SENSORY ENABLING TECHNOLOGY ACCEPTANCE MODEL (SE-TAM):
THE USAGE OF SENSORY ENABLING TECHNOLOGIES
FOR ONLINE APPAREL SHOPPING

Except where reference is made to the work of others, the work described in this dissertation is my own or was done in collaboration with my advisory committee. This dissertation does not include proprietary or classified information.

____
Jiyeon Kim

Certificate of Approval:

____
Michael Solomon
Professor
Consumer Affairs

____
Sandra Forsythe
Wrangler Professor
Consumer Affairs

____
David Shannon
Professor
Foundations of Educations

____
Yehia El-Mogahzy
Professor
Textile Engineering

____
Stephen L. McFarland
Acting Dean
Graduate School

SENSORY ENABLING TECHNOLOGY ACCEPTANCE MODEL (SE-TAM):

THE USAGE OF SENSORY ENABLING TECHNOLOGIES

FOR ONLINE APPAREL SHOPPING

Jiyeon Kim

A Dissertation

Submitted to

the Graduate Faculty of

Auburn University

in Partial Fulfillment of the

Requirements for the

Degree of

Doctor of Philosophy

Auburn, Alabama
August 7, 2006

SENSORY ENABLING TECHNOLOGY ACCEPTANCE MODEL (SE-TAM):

THE USAGE OF SENSORY ENABLING TECHNOLOGIES

FOR ONLINE APPAREL SHOPPING

Jiyeon Kim

____
Signature of Author

____
Date of Graduation

SENSORY ENABLING TECHNOLOGY ACCEPTANCE MODEL (SE-TAM):

THE USAGE OF SENSORY ENABLING TECHNOLOGIES

FOR ONLINE APPAREL SHOPPING

Jiyeon Kim

Doctor of Philosophy, August 7, 2006
(M.S., University of Georgia, 2003)
(B.S., American InterContinental University, 2000)
(B.S., Catholic University of Korea, 1991)

116 Typed Pages

Directed by Sandra Forsythe

This study investigates online shoppers' adoption of visual sensory enabling technologies showing that these sensory experience enablers provide a dual role in enhancing online apparel shopping by (a) reducing perceived product risk and (b) increasing the entertainment value of the online shopping process. We proposed a sensory enabling technology acceptance model (SE-TAM) to examine this dual role of sensory experience enablers in the online apparel shopping process and tested the model

for three types of sensory enabling technologies (2D larger view and alternate views, 3D rotation views, and Virtual Try-on) widely applied in online apparel retail sites.

The researchers conducted a focus group interview and a pilot study with a college student sample and a main study with a national sample. The results from both pilot study and the main study supported the links between beliefs, attitudes and behavior in adoption of sensory enabling technology, thereby providing empirical validation of the proposed SE-TAM model. Impacts of technology anxiety and innovativeness on actual use of sensory enabling technologies appeared to be different by technology. Each of the sensory enabling technologies examined differed with respect to the functional and hedonic roles served with each making a unique contribution to online apparel shopping – either by reducing product risk perceptions or increasing perceived entertainment value.

Style manual or journal used: Publication Manual of the American Psychological Association (5th edition)

Computer software used: Microsoft Word, Microsoft FrontPage, SPSS 12.0 for Windows, and Amos 5.0

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1
INTRODUCTION

1.1 Need for sensory input in online apparel shopping

Although the Internet has become a common media for online shopping, many consumers still hesitate to make online purchases. Reports suggests that 78% of online shoppers abandon their shopping carts, with 55% abandoning carts before they enter the checkout process (Goldwyn, 2003). These findings suggest that many online shoppers have an initial intention to purchase online but are not sure about their decision toward the end of the purchase process. Purchase decisions are accompanied by some degree of uncertainty about the consequences of the purchase, particularly for apparel products in an online environment where there is limited sensory input for detailed examination and evaluation of the product. Because apparel shoppers often prefer shopping in traditional stores for this reason, online retailers are turning to sensory experience enabling technologies to enhance consumers' online shopping experiences.

Sensory enablers can deliver product information that is similar to the information obtained from direct product examination, reducing product risk. In addition, interactivity and customer involvement created by sensory enablers can enhance the entertainment value of the online shopping experience. With sensory enabling technologies, a customer can examine clothing by using zoom in, alternative views, and 3D interactive view features to see the details of the clothing and accessories and even the texture of the fabric for better examination. Consumers can also change the color and jump to a different style, or create a virtual model to try on various clothing on items. Internet shoppers can now see clothing on virtual models in full 360-degree rotation view with a close-up option for viewing details. This type of interaction between the user and the technology may provide fun experience, enhancing the entertainment value of the online shopping.

1.2 Sensory enabling technologies

Sensory enabling technologies are defined as technologies providing sensory input in the online shopping environment as a proxy for sensory experiences encountered in direct product examination. Major categories of sensory enabling technologies are product visualization technologies (visual support) and haptic interfaces (tactile support). Sensory enabling technologies include audio and/or video inputs that allow users to inspect products indirectly by providing a product image that shoppers can manipulate. Some sensory enabling technologies, such as haptic interfaces, require certain devices (e.g., pen, glove, or mouse-type interface). Haptic interfaces allow users to feel the textures of computer-generated objects in virtual space created with virtual reality modeling language (VRML) that can send haptic information to the device. Product visualization technologies allow consumers to zoom in close on product features, rotate and view the product from several angles, and view the product in a variety of colors and on a model. Both of these technologies have the potential to reduce product risks and enhance customers' shopping experiences.

Since the purpose of this study is to investigate consumers' adoption of sensory enabling technologies in online shopping for apparel, only sensory enabling technologies that are widely applied in apparel online shopping sites and used by consumers are under investigation in the current study. Despite the emerging advances in development of haptic devices, this type of sensory enabling technology was excluded because they are not generally available to consumers for apparel online shopping purposes. Therefore, only product visualization technologies such as larger view (super close-up; zoom in/out; enlargement), alternate view (views from 2-3 angles), 3D interactive view (views from every angle as a consumer drag a mouse), and virtual try-on (virtual model) are under investigation in the current study.

1.2.1 Role of sensory enabling technologies in online apparel shopping

Many online retailers are beginning to use enhanced sensory experience enabling technologies, especially in the fashion industry, in an attempt to improve sales and enhance online shopping experiences. These technologies can be used to reduce product risks and increase shopping enjoyment, and thereby building positive attitudes toward the sites effectively using sensory experience technologies.

The basis of perceived risk is concern that purchases will lead to consequences that cannot be (or different from) anticipated and may be unpleasant (Bauer, 1960). Therefore, understanding the risks associated with purchases and the risk reduction strategies to avoid dissonance between this anticipation and consequences have been important for retailers. Shopping through the Internet is perceived to have a higher level of risk than traditional shopping environments, due to the lack of opportunity to physically examine the product purchases. Product risk associated with online purchase comes from the inability to physically examine the product and the lack of personal contact (Goldsmith & Goldsmith, 2002; Phau & Poon, 2000; Poon, 1999). Purchasing apparel online is particularly risky because many of the characteristics of apparel that are important in consumer decision making (e.g., fit, hand, quality, color) are difficult to present on screen and standard descriptors of a product (in web sites) are often insufficient for product evaluation (Grewal, Iyer, & Levy, 2004; Kartsounis, Magnenat-Thalmann, & Rodrian, 2001). Therefore, online apparel retailers must provide for satisfactory proxy evaluation opportunities through various sensory experience enabling technologies to enhance online purchases by reducing product risks and increasing shopping enjoyment.

In addition to the impact of sensory experience technology on risk perceptions, sensory experience enablers also have the ability to enhance online shopping enjoyment. Hedonic motivations have been shown to exert powerful influences on shopping behavior in both traditional and online shopping environments (Menon & Kahn, 2002). Hirschman and Holbrook (1982) described consumers' hedonic motivations as seeking fun, fantasy, arousal, sensory stimulation, and enjoyment. The entertainment value of shopping has been defined as the "appreciation of an experience for its own sake, apart from any other consequence that may result (Holbrook, 1994, p.40). In traditional shopping channels, fulfilling hedonic shopping motives -- such as experiencing fun, amusement, fantasy, and sensory stimulation, results in increased time spent shopping and increased purchases (Forsythe & Bailey, 1996). Online shoppers may use the Internet to find useful information and/or to browse for enjoyment (Schlosser, 2003). Childers, Carr, Peck, and

Carson (2001) have confirmed that hedonic motives for online shopping are one of the important predictors of attitudes toward online shopping. In fact, the Internet has gained importance as an entertaining medium for shopping as consumers are becoming increasingly familiar with the multimedia features of the Internet (Orwall, 2001). Previous studies have verified that if users have more playful experience with technologies (e.g., sensory enabling technologies), they will be more willing to use them (Igbaria, Schiffman, & Wieckowshi, 1994; Teo, Lim, & Lai,1999). Therefore, it can be expected that enhanced shopping entertainment provided by sensory enabling technologies can fulfill the hedonic shopping motives of shoppers and thereby influence their online purchase behavior.

Using advanced technologies (e.g., sensory enabling technologies) featuring interactive multimedia to enhance online shopping is a phenomenon that is just beginning to be exploited. These technologies can offer many benefits to online retailers, including increased time spent on a site and higher surfer-to-buyer conversion rates. The success of online apparel retailing may depend, to a large extent, upon the successful use of sensory enablers to reduce perceived product risk that may deter online apparel purchases and to provide a more entertaining shopping experience.

Many online shoppers use the Internet to search for product information but do not actually purchase online because of uncertainty regarding the product shown online. Other shoppers may not be motivated to purchase online because they find the online shopping process to lack emotional appeal and entertainment value. Effective use of sensory enablers may reduce customers' uncertainty about the product presented online by providing better product information through proxy sensory experiences. In addition, sensory enablers can increase entertainment value in online shopping environment through more compelling online virtual experiences. However, these sensory enabling technologies will not be effective if shoppers on the site do not use them. Therefore, it is necessary to fully understand the adoption process for sensory enablers, the factors that impact adoption of sensory enablers, and the impact of sensory enabler adoption on online apparel purchase behavior.

Given that many online shoppers are still reluctant to actually purchase online because of uncertainties regarding the product and that enjoyment is an important motivator for some online shoppers, this paper posit that sensory experience enablers provide a dual role in enhancing online apparel shopping by (a) reducing perceived product risk and (b) increasing the entertainment value of the online shopping process. We also propose a model to examine this dual role of sensory experience enablers (hereafter called sensory enablers) in the apparel shopping process. Sensory enabling technologies may provide the proxy product experiences required to better evaluate a product, thereby reducing perceptions of product risk. For example, close up pictures or super zoom in photos show product detail and alternative views allow shoppers to see a product from various angles for more accurate visual examination. Some sensory enabling technologies, such as virtual model/try-on and interactive three dimensional (3D) product displays, may enhance the entertainment derived from online shopping in addition to reducing product risk**.** Virtual model software called My Virtual Model™ lets shoppers create their own model by inputting their body sizes so that shoppers can try clothing by proxy to see how the items might look on them. Interactive 3D presentations let shoppers see a product from every angle, adding to the entertainment value of shopping experiences through enhanced shopper interactivity with the product. For instance, in Eddie Bauer's online Daypack backpack collection, featured by Viewpoint™'s 3D technology, customers can interact with the bags online in a number of ways, such as virtually turning them over, zooming in and out, and even detaching their parts by clicking and dragging a mouse on contact with a product (Mahoney, 2001).

1.3 Rationale and purpose

Given the potential of advanced sensory experience technologies to impact online shopping, it is critical to understand the impact of sensory enablers as a product risk reliever for online apparel shopping and as a tool to increase the entertainment value of online apparel shopping. Considerable research has been conducted to examine online shopping, and a few studies have investigated the adoption of new Internet technologies. Nevertheless, despite the growing importance of sensory enablers in the online retailing environment, there is little academic literature on the role of sensory enablers in online shopping.

The purpose of this study is to develop and test a conceptual framework that explains the adoption process of sensory enabling technology and the usage of sensory enablers for online apparel shopping by incorporating well-known theories explaining consumer behavior and information technology acceptance. To do this, we develop a conceptual model, propose testable hypotheses about sensory enablers' adoption process, and test the hypotheses using data from national sample of Internet users.

CHAPTER 2

REVIEW OF LITERATURE

This chapter includes the literature review of the conceptual framework for the current study and the proposed model and hypotheses to explain the adoption process of sensory enabling technologies and its impact on online apparel shopping. The conceptual framework developed in this paper is based on the consumer decision-making process, diffusion of innovation theory, theory of reasoned action, theory of planned behavior, and the technology acceptance model. Several progressive models explaining the consumer's decision process and an adoption of technology are presented and discussed. Finally, the proposed sensory enabler acceptance model is introduced to explain the usage of sensory enablers for online apparel shopping.

2.1 Literature review

Based on the technology acceptance model and diffusion of innovations theory (Alba, Lynch, Weitz, Janiszewski, Lutz, Sawyer, & Wood, 1997, Jahnson, Lennon, Jasper, Damhorst, & Lakner, 2003; Van den Poel & Leunis, 1999; Teo & Teong, 2003), people adopt an innovative technology if the innovation is perceived to be effective to achieve the task (Davis, 1987; Rogers, 1995). We examine the antecedents to adoption of sensory enabling technology in both functional (to reduce product risks by enhancing product trialability and observability) and hedonic aspects (to provide entertaining experiences during the shopping process) as well as two important external variables – innovativeness and technology anxiety – that are expected to impact on the adoption of sensory enablers.

2.1.1 Consumer decision-making process (EBM)

The EBM model (Engel, Blackwell, & Miniard, 1995) provides insight into the nature of consumer buying in traditional retail environments and an initial formula for examining the online buying process (O'Brien, 1987). It comprehensively addresses the consumer decision-making process (Figure 1a).

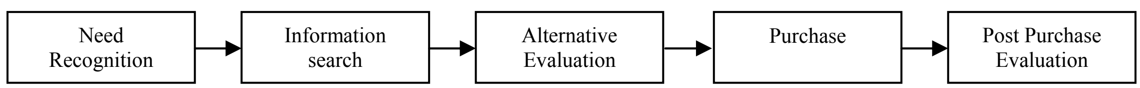


Figure 1a. Consumer decision-making process model (Engel, Blackwell, & Miniard, 1995)

Like the traditional consumer decision-making process, the online consumer decision-making process begins with recognition of a need or desire. In this case, however, information search and alternative evaluation can be completed simultaneously on the web in a short period of time (Figure 1b). If concerns regarding the intended online purchase are great, a customer's initial online purchase intention may change. For example, if the perceived risk outweighs the perceived benefits of buying online, the customer will likely to use an alternative shopping channel (e.g., brick-and–mortar store) to make a purchase. However, if the risk is reduced by various risk relievers, the customer will more likely make a purchase online as illustrated in Figure 1b.

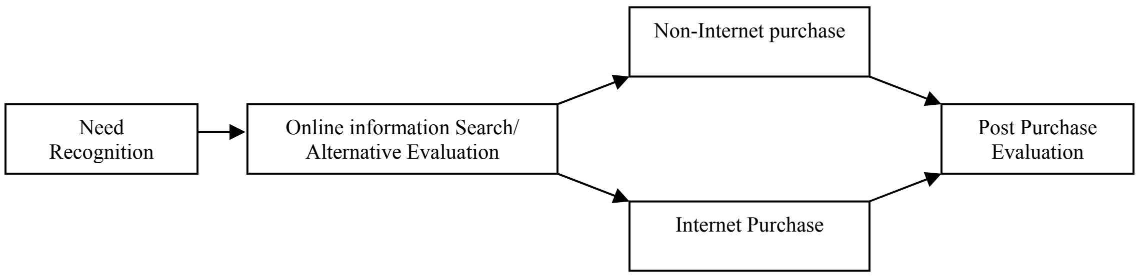


Figure. 1b. Online consumer decision-making process (developed by researchers)

2.1.2 Diffusion of Innovation theory

Diffusion of Innovation theory explains the process that communicates an innovation to members within a social system over a period of time and how consumers either adopt or reject the innovation (Rogers, 1983). Within a social system, an innovation is introduced, communicated, evaluated, and consequently, either adopted or rejected. According to Rogers (1995), most individuals try out a new technology on partial bases first, then, if they perceive advantages in using it, they will adopt the innovation.

In this case, sensory enabling technology is thought as the innovation. First, a consumer is exposed to the innovative sensory enabling technology and becomes aware of its function. By trying the new sensory enabling technology, the consumer makes a decision regarding whether to adopt or reject the innovation. This decision may depend on the perceived relative advantage of the sensory enabler in reducing product risks and/or increasing entertainment value of the online shopping process. However, user commitment to continue to use these technologies is still subject to change based on satisfaction with the technologies.

Within the adoption literature, perceptions of innovation characteristics (e.g., relative advantage and complexity) (Rogers, 1995; Venkatraman, 1991) and individual differences (innovativeness and technology anxiety) (Manning, Bearden, & Madden, 1995; Robinson, Marshall, & Stamps, 2004; Meuter, Ostrom, Bitner, & Roundtree, 2003; Meuter, Bitner, Ostrom, & Brown, 2005) have been shown to predict adoption behaviors. Therefore, perceptions of innovation characteristics and individual differences regarding the innovation are important antecedents to the adoption process of sensory enablers.

2.1.3 Theory of Reasoned Action (TRA): beliefs, attitude, intentions, and behaviors

The theory of Reasoned Action (TRA) proposed by Fishbein and Ajzen (1975) is a best-known and widely supported attitude-behavioral intention theory. According to TRA, a person's performance of a specified behavior is predicted by his or her behavioral intention to perform the behavior, and behavioral intention is jointly determined by the person's attitude, influenced by beliefs, and subjective norm concerning the behavior (Ajzen & Fishbein, 1980). However, it has been suggested in the literature that behavioral intentions be formed with minimal influence of subjective norms (Bagozzi, 1981; Dabholkar, 1994b; Warshaw, 1980). Particularly in the self-service technology (e.g., SET) context, where subjective norms are not expected to be as critical as they would be in the case of conspicuous products or important social issues, beliefs and attitude are expected to have more important role to predict behavioral intentions of using than subjective norms.

From TRA perspective, beliefs, the linkage between attitudes, intensions, and behaviors is important. A consumer may believe that using the SETs is beneficial and thereby may have a favorable attitude toward using SETs. However, external factors, such as different levels of innovativeness and technology anxiety, may influence an individual's adoption of SETs as well.

2.1.4 Theory of Planned Behavior (TPB): behavioral control

The theory of planned behavior extended the theory of reasoned action by adding perceived behavioral control as a factor that can influence an intentions and behaviors link (Ajzen, 1991). Perceived behavioral control is defined as "the perceived ease or difficulty of performing the behavior of interest" (Azjen, 1991, p.183). This construct is especially relevant for technology usage and adoption. For example, Davis (1989) found ease of use to be an important factor in information technology acceptance. Similarly, Dabholkar (1996) found ease of use and perceived control to be important determinants of self-service technology.

In the context of SET usage, perceived behavioral control refers to how easy or difficult it will be to use SETs. It is related to the consumer's confidence in his/her ability to perform the behavior (using SETs) (Hoffman and Novak, 1996). For example, if two consumers have equally attitude toward shopping online, the consumer who has more confidence in his/her ability is more likely to actually shop online using SET. Hoffman and Novak (1996) suggest that perceived behavioral control is important in determining consumer usage of hypermedia computer-mediated environments. In fact, they state that such media, unlike traditional media, can serve as the basis for consumer control due to the interactive environment. Dabholkar (1996) also found control to be an important determinant for using technology-based self-service. Consumers are more likely to use technology-based self-service if it offers them a sense of control. Interactivity of SET will increase consumer involvement and control, and thereby encourage use of SET.

