Computers in Human Behavior 70 (2017) 104–112

Contents lists available at ScienceDirect

Computers in Human Behavior

journal homepage: www.elsevier.com/locate/comphumbeh

Full length article

Assessing the acceptance of technological implants (the cyborg): Evidences and challenges

Jorge Pelegrín-Borondo [a], Eva Reinares-Lara [b], Cristina Olarte-Pascual [a, *]

[a] Department of Business Administration, Universidad de La Rioja, Facultad de Ciencias Empresariales, La Cigüeña 60, 26006, Logroño, La Rioja, Spain
[b] Department of Business Administration, Universidad Rey Juan Carlos, Facultad de Ciencias Jurídicas y Sociales, Paseo Artilleros s/n., 28032, Vicálvaro, Madrid, Spain

A R T I C L E I N F O

Article history:
Received 28 June 2016
Received in revised form
9 December 2016
Accepted 28 December 2016
Available online 3 January 2017

JEL classification:
M3

Keywords:
Insideable
Technology acceptance
Perceived usefulness
Ease of use
Emotions
Subjective norm

A B S T R A C T

Society has already accepted the use of physical implants that increase an individual's seductive power as well as technological implants that correct physical disabilities. Various companies are currently developing technological implants to increase the innate capacity of the human body (insideables) (e.g., memory implants). Public acceptance of this new technology has not yet been investigated in academic research, where studies have instead focused on the ethical and evolutionary implications of insideables. The main aim of this study is the development of a model, namely the Cognitive-Affective-Normative (CAN) model, for assessing the acceptance of new types of technological products. The CAN model combines the cognitive variables *perceived usefulness* and *perceived ease of use*, as well as the normative variable *subjective (or social) norm*, from the TAM models with the affective variables *positive emotions*, *negative emotions* and *anxiety*. The CAN model was tested on a sample of 600 randomly selected individuals through structural equation modeling. Data were obtained from a self-administered, online survey. The proposed model explains 73.92% of the intention to use the technological product in the very early stages of its adoption, that is, its early acceptance. Affective and normative factors have the greatest influence on the acceptance of a new technology; within the affective dimension, positive emotions have the greatest impact. Any technology acceptance model should thus consider the emotions that the new technology produces, as well as the influence of the social norm.

1. Introduction

Technological implants are electronic devices implanted in the human body. They can be classified into two types: implants that correct for physical disabilities and implants that increase the human body's innate capacity. This study presents an original model of technology acceptance, namely, the Cognitive-Affective-Normative (CAN) model, designed to explain people's intention to use technological implants to increase the innate capacity of their bodies (henceforth, 'technological implants to increase innate capacity' or '*insideables*'). The CAN model is based on the previous technology acceptance models TAM (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989) and TAM2 (Venkatesh & Davis, 2000), which have been expanded to include affective variables. Specifically, the CAN model combines the cognitive variables *perceived usefulness* and *perceived ease of use*, as well as the normative variable *subjective (or social) norm*, from the TAM models with the affective variables *positive emotions*, *negative emotions* and *anxiety*. The CAN model was tested on a sample of 600 randomly selected individuals through structural equation modeling. Data were obtained from a self-administered, online survey.

Today, many companies are either developing or patenting and commercializing insideables. Olarte-Pascual, Pelegrín-Borondo, and Reinares-Lara (2015) showed that part of society is ready to accept technological implants to increase innate capacities. Examples of *insideables* include future implants, such as memory implants (MIT Technology Review, 2013), implants that are currently available on the market, such as the personal identification implants sold by VeriChip, and patented implants that have not yet been brought to market, such as the microphone patented by Motorola that can be implanted in the neck to reduce problems with bad reception or the tattoo developed by Nokia that vibrates when there is an incoming call. Consumer acceptance of *insideables*

* Corresponding author.
E-mail addresses: jorge.pelegrin@unirioja.es (J. Pelegrín-Borondo), eva.reinares@urjc.es (E. Reinares-Lara), cristina.olarte@unirioja.es (C. Olarte-Pascual).

http://dx.doi.org/10.1016/j.chb.2016.12.063
0747-5632/

would open up a huge potential market for businesses. Nevertheless, public acceptance of this new technology has not yet been investigated