* It basically tells you that the experiment is completely safe, that your participation will be anonymous and your answers will not affect your grade in class. So everything that comes out from this study will be kept confidential.

This experiment is about using a PDA to download MP3 files from certain commercial Web sites. Don't worry! We are not going to ask you to do anything weird.

To turn on the PDA, you simply need to operate this power button. *(Show the subject how to turn on)*

The stylus is located on the side of the device; just pull it down and take it out. *(Show the subject how to pick up the stylus)*

To choose a program, just tap on the icon on the screen, like this. *(Show how to tap by using a stylus)*
If you want to go back to the menu page, just tap on the "Home" icon on the lower left corner.

For this experiment, you will need to use a browser, ***NetFront 3.0***. Tap on it, and here's a Web page that has been already downloaded on this PDA.
To go to another site, just tap on the upper left corner and choose "Enter Address."

Tap on the "Past Input" option, and choose among the Web sites that have been pre-indicated.
For the purpose of this study, we want you to remain on these two Web sites that we provide. *(Show the subjects both "MusicWorld.Com" and "MP3Topia.Com")*

To download a song from MP3Kingdom.Com:

(1) choose the **genre** of the song you wish to search,
(2) tap on **first letter** of the artist's name,
(3) choose the **artist** from the list,
(4) choose a specific **album**,
(5) and finally, select a **song** in that album.

So, for example, to download the song "Hotel Paper" in the "Hotel Paper" album by "Michelle Branch," go under "Rock," choose "M," choose "Michelle Branch", tap on "Hotel Paper" album, and select "Hotel Paper." Here's the last page that shows the song's information: running time, album, artist, genre etc... tap on the "Download" button, and just wait until the file is stored in the PDA.

The other site provides a different interface.
To download a song from MP3Topia.Com:

(1) **begin typing the first letter** of the artist's name,
(2) **select** a name in the list below,
(3) then **begin typing the song title,**
(4) and again, **select** a song from the list.

So, for instance, to download "Island In The Sun" by "Weeper," start typing, like this *(show how to type by using the virtual keyboard, Graffiti, or the keypad)*, and whenever you want to select, just tap on the name.
Then, type again the song title, "Island...." and see? Select the song, and the last page looks similar to that from MP3Topia.Com. Tap on "Download" to get the song.

You can listen to these songs by using "Audio Player" program.
Go to the menu, choose "Audio Player" icon, and tap on the play button.
(Show them how to play the songs)

Positive Influence
Isn't this cool? Of course, you might be able to download songs for free by using Kazaa or Morpheus, but that is now considered illegal, right? And you don't actually need to synchronize with your computer to put your music on your PDA. I wonder if they are planning to commercialize this type of MP3 service, because if they do, and if I have the device, I'll definitely use it. I heard there exist similar services abroad, like in Japan, Australia, and Europe. They can actually download songs on cell phones and use them as MP3 players! You may know that using P2P file sharing programs can actually penalize the individual users since it's now legally punishable by law.

Negative Influence
I'm doing the training sessions because I was asked to, but personally, I don't think this will work commercially. You can buy MP3 players for a fraction of the price of a PDA, and you can download songs for free through any P2P file sharing program, such as Kazaa or Morpheus. I heard that there exist such services in overseas, like in Japan and Europe, but it seems that they are not quite popular. Downloading is fast here because we're using a wireless LAN, but if we were using a cellular technology, the process will take so much more time. I guess this will end up being useless.

APPENDIX 3: HANDOUTS FOR TASK DESCRIPTION

First Set of Tasks

1st Subtask: Find/Download 5 songs by *Counting Crows*, in the album *"This Desert Life"* (music genre: Rock)

2nd Subtask: Find/Download 5 songs by *Urban Knights*, in the album *"Urban Knights V"* (music genre: Jazz)

> Please see the experiment administrator right after you have completed each subtask

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Second Set of Tasks

1st Subtask: Find/Download the song *"Awesome"* by *Gerald Levert* (music genre: R&B)

2nd Subtask: Find/Download the song *"Someday"* by *Nickelback* (music genre: Rock)

> Please see the experiment administrator right after you have completed each subtask

APPENDIX 4: EXPERIMENT PROTOCOL AND DEBRIEFING STATEMENT

1. Welcome the participant, tell them to read and sign the consent form

2. Introduction to the tasks
- **The purpose of this study is to record your evaluation of using commercial Web sites on PDAs. You will be asked to perform a few tasks that involve searching, finding and downloading MP3 files on the PDA. There will be a total of four tasks, and you will eventually complete two questionnaires. Each of them will take approximately 5-10 minutes. Once you are done with a task, you will be able to freely use the PDA.**

- **The tasks are written on folded papers. Please, unfold the paper only when you are told to do so.**

3. Instructions on using PDA
- **This is how you use a PDA.** *(Provide instruction about activating, tapping and writing)*

- **The PDA is connected online wirelessly. You will be able to browse through any Web site with the device. However, I'd like you to remain on the Web sites that are provided for the tasks.**

- **This is how you use a Web browser.** *(Provide instruction about Web browser use)*

- **Let me show you how you can find a song on the Web site. To download a song from a Web site you simply need to tap on the "download" button...**
  (This is when you express your positive/negative opinion)

4. Ask: **Do you have any questions?**

5. Give the subject the task descriptions. Tell them not to read until they are told to.

6. Begin 1st task
- **Unfold the first paper and perform the task as it is written on it. Tell me when it's over.**

7. Begin 2nd task
- **Now perform the second task. Tell when you are done.**

8. *Hand out first survey*

9. Begin 3rd task
- **Unfold the paper and perform the third task. Notify me when you are through.**

10. Begin 4th task
- **Begin the fourth task. Let me know when you have finished.**

11. *Hand out second survey*

12. When surveys are completed, debrief subjects
- **The true purpose of the study is to examine how social influence and interface design affects your perception and intention in using mobile devices for purchasing digital goods. The system is not real; it was made up by the researcher for the purpose of the study.**

- **Please do not inform any of your classmates of the purpose of the study because other students will also be participating throughout the week.**

As mentioned in the consent form, if you want to know about the result or have any questions about the study you can contact the researcher. Thank you again for participating in the study

APPENDIX 5: CONSENT FORM

Experimental Mobile Commerce Study

To be conducted by
Zoo-Hyun Chae
Department of Telecommunication and Department of Communication
Michigan State University, East Lansing, Michigan

Please ask the study investigator to explain any words or information that you do not clearly understand.