2.1.5 Technology Acceptance Model (TAM)

The technology acceptance model (TAM) has been widely used and supported in information system literature as a tool for investigating and predicting user information technology (e.g., new software package, Internet, etc.) acceptance (e.g., Taylor & Todd, 1995; Chau, 1996; Pavlou, 2003; Shin, 2004; Money & Turner, 2004). TAM is based on TRA to explain information system usage and acceptance behaviors with two key beliefs that specifically account for information system usage -- ease-of-use and usefulness (Davis, 1989). Perceived usefulness is defined as the degree to which a person believes that using a particular system would enhance his or her task-related performance (Davis, 1989). Ease-of-use is defined as "the degree to which a person believes that using a particular system would be free of effort." (Davis, 1989, p. 320). Both perceived usefulness and perceived ease of use predict attitude toward using the system, defined as the user's desirability of using the system. Attitude influences the individual's behavioral intention to use the system. Actual use of the system is predicted by behavioral intention.

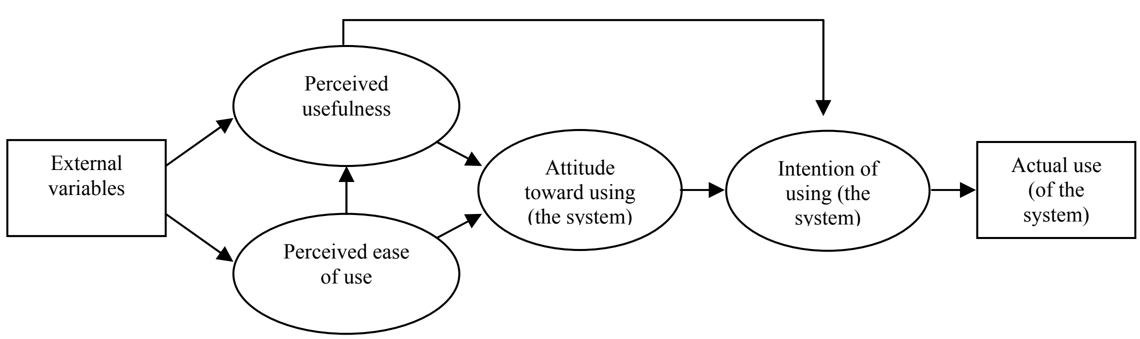


Figure 2a. Technology acceptance model (Davis, 1989)

Later research using TAM found the influence of perceived ease-of-use was mediated by perceived usefulness and enjoyment in usage of computers in the workplace (Davis, Bagozzi, and Warshaw, 1992). The enjoyment construct was then added to the Technology Acceptance Model to explicitly explain the role of intrinsic motivation in adoption of a new technology (Davis et al., 1992; Heijden, 2004). Perceived enjoyment is defined as the extent to which the activity of using the technology is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated (Davis, 1992).

Heijden (2000) developed eTAM, adopting the original Technology Acceptance Model to a website context. In the eTAM framework, the concept of perceived relative usefulness and perceived relative enjoyment are identified as strong influential variables to usage (Figure 2b). Whereas perceived usefulness and perceived enjoyment are strong indicators of website revisit intention, perceived ease-of-use indirectly affects the website revisit intention by influencing perceived relative usefulness and perceived relative enjoyment (Heijden, 2000). The eTAM model of the technology adoption process is consistent with research on retail shopping behavior supporting the presence of both utilitarian and hedonic motivations for online shopping (Babin, Darden, & Griffin, 1994; Chilers et al., 2001). Furthermore, the substitutability of the online environment for direct examination of a product was found to be an important predictor of online shopping attitudes (Childers et al., 2001)

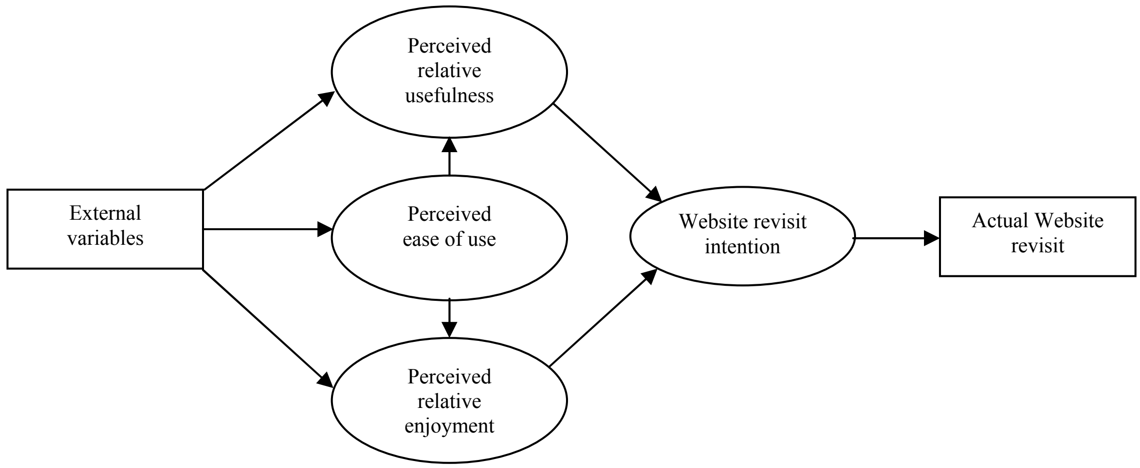


Figure 2b. eTAM: A revised version of TAM to explain website revisits (Heijden, 2000)

Just as motivations to engage in retail shopping include both functional and hedonic dimensions (Childers' et al., 2001), the process of the adoption of sensory enabling technology is expected to be influenced by shoppers' functional and hedonic motivations to shop online. Within the TAM and eTAM frameworks, perceived usefulness of sensory enabling technology reflects functional aspects of shopping, and entertainment value reflects hedonic aspects of shopping. While some consumers may use sensory enablers primarily for functional purposes, such as improved multidimensional examination of a product (perceived usefulness), others use these sensory enabling technologies primarily for hedonic purposes (Childers et al, 2001), such as enhancing shopping enjoyment by creating a virtual model or trying out customized products. As online shoppers find sensory enablers to be effective in reducing product risk and/or increasing enjoyment of the shopping process, they will be more likely to adopt these technologies. Therefore, as the perceived usefulness, ease of use, and entertainment value of the new sensory enabling technology increases, the likelihood of adoption of a sensory enabler will increase (Figure 2c).

The resulting sensory enabling technology acceptance model (Figure 2c) illustrates the impact of perceived usefulness and perceived entertainment value on adoption of sensory enabling technology, in contrast to the Heijden (2000) model that examines website revisit intentions. This model of the adoption process for sensory enablers is supported by eTAM, particularly with respect to entertainment value and usefulness in online context. Later, in our conceptual model, actual use can be viewed as evidence of the customer's decision to adopt sensory enablers. Considering the nature of sensory enablers as interactive multi-media technology that provide proxy sensory experiences, we expect strong relationships between adoption of sensory enablers and perceived usefulness, perceived entertainment value, and perceived ease-of-use.

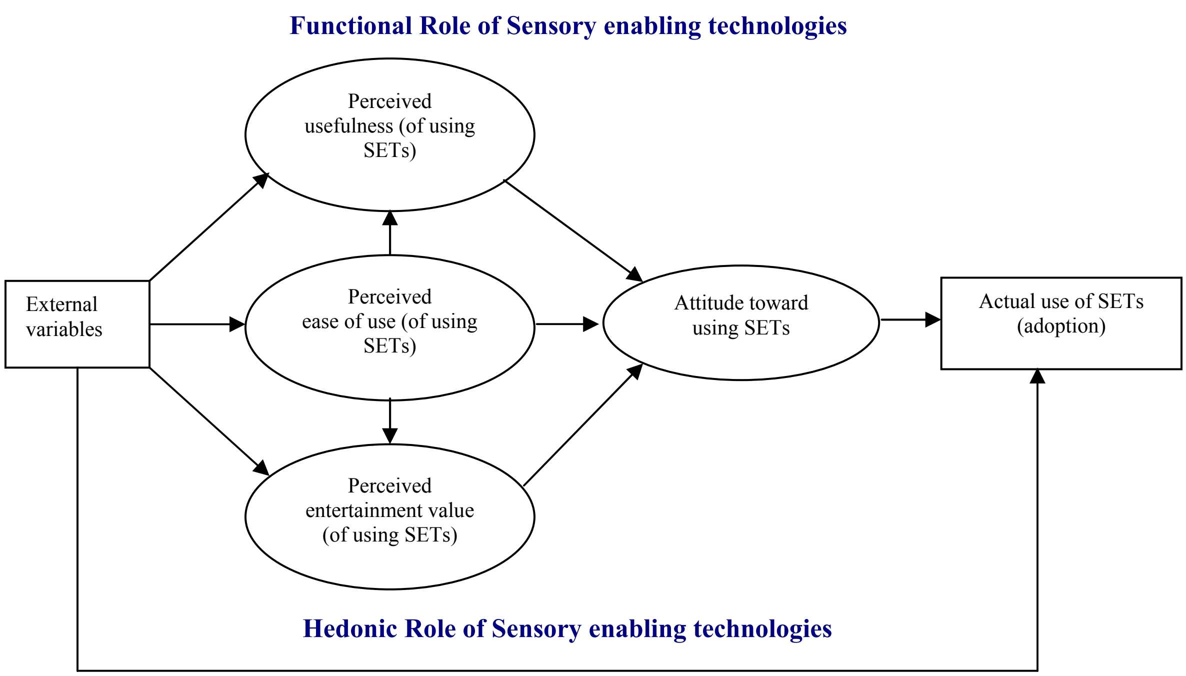


Figure 2c. Sensory enabling technology acceptance model (developed by the researcher)

2.2 Research model and proposed hypotheses

Given the lack of prior research examining the role of sensory enabling technologies in reducing product risk (functional role) or providing fun shopping experiences (hedonic role), a conceptual model was developed to guide examination of the adoption process for sensory enabling technologies and the impact of sensory enabling technology usage on online apparel purchase behavior (Figure 3). The proposed integrated model of sensory enabling technologies adoption in online apparel shopping extends the eTAM model to the online consumer decision-making process and is consistent with research on online shopping behavior supporting the importance of both functional and hedonic motivations for online shopping behavior (Childers et al., 2001).

In this section, the sensory enabling technology acceptance model (SE-TAM) (Figure 3) and resulting research hypotheses are proposed to explain the usage perceptions of sensory enabling technologies (here after called SETs) for online apparel shopping. This model will allow researchers to examine (1) the relationships between perceived usefulness, ease of use, and entertainment value of sensory enabling technologies, (2) the influence of these beliefs (perceived usefulness, ease-of-use, and entertainment value) on attitude toward using SETs, (3) the influence of attitude toward using SETs on actual use of SETs, (4) regardless of the attitude, the moderating influence of innovativeness and technology anxiety on the actual use of SETs, and (5) post use evaluation of SETs for online apparel purchases. Finally, (6) the relationships between the adoption of SETs and consumer's online apparel purchase intention, intention to reuse of SETs as well as revisit intention will be examined.

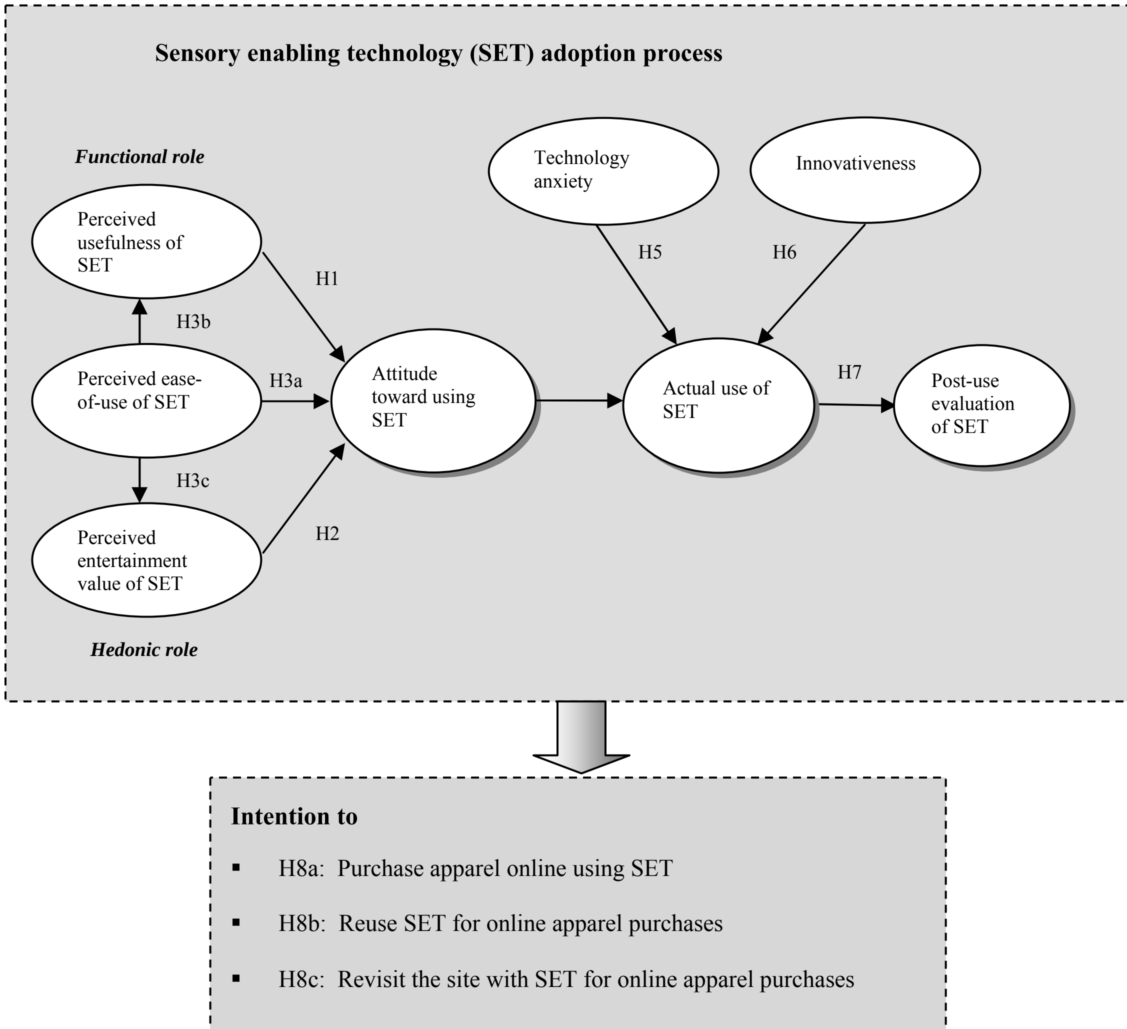


Figure 3. Proposed conceptual model: Sensory Enabling Technology Acceptance Model (SE-TAM): usage of SETs for online apparel shopping

The proposed conceptual model illustrates the sensory enabling technology adoption process in general (a master model for all types of SETs) and the usage intentions of SETs for online apparel shopping. The perceived usefulness of sensory enabling technologies to facilitate product evaluation and reduce product risk will impact the adoption of SETs. Adoption of SETs will also be influenced by perceived entertainment value of using sensory enabling technologies. Innovativeness and technology anxiety are also expected to moderate consumers' actual use of SETs regardless of the formed attitude (weather it's positive or negative).

The two major roles of sensory enabling technologies (functional and hedonic) are identified in the model. First, sensory enabling technologies have functional value (perceived usefulness) because they reduce perceived product risks by providing proxy sensory experiences to improve product evaluations online. Second, sensory enabling technology has hedonic value (perceived entertainment value) as it provides entertainment to shoppers using multimedia sensory enabling technology to enhance their enjoyment of the shopping process. Both functions will, in turn, impact the adoption of sensory enabling technologies and subsequent post use evaluation of SET.

Perceived ease-of-use impacts consumers' attitude toward using SETs and also indirectly impacts the attitude through its impact on perceived usefulness and entertainment. Consumers' positive attitude toward using SETs will result in actual use of SETs and vise versa. At this stage, innovativeness and technology anxiety will have moderating impact on the actual use of SET. That is, for instance, one with a higher level of technology anxiety may be hesitant to use a SET despite his/her positive attitude toward using a SET for online apparel shopping. By contrast, one with a higher level of innovativeness may not perceive a SET as much useful or entertaining, but he/she may still decide to use it to give it a try. Most TAM related research examining users' technology acceptance has ended at the behavior or behavioral intention of using the system/technology. However, the researchers concluded that in order to examine the true adoption of SETs, it is important to consider post-use evaluation of SETs and include this construct in the SET adoption process. The use of sensory enabling technologies in online shopping is likely to lead to more positive post use evaluations of SETs, increasing consumers' intentions to purchase apparel online using SETs, reuse SETs for online apparel shopping, and revisit the site that provide SETs for online apparel shopping.

Based on the proposed conceptual model, research hypotheses are proposed regarding the impact of perceived usefulness, perceived ease-of-use, and perceived entertainment value of SET as well as innovativeness and technology anxiety on a customer's adoption of sensory enabling technologies and post use evaluation. Some SETs may have stronger role in functional and weaker in hedonic, some may be opposite, and others may have both. Also actual use of a certain SET may more be influenced by consumers' innovativeness and technology anxiety. Using the master model of sensory enabling technology acceptance, linear combination of functional and hedonic roles in each SET as well as the impact of the mediating factors (each path) to reach the adoption can be examined.

2.2.1 Hypothesis regarding perceived usefulness of SET

Insufficient information on product attributes and shoppers' inability to accurately evaluate the quality of the product online result in increased product risk. Perceived risk may be reduced either by decreasing the probability of a failure and/or by decreasing the severity of the loss (Van den Poel & Leunis, 1999). Online shoppers can use sensory enabling technologies to reduce the probability of a poor choice through better evaluation of the online product prior to purchase. The use of sensory enabling technologies as a proxy for physical examination may play a major role in reaching a product purchase decision, especially for individuals with a higher need for sensory input and especially when shopping for products (e.g. apparel) that require higher sensory input for evaluation (Citrin, et al., 2003). Particularly for apparel, product risk has been considered as one of the most critical barriers to online purchase because an apparel purchase decision requires an evaluation of fit and appearance on the body. Therefore, sensory enabling technology may be especially useful to provide proxy sensory experiences that can serve as a surrogate for direct product examination when evaluating apparel products online. This leads to the following hypothesis.

H1. Perceived usefulness of SET will have a positive impact on attitude toward using SET for online apparel shopping.

2.2.2 Hypothesis regarding perceived entertainment value of SET

The entertainment provided by shopping has been found to be an important shopping motivation in traditional shopping environments (Bloch, Sherrel, & Ridgway, 1986; Babin et al., 1994) as well as online shopping environment (Hoffman & Novak, 1996; Childers et al., 2001). For example, looking at a product in 360°degree view and trying on clothing on a "Virtual Me" (virtual try-on technology) can provide entertainment to customers' online shopping experiences in addition to facilitating their product evaluation. Isen (1987) found that positive affect (e.g., entertainment) enables subjects to handle greater informational complexity, be more optimistic about the likely outcome of an anticipated experience, and be more willing to experiment. Given that hedonic use of the Internet plays an important role for online shopping (Childers et al., 2001; Menon & Kahn, 2002), it can be expected that the entertainment value provided by sensory enabling technologies will likely encourage online search, revisit, and purchase. Positive shopping experiences, resulting from using sensory enabling technologies, create more positive attitudes toward using sensory enabling technologies. This leads to the following hypothesis.

H2. Perceived entertainment value of SET will have positive impact on attitude toward using SET for online apparel shopping.

