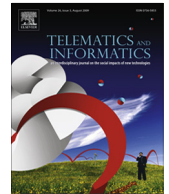




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Validation of Haptic Enabling Technology Acceptance Model (HE-TAM): Integration of IDT and TAM

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ABSTRACT

This study examined the factors affecting the adoption of Haptic Enabling Technology (HET) based products by developing an integrated research framework which combines Innovation and Diffusion Theory (IDT) and Technology Acceptance Model (TAM). Also, we added the concepts of presence and perceived enjoyment to shed light on the hedonic aspect of consumer's adoption of innovation product like HET product.

Using structural covariance analysis, the study found that first, the product specific characteristics of HET-relative advantage, compatibility, ease of use, and presence had significant impact on perceived usefulness. Especially significant were the effects of ease of use and presence. Second, relative advantage, compatibility, ease of use, and presence were all found significant in their effects on perceived enjoyment with ease of use and relative advantage being relatively more significant. Third, the perceived usefulness and perceived enjoyment had significant impact on the adoption intention of HET products, with perceived enjoyment being more significant than perceived usefulness, which explains hedonic motives of HET product use.

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1. Introduction

In the age of digital economy driven by technological advances, information of all kinds is proliferating at fast speed. Normally, people receive new information mostly through audio and visual organs. But people are limited in their ability to make informed as well as effective responses to these stimuli, as the amount of incoming information sharply increases (Brewster and Brown, 2004). When it comes to human information processing, syn-esthetic feedback was found more effective than one-dimensional feedback in terms of feedback speed and usefulness (Vilimek and Zimmer, 2007). For this reason, there has been increased attention to haptic-enabling technology which is harnessed with advantages of multi-sensory information feedback (Lorna et al., 2005).

Haptic Enabling Technology (HET here-in-after) was originally designed to enhance interface between humans and virtual environment through mechanical devices. Using HET products, people can give instructions to virtual environment and take in information through haptic feedback from virtual environment. Thus, HET products may be considered not a continuous improvement over existing products, but a disruptive innovation that is driven by interactivity and situational adaptability (Jung and Myung, 2008). HET is currently put into a wide range of applications in different fields with most active uses found in medical field. Now doctors can perform a surgery while looking at a monitor away from the patient using three

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dimensional anatomical images and even get tangible feel of the patient's skin tissue through machine operated power transmission. Besides medical field, HET is now used in a variety of applications at an accelerating speed of diffusion. For instance, there are HET-based products which interact with users by not only audio-visual stimuli but haptic one, such as Nintendo's Nintendo DS and Wii, iPhone, iPad from Apple, and Galaxy S and Galaxy Tab from Samsung. Also, HET is expected to grow fast due to its applicability in entertainment industries with the arrivals of 4D movies and experiential simulators.

Although studies on HET are scarce yet, there have been quite a few studies done in the past which approached new product adoption from the standpoint of innovation diffusion. Previous studies on innovation technology included innovation marketing drawing on innovative characteristics (Ganesh et al., 1997), communication research based on innovation diffusion theory (Rogers, 1995), and technology management of innovation product (Kelly and Brooks, 1991). Several studies on innovation adoption focused on product characteristics, such as relative advantage, compatibility, complexity, divisibility, and observability to determine their effects on the adoption of innovative products (Rogers, 1995; Hong et al., 2008; Suh, 2004). Others studies approached the adoption issue from a consumer-centric perspective based on Technology Acceptance Model (TAM) by incorporating perceived usefulness and perceived ease of use (Davis, 1989; Oh, 2010). Although TAM and IDT, two representative models have contributed to explaining consumer behavior related to the adoption of innovative products, they are limited because these models didnot take product characteristics into account. Therefore, it seems appropriate to develop an integrated research model which reflects product characteristics and combines the two models of product adoption in order to better understand the effects of product and consumer characteristics on the adoption of HET.

With this in mind, this study aims to examine the factors affecting HET-based product adoption by incorporating established theories of TAM model and Innovation and Diffusion Theory (IDT). For this purpose, with a view to developing an integrated research framework tailored to HET products, this study added two new constructs-presence and perceived enjoyment. The presence concept was adopted to infuse the element of realism that is critical in virtual environment, and perceived enjoyment was added in order to incorporate the affective outcomes associated with the use of HET products. This study's main objective is to validate this new research model, labeled HE-TAM (Haptic Enabling Technology Acceptance Model) that was created by theoretical integration. We anticipate that this integrated approach will prove its applicability with regard to HET product adoption, thus contribute to the current literature.

2. Literature review

2.1. Haptic Enabling Technology; HET

The majority of current computer technologies mainly rely on audiovisual information to establish information interface between humans and computers. However, the desire to attain ever more concrete and realistic information via virtual reality brought Haptic Enabling Technology which transmits not just information but also senses of touch and power. The term 'haptic' originates from 'haptesthai', a Greek word denoting 'touching' and is commonly referred to mean Haptic Enabling Technology (Wikipedia, 2010). HET product is created to enhance syn-esthetic interface between humans and virtual environment. Through HET one gives virtual environment orders and receives feedback in the form of touch and power. As such, HET may be viewed as a disruptive rather than continuous innovation, which drastically upgrades the levels of human-machine interactivity and situational adaptability. Applications of HET are rapidly spreading to make remote controllability a reality, making active inroads in medicine, entertainment, and space and ocean explorations. Especially noteworthy is application in entertainment field, as a wide range of innovations are finding their uses in products such as home game devices (Nintendo Wii, Microsoft's PlayStation, Sony's X-Box), 4D movie theaters, and driving simulators. This study focuses on some of these entertainment products with a view to finding the factors affecting the adoption of HET products.

2.2. Characteristics of HET product

To examine the role of product characteristics on HET adoption, we incorporated in this study the innovation characteristics proposed in Rogers' (1983) theory of innovation diffusion. Rogers (1983) defined innovation as "ideas, customs or objects that are perceived as new by individuals or other adopting units who use them" and argued that some characteristics of innovation products influence their adoption, such as relative advantage, compatibility, complexity, divisibility, and observability (Rogers, 1995). He posited that relative advantage, compatibility, divisibility, and observability exert positive influence on innovation adoption, whereas complexity and perceived risk exert negative influence. In short, when innovation products have certain advantages, and are compatible with extant system or user behavior, and are easily observable and triable, they are easily adopted, but when they are complicated, adoption rarely takes place. What this observation implicates is that innovation characteristics are not necessarily unique features specific to innovation product, but a relative concept whose evaluations is contingent upon adopter's subjective perception (Agarwal and Prasad, 1998). Tomatzky and Klein (1982) conducted a meta analysis on innovation diffusion studies and found that there are some variations in the extent to which product characteristics impact on innovation adoption. Specifically, the three characteristics-relative advantage, compatibility, and complexity-had consistently strong impact on innovation adoption, whereas divisibility and communicability showed inconsistent findings on their effects on new product adoption.

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