INTRODUCTION

As a student of Communication Arts and Sciences, you are being invited to participate in a study that investigates the motivational factors for using mobile commerce. Researchers at Michigan State University will conduct this research.

PURPOSE

The purpose of this study is to determine the factors that influence perceptions, intentions and performance on the wireless Internet accessed via mobile devices. You will evaluate a mobile system that provides online music files.

PROCEDURE

This survey is anonymous and your name will not be associated with your answers. You will be provided with a personal digital assistant (PDA) and given a short instruction on how to use it. Afterward, you will be asked sit anywhere in the room and perform four tasks by browsing the wireless Internet through the PDA. Your tasks involve finding a number of music titles and downloading them on your device. After each set of two tasks, you will be given a short survey in order to record your perceptions and purchase intention. We estimate that your total participation for this project will require about twenty minutes. Your completion of the questionnaires is completely voluntary and will have no effect on your evaluation in any class.

RISKS

Although it is highly unlikely, there is a chance that you might feel uncomfortable with the mobile device and/or questionnaire. If for any reason you find a survey question inappropriate, you have the right to decline answering that question, or just stop participating. The study can be postponed and/or terminated in order to make the experience a positive one.

BENEFITS

We cannot and do not guarantee you will directly benefit if you take part in this study. Through your comments we can obtain valuable information about the factors that influence the use of mobile devices for electronic commerce. Your participation in this study is completely optional, and you may earn extra credit in your class by doing an alternate assignment.

PAYMENT OF SUBJECTS

As a participant in this research study you will receive classroom extra credit. If you choose not to participate, then you may do an alternate assignment for extra credit.

ALTERNATIVES

The alternative to participating in this research study is to decline. Participation is purely voluntary, and for research purposes only. Those who decline participation in any aspect of this study will not be penalized for any reason.

CONFIDENTIALITY/PRIVACY

The investigators will keep confidential all research related to records and information in this study. Throughout the study, all information from the survey will be kept confidential. Results of the study will only be published in aggregate. The raw data will only be accessible to the researcher, Zoo Chae. All data will be recorded on the paper survey forms, which will be kept in a secure location, and then be entered into a computer for storage. The computer, protected by password authentication, is only accessible to the researcher. Your privacy will be protected to the maximum extent allowable by law.

QUESTIONS

If you have any questions after reading this form, please contact Zoo-Hyun Chae at the following address: 442 Communication Arts Building, Michigan State University, East Lansing, Michigan 48824-1212, telephone: (517) 432-9855, email: chaezoo@msu.edu.

Questions concerning your rights as a participant in a research study may be directed to: Dr. Peter Vasilenko at the University Committee on Research Involving Human Subjects, Michigan State University, 202 Olds Hall, East Lansing, Michigan 48824-2180, or call at (517) 355-2180.

CONSENT

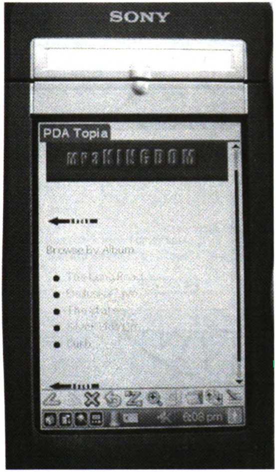
If you have no additional questions at this time, please sign below to indicate your voluntary participation in this study. A copy of this form will be provided for your records.

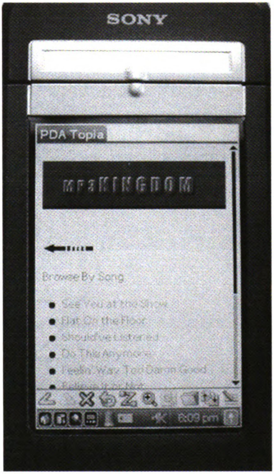
Signature ____ Date ________________

Please print your name ____

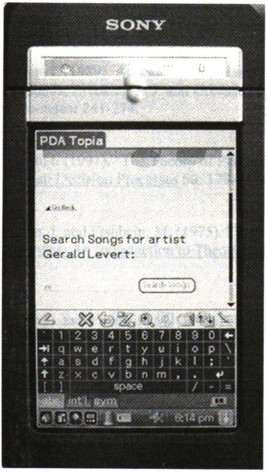
APPENDIX 6: PICTURE SAMPLES OF THE NAVIGATIONAL SYSTEMS

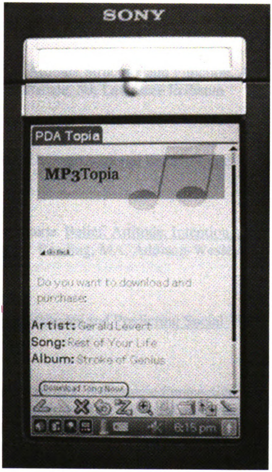
MP3Kingdom: Horizontal-Depth





MP3Topia: Interactive





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