2.2.3 Hypotheses regarding perceived ease-of-use of SET

Research has confirmed ease-of-use as an important factor in predicting attitude toward technology-based self-service, such as using Internet (Dabholkar, 1996; Davis et al., 1992, Heijden, 2000). In addition, according to Rogers, complexity, the antithesis of ease-of-use (Agarwal and Prasad, 1997), will reduce an individual's willingness to adopt the system. Previous researchers have found that perceived ease-of-use has a positive influence on the user's attitude towards actually using the Internet to send e-mails (Szajna, 1996; Gefen & Straub, 1997). Liao, Shao, Wang and Chen (1999) found the lower the perceived complexity of using a service provided by Internet Banking is (i.e., ease-of-use), the more positive the attitude of the consumer towards using this service will be. That is, the greater the perceived ease-of-use of a system/technology is, the more positive the attitude will form toward it. Therefore, it can be expected that perceived ease-of-use has a positive affect on consumer attitudes towards using sensory enabling technologies.

H3a. Perceived ease-of-use of SET will have positive impact on attitude toward using SET for online apparel shopping.

Previous TAM research demonstrates strong empirical support for a positive relationship between perceived ease-of-use and perceived usefulness (Davis, 1989; Adams, Nelson, & Todd, 1992; Segars & Grover, 1993). That is, the easier a sensory enabling technology is to use, the more useful the sensory enabling technology is perceived to be. This relationship is confirmed in the website environment as well, as the easier website technology is to use, the more useful the site is perceived to be (Heijden, 2000).

H3b. Perceived ease-of-use of SET will have positive impact on perceived usefulness of SET for online apparel shopping.

Igbaria, Parasuraman and Baroudi (1996) found support for a positive relationship between perceived entertainment value and system usage. By contrast, perceived complexity (the opposite of perceived ease-of-use) was negatively correlated with perceived entertainment value (Igbaria, et al., 1996). These findings lead to the expectation that the easier sensory enabling technologies are to use, the greater the perceived entertainment value of online shopping.

H3c. Perceived ease-of-use of SET will have positive impact on perceived entertainment value of SET for online apparel shopping.

2.2.4 Hypotheses regarding actual use of SET

The innovation literature specifies that an individual's attitude towards using an innovation (e.g., sensory enabling technologies) influences adoption of the innovation

(Rogers, 1995). Therefore, an individual's use of the technology would be a function of his/her attitude towards its use (Moore & Benbasat, 1991). The theory of reasoned action, on which TAM is based, incorporates the construct of attitude -- the more positive the attitude to perform a behavior the more likely an individual is to perform the behavior (Ajzen and Fishbein 1980). Consumers who have favorable attitudes toward online shopping with successful purchase experiences from the Internet are less likely to abort intended transactions (Cho, 2004). In this study, it is expected that consumers who have a positive attitude toward sensory enabling technologies will be more likely to adopt sensory enabling technologies.

H4. Attitude toward using SET will have positive impact on actual use of SET for online apparel shopping.

Like any other technology adoption process, consumers will not use SETs unless they feel comfortable with the technology. Davis et al. (1989) and Venkatesh and Davis (1996) have suggested that self-efficacy is an antecedent of object usability. Others found that computer self-efficacy is a precursor to Internet usage (Rampoldi-Hnilo, 1996, Maitland, 1996). Ajzen (1991) in his theory of planned behavior asserted that behavior and strongly influenced by an individual's confidence in his/her ability to perform a behavior. According to Rogers (1995), people are more likely to adopt an innovation they are comfortable with and that is compatible with other technologies they already use. Thus, consumers may avoid using a new technology if they are not comfortable with using the technology even when they can see the benefits of using it. Technology anxiety is defined as the fear and apprehension people feel when considering use or actually using technology-related tools (Cambre & Cook, 1985; Scott & Rockwell, 1997; Meuter et al. 2003). Research on usage patterns of self-service technologies (SSTs) (e.g., online shopping) indicates that respondents with higher levels of technology anxiety use fewer SSTs and that technology anxiety is a consistent predictor of SST usage (Meuter, Ostrom, Bitner, & Roundtree, 2003; Meuter, Bitner, Ostrom, & Brown, 2005). Consumers' overall anxiety toward using technologies is expected to influence their use of SETs. This leads to the following hypothesis.

H5. Regardless of the attitude toward using SET, technology anxiety of a consumer will have a direct impact on use of SET for online apparel shopping.

Innovativeness has often been viewed as the latent underlying preference for new and difference experiences (Carson & Grossbart, 1985; Hirschman, 1980; Venkatraman & Price, 1990). Innovativeness motivates a search for new experiences that stimulate the mind and/or senses (Pearson, 1970; Hirschman, 1984; Venkatraman & Price, 1990). Thus, innovators are more likely to explore new stimuli and situations because of higher need for stimulation, while less innovative consumers are more comfortable with familiar situations and stimuli and avoid new or unusual situations or stimuli. In a technology context, personal innovativeness is defined as the willingness of an individual to try out new technology (Robinson Jr., et al, 2004).

Researchers have noted that adoption of in-home shopping methods is not only a function of attitudes, needs, and experiences, but also personal characteristics such as innovativeness (Eastlick, 1993; Shim & Drake, 1990). The positive relationship between personal innovativeness and use of technology has been found in the field of sales people's technology usage (Robinson et al., 2004). Researchers noted that innovators possess strong preferences for either or both new cognitive and sensory experiences (Hirschman, 1984; Venkatraman & MacLnnis, 1985). Consumers who possess high levels of innovativeness are more likely to seek multiple sources of information and new experiences that stimulate senses as they form their perceptions about a technology (Agarwal and Prasad, 1998, Flynn and Goldsmith, 1993 and Midgley and Dowling, 1978; Hirschman, 1984). Research shows the innovativeness of a consumer will impact the way he/she perceives risk in a specific situation (Onkvisit & Shaw, 1994). The willingness to take risks accounts for as much as 35% of the difference between innovator and non-innovators, and innovators are less likely to perceive risk than non-innovators (Goldsmith, 1987). Therefore, it is expected that a consumer who is innovative will more likely to try SETs even if with skepticism.

H6. Regardless of the attitude toward using SET, the innovativeness of a consumer will have a direct impact on use of SET for online apparel shopping.

2.2.5 Hypothesis regarding post-SET use evaluation

Post use evaluation is defined as an individual's subjectively derived evaluation of any outcome and/or experience associated with using technology (Westbrook, 1980). Individuals will adopt a specific behavior (e.g., using sensory enabling technology) if they perceive it will lead to positive outcomes (Compeau & Higgins, 1995). Therefore, it can be expected that if a SET performs as expected, providing advantages by helping consumers to evaluate a product more adequately, consumers are likely to evaluate the SET favorably and, as a result, be satisfied by using SET, reuse the SET, and spread positive word-of-mouth about using SET. Schlosser (2003) found that after visiting a web site with interactive virtual product presentation, both browsers and searchers reported more positive attitudes and purchase intentions. Therefore, adoption of sensory enabling technologies is expected to result in positive post use evaluation, future intention to use the SET and willingness to convey positive word of mouth. This leads to the following hypothesis.

H7. Use of SET will result in a positive evaluation of SET for online apparel shopping.

2.2.6 Hypotheses regarding the impact of the adoption of SETs on consumer's intention

The impact of sensory enabling technologies on actual online sales has also been supported in the industry (Mahoney, 2001). For example, sales of Eddie Bauer's Daypack backpack showed a 25% increase when the product was featured online through interactive 3D technology provided by Viewpoint™ (Mahoney, 2001). According to an e-mail test run byGifts.com, the conversion rate among 50,000 consumers who viewed a Mother's Day pendant through a RichFX 3D video presentation was approximately seven times higher than among the 50,000 shoppers who viewed only the 2D version of the pendant (Mahoney, 2001). Hypothesis 10, regarding the impact of SET usage on Internet purchase intention, is not included in the proposed model since the model is to explain adoption process of sensory enabling technologies. However, based on the reports about the positive impact of 3D product visualization on online sales, there is good reason to expect that adoption of sensory enabling technology will impact online apparel purchase intentions. This leads to the final hypothesis.

H8. Adoption of SET will be positively related to (a) consumers' intention to reuse SETs for online apparel shopping purpose (b) consumers' intention revisit the site that provides SETs for online apparel shopping purpose, and (c) consumers' intention to purchase apparel online using SETs.

CHAPTER 3

METHOD

This chapter describes methodology used for this study and explains the procedure. An experimental research method was used to investigate the consumer's adoption process for sensory enablers and their post use evaluations of sensory enablers for online apparel shopping. This chapter describes the experimental research design, instrument development, sample selection and survey administration, and data analysis.

3.1 Latent constructs

Constructs to investigate the adoption process of sensory enablers in online apparel shopping were identified from the literature review. Conceptual definitions of each of the constructs examined in this study and sources for the definitions are in Table 1.

Table 1. Conceptual definitions

Constructs	***Conceptual definitions***	**Source**
Technology anxiety	The fear and apprehension people feel when considering use of or actually using technology-related tools.	Cambre & Cook, 1985; Scott & Rockwell, 1997; Meuter et al. 2003

Innovativeness	The degree to which a person is relatively earlier than other members of his or her social system in adopting an innovation. In a technology context, innovativeness is the willingness of an individual to try new technology.	Rogers, 1983 Robinson Jr., et al, 2004
Perceived usefulness	The degree to which a person believes that using a particular technology would enhance his or her task-related performance.	Davis, 1989
Perceived ease-of-use	The degree to which a person believes that using a particular technology would be free of effort.	Davis, 1989
Perceived entertainment value (perceived enjoyment)	The extent to which the activity of using a technology is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated.	Davis et al. 1992
Attitude	An overall affective evaluation that can range from extremely positive to extremely negative.	Childers et al., 2001
Actual use	Consumers' use of SET when shopping online.	
Post use evaluation	An individual's subjectively derived evaluation of any outcome and/or experience associated with using technology.	Westbrook, 1980

3.2 Research Design

Three major sensory enablers currently available at online shopping sites were selected for this study: (1) super zoom in (close-up view) and alternate views (views from

2-3 angles), (2) 3D interactive display (views from every angle as a consumer drags a mouse), and (3) virtual try-on (virtual model). The online survey questionnaire consisted of 10 sections. The first eight sections of the survey included measures of the 8 constructs in this study: (1) innovativeness, (2) technology anxiety, (3) perceived usefulness of SET, (4) perceived ease-of-use of EST, (5) perceived entertainment value of SET, (6) attitude toward using SET, (7) actual use of SET, and (8) post use evaluation (see appendix A). These constructs were measured using 7-point Likert-type scales ranging from 1 (strongly disagree) to 7 (strongly agree). The last two sections include general questions regarding past online apparel purchases and respondent demographics. Two items were used to measure Internet apparel purchase behaviors (e.g., frequency and dollar amount).

3.2.1 Instrument Development

Multi-item scales to measure the model constructs were developed based on the literature review (see table 1) and the focus group interview. An online survey questionnaire with 46 questions was developed for the pilot test. The eight constructs from the research model and online apparel purchase behavior were measured through the survey administration. Thirty six items were used to measure the eight latent constructs: technology anxiety (TA), innovativeness (INN), perceived usefulness (PU), perceived ease-of-use (PEOU), perceived entertainment value (PE), attitude (ATT), actual use (USE), and post use evaluation (EVA). Operational definitions of the constructs and the scale items to measure each construct are shown in the Table 2.

To measure technology anxiety and innovativeness, items with high reliability were selectively taken from previous research (Meuter et al, 2005; Robinson Jr. et al., 2004). The other six constructs were measured by items adopted from previous research (Childers et al., 2001; Heijden, 2000; Maxham, 2001). Two items to measure Internet apparel purchases were adopted from Kwon and Lee (2003). Amount of money spent for apparel purchase online and frequency of shopping apparel online were measured for this construct (see appendix A).

Table 2. Constructs and scale items

Technology anxiety (The state of mind regarding users' ability and willingness to use technology-related tools)	
1. I feel apprehensive about using technology. 2. Technical terms sound like confusing jargon to me. 3. I have avoided technology because it is unfamiliar to me. 4. I hesitate to use most forms of technology for fear of making mistakes I cannot correct.	Meuter et al. (2005)
Innovativeness (The desire/willingness to use new technology)	
5. If I heard about a new technology, I would look for ways to experiment with it. 6. Among my peers, I am usually the first to try out new technologies. 7. In general, I am hesitant to try out new technologies. 8. I like to experiment with new technologies.	Robinson Jr. et al. (2004)
Perceived Usefulness of SET (How useful SET is perceived to be in examining products online)	
9. SET improves my online shopping productivity. 10. SET enhances my effectiveness when shopping online. 11. SET is helpful in buying what I want online. 12. SET improves my online shopping ability.	Adopted from Childers et al. (2001).

13. SET provides information about a product similar to that from a direct personal examination. 14. SET allows me to judge a product's quality as accurately as an in-person appraisal of the product. 15. SET provides information about a product's materials and workmanship similar to that available from a direct personal examination.	
Perceived Ease-of-use of SET (How easy/complex using SET is perceived to be)	
16. Using SET is clear and understandable. 17. Using SET does not require a lot of mental effort. 18. SET is easy to use.	Adopted from Childers et al. (2001).
Perceived Entertainment value of SET (How enjoyable/fun using SET is perceived to be)	
19. Shopping with SET is fun for its own sake. 20. Shopping with SET makes me feel good. 21. Shopping with SET would be boring. 22. Shopping with SET involves me in the shopping process. 23. Shopping with SET is exciting. 24. Shopping with SET is enjoyable. 25. Shopping with SET is interesting.	Adopted from Childers et al. (2001).
Attitude toward using SET (The degree of positive/negative feelings toward using SET)	
26. Using SET is a good/bad idea. 27. Using SET is superior/inferior. 28. Using SET is pleasant/unpleasant. 29. Using SET is appealing/unappealing.	Adopted from Childers et al. (2001) and Heijden (2000)
Actual use of SET (use in browsing and/or purchasing online)	

30. I use SETs (when available) for purchasing apparel online. 31. I use SETs (when available) for browsing for apparel shopping online.	Developed by the researcher
Post use evaluation (Level of satisfaction from the outcome, future intention to use, willingness to convey positive word of mouth)	
32. Overall, I am satisfied with using SET. 33. In my opinion, SET provides a satisfactory help when I make a purchase decision. 34. I will continue using SET when I shop for apparel online. 35. I would share my good experience about using SET for apparel shopping. 36. I would recommend shopping at a site with good SET.	Adopted form Maxham III (2001)

3.3. Sample selection / Data collection methods

3.3.1. Focus group interview

Focus group interview was administered to the sample in lab setting (1) to examine (and compare) the functional and hedonic roles of each selected SET is perceived to be by consumers when shopping apparel online, (2) to examine consumers' perceptions of ease-of-use for each SET, and (3) to gain insights as to how consumers use the SET in the apparel shopping process and the type of apparel products for which SETs would be most helpful. Eleven students enrolling Consumer Affairs participated in the interview.

First, the researcher provided definitions and examples of the sensory enablers -- 2D views (super zoom in and alternate views), 3D interactive display, and virtual try-on, in a visual presentation prior to the survey. After the presentation, the participants were asked to try all three types of SETs as if they were shopping for clothing. Then, the researcher led a focus group interview regarding their experience with SETs. The researcher asked the same questions regarding each of the three SETs:

1) Describe your experience with SET.
2) Did you find it useful? How? Why? Why not?
3) Did you find it easy to use? Or difficult? How? Why?
4) Did you find it entertaining? How?
5) What's the best part of using SET?
6) What's the worst pat, if any?
7) Would you like to use SET for apparel purchase? Why? Why not?
8) For what type of clothing would you find it more useful?
9) Would you recommend it to others? Why? Why not?

The focus group interview provided qualitative information regarding consumers' perceptions about using SETs. Unlike mass survey asking specific questions, people are encouraged to talk to one another: asking questions, exchanging anecdotes and commenting on each others' experiences and points of view. The focus group is particularly useful for exploring people's knowledge and experiences and can be used to examine not only what people think but how they think and why they think that way. This information alone, however, is not sufficient to achieve the objectives of this study and made it difficult for the generalization since the response may be subjective and the demographics of the subjects were very biased. The focus group interview was particularly useful in providing insights for interpretation of the quantitative data analyses results.

3.3.2 Pilot study

Prior to conducting a national survey, it is important to test concepts and physical designs and procedure of the survey as well as data conversion through pilot test. The pilot test can also be useful in determining the consistency of scale items and the reliability and validity of construct measures.

A convenience sample was used for the pilot test. The sample group for the pilot test was students enrolled in the College of Human Sciences at Auburn University. A separate online survey was developed for each SET (2D views, alternate views, 3D rotation views, and virtual try-on) (see Appendix B). The constructs were measured using 7-point Likert-type scales ranging from 1 (strongly disagree) to 7 (strongly agree). Each survey contained the same items but they referred to the particular SET assigned. The three online surveys (and corresponding stimulus websites) were randomly assigned to students enrolled in Auburn University; one survey per student. Upon clicking the hyperlink provided in the survey, respondents were led to the stimulus site for the assigned SET. After completing the online apparel shopping simulation using the selected SET, respondents completed the survey with respect to their simulated shopping experience with the assigned SET. Upon submitting the survey, the data were stored in a separate file (for each sensory enabler) for data analysis. The pilot test analysis results were used for model verification and elimination of redundant and irrelevant questions, or those not representative of the domain.

3.3.3 National sample survey administration

After eliminating redundant and irrelevant items through pilot test analysis, a final version of an online survey was administered to a national panel of online shoppers randomly selected from a pool of participants included in the database purchased from a survey company. The selected members of the panel received an email containing the online survey link. Upon clicking the link provided in the survey, they were led to one of the three stimulus sites containing one of the three sensory enablers. After the shopping simulation, they were asked to complete the survey with respect to their simulated shopping experience with the assigned sensory enabler.

3.4 Data analysis strategy

Due to the complexity of conducting multiple group comparison, it was important to select the most effective analysis methods to achieve the objectives of the current study. The same statistical analysis methods were used for both the pilot test and the actual test. Data were first analyzed using descriptive statistics, Pearson correlations, and reliability analysis using SPSS 12.0. The reliability and validity of the measures in this particular context with this particular sample was tested.

The validity of the scale items for the measurement models (eight latent variables for each of the three sensory enablers – total of 32 measurement models) was tested using confirmatory factor analysis (CFA). Each latent construct was manifested by multiple indicators. The measurement models included 36 items measuring eight latent constructs: technology anxiety (TA), innovativeness (INN), perceived usefulness (PS), perceived ease-of-use (PEOU), perceived entertainment value (PE), attitude (AT), actual use (USE), and post use evaluation (PUE). EFA and CFA were used to remove complex items and irrelevant items. The validity of the measurement models was assessed by fit indices (CMIN, CFI, GFI, RAMSEA, etc.), goodness-of-fit measures between the data and the proposed measurement models.

The hypothesized structural model was tested using AMOS 4.0. Single and Multiple-group structural equation modeling (SEM) were used for evaluation of the structural modes for three types of sensory enabling technologies (total three structural models). Structural Equation Modeling (SEM) is a powerful statistical analysis method with maximum likelihood estimates of parameters, explaining all factors and variables simultaneously. That is, the estimates of the model parameters are calculated all at once (Winer, Brown, & Michels, 1991). SEM takes into account the modeling of interactions, measurement error, correlated error terms, multiple latent independents each measured by multiple indicators, and one or more latent dependents also each with multiple indicators (Kline, 1998).

First, single-group SEM was conducted for each SET to obtain information regarding variables and paths in the proposed model within a group (SET) using AMOS 5.0 (Arbuckle, 2003). Next, multiple-group SEM was conducted to assess the hypothesized model fit across the groups and to test invariance of all structural paths parameters across the three groups (2D zoom-in and alternate views, 3D rotation views, and Virtual Try-on). To do so, the researcher compared the base model and the model with equality constraints imposed. According to the Byrne and Campbell (1999) and Raju et al. (2002), if the model fit is not significantly worse when parameters are constrained to be equal across the groups, then there is no difference in the model across the groups.

The invariance test for the model can be achieved by comparing Chi-square (χ^2) values and degrees of freedom (*df)* for the base model and the constrained model. In this comparison, the increase in χ^2 values due to constraining parameter estimates to be equal across groups was used as a significance test. Once differences were found among the three groups based on significant differences in Chi-square values ($\Delta\chi^2$), a series of two-group SEM was conducted to determine in which group the differences lie. This analysis allowed the researchers to test the invariance of the hypothesized model across the groups. Recall that the structural model was the adoption process of SET. To test, the H8 (a, b, c) that was not included in the structural model, Regression analysis was conducted.

Each SET was expected to serve functional and hedonic roles in different degrees. That is, each would have a different linear combination of functional and hedonic roles; one might have a more functional role than hedonic role and vise versa. Thus, to see the mean differences in functional and hedonic roles of SETS among the three SETs, the researchers conducted Multivariate Analysis of Variance (MANOVA) first and Discriminant Function Analysis (DFA) as a follow-up analysis using SPSS 12.0. Due to its nature of taking into account a linear combination of dependent variables, MANOVA is more powerful than a series of independent samples pair-wise t-test in detecting possible differences among groups on dependant variables (Meyers, Gamst, & Guarino, 2006). Once the significant differences were found, the follow-up step is to assess whether there are differences among groups on the mean values for particular linear combinations of dependent variables (here, functional and hedonic roles). A popular follow-up approach has been to conduct separate multiple ANOVAs for each variable. However, individual ANOVAs do not take into account the multivariate nature of

MANOVA (linear combination of dependent variables) (Green & Salkind, 2002). Thus, DFA was used as a follow-up analysis to a significant MANOVA. DFA yields uncorrelated linear combinations of dependant variables that maximize differences among groups, showing group membership in one or more functions (functional and/or hedonic roles). These analyses provided insights regarding the most effective types of sensory enabling technologies in terms of reducing product risks (functional role) and/or increasing entertainment value of online apparel shopping (hedonic role).

CHAPTER 4

ANALYSES AND RESULTS

In this chapter, first, a focus group interview results were explained. Next data analyses were conducted with pilot test data and then with the actual test data set from a national sample. This chapter provides step-by-step data analyses along with the results for both pilot test and actual test.

4.1. Focus group interview results

Most interviewees said they perceived 2D zoom-in and alternate views (2D views) to be easy to use and useful but not very entertaining. For example, one interviewee said, "It's useful because I could see the clothing in more detail, such as how is constructed". Another said, "It was somewhat interesting to see the back and inside of the clothing but nothing much entertaining." Another interviewee mentioned, "I'll definitely use is when available because it's helpful to see what the clothing looks like in detail when purchasing apparel online," indicating perceived usefulness and favorable intention to use this SET again. Interviewees stated that 2D views were useful in shopping for basics, clothing with some details, like outerwear, and jackets, but not for buying clothing that requires an exact fit such as jeans or formal dresses. For example, one interviewee said, “I would buy clothing that I have nothing to worry about fitting. For example, clothing that I know the size and fit already.”

Interviewees perceived 3D rotation views to be easy to use and the most helpful for online apparel shopping as they provide the best information regarding the clothing appearance. For instance, one interviewee said, “It was very useful to see how the clothing looks on 360^{o} -- I could see the clothing in detail as well as how it looked from angles all around.” Another interviewee said, “It was interesting to see clothing on 360^{o} online.” All of the interviewees expressed positive intentions to use 3D rotation views for online apparel shopping when it is available. One interviewee said, “I will definitely use it for apparel shopping online because it provided me the look that I would see on a real mannequin.” Interviewees agree that 3D rotation view would be the most helpful when purchasing clothing that need to show the back of the clothing or with a lot of detail front, back, and side.

Interviewees had different opinions about using Virtual Try-on for online apparel shopping. Two people found using Virtual Try-on to be somewhat confusing, and nine people felt it’s not difficult to use it. For example, one interviewee mentioned, “I do not know my measurements well, such as my thigh size. I was confused by that matter but not by the procedure of creating the model.” The majority of the interviewees agreed that it was more entertaining than functional because the way the clothing looks on the model didn’t really help in imagining how it would look on them in person. One interviewee said, “It was interesting to create my model, but the clothing didn’t look like it would on the real me.” Another interviewee said, “It was interesting to create my model and try clothing on it and it’s more amusing than anything else. As for the future intention to use, one interviewee said, “For fun, I will do it, but it doesn’t provide me a whole lot of information compared to the other technologies …. Virtual try-on would be useful for online apparel shopping because it shows how the clothing would look on the body.” Interviewees intended to use Virtual Try-on when shopping for bathing suits or dresses to see how it would look like on a body (See Appendix A for a summary of the transcribed dialogue).

4.2 Pilot study data analyses and results

The pilot test data analysis provided information regarding whether or not the items were manifest of each latent variable and item reduction. With the pilot test data, the proposed model was evaluated by estimating the standardized structural coefficients for the hypothesized paths. The results helped the researcher to determine whether or not modification of the proposed model was necessary.

4.2.1 Demographic characteristics

Survey participants were undergraduate students at Auburn University. We received 354 valid and complete responses from 3,000 online survey requests (12% return rate). Thirty one percent of the respondents were male and 69% were female. Twenty three percent of the respondents had not purchased apparel online during the past 6 months, 39% had purchased apparel online 1-2 times, 19% had purchased 3-4 times, 11% had purchased 5-6 times, and 8% had purchased more than 6 times during the past 6 months. Thirty percent of the respondents had spent a total of $1-100, 19% spent $101-200, 13% spent $201-300, 6% of spent $301-400, and the rest (9%) spent $400 or more on online apparel purchases during the past 6 months. The majority of the respondents had used the 2D views (97%) and 3D rotation view (94%) for online apparel shopping, and more than half (62%) of the respondents had experienced Virtual Try-on at least once. These respondents were moderate online apparel shoppers with relatively high experience with the SETs under investigation, indicating the characteristics of the sample were suitable for this investigation.

4.2.2 Reliability and validity

The results of reliability tests showed that all measurements are reliable with Cronbach's alphas greater than .8 (Table 1). Principal component analysis showed acceptable discriminant validity among the nine constructs and good internal consistency with most constructs' Eigenvalues over 1 (except USE α = .9 and EVA α = .8). According to Marsh and Hau (1999), standardized factor loadings greater than .6 indicates relatively high factor loading. Items with relatively low factor loadings and items with high inter-item correlation coefficients were eliminated. After the eliminations, all factor loadings for the nine constructs were high, indicating that remaining items provided good manifestations of the relevant latent constructs (Table 1). As for model fit assessment, a rule of thumb for the incremental goodness-of-fit indexes (e.g., CFI, GFI, etc.) is that values greater than roughly .9 may indicate reasonably good fit of the model (Hu & Bentler, 1999). These results showed good measurement model fit for all nine measurement models with all CFI and GFI values greater than .9 (Table 3).

Table 3. Reliability measures, measurement model fit, and factor loadings for all groups

Constructs	Reliability α	Goodness-of-Fit indexes	Scale items	Factor loadings
Technology anxiety (TA)	.801	GFI= .98 CFI= .97	1. Technical terms sound like confusing jargon to me. 2. I have avoided technology because it is unfamiliar to me. 3. I hesitate to use most forms of technology for fear of making mistakes I cannot correct.	.67 .70 .81
Innovativeness (INN)	.831	GFI= .96 CFI= .97	4. If I heard about a new technology, I would look for ways to experiment with it. 5. Among my peers, I am usually the first to try out new technologies. 6. I like to experiment with new technologies.	.81 .72 .84
Perceived usefulness of SET (PU)	.884	GFI= .94 CFI= .93	7. *SET improves my online shopping productivity. 8. *SET enhances my effectiveness when shopping online. 9. *SET is helpful in buying what I want online. 10. *SET improves my online shopping ability.	.90 .94 .91 .82
Perceived ease-of-use of SET (PEOU)	.908	GFI= .97 CFI= .96	11. Using *SET is clear and understandable. 12. Using *SET does not require a lot of mental effort. 13. *SET is easy to use.	.84 .89 .90
Perceived entertainment value of SET (PE)	.911	GFI= .98 CFI= .97	14. Shopping with *SET is fun for its own sake. 15. Shopping with *SET is exciting. 16. Shopping with *SET is enjoyable. 17. Shopping with *SET is interesting.	.82 .86 .97 .84
Attitude toward using SET (ATT)	.884	GFI= .93 CFI= .95	18. Using *SET is a good/bad idea. 19. Using *SET is superior/inferior. 20. Using *SET is pleasant/unpleasant. 21. Using *SET is appealing/unappealing.	.75 .76 .83 .90
Actual use of SET (USE)	.903	GFI= .96 CFI= .95	22. I use *SETs (when available) for purchasing apparel online.	.98

			23. I use *SETs (when available) for browsing for apparel shopping online.	.75
Post use evaluation of using SET (EVA)	.922	GFI= .98 CFI= .99	24. Overall, I am satisfied with using *SET. 25. In my opinion, *SET provides a satisfactory help when I make a purchase decision. 26. I will continue using *SET when I shop for apparel online. 27. I would recommend shopping at a site with good *SET.	.82 .88 .92 .83
Intention to purchase, reuse, and revisit (INT)	.916	GFI= .98 CFI= .97	28. I would be likely to use *SET again for online apparel shopping. 29. I would be likely to visit a site providing *SET for online apparel shopping. 30. I would be likely to purchase apparel from a site providing *SET.	.82 .98 .86

*SET was replaced with a specific SET term (2D view larger view & alternate views / 3D rotation view / Virtual Try-on) for each survey.

4.2.3 Structural model evaluation and multiple group comparison

Structural equation modeling was conducted for hypotheses testing, model evaluation, and model comparison. Technology anxiety, innovativeness, perceived usefulness, perceived ease of use, perceived entertainment value represent exogenous variables -- independents with no prior causal variable. Attitude, actual use, and post-use evaluation are endogenous variables – where attitude and actual use as mediating variables (causes of other mediating and dependent variables) and post-use evaluation as a pure dependent variable. The statistical significance of structural parameter estimates (structural coefficients) was examined to determine the validity of the hypothesized paths. Fit indexes (CFI, GFI, and RMSEA) provided information regarding the goodness-of-fit between the data and the proposed structural models. The structural coefficients for each group in the proposed SE-TAM are displayed in Figure 4a, 4b, and 4c, respectively.

The comparisons of the standardized structural coefficients (within a SET and among the three SETs) are presented in Table 4.

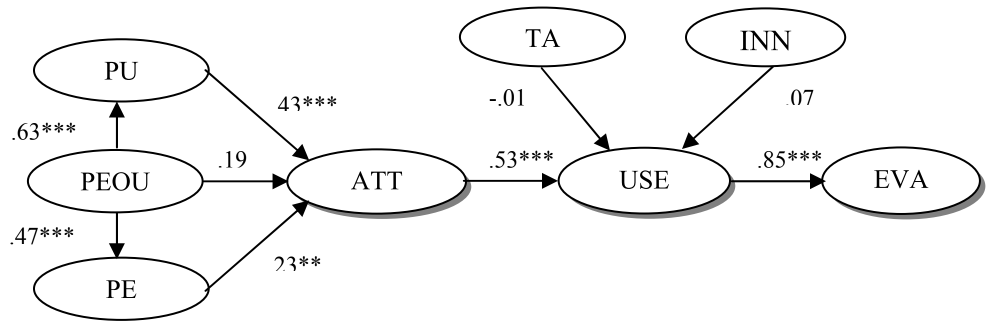


Figure 4a. 2D views (larger view & alternate views) acceptance model

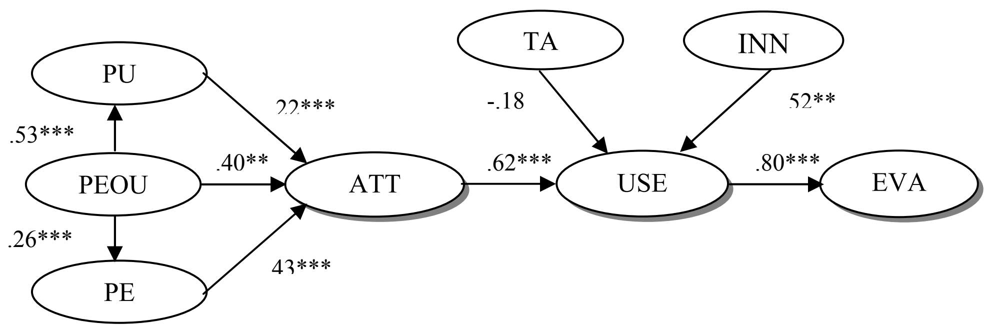


Figure 4b. 3D rotation view acceptance model

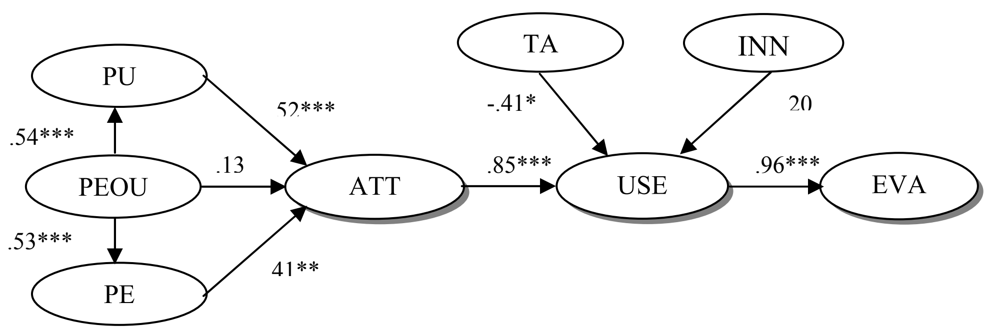


Figure 4c. Virtual Try-on acceptance model

*** = sig. at p < .001, ** = sig. at p < .01, * = sig. at p < .05

The overall results supported the links between beliefs (PU, PEOU, and PE), attitudes and behavior in adoption of sensory enabling technology. The results for 2D zoom-in and alternate views showed that all hypotheses were supported except H3a (PEOU → ATT) (β= .19, p= .13), H5 (TA → USE) (β= -.01, p= .97), and H6 (INN → USE) (β= .07, p= .64). For 3D rotation views, the results supported all hypotheses except H5 (TA → USE) (β= -.18, p= .26). For Virtual Try-on, all hypotheses were supported except H3a (PEOU → ATT) (β= .13, p= .46) and H6 (INN → USE) (β= .20, p= .21)

Table 4. Within-group path coefficients and significance for hypotheses

Hypotheses		**2D zoom-in and alternate views**		**3D rotation view**		**Virtual Try-on**	
		Coefficients	Sig.	Coefficients	Sig. p	Coefficients	Sig.
H1.	PU → ATT	.43	***	.21	***	.52	***
H2.	PE → ATT	.23	**	.43	***	.41	***
H3a.	PEOU → ATT	.19	NS	.40	**	.13	NS
H3b	PEOU → PU	.63	***	.53	***	.51	***
H3c	PEOU → PE	.47	***	.26	***	.67	***
H4	ATT → USE	.53	***	.62	***	.85	***
H5	TA → USE	-.01	NS	-.21	NS	-.41	*
H6	INN → USE	.07	NS	.52	**	.20	NS
H7	USE → EVA	.85	***	.80	***	.96	***
H8a	EVA → INTa	.84	***	.70	***	.90	***
H8b	EVA → INTb	.81	***	.79	***	.84	***
H8c	EVA → INTc	.73	***	.75	***	.78	***

*** = sig. at p < .001, ** = sig. at p < .01, * = sig. at p < .05

The hypothesis regarding the impact of perceived ease-of-use on consumers' attitudes toward using sensory enabling technologies was supported for 3D rotation view

– but not for 2D zoom-in and alternate views and Virtual Try-on. Attitude toward using SETs had a significant impact on the actual use of all three SETs. However, the direct impact of technology anxiety and innovativeness differed among SETs. Neither technology anxiety nor innovativeness had a significant impact on the actual use of 2D zoom-in and alternate views. However, technology anxiety had a significant negative influence on the use of Virtual Try-on, and innovativeness had a positive impact on use of the 3D rotation technology.

Regression analysis was conducted to examine the relationship between post purchase evaluation and intentions (H8a,b,c). Recall that the SET acceptance model was developed to explain the adoption process of SETs, and the researcher expected that adoption of these technologies will positively impact consumers' intentions to (a) reuse SET for online apparel shopping, (b) revisit the site with SETs, and (c) purchase apparel online using SETs. All three hypotheses (H8a, b, c) were strongly supported for all three groups (β coefficients and significance are presented in Table 4). For all three sensory enabling technologies, post-use evaluation of sensory enabling technologies had a significant positive impact on consumers' (a) intention to reuse sensory enabling technologies for online apparel shopping, (b) intention revisit the site that provide sensory enabling technologies for online apparel shopping purpose, and (c) intention to purchase apparel online using sensory enabling technologies.

Multiple-group Structural Equation Modeling was performed to assess the Hypothesized model across SET groups and to test the invariance of path parameters across all groups simultaneously. According to the rule of thumb suggested by researchers (Browne & Cudck, 1993; Hu & Bentler, 1999), the fit indexes indicated acceptable model fit for the proposed model across the groups with CFI= .8, GFI= .9, RAMSEA = .05.

After the initial model assessment, all path parameters were constrained to be equal across three groups to test whether or not the constrained model is invariant across the groups. The summary of the χ^2 values and $\Delta\chi^2$ values (differences of χ^2 values between the base model and constrained model) for the series of analyses involved in testing invariance are presented in Table 5.

Table 5. Multiple-group structural model invariance test

<table>
<tr><th colspan="2">Groups</th><th>Model Description</th><th>χ^2</th><th>df</th><th>$\Delta\chi^2$</th><th>Δdf</th><th>Sig.</th><th>Invariant</th></tr>
<tr><td rowspan="2">Three-group model comparison</td><td rowspan="2">2D views/3D rotation view/Virtual Try-on</td><td>Base Model 1</td><td>1717.33</td><td>867</td><td rowspan="2">36.59</td><td rowspan="2">18</td><td rowspan="2">**</td><td rowspan="2">No</td></tr>
<tr><td>Model 1 with equality constraint</td><td>1763.91</td><td>885</td></tr>
<tr><td rowspan="6">Two-group model comparison</td><td rowspan="2">2D views/3D rotation view</td><td>Base Model 1a</td><td>1166.19</td><td>578</td><td rowspan="2">9.45</td><td rowspan="2">9</td><td rowspan="2">NS</td><td rowspan="2">Yes</td></tr>
<tr><td>Model 1a with equality constraint</td><td>1175.63</td><td>587</td></tr>
<tr><td rowspan="2">Virtual Try-on/2D views</td><td>Base Model 1b</td><td>1112.95</td><td>578</td><td rowspan="2">18.24</td><td rowspan="2">9</td><td rowspan="2">*</td><td rowspan="2">No</td></tr>
<tr><td>Model 1b with equality constraint</td><td>1131.19</td><td>587</td></tr>
<tr><td rowspan="2">Virtual Try-on/3D rotation view</td><td>Base Model 1c</td><td>1175.48</td><td>578</td><td rowspan="2">26.26</td><td rowspan="2">9</td><td rowspan="2">**</td><td rowspan="2">No</td></tr>
<tr><td>Model 1c with equality constraint</td><td>1201.74</td><td>587</td></tr>
</table>

Base Model 1: Three-group structural model (2D/3D/VT)
Base Model 1a: two-group structural model (2D/3D)
Base Model 1b: two-group structural model (VT/2D)
Base Model 1b: two-group structural model (VT/3D)

The first entry shows the fit (χ^2) of the initially hypothesized structural model when tested simultaneously across three groups with no equality constraints. The second entry reports the fit of the model when equality constraints were imposed on all path parameter estimations. The difference in χ^2 value ($\Delta\chi^2$) and the significance were also reported as a determinant of invariance. The model fit difference from the first test (three-group) results showed that all structural paths' parameters are not invariant across the groups ($\Delta\chi^2$= 36.585, Δdf= 18, p= .006), indicating significant differences among groups.

Given this difference among three groups, three sets of two-group Structural Equation Modeling were then conducted for pair-wise comparison of the models. The model fit comparison for 2D and 3D groups was not significantly different, indicating the base and constrained models were invariant ($\Delta\chi^2$= 9.45, Δdf= 9, p= .40) with alpha at .05. Given this finding, it is expected that any inequality of parameters across the three groups of SETs, as determined in the first tests for invariance, must logically lie between Virtual Try-on and 2D/3D view groups. As expected, the results for the next two tests revealed statistically significant differences of path parameter estimates between Virtual Try-on and 2D views ($\Delta\chi^2$= 18.24, Δdf= 9, p= .03) as well as Virtual Try-on and 3D rotation view ($\Delta\chi^2$= 26.26, Δdf= 9, p= .002). This leads to the conclusion that Virtual Try-on is significantly different from the other two SETs (2D views and 3D rotation view) with respect to estimated path parameters.

4.2.4 *Differences in the functional and hedonic roles of SETs*

In order to test the assumption of each SET having different linear combination of functional and hedonic roles, Multivariate Analysis of Variance (MANOVA) was conducted. The three groups (representing the three SETs) were independent variables and PU and PE were dependent variables. First, the Box's test of equality of covariance matrices showed that the equality of covariance assumption across groups was not violated ($p = .02$). Significant differences were found among the three groups regarding (functional verses hedonic) usage perceptions (the linear combination of PU and PE) of SETs, Wilks' $\Lambda = .753$, $F (4, 354) = 25.32$, $p< .001$. The multivariate Partial Eta squared ($\eta^2 = .13$) indicated a moderate effect size.

Given the significant MANOVA, Discriminant Function Analysis (DFA) was then conducted to examine differences in SET groups on usage perceptions of SETs (PU and PE). As expected, two discriminat functions were identified. Structure matrix coefficients were high on PU (.872) and low on PE (.029) for the first function (functional role of SETs) and low on PU (.489) and high on PE (1.00) for the second function (hedonic role of SETs). Overall Wilks' Lambda showed significant differences among groups in both functional and hedonic roles (Table 6), indicating that both functions successfully discriminate groups. The group centroids indicate that the Virtual Try-on group was negatively discriminated from the other two SETs (2D and 3D views) with respect to the functional role (-.83), and the 2D view group was negatively separated from the other two SETs (3D rotation and Virtual Try-on) with respect to the hedonic role (-.16). The 3D rotation view group served both functional and hedonic roles with a slightly higher functional role (.24) than hedonic role (.18) (Table 7).

Table 6. Wilks' Lambda and significance

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
Functional and Hedonic	.753	99.664	4	.000***
Hedonic	.980	7.106	1	.007**

Table 7. Group centroids by function

SET groups	Function	
	Functional	Hedonic
2D views	.476	-.161
3D rotation view	.237	.175
Virtual Try-on	-.829	-.040

Unstandardized canonical discriminant functions evaluated at group means

4.3 National sample data analyses and results

After the pilot test data analyses were completed data were collected form a national sample of online shoppers and the same set of data analyses was conducted with the data from a national sample.

4.3.1 Demographic characteristics

Survey participants were a online shoppers, 19 and older. We received 1471 valid and complete responses from 4,200 online survey requests resulting in a 35% response rate. Fifty two percent of the respondents were male and 48% were female. Thirty one percent of the respondents were age 19-30, 36% was age 31-50, and 33% was age 51 and older. The majority of the respondents (86%) had a college level education (some college and college graduate). Fifteen percent of the respondents had household income less than $30,000, 23% had household income $30,000-49,999, 26% had household income $50,000-74,999, 17% had household income $75,000-99,999, 17% had household income $100,000-149,999, and the rest (7%) had household income over $150,000.

Thirty seven percent of the respondents had purchased apparel online 1-2 times during the past six months, 21% had purchased 3-4 times, 9% had purchased 5-6 times, and 9% had purchased more than 6 times during the past six months. Only 24% of the respondents had not purchased apparel online in the past six months. Twenty seven percent of the respondents spent a total of $1-100, 20% spent $101-200, 13% spent $201-300, 8% of spent $301-400, and (8%) spent $400 or more on online apparel purchases during the past 6 months. The majority of the respondents had used the 2D views (93%) and 3D rotation views (85%) for online apparel shopping, and more than half (65%) of the respondents had used Virtual Try-on. The results indicate that the respondents tend to be moderate to heavy online apparel shoppers with relatively high experience with the SETs under investigation, indicating the characteristics of the sample were suitable for this investigation.

4.3.2 Reliability Test, Principal Component Analysis, and Confirmatory Analysis (CFA)

Although the reliability and validity of the multiple items manifesting each latent construct were confirmed in the pilot test, the researcher conducted a set of reliability test to ensure the internal consistency and validity of the items with national sample. The results of reliability test showed that all measurements were reliable with Cronbach's alphas greater than .9 (see Table 8), demonstrating all of the Cronbach's alphas were higher than those from pilot test data. Principal component analysis showed acceptable discriminant validity among the nine constructs and good internal consistency with most constructs' Eigenvalues over 1 (except ATT α = .9, USE α = .7, and EVA α = .7). All factor loadings for the nine constructs were high, indicating the items were manifestating the construct to which they belong (Table 8). The overall item factor loadings were higher than those from the pilot test data. The CFA results showed an excellent measurement model fit for the nine measurement models (TA, INN, PU, PEOU, PE, ATT, USE, and EVA) with all CFI and GFI values greater than .9 (Table 8).

Table 8. Reliability measures, measurement model fit, and factor loadings for all group

Constructs	Reliability α	Goodness-of-Fit indexes	Scale items		Factor loadings
Technology anxiety (TA)	.887	GFI= .998 CFI= .999	37.	Technical terms sound like confusing jargon to me.	.78
			38.	I have avoided technology because it is unfamiliar to me.	.92
			39.	I hesitate to use most forms of technology for fear of making mistakes I cannot correct.	.87
Innovativeness (INN)	.890	GFI= .966 CFI= .970	40.	If I heard about a new technology, I would look for ways to experiment with it.	.88
			41.	Among my peers, I am usually the first to try out new technologies.	.81
			42.	I like to experiment with new technologies.	.88
Perceived usefulness of SET (PU)	.968	GFI= .979 CFI= .993	43.	*SET improves my online shopping productivity.	.94
			44.	*SET enhances my effectiveness when shopping online.	.97
			45.	*SET is helpful in buying what I want online.	.95

			46.	*SET improves my online shopping ability.	.90
Perceived ease-of-use of SET (PEOU)	.951	GFI= .996 CFI= .998	47. 48. 49.	Using *SET is clear and understandable. Using *SET does not require a lot of mental effort. *SET is easy to use.	.91 .93 .95
Perceived entertainment value of SET (PE)	.949	GFI= .975 CFI= .987	50. 51. 52. 53.	Shopping with *SET is fun for its own sake. Shopping with *SET is exciting. Shopping with *SET is enjoyable. Shopping with *SET is interesting.	.89 .90 .95 .90
Attitude toward using SET (ATT)	.943	GFI= .931 CFI= .962	54. 55. 56. 57.	Using *SET is a good/bad idea. Using *SET is superior/inferior. Using *SET is pleasant/unpleasant. Using *SET is appealing/unappealing.	.83 .88 .92 .95
Actual use of SET (USE)	.967	GFI= .979 CFI= .976	58. 59.	I use *SETs (when available) for purchasing apparel online. I use *SETs (when available) for browsing for apparel shopping online.	.96 .98
Post use evaluation of using SET (EVA)	.959	GFI= .950 CFI= .980	60. 61. 62. 63.	Overall, I am satisfied with using *SET. In my opinion, *SET provides a satisfactory help when I make a purchase decision. I will continue using *SET when I shop for apparel online. I would recommend shopping at a site with good *SET.	.93 .94 .95 .88
Intention to purchase, reuse, and revisit (INT)	.961	GFI= .995 CFI= .998	64. 65. 66.	I would be likely to use *SET again for online apparel shopping. I would be likely to visit a site providing *SET for online apparel shopping. I would be likely to purchase apparel from a site providing *SET.	.93 .98 .92

*SET was replaced with a specific SET term (2D zoom-in and alternate views - larger view & alternate views / 3D rotation view / Virtual Try-on) for each survey.

4.3.3 Structural Equation Modeling (SEM) and Regression Analysis

Structural Equation Modeling was first conducted to test hypotheses by estimating the structure coefficients for each group (2D views, 3D rotation view, and Virtual Try-on). The results are displayed in figures 5a, 5b, and 5c, respectively (see appendix D, E, and F for the complete models with factor loadings and structural coefficients). This information was compared within a SET and among the three SETs (Table 9).

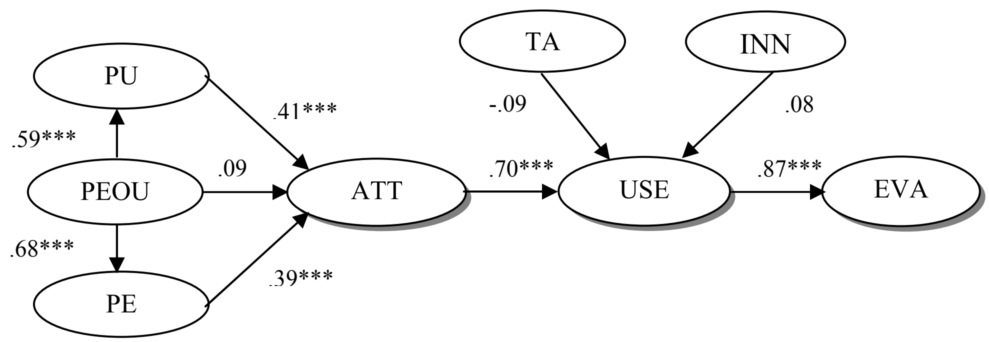


Figure 5a. 2D views (larger view & alternate views) adoption process

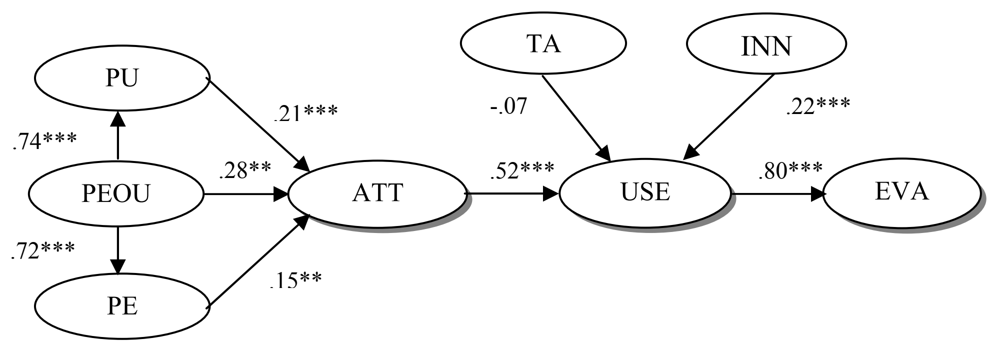


Figure 5b. 3D Rotation view adoption process

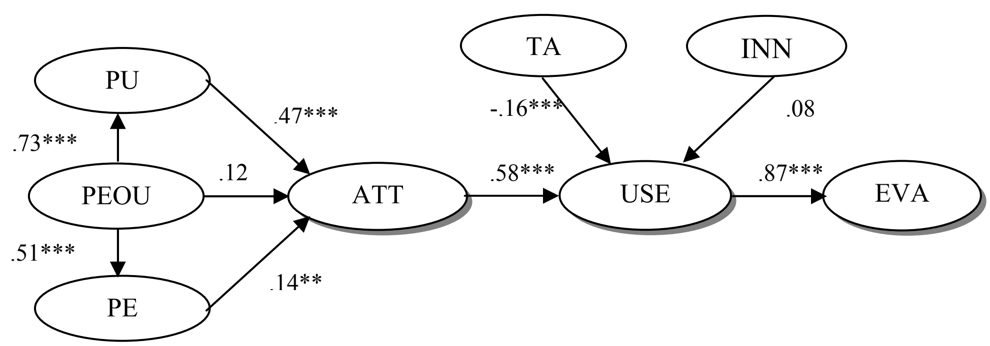


Figure 5c. Virtual Try-on adoption process

*** = sig. at p < .001
** = sig. at p < .01
* = sig. at p < .05

Consistent with the pilot study results, the results from the national sample confirmed the links between beliefs (PU, PEOU, and PE), attitudes and behavior in adoption of sensory enabling technology, thereby providing empirical validation of the proposed SE-TAM model. For 2D views, all hypotheses in the SE-TAM were supported except H3a (PEOU → ATT) (β= .09, p= .114), H5 (TA → USE) (β= -.09, p= .02), and H6 (INN → USE) (β= .08, p= .05). The results supported all hypotheses for the 3D rotation view only except H5 (TA → USE) (β= -.065, p= .10). Only H3a (PEOU → ATT) (β= .12, p= .07) and H6 (INN → USE) (β= .10, p= .05) were rejected for Virtual Try-on. Although the results showed a significant direct impact of PEOU on ATT for the 3D rotation view, it didn't appear to be significant for 2D views and Virtual Try-on. More distinction among the SETs lies on the direct impact of TA and INN on USE. Neither TA nor INN appeared to be influencing factors for using 2D views. INN positively influenced the use of 3D rotation view whereas TA negatively influenced the use of Virtual Try-on.

Table 9. Within-group path coefficients and significance for hypotheses

Hypotheses		**2D zoom-in and alternate views**		**3D Rotation View**		**Virtual Try-on**	
		Coefficient	Sig.	Coefficient	Sig. p	Coefficient	Sig.
H1.	PU → ATT	.41	***	.29	***	.47	***
H2.	PE → ATT	.39	***	.15	**	.14	**
H3a.	PEOU → ATT	.09	NS	.28	***	.12	NS
H3b	PEOU → PU	.59	***	.74	***	.73	***
H3c	PEOU → PE	.69	***	.72	***	.51	***
H4	ATT → USE	.70	***	.52	***	.59	***
H5	TA → USE	-.09	NS	-.07	NS	-.16	***

H6	INN → USE	.08	NS	.22	***	.08	NS
H7	USE → EVA	.87	***	.80	***	.87	***
H8a	EVA → INTa	.88	***	.92	***	.92	***
H8b	EVA → INTb	.85	***	.87	***	.91	***
H8c	EVA → INTc	.81	***	.82	***	.88	***

*** = sig. at $p < .001$, ** = sig. at $p < .01$, * = sig. at $p < .05$

Regression analysis was used to examine the hypothesis – impact of SET adoption on consumers' intention (H8a) to reuse SET for online apparel shopping, (H8b) to revisit the site with SETs, and (H8c) to purchase apparel online using SETs -- not included in the structural model. Just like the results from the pilot test, all three hypotheses (H8a, b, c) were strongly supported for all three groups with Beta coefficients greater than .8 (β coefficients and significance are presented in table 9), indicating a strong connection between the adoption of SETs and intention.

Then, multiple-group Structural Equation Modeling was performed to test for invariance of path parameters across SETs simultaneously. Again, the hypothesized model was evaluated by three fit measures –the comparative fit index (CFI), the goodness of fit index (GFI), and the root mean square error of approximation (RMSEA). Because Chi-square is quite sensitive to large sample sizes (Byrne, 2001), CMIN was not used for the model assessment for the current study. Based on the rule of thump suggested by researchers (Hu & Bentler, 1999; Browne & Cudeck, 1993), the model fit for the proposed model across the groups was reasonably good, with CFI= .8, GFI= .9, RMSEA = .05.

To test invariance among SET models, first, the researcher imposed equality constraints to all path parameters to generate the constrained model. Then, the researcher compared the fit of the base model with free parameter estimation and the constrained model with equality constraints imposed on parameter estimation. The summary of the χ^2 values and $\Delta\chi^2$ values (differences of χ^2 values between the base model and constrained model) for the series of analyses involved in testing invariance are presented in Table 10.

The Chi-square difference ($\Delta\chi^2$) indicated statistical differences in the model comparisons when the base model and the constrained model fit was compared simultaneously across the three groups ($\Delta\chi^2$= 88.71, Δdf= 18, p<.01). Thus, three sets of pair-wise two-group SEMs were performed to determine whether the constrained model was invariant across any two of the three groups. Specifically, pair-wise comparisons of the models for 2D view and 3D rotation view groups followed by the comparison of the models for Virtual Try-on and 2D view groups and finally a comparison of the models for Virtual Try-on and 3D rotation view groups were necessary to see where the differences lie. The model fit comparison for 2D and 3D groups showed that the models (base and constrained models) were statistically different ($\Delta\chi^2$= 58.44, Δdf= 9, p<.01). The results for the next two tests revealed significant differences in path parameter estimates between VT and 2D ($\Delta\chi^2$= 54.45, Δdf= 9, p< .01) as well as VT and 3D ($\Delta\chi^2$= 20.50, Δdf= 9, p= .015). This leads to a conclusion that all three SETs are statistically different from each other.

Table 10. Multiple-group invariance test

Groups		**Model Description**	**χ^2**	***df***	**$\Delta\chi^2$**	**Δdf**	**Sig.**	**Invariance**
Three-	2D views/3D	Base Model 1	5282.43	945	88.71	18	**	No

group model comparison	rotation view/Virtual Try-on	Model 1 with equality constraint	5371.13	963				
Two-group model comparison	2D views/3D rotation view	Base Model 1a	3737.43	630	58.44	9	**	No
		Model 1a with equality constraint	3795.86	639				
	Virtual Try-on/2D views	Base Model 1b	3281.18	630	54.45	9	**	No
		Model 1b with equality constraint	3335.73	639				
	Virtual Try-on/3D rotation view	Base Model 1c	3546.14	630	20.50	9	*	No
		Model 1c with equality constraint	3366.64	639				

Base Model 1 : Three-group structural model (2D/3D/VT)
Base Model 1a: two-group structural model (2D/3D)
Base Model 1b: two-group structural model (VT/2D)
Base Model 1b: two-group structural model (VT/3D)
** = sig. at $p < .01$, * = sig. at $p < .05$

4.3.4 Differences in the functional and hedonic roles of SETs

Multivariate Analysis of Variance (MANOVA) was conducted to examine the mean difference of functional and hedonic roles among SETs. The Box's test of equality of covariance matrices indicated the equality of covariance assumption across group was not violated ($p = .002$). Significant differences were found among three groups on the PU (functional role) and PE (hedonic role) (Wilks' $\Lambda = .824$, $F(4, 1471) = 74.65$, $p < .001$) with a moderate effect size ($\eta^2 = .092$) of the difference.

Since the MANOVA result indicated differences in functional and hedonic role among ESTs, the follow-up analysis was conducted to examine the differences of SET groups on the linear combination of PU and PE. Two discriminat functions were identified from the follow-up Discriminant Function Analysis (DFA). Consistant with the pilot test results, the first function represented functional aspects of SETs with structure matrix coefficients being high on PU (.794) and low on PE (.149) and the second function represented hedonic aspects of SETs with structure matrix coefficients being low on PU (.068) and high on PE (.989). Overall Wilks' Lambda showed suggested both functions successfully discriminate groups (see Table 11 for significance). SET groups showed more noticeable differences in functional roles than they did in hedonic roles. The Virtual Try-on group was negatively discriminated from the other two (2D and 3D views) with regard to functional roles served (-.595). The 2D view group was negatively separated from the other two groups (3D view and Virtual Try-on) in hedonic roles (-.105), meaning 2D views serve a much smaller hedonic role than the other two do. The 3D rotation view group seved both functional and hedonic roles with a slightly higher functional (.195) than hedonic role (.158) (Table 12).

Table 11. Wilks' Lambda and significance

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
Functional and Hedonic	.824	284.478	4	.000***
Hedonic	.987	18.803	1	.000***

Table 12. Functions at group centroids

SET groups	Function	
	Functional	Hedonic
2D	.473	-.105
3D	.195	.158
VT	-.595	.052

Unstandardized canonical discriminant functions evaluated at group means

CHAPTER 5

DISCUSSION OF FINDINGS

This chapter provides interpretation of the results as well as discussion of differences of the findings from both pilot and main study.

5.1 Discussion of findings

The results from both the pilot study and the main study confirmed perceived usefulness and perceived entertainment value of sensory enabling technologies as strong predictors of attitude toward using all three sensory enabling technologies. Theses findings are consistent with research supporting the presence of both utilitarian and hedonic motivations in retail shopping (Babin et al., 1994) and in online shopping (Childers et al., 2001).

Especially, the impact of perceived entertainment value on attitude showed some interesting differences among sensory enabling technologies. Although the impact of perceived entertainment value was statistically significant for all three sensory enabling technologies, the coefficients (PE → ATT) from the national sample data analysis were much smaller than those from the pilot test with student sample for 3D rotation views (.43 > .15) and Virtual Try-on (.41 > .14), indicating differences in effect of perceived entertainment value on attitude toward using sensory enabling technologies for general online shopper and college students. This may be because younger people are more used to using Internet related technologies and thereby having more fun experiences with them than general online shoppers. Thus, college students may find entertainment value to be important determinant to form their attitudes toward using these types of technologies.

The impact of perceived ease-of-use on the other two beliefs – perceived usefulness and entertainment value -- was significant for all three sensory enabling technologies, indicating the significant indirect impact of perceived ease-of-use on attitude. However, the direct impact of perceived ease-of-use on consumers' attitude toward using sensory enabling technologies was supported only for 3D rotation views. This may be because 2D zoom-in and alternate views are already very easy to use, and people expect using Virtual Try-on to be somewhat more complicated than other sensory enabling technologies. Davis, Bagozzi, and Warshaw (1992) found the indirect influence of perceived ease-of-use on attitude was mediated by perceived usefulness and enjoyment. However, research testing TAM has shown inconsistent results regarding the direct impact of ease-of-use on attitude. Thus, it seems likely that the impact of perceived ease-of-use on attitude differs by technology.

Attitude toward using sensory enabling technologies had a significant impact on the actual use of all three sensory enabling technologies. Consumers are more likely to use sensory enabling technologies if they have a positive attitude toward using them. The impact of technology anxiety and innovativeness appeared to differ among sensory enabling technologies. Technology anxiety had a negative impact only on the use of Virtual Try-on, and innovativeness had a significant positive influence only on the use of

3D rotation view. However, neither technology anxiety nor innovativeness had a significant influence on the use of 2D views. Hoffman and Novak (1996) related the consumer's confidence (anxiety) in his/her ability to perform the behavior to the actual behavior. This means that consumers may avoid using a new technology if they are not comfortable with using the technology even when customers can see the benefits of using it. The ability and willingness of customers to use new technologies is expected to influence the use of those technologies (Parasuraman, 2000). Research has suggested that consumers with higher levels of technology anxiety use fewer self-service technologies (Meuter, Ostrom, Bitner, & Roundtree, 2003), and innovativeness will impact the way consumers perceive new technologies (Onkvisit & Shaw, 1994). These results, lead to the conclusion that consumers with high levels of technology anxiety may not use Virtual Try-on whereas innovative consumers are more likely to try the 3D rotation view regardless of their attitude toward using such technologies for online apparel shopping.

The actual use of sensory enabling technologies had a significant positive impact on the post-use evaluation of all three technologies. The experience of using sensory enabling technologies results in satisfactory or unsatisfactory outcomes and leads to positive or negative evaluations about using sensory enabling technologies. Finally, for all three sensory enabling technologies, adoption (represented by post-use evaluation) of sensory enabling technologies had significant positive impact on consumers' intention to reuse sensory enabling technologies for online apparel shopping purpose, consumers' intention revisit the site that provide sensory enabling technologies for online apparel shopping purpose, and consumers' intention to purchase apparel online using sensory enabling technologies. These results were in line with previous findings that the interactive nature of online shopping sites provided by product virtualization technologies enhanced shoppers' attitudes toward the online retailer, desire to browse or revisit the site, and purchase behavior (Fiore & Jin, 2003; Li, Daugherty, & Biocca, 2001). Research in online advertising shows that 3D virtual product demonstrations led to higher buying intentions than when the product was displayed in a static image (Schlosser, 2003; Li, Daugherty, & Biocca, in press). Industry reports confirm the successful application of Virtual Try-on in online apparel shopping sites. For example, after applying My Virtual Model™ technology, Lands' End had a 19% increase in conversion rates and a 16% increase in online order size (Waxer, 2001).

Although the overall results from national sample strongly confirmed the results from the pilot study, there were some differences in the results for the multiple group-SEM. The results from the national sample data set revealed significant differences in path parameter estimates among all three SET models (2D zoom-in and alternate views, 3D rotation view, and Virtual Try-on), leading to a conclusion that the path parameter estimates for all three sensory enabling technologies are statistically different from each other. The difference between 2D and 3D rotation view was not found in the pilot-test result as the path parameter estimates for 2D and 3D rotation view models were statistically invariant, and only Virtual try-on is statistically different from the other two. This may be due to the different sample characteristics for the pilot test (student sample) and the actual test (national sample) Considering for the pilot test and the main study, the result, however, may be different with a different sample at a different time.

All three technologies appeared to possess both functional and hedonic roles, but to different degrees. Virtual Try-on served a stronger hedonic role, significantly increasing the entertainment value of the online shopping process whereas 2D views played a stronger functional role. The 3D rotation technology appeared to serve both roles similarly. These results were consistent with the focus group interview results showing that interviewees evaluated 2D views to be functional but not very entertaining. There were some discrepancies about the interviewees' perceptions regarding Virtual Try-on; however, the consensus was that although it was entertaining to create a virtual model and try on clothing, it didn't help much with product evaluation because the graphic is different from the actual clothing. Thus, Virtual Try-on was perceived by interviewees to primarily serve a hedonic role. Almost all interviewees agreed that 3D rotation provided both functional and hedonic roles and was the most effective of the three sensory enabling technologies examined.

The results from both pilot study and the main study supported the links between beliefs, attitudes and behavior in adoption of sensory enabling technology, thereby providing empirical validation of the proposed SE-TAM model. Impacts of technology anxiety and innovativeness on actual use of sensory enabling technologies appeared to be different by technology. Each of the sensory enabling technologies examined differed with respect to the functional and hedonic roles served with each making a unique contribution to online apparel shopping – either by reducing product risk perceptions or increasing perceived entertainment value.

CHAPTER 6

SUMMARY AND IMPLICATIONS

This chapter provides a summary of findings and implications for future research.

6.1. Summary

The results provided empirical validation of the perceive usefulness and the perceive entertainment value of sensory enabling technologies as strong predictors of attitude toward using all three sensory enabling technologies tested. The impact of perceived ease-of-use on consumers' attitude toward was statistically significant only for 3D rotation views, indicating that the impact of perceived ease-of-use on attitude differed by technology. Attitude toward using sensory enabling technologies had a significant impact on actual use of all three sensory enabling technologies. The impact of technology anxiety and innovativeness appeared to differ by technology as the impact of technology anxiety and innovativeness on the actual use of sensory enabling technologies were not statistically significant for 2D zoom-in and alternate views. Technology anxiety had a negative impact on the use of Virtual Try-on. Innovativeness had significant positive influence on the use of 3D rotation view. These results lead to the conclusion that consumers with high level of technology anxiety may not use Virtual Try-on whereas innovative consumers are likely to try the 3D rotation view regardless of their attitude toward using such technologies for online apparel shopping. The actual use of these sensory enabling technologies had a significant positive impact on the post-use evaluation of all three technologies.

Finally, the adoption of all three sensory enabling technologies had a significant positive impact on consumers' intention to reuse sensory enabling technologies for online apparel shopping purpose, consumers' intention revisit the site that provide sensory enabling technologies for online apparel shopping purpose, and consumers' intention to purchase apparel online using sensory enabling technologies. Virtual Try-on provided a stronger hedonic role, increasing the entertainment value of the online shopping process whereas 2D views played a strong functional role. The 3D rotation views appeared to serve both roles in similar degrees.

6.2 Implications for future Research

A significant contribution of this study is the examination of the equivalence of the hypothesized model across three widely applied Sensory enabling technologies, providing empirical validation of the proposed SE-TAM model. Most studies based on TAM and TRA have tested only a master model – this approach may increase the error of generalization when the results are applied to different technologies. Thus, invariance testing of the model fit across groups provided important insights in applying the master model to different sensory enabling technologies providing different functional and hedonic roles. For example, Virtual try-on will serve a more hedonic role than other sensory enabling technologies; however technology anxiety will negatively impact consumers' use of this technology, illustrating some of the problems with trying to apply a master model to various Sensory enabling technologies. The approach used here, using the multiple-group structural equation modeling, allows us to test the fit of the master model across Sensory enabling technologies.

The proposed SE-TAM has a number of applications for future research. Based on the findings of this study and the validation of the proposed model, future study can examine consumers' perceptions about various sensory enablers for product evaluation and entertainment. Particular demographics associated with adoption of sensory enablers, their usage patterns, post-purchase satisfaction, and future patronage of the web site can also be investigated.

The adoption of sensory enabling technologies may be related to consumer characteristics. That is, some sensory enabling technologies may be preferred by particular consumers. For instance, Korgaonkar and Moschis (1987) found that certain characteristics of consumers (e.g., time-consciousness, opinion leadership, and high-tech inclinations) predicted positive attitudes toward videotex services. Childers (2001) found gender difference in the need for sensory input in online shopping. Research has noted that adoption of in-home shopping methods is a function of attitudes, experiences, and personal characteristics (Eastlick, 1993; Shim & Drake, 1990). Thus, it will be important to identify consumer variables that may influence the adoption of sensory enabling technologies for online shopping.

The adoption of sensory enabling technologies may also be related to the particular product shopped. The focus group interview revealed different needs for Sensory enabling technologies by product. Interviewees stated that clothing would especially benefit from alternate views and 3D rotation views as it is important to see how a garment looks from all sides. Interviewees also stated that although clothing shown on the virtual model didn't quite look real, they would likely to use it for items that need to be shown on the body. This indicates that the effectiveness of a particular SET may differ by product category.

Many online retailers are turning to enhanced product visualization software, especially in the fashion apparel industry, in an attempt to improve sales and enhance customers' shopping experiences. The success of online apparel retailing may depend, to a large extent, upon the successful use of sensory enabling technologies to reduce perceived product risk that may deter online apparel purchases and to provide a more entertaining shopping experience. Many online shoppers use the Internet to search for product information but do not actually purchase online because of uncertainty regarding the product shown online. Other shoppers may not be motivated to purchase online because they find the online shopping process to lack emotional appeal and entertainment value. Effective use of sensory enabling technologies reduces customers' uncertainty about the product presented online by providing better product information through proxy sensory experiences. In addition, sensory enabling technologies can increase entertainment value in online shopping environment through more compelling online virtual experiences.

However, these sensory enabling technologies will not be effective if shoppers on the site do not use them. Therefore, it is necessary to fully understand the adoption process for sensory enabling technologies, the factors that impact adoption of sensory enabling technologies, and the impact of sensory enabling technology adoption on online apparel purchase behavior. The findings of this study will contribute to a better understanding of the adoption process sensory enabling technologies by providing information regarding the factors that impact adoption of sensory enabling technologies. It also provided insight to the relationship between sensory enabling technology adoption and online apparel purchase behavior regarding consumers' intention to purchase apparel using sensory enabling technologies, intention to reuse sensory enabling technologies for online apparel shopping, and intention to revisit the site with sensory enabling technologies for apparel shopping.

The results of this study demonstrated the functional and hedonic roles served by the selected sensory enabling technologies in online apparel shopping. The findings regarding the functional and/or hedonic roles served by the sensory enabling technologies examined will provide retailers with insights into the most effective types of sensory enabling technologies with respect to reducing product risks and/or increasing the entertainment value of online apparel shopping. Potential benefits of adoption of sensory enabling technologies to online retailers are by reducing perceived product risk and by providing more entertaining online shopping experiences Sensory enabling technologies may help Attract online shoppers to the site, increase fun shopping time spent on the site, increase frequency of revisit, and higher surfer-to-buyer conversion rates. Industry reports have supported the positive impact of visualization features on online apparel sales (Internetretailer.com, 2003). Based on the findings of this study, online apparel retailers may identify opportunities for providing effective sensory enabling technologies to enhance their consumers' online apparel purchase behavior either by reducing perceived risk through better online product evaluation or by enhancing consumers' enjoyment of the shopping process on their website.

6.3. Limitations

This study had some limitations in subject selection for the focus group interview and creating experimental conditions that were use for simulated shopping using sensory enabling technologies. The subjects for the focus group interview were limited to female college students, which might result biased findings regarding general consumers' perceptions about sensory enabling technologies. For the online survey, the research was not able to control the experimental setting for the shopping simulation. For example, the links to the shopping sites containing each sensory enabling technology had to be one of the online retailer's sites, meaning that they were not completely created sites showing the same apparel product. That was due to the fact that most of the sensory enabling technologies had trade marked or patented by several creators and not allowed to be exactly copied and used. However, the research chose the closest possible product from the online retailers' site in order to minimize the variances. Another limitation for conducting the online survey was that the participants were asked to simulate the shopping that didn't involve actual purchase. Although the questionnaire was designed to measure consumers' perception about sensory enabling technologies not to measure direct purchase behaviors, this situational factor (not making a purchase right away using a sensory enabling technology) might have influenced the findings.

REFERENCES

Adams, D.A., Nelson, R.R. & Todd, P.A. (1992). Perceived usefulness, ease of use, and usage of information technology: a replication. *MIS Quarterly*, June, 227-247.

Advertising Age (2000). Malls move to capture sales lost to the net, July 31, 28, Chicago, IL. Crain Communications.

Agarwal R, Prasad JA. conceptual and operational definition of personal innovativeness in the domain of information technology, Information System Research, 1998; 9 (June): 204–215.

Agarwal, R. & Prasad, J. (1998). A conceptual and operational definition of personal innovativeness in the domain of information technology, *Information System Research,* 9 (June), 204–215.

Ajzen, I (1991). The theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, 50, 179-211.

Ajzen, I. & Fishbein, M. (1980). *Understanding attitudes and predicting behavior*., Englewood Cliffs, NJ: Prentice Hall.

Ajzen, I.& Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*, Prentice-Hall, Englewood Cliffs NJ.

Alba, J. Lynch, B. Weitz, C. Janiszewski, R. Lutz, A. Sawyer, & S. Wood . (1997). Interactive home shopping: consumer, retailer, and manufacturer incentives to participate in electronic marketplaces. *Journal of Marketing*, 61(3), 38–53.

Arbuckle, J.L.(2003). Amos 5.0 user's guide. Marketing Department, SPSS Inc.: SmallWaters Corp, Chicago. IL.

Arnold, M.J. & Reynolds, K.E. (2003). Hedonic shopping motivations. *Journal of Retailing,* 79, 77-95

Babin, B.J., Darden, W.R., & Griffen, M. (1994). Work and/or fun: measuring hedonic and utilitarian shopping value. *Journal of Consumer Research*, 20(4), 644–656.

Bagozzi, R.P. (1981), Attitudes, intentions, and behavior: a test of some key hypotheses, *Journal of Personality and Social Psychology*, 41.607-26.

Bhatnagar, A. & Ghose, S. (2003). Segmenting consumers based on the benefits and risks of Internet shopping. *Journal of Business Research*.

Bloch, P.H., Sherrell, D.L., & Ridgway, N.M. (1986). Consumer search: an extended framework. *Journal of Consumer Research.* 13 (June),119-126.

Browne, M. W. & Cudeck, R. (1993). Alternative ways of assessing model fit. In K.A. Bollen & J.S. Long (Eds.), *Testing structural equation models* (pp.136-162). Newbury Park, CA: Sage.

Byrne, B.M. & Campbell, T.L. (1999). Cross-cultural comparisons and the presumption of equivalent measurement and theoretical structure: a look beneth the surface. *Journal of Cross-cultural Psychology*.30 (2), 555-574.

Byrne, B.M. (2001). *Structural equation modeling with Amos: basic concepts, applications, and programming.* Mahwah, NJ: Erlbaum.

Cambre, M.A. & Cook, D.L. (1985). Computer anxiety: definitions, measurement, and correlations. *Journal of Education and Consumer Research*, 37-54.

Chau, P. Y. K. (1996).An Empirical Assessment of a Modified Technology Acceptance Model,*Journal of Management Information Systems,*13 (2), 185-204.

Chilers, L., Carr, C.L., Peck, J., & Carson, S. (2001). Hedonic and utilitarian motivations for online retail shopping behavior. *Journal of Retailing*, 77, 511-535.

Cho J. Likelihood to abort an online transaction: influences from cognitive evaluations, attitudes, and behavioral variables. Information & Management, 2004; 41-48: 827-838.

Citrin, A.V., Stem, D.E., Spangenberg, E.R., & Clark, M.J. (2003). Consumer need for tactile input: An Internet retailing challenge. Journal of Business Research, 56, 915-922.

Compeau, D.R. & Higgins, C. A. (1995). Computer Self-Efficacy: Development of a Measure and Initial Test. *MIS Quarterly*, 19 (2).189-211.

Dabholkar, P.A. (1994), *Technology-based service delivery: a classification scheme for developing marketing strategies*, in Swartz, T.A., Bowen, D.E., Brown, S.W. (Eds),Advances in Services Marketing and Management, JAI Press Inc., Greenwich, CT, 241-71.

Dabholkar, P.A., (1996). Consumer evaluations of new technology-based self-service options: an investigation of alternative models of service quality. *International Journal of Research and Marketing.* 13**,** 29–51.

Davis, F.D. (1989).Perceived usefulness, perceived ease of use, and user acceptance of information technology, *MIS Quarterly*, 13 (September), 319-340.

Davis, F.D., Bagozzi, R.P. & Warshaw, P.R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology,* 22(14), 1111-1132.

Eastlick, M.A. (1993), Predictors of videotex adoption, *Journal of Direct Marketing*, 7 (3), 66-74.

Engel, J.F., Blackwell R.D., & Miniard, P.W. (1995). *Consumer Behavior.* 8th ed. Fort Worth: Dryden Press.

Fiore, A.M., Jin, H.J., & Kim, J. (in press). For Fun and Profit: Image Interactivity, Hedonic Value, and Responses Towards an Online Store. *Psychology & Marketing*

Flynn, L.R. & Goldsmith, R.E. (1993).A validation of the Goldsmith and Hofacker innovativeness scale, *Eduation and Psychology.* 53, 1105–1116.

Forsythe, S.M. & Bailey, A. (1996). Shopping enjoyment, perceived time poverty and time spent shopping. *Clothing and Textiles Research Journal*, 14, 185-191.

Forsythe, S.M. & Shi, B. (2003). Consumer patronage and risk perceptions in Internet shopping. *Journal of Business Research*, 56 (11), 867-875.

Gefen, D. & Straub, D. (1997).Gender differences in the perception and use of e-mail: an extension to the technology acceptance model, *MIS Quarterly,* 21(4), 389–400.

Goldsmith, R.E. & Goldsmith, E.B. (2002). Buying apparel over the Internet. *The Journal of Product and Brand Management.*11(2/3), 89-100.

Goldwyn, C. (2003). *The art of the cart.* Vividence Corporation Report. Retreaved September 20, 2005. [On-line] Available: http://www.keynote.com/downloads/cem/wp_stop_losing_customers.pdf

Green, S.B. & Salkind, N.J. (2003). *Using SPSS for Windows and Mackintosh: analyzing and understanding data (3rd Ed).* Upper Saddle River, NJ: Prentice Hall.

Grewal, D., Iyer, G.R., & Levy, M. (2004). Internet retailing: enablers, Limiters and Market consequences. Journal of Business Research. 57 (7). 703-713.

Heijden H. User acceptance of hedonic information systems, MIS Quarterly, 2004; 28 (4): 695-703.

Heijden, H. (2000). E-TAM: a revision of the technology acceptance model to explain websites revisits. Research Memorandum. September.

Hirschman, E.C. & Holbrook, M.B. (1982) Hedonic consumption: emerging concepts, methods and propositions. *Journal of Marketing* 46 (3), 92–101.

Hirschman, E.C. (1980). Innovativeness, novelty seeking, and consumer creativity, *Journal of Consumer Research*, 7, 283-295.

Hirschman, E.C. (1984). Experience seeking: a subjectivistic perception of consumption, *Journal of Business Research,* 12, 115-136.

Hoffman, D. L., & Novak, T.P. (1996). Marketing in Hypermedia Computer-Mediated Environments: Conceptual Foundations. *Journal of Marketing*, 60(3), 50-68.

Holbrook, M.B. (1994). The Nature of Customer Value: An Axiology of Services in the Consumption Experience, 21–71 *in Service Quality: New Directions in Theory and Practice,* Roland T. Rust and Richard L. Oliver, (Eds.), Newbury Park, CA: Sage.

Hu, L. T. & Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling*, 6, 1-55.

Igbaria, M., Parasuraman, S., & Baroudi, J.J. (1996). A motivation model of microcomputer usage. *Journal of Management Information Systems*, 13(1), 127-143.

Igbaria, M., Schiffman, S.J. & Wieckowshi, T.S. (1994). The respective roles of perceived usefulness and perceived fun in the acceptance of microcomputer technology. *Behavior and Information Technology,* 13 (6), 349–361.

Internetretailer.com. (2003). Visualization feature increases conversions on apparel by 15% Orvis.com. Retreaved September 20, 2005. [On-line] Available: http://www.internet retailer.com/dailynews.asp?id=9360.

Isen, A. M. (1987). Positive affect, cognitive process, and social behavior. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology*, 20, 203-253.

Johnson, K.P., Lennon, S.J., Jasper, C., Damhorst, M.L., & Lakner H.B. (2003). An application of Rogers' innovation model: use of Internet to purchase apparel, food, and home furnishing products by small community consumers. *Clothing and Textiles Research Journal,* 21(4), 185-196.

Kartsounis, G.A, Magnenat-Thalmann, N., & Rodrian, H. (2001). E-tailer: integration of 3D scanners, CAD and virtual try-on technologies for online retailing of made-to-measure garments. Research and Technological Development (RTD) project.

Klein, L. R. (1998). Evaluating the potential of interactive media through new lens: search versus experience goods*, Journal of Business Research*. 41 (3). 195-203.

Klein, L.R. (2003). Creating virtual product experiences: the role of telepresence. *Journal of Interactive Marketing.* 17(1), 41-55.

Kline, R. B. (1998). Principles and practice of structural equation modeling. New York: The Guilford Press.

Korgaonkar, P.K. & Moschis, G.P. (1987). Consumer adoption of videotext services, Journal of Direct Marketing, 1, 63–71.

Li, H., Daugherty, T.,& Biocca, F. (in press). The role of virtual experience in consumer learning. Journal of Consumer Psychology.

Liao, S., Shao, Y.P., Wang, H., & Chen, A.. (1999). The adoption of virtual banking: an empirical study, *International Journal of Information Management* 19 (1), 63–74.

Mahoney, M. (2001). E-tailers dangle 3D imaging to covert surfers to buyers. *E-commerce Times.* September 20. [On-line] Available: http://www.ecommercetimes.com/perl/story/13521.html

Manning, K. C. Bearden, W. O. & Madden, T.J. (195). Consumer Innovativeness and the Adoption Process.*Journal of Consumer Psychology*, 4 (4). 329-345.

Marsh, H. W. & Hau, K. T. (1999). Confirmatory factor analysis: strategies for small sample sizes. N R. H. Hoyle (Ed.), *Statistical strategies for small sample research.* Thousand Oaks, CA: Sage.

Media Metrix. Statistics bureau. [On-line] Available: www.http://medimetrix.com

Menon, S. & Kahn, B. (2002). Cross-category effects of induced arousal and pleasure on the internet shopping experience. *Journal of Business Research,* 78(May), 31-40.

Meuter, M. L., Ostrom, A.L., Bitner, M.J., & Roundtree, R. (2003). The influence of technology anxiety on consumer use and experiences with self-service technologies. *Journal of Business Research,* 56, 899-906.

Meuter, M.L., Bitner, M.J., Ostrom, A. L., & Brown, S.W.2005 (2005). Choosing Among Alternative Service Delivery Modes: An Investigation of Customer Trial of Self-Service Technologies. *Journal of Marketing,* 69 (2), 61-83.

Meyers, L.S., Garmst, G., & Guarino, A. J. (2005). *Applied multivariate research: design and interpretation,* Thousand Oaks, CA: Sage.

Midgley, D.F. & Grahame, R. (1978). Dowling, Innovativeness: the concept and its measurement, *Journal of Consumer research.* 4 (March), pp. 229–242.

Moore, G. C., & Benbasat, I. (1991). Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation," *Information Systems Research*, 2 (3), 192-222.

O'Brien, J. (1987). *An empirical evaluation of the EKB model relative to the decision making process*. In: Hawes, J.M. & Gilson. G.B., editors. Developments in marketing science. Akron, OH: Academy of Marketing Science.

Odom, M.D., Kumar, A., & Sanders, L. (2002). Web assurance seals: How and why they influence consumers' decisions. *Journal of Information Systems*, 16 (2), 231-250.

Orwall, B. (2001). Thumbs up: what makes a good entertainment site click? We're starting to get the answers. *Wall Street Journal*: Dow Jones & Company, March, 26, R6.

Pavlou, P. A. (2003). Consumer acceptance of electronic commerce: Integrating trust and risk with the technology acceptance model. *International Journal of Electronic Commerce,* 7(3), 69–103.

Pearson, P.H. (1970). Relationships between global and specified measures of novelty seeking, *Journal of Consulting and Clinical Psychology,* 34, 199-204.

Peck J, Childers T. Individual Differences in Haptic Information Processing: The "Need for Touch" Scale. Journal of Consumer Research: 30; 430-442

Peck, J. & Childers, T. L. (2000). To have and to hold: the influence of haptic information on product judgments, working paper, University of Minnesota.

Phau, I., & Poon, S. M. (2000). Factors influencing the types of products and services purchased over the Internet. *Internet Research, 10*(2), 102.

Poon, S. (1999). The nature of goods and Internet commerce benefit: A preliminary study, *IEEE,* 1-7.

Raju, N.S., Lafitte, L.J., Byrne, B.M. (2002). Measurement equivalance: a comparison of methods based on confirmatory factor analysis and item response theory. *Journal of Applied Psychology.* 87 (2). 517-529.

Robinson Jr., L., Marshall, G.W., & Stamps, M.B. (2004). Sales force use of technology: antecedents to technology acceptance. Journal of Business Research.

Rogers, E. (1983). The diffusion of innovation. New York: The Free Press.

Rogers, E. (1995). *Diffusion of Innovations* (4th ed.). New York: The Free Press.

Roselius,T. (1971). Consumer rankings of risk reduction methods, *Journal of Marketing*, 35 (January), 56-61.

Schlosser, A. E. (2003). Experiencing products in the virtual world: The role of goal and imagery in influencing attitudes versus purchase intentions. Journal of Consumer Research, 30 (September), 184-197.

Scott, C.R. and Rockwell, S.C. (1997). The effect of Communication, writing, and technology appehension on likelihood to use new communication technologies, *Communication Education*, 46 (January), 44-62.

Segars, A.H. & Grover, V. (1993). Re-examining perceived ease of use and usefulness: a confirmatory factor analysis, *MIS Quarterly,* December, 517-525.

Shim, S. & Drake, M.F. (1990). Consumer intention to utilize electronic shopping, *Journal of Direct Marketing,* 4 (Summer), 22-33.

Shim, S., Drake, M.F. (1990), Consumer intention to utilize electronic shopping, *Journal of Direct Marketing*, 4 (3),22-33.

Szajna, B. (1996).Empirical evaluation of the revised technology acceptance model, *Management Science,* 42 (1), 85–92.

Szybillo, G. & Jacoby, J. (1974). Intrinsic versus extrinsic cues as determinants of perceived product quality. *Journal of Applied Psychoogy.*59 (February), 74–78.

Taylor, S. & Todd, P. (1995**).** Assessing IT Usage: The Role of Prior Experience**.** *MIS Quarterly*, 19 (4), 561-57.

Teo, T. S.H. & Teong, Y.D. (2003). Assessing the consumer decision process in the digital market place, *Journal of Business Research,* 32, 349-363.

Teo, T.S.H., Lim, V.K.G. & Lai, R.Y.C. (1999). Intrinsic and extrinsic motivation in Internet usage. *Omega,* 27 **(**1), 25–37.

Van den Poel, D. & Leunis, J. (1996). Perceived risk and risk reduction strategies in mail-order versus retail store buying. *The International Review of Retail, Distribution and Consumer Research,* 6(4), 351-371.

Van den Poel, D. & Leunis, J. (1999). Consumer acceptance of the Internet as a channel of distribution. *Journal of Business Research*, 45(3), 249-256.

Venkatraman M.P. The impact of innovativeness and innovation type on adoption-Journal of Retailing, 1991: 67(1): 51-67.

Venkatraman, M.P. & Price, L.P (1990). Differentiating between cognitive and sensory innovativeness: concepts, measurement and their implications, *Journal of Business Research,* 20, 293-315.

Warshaw, P.R. (1980), A new model for predicting behavioral intentions: an alternative to Fishbein, *Journal of Marketing Research*, 17.153-72.

Westbrook, R.A. (1980). A Rating Scale for Measuring Product/Service Satisfaction. *Journal of Marketing*, 44 (4). 68-72.

Winner, B. J., Brown, D.R., & Michels, K. M. (1991). *Statistical principles in experimental design (3rd Ed.).* Boston, MA: McGraw-Hill.

APPENDICES

Appendix A. Focus group discussion questions and the summary of the transcribed responses

After trying 2D views – Larger view and alternate views

- Did you find it useful? How? Why? Why not?

It was useful because I could see the clothing in more detail, such as how is constructed.

- Did you find it easy to use?

It was very easy to use.

- Did you find it entertaining? How?

It was somewhat interesting to see the back and inside of the clothing but nothing much entertaining. Interesting to look at different pictures of the clothing.

- What's the best part of using SET?

I could examine the clothing better with this feature than I could with one picture. It was useful to see the detail of the clothing with larger views

- What's the worst pat, if any?

There's nothing bad about using it.

- Would you like to use SET for apparel purchase? Why? Why not?

I'll definitely use is when available because it's helpful to see what the clothing looks like in detail when purchasing apparel online.

- For what type of clothing would you find it more useful?

Anything would be helped by it. Basics, clothing with some details, like outerwear, jackets… But I won't buy clothing that requires fit a lot, such as jeans or formal dresses. I would buy the clothing that I have nothing to worry about fitting. For example, the clothing that I know the size and fit already.

- Would you recommend it to others? Why? Why not?

Yes, because it's useful in examining clothing online.

After trying 3D rotation view

- Did you find it useful? How? Why? Why not?

It was more useful than larger view. It was very useful to see how the clothing looks on 360. I could see the clothing in detail as well as how it looked like from angles all around. It was also good that I could see the clothing on a form so that I would know how the clothing would look/fall on a real person. It was the most useful, providing the best information regarding the clothing appearance.

- Did you find it easy to use? Or difficult? How? Why?

It was very easy to use.

- Did you find it entertaining? How?

It was more functional than entertaining. It was interesting to see clothing on 360 online.

- What's the best part of using SET?

I could evaluate clothing better with it than with any other sensory enabling technologies available online. I could see everything; it shows the clothing on a form, showing how it drapes on the bottom.

- What's the worst pat, if any?

There's nothing bad about using it.

- Would you like to use SET for apparel purchase? Why? Why not?

Absolutely. I will definitely use it for apparel shopping online because it provided me the look that I would see on a real mannequin. It shows a lot like it looks on a body.

- For what type of clothing would you find it more useful?

Any clothing shopping would benefit form it, specifically the clothing that need to show the back of the clothing or with a lot of detail front, back, and side. I like this better than 2D zoom-in and alternate views because I could see the clothing better in every angle as oppose to alternate views showing only different sections of it.

- Would you recommend it to others? Why? Why not?

Definitely I would recommend it for online apparel shopping because it's very helpful in examining clothing in detail and on a body.

After trying Virtual try-on

- Did you find it useful? How? Why? Why not?

It was interesting to create my model, but the clothing didn't look like it would on the real me. The clothing on the model looked too graphic. It didn't look like the real clothing on the static picture. The way the clothing looks on the model didn't really help in examining it or how it would look on me. However, it showed how the clothing would look like on a body, such as how it would fall on a body, length, etc. So it was useful for that matter.

- Did you find it easy to use? Or difficult? How? Why?

Two people answered - Somewhat confusing

Nine people answered – not difficult

I do not know my measurements well, such as my thigh size. I was confused by that matter but not by the procedure of creating the model.

- Did you find it entertaining? How?

Interesting to create my model and try clothing on it. It was more entertaining than functional, and actually the most amusing than anything else.

- What's the best part of using SET?

It was interesting to create my model and try clothing on it even though it didn't quite look like it would on me.

- What's the worst pat, if any?

Not really…but if I had a slow Internet connection, I might have been annoyed. As long as the Internet connection speed catches up, I would like to use it for fun. If you don't know your measurements, it would be frustrating if they were not able to fill out the information to create the model. It doesn't show the real clothing. As for the product evaluation, I couldn't get much information about out of it…not the detail either.

- Would you like to use SET for apparel purchase? Why? Why not?

For fun, I will do it, but it doesn't provide me a whole lot of information compared to the other technologies. With a help of the different views, Virtual try-on would be useful for online apparel shopping because it shows how the clothing would look on the body.

- For what type of clothing would you find it more useful?

I wouldn't use it for a jacket purchase. I would probably use it for something that requires how it would fit on a body like bathing suit or dresses that I would like to see how it would look like on a model—for fit, cut, and draping.

- Would you recommend it to others? Why? Why not?

Yes, I will tell others that it's interesting to try. Some people might like it better. It's neat to look at the clothing on a created model.

General questions about online apparel shopping

- What type of clothing do you normally buy online?

Basics and something that doesn't requires precise fit.
Clothing from the brand I already know my size and fit.
Clothing from the brand that I don't have a physical store near by.

- What are the comments about using sensory enabling technologies for shopping apparel online?

More the SET available is the better in helping apparel online shopping.
I would like to shop at the site that provides all these Sensory enabling technologies so that I could see clothing better.

- Obstacles of purchasing apparel online

With the help of Sensory enabling technologies, I can see clothing in detail and how it would look like on a body and examine it closely. For the most part of the clothing examination associated with shopping online would be taken cared by them.
However, the biggest obstacle for purchasing apparel online now would be trying it on to see the fit comfort; how I feel in it and if it fits in a certain way I like.

Appendix B: Sample initial survey questionnaire

Section1: **Technology Anxiety (TA)**

Please answer the questions in general.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1. I feel apprehensive about using technology.	1	2	3	4	5	6	7
2. Technical terms sound like confusing jargon to me.	1	2	3	4	5	6	7
3. I have avoided technology because it is unfamiliar to me.	1	2	3	4	5	6	7
4. I hesitate to use most forms of technology for fear of making mistakes I cannot correct.	1	2	3	4	5	6	7

Section2: **Innovativeness (INN)**

Please answer the questions in general.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
5. If I heard about a new technology, I would look for ways to experiment with it.	1	2	3	4	5	6	7
6. Among my peers, I am usually the first to try out new technologies.	1	2	3	4	5	6	7
7. In general, I am hesitant to try out new technologies.	1	2	3	4	5	6	7
8. I like to experiment with new technologies.	1	2	3	4	5	6	7

Section 3**: Perceived Usefulness of Sensory Enablers (PU)**

Please answer the questions based on your simulated shopping experience with **super zoom in** you've just tried.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
9. **Super zoom in** improves my online shopping productivity.	1	2	3	4	5	6	7
10. **Super zoom in** enhances my effectiveness when shopping online.	1	2	3	4	5	6	7
11. **Super zoom in** is helpful in buying what I want online.	1	2	3	4	5	6	7
12. **Super zoom in** improves my online shopping ability.	1	2	3	4	5	6	7
13. **Super zoom in** provides information about a product similar to that from a direct personal examination.	1	2	3	4	5	6	7
14. **Super zoom in** allows me to judge a product's quality as accurately as an in-person appraisal of the product.	1	2	3	4	5	6	7

15. **Super zoom in** provides information about a product's materials and workmanship similar to that available from a direct personal examination.	1	2	3	4	5	6	7

***<u>Section 4</u>*: Perceived Ease-of-Use of Sensory Enablers (PEOU)**

Please answer the questions_based on your simulated shopping experience with **super zoom in** you've just tried.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
16. Using **super zoom in** is clear and understandable.	1	2	3	4	5	6	7
17. Using **super zoom in** does not require a lot of mental effort.	1	2	3	4	5	6	7
18. **Super zoom in** is easy to use.	1	2	3	4	5	6	7

***<u>Section 5</u>*: Perceived Entertainment Value of Sensory Enablers (PE)**

Please answer the questions_based on your simulated shopping experience with **super zoom in** you've just tried.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
19. Shopping with **super zoom in** is fun for its own sake.	1	2	3	4	5	6	7
20. Shopping with **super zoom in** makes me feel good.	1	2	3	4	5	6	7
21. Shopping with **super zoom in** would be boring.	1	2	3	4	5	6	7
22. Shopping with **super zoom in** involves me in the shopping process.	1	2	3	4	5	6	7
23. Shopping with **super zoom in** is exciting.	1	2	3	4	5	6	7
24. Shopping with **super zoom in** is enjoyable.	1	2	3	4	5	6	7
25. Shopping with **super zoom in** is interesting.	1	2	3	4	5	6	7

***<u>Section 6</u>*: Attitude toward using Sensory Enablers (AT)**

Please answer the questions_based on your simulated shopping experience with **super zoom in** you've just tried.

	negative			Neutral			positive
26. Using **super zoom in** is a bad/good idea.	1	2	3	4	5	6	7
27. Using **super zoom in** is inferior/superior.	1	2	3	4	5	6	7
28. Using **super zoom in** is unpleasant/pleasant.	1	2	3	4	5	6	7
29. Using **super zoom in** is unappealing/appealing.	1	2	3	4	5	6	7

***<u>Section 7</u>*: Actual use of Sensory Enablers (USE)**

Please answer the questions_based on your simulated shopping experience with **super zoom in** you've just tried.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
30. I use **super zoom in** (when available) for purchasing apparel online.	1	2	3	4	5	6	7
31. I use **super zoom in** (when available) for browsing for apparel shopping online.	1	2	3	4	5	6	7

***<u>Section 8</u>*: Post use evaluation of Sensory Enablers (PUE)**

Please answer the questions based on your simulated shopping experience with **super zoom in** you've just tried.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
32. Overall, I am satisfied with using **super zoom in**.	1	2	3	4	5	6	7
33. In my opinion, **super zoom in** provides a satisfactory help when I make a purchase decision.	1	2	3	4	5	6	7
34. I will continue using **super zoom in** when I shop for apparel online.	1	2	3	4	5	6	7
35. I would share my good experience about using **super zoom in** for apparel shopping.	1	2	3	4	5	6	7
36. I would recommend shopping at a site with good **super zoom in**.	1	2	3	4	5	6	7

***<u>Section 9</u>*: General questions about Internet Apparel Purchase and Use of Sensory enabling technologies**

Please choose one based on your <u>Internet shopping experience in past six month</u>.

	Nat at all	1-2 times in past 6months	3-4 times in past 6months	5-6 times in past 6months	More than 6 times in past 6months
37. On average, how often have you made apparel purchases online, during the past six months?	1	2	3	4	5

	$0	$1 - $100	$101 - 200	$201 - 300	$301 - 400	$401 - 500	More than $500
38. What is the total amount you spent on apparel purchases online, during the past six months?	1	2	3	4	5	6	7

	Nat at all	occasionally	sometimes	often	Almost always
39. On average, how often do you use **super zoom in** (close-up view; larger view; super enlargement) when	1	2	3	4	5

available?

40. On average, how often do you use **alternative views** (views from 2-3 angles) when available?	1	2	3	4	5
41. On average, how often do you use **3D interactive display** (views from every angle as a consumer drag a mouse) when available?	1	2	3	4	5
42. On average, how often do you use **virtual try on** (create a virtual model and try clothing on it) when available?	1	2	3	4	5

<u>Section 10</u>**: Demographics**

	19-23	24-30	31-40	41-50	51 or older
43. Age	1	2	3	4	5

	Male	Female
44. Gender	1	2

	Less than High school	High school	1-3 years of college	College graduate	Graduate school
45. Education level	1	2	3	4	5

	Less than $30,000	$30,000-49,000	$50,000-74,999	$75,000-99,999	$100,000 – 149,999	Over $150,000
46. Household income level	1	2	3	4	5	6

Appendix C: Sample final survey questionnaire

Section 1:

Please answer the questions in general.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1. Technical terms sound like confusing jargon to me.	☐	☐	☐	☐	☐	☐	☐
2. I have avoided technology because it is unfamiliar to me.	☐	☐	☐	☐	☐	☐	☐
3. I hesitate to use most forms of technology for fear of making mistakes I cannot correct.	☐	☐	☐	☐	☐	☐	☐

Section 2:

Please answer the questions in general.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
4. If I heard about a new technology, I would look for ways to experiment with it.	☐	☐	☐	☐	☐	☐	☐
5. Among my peers, I am usually the first to try out new technologies.	☐	☐	☐	☐	☐	☐	☐
6. I like to experiment with new technologies.	☐	☐	☐	☐	☐	☐	☐

***Section 3*:**

Please answer the questions based on your simulated shopping experience with **larger view and alternate views** you've just tried.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
7. **Larger view and alternate views** feature improves my online shopping productivity.	☐	☐	☐	☐	☐	☐	☐
8. **Larger view and alternate views** feature enhances my effectiveness when shopping online.	☐	☐	☐	☐	☐	☐	☐

9. **Larger view and alternate views** feature is helpful in buying what I want online.							
10. **Larger view and alternate views** feature improves my online shopping ability.							

Section 4:

Please answer the questions_based on your simulated shopping experience with **larger view and alternate views** you've just tried.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
11. Using **larger view and alternate views** feature is clear and understandable.							
12. Using **larger view and alternate views** feature does not require a lot of mental effort.							
13. **Larger view and alternate views** feature is easy to use.							

Section 5:

Please answer the questions_based on your simulated shopping experience with **larger view and alternate views** you've just tried.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
14. Shopping with **larger view and alternate views** feature is fun for its own sake.							
15. Shopping with **larger view and alternate views** feature is exciting.							
16. Shopping with **larger view and alternate views** feature is enjoyable.							
17. Shopping with **larger view and alternate views** feature is interesting.							

Section 6:

Please answer the questions based on your simulated shopping experience with **larger view and alternate views** you've just tried.

	negative -3	-2	-1	Neutral 0	1	2	positive 3
18. Using **larger view and alternate views** feature is a bad/good idea.							
19. Using **larger view and alternate views** feature is inferior/superior.							
20. Using **larger view and alternate views** feature is unpleasant/pleasant.							
21. Using **larger view and alternate views** feature is unappealing/appealing.							

***Section 7*:**

Please answer the questions based on your simulated shopping experience with **larger view and alternate views** you've just tried.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
22. I use **larger view and alternate views** feature (when available) for purchasing apparel online.							
23. I use **larger view and alternate views** feature (when available) for browsing for apparel shopping online.							

***Section 8*:**

Please answer the questions based on your simulated shopping experience with **larger view and alternate views** you've just tried.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
24. Overall, I am satisfied with using **larger view and alternate views** feature.							
25. In my opinion, **larger view and alternate views** feature provides a							

satisfactory help when I make a purchase decision.							
26. I will continue using **larger view and alternate views** feature when I shop for apparel online.							
27. I would recommend shopping at a site with good **larger view and alternate views** feature .							

<u>Section 9</u>:

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
28. I would be likely to use **larger view and alternate views** feature for apparel shopping again.							
29. I would be likely to visit a site providing **larger view and alternate views** feature for apparel shopping.							
30. I would be likely to purchase apparel from a site providing **larger view and alternate views** feature.							

<u>Section 10</u>:

Please choose one based on your <u>Internet shopping experience in past six month</u>.

	Nat at all	1-2 times in past 6months	3-4 times in past 6months	5-6 times in past 6months	More than 6 times in past 6months
31. On average, how often have you made apparel purchases online, during the past six months?					

	$0	$1 - $100	$101 - 200	$201 - 300	$301 - 400	$401 - 500	More than $500
32. What is the total amount you spent on apparel purchases							

online, during the past six months?							

	Nat at all	occasionally	sometimes	often	Almost always
33. On average, how often do you use **super zoom in** (close-up view; larger view; super enlargement) when available?	○	○	○	○	○
34. On average, how often do you use **alternate views** (views from 2-3 angles) when available?	○	○	○	○	○
35. On average, how often do you use **3D rotation view** (views from every angle as a consumer drag a mouse) when available?	○	○	○	○	○
36. On average, how often do you use **virtual try on** (create a virtual model and try clothing on it) when available?	○	○	○	○	○

***<u>Section 11</u>*:**

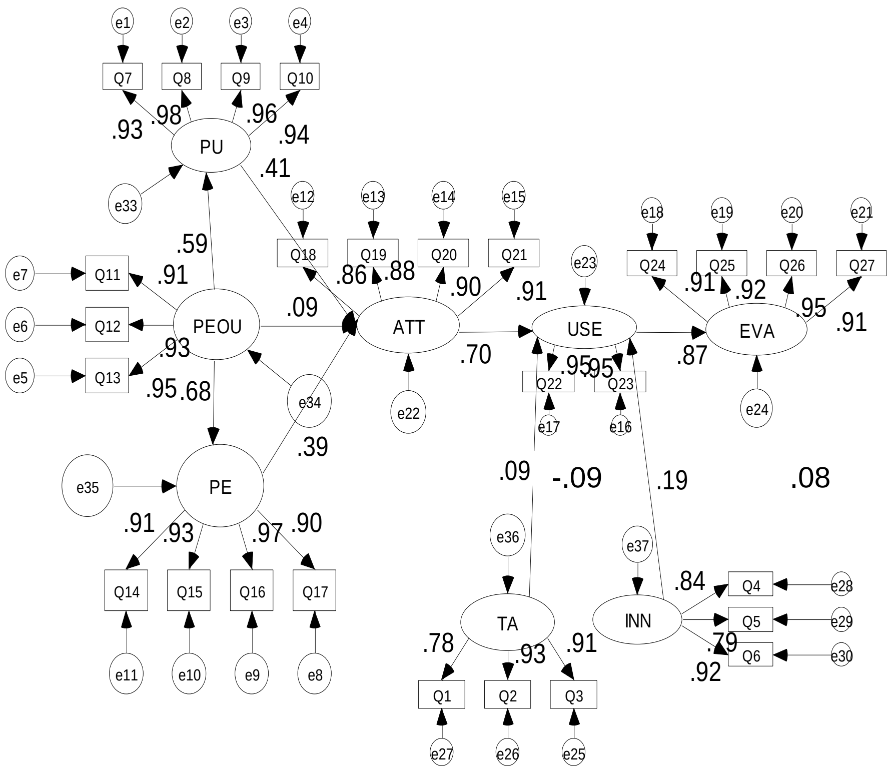
	19-23	24-30	31-40	41-50	51 or older
37. Age	○	○	○	○	○

	Male	Female
38. Gender	○	○

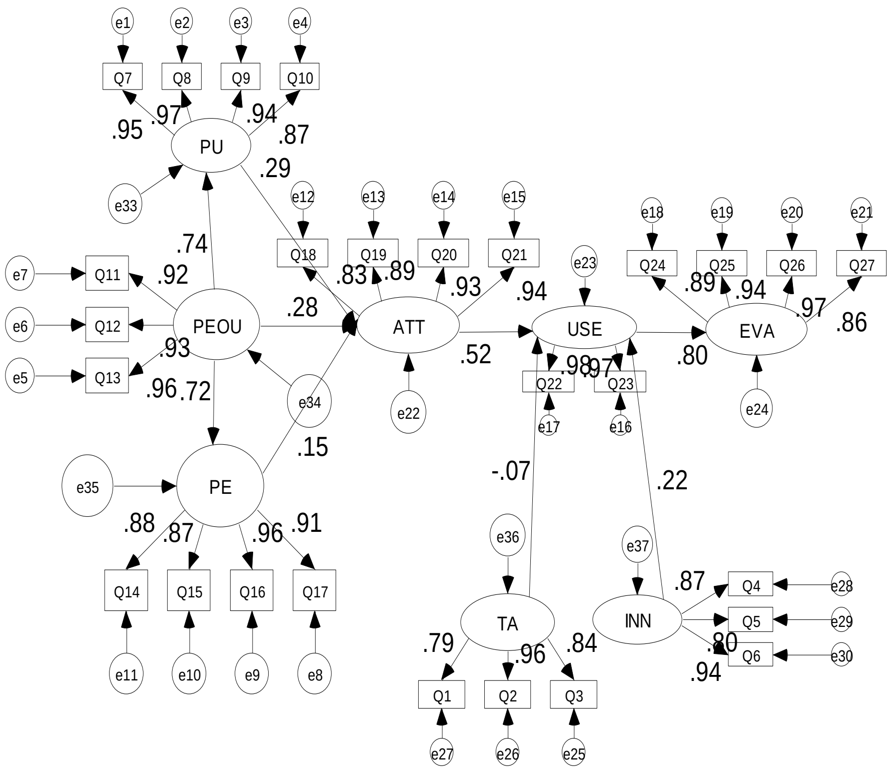
	Less than High school	High school	1-3 years of college	College graduate	Graduate school
39. Education level	○	○	○	○	○

	Less than $30,000	$30,000-49,000	$50,000-74,999	$75,000-99,999	$100,000 – 149,999	Over $150,000
40. Household income level	○	○	○	○	○	○

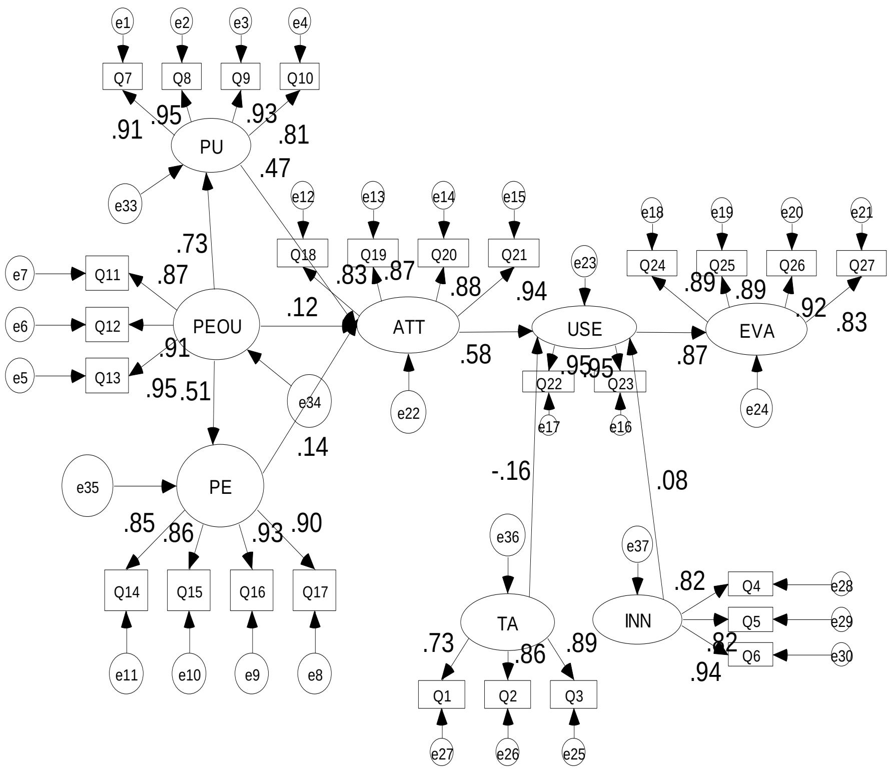
Appendix D. Factor loadings and structural coefficients -- 2D



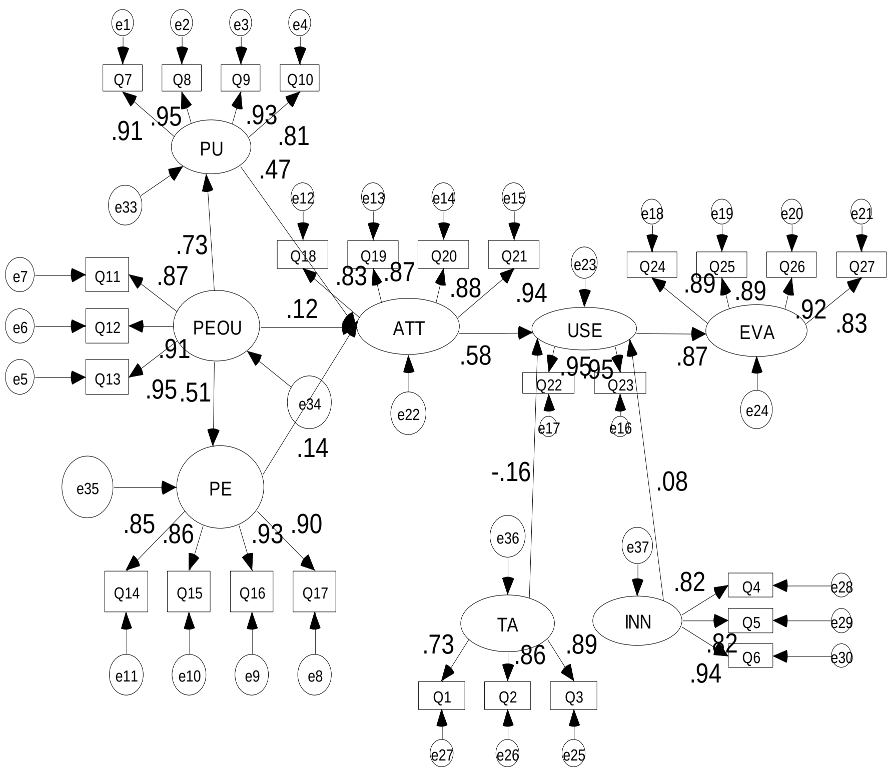
Appendix E. Factor loadings and structural coefficients -- 3D



Appendix F. Factor loadings and structural coefficients – Virtual Try-on

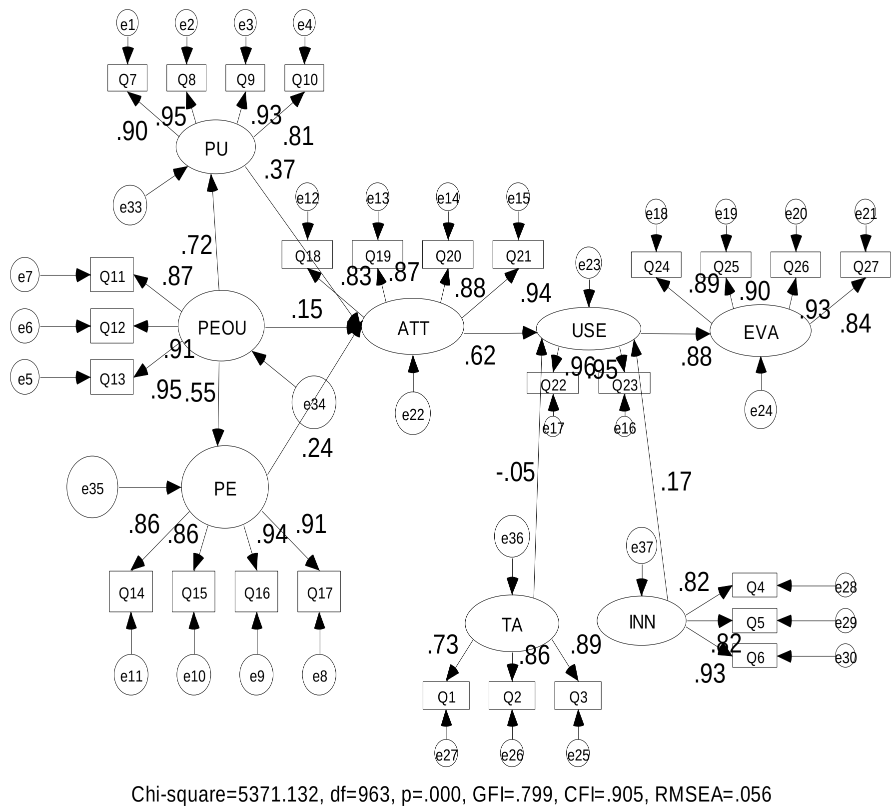


Appendix G. Three-group structural modeling – base model with free estimation of coefficients



Chi-square=5282.425, df=945, p=.000, GFI=.802, CFI=.907, RMSEA=.056

Appendix H. Three-group structural modeling – constrained model with equality constraints imposed



Appendix I. Structural coefficients and significance -- 2D zoom-in and alternate views

			Standardized Estimate	Estimate	S.E.	C.R.	P
PE	<---	PEOU	.685	.619	.036	17.409	***
PU	<---	PEOU	.592	.590	.040	14.603	***
ATT	<---	PEOU	.086	.077	.049	1.582	.114
ATT	<---	PU	.410	.367	.039	9.432	***
ATT	<---	PE	.394	.389	.048	8.064	***
USE	<---	ATT	.696	.904	.052	17.478	***
USE	<---	TA	-.086	.108	.044	2.465	.024
USE	<---	INN	.076	.086	.044	1.936	.053
EVA	<---	USE	.869	.765	.029	26.382	***

Appendix J. Structural coefficients and significance -- 3D rotation view

			Standardized Estimate	Estimate	S.E.	C.R.	P
PE	<---	PEOU	.718	.631	.033	18.901	***
PU	<---	PEOU	.736	.714	.034	20.785	***
ATT	<---	PEOU	.283	.270	.069	3.925	***
ATT	<---	PU	.290	.285	.057	5.041	***
ATT	<---	PE	.149	.161	.061	2.654	.008
USE	<---	ATT	.515	.589	.049	12.021	***
USE	<---	TA	-.065	-.074	.045	-1.634	.102
USE	<---	INN	.217	.267	.050	5.339	***
EVA	<---	USE	.804	.635	.028	22.948	***

Appendix K. Structural coefficients and significance – Virtual Try-on

			Standardized Estimate	Estimate	S.E.	C.R.	P
PE	<---	PEOU	.508	.537	.046	11.684	***
PU	<---	PEOU	.733	.711	.037	19.250	***
ATT	<---	PEOU	.117	.123	.067	1.822	.069
ATT	<---	PU	.466	.504	.066	7.653	***
ATT	<---	PE	.142	.141	.045	3.127	.002
USE	<---	ATT	.585	.614	.045	13.569	***
USE	<---	TA	-.158	-.151	.038	-3.931	***
USE	<---	INN	.080	.291	.055	5.307	.054
EVA	<---	USE	.872	.739	.030	25.040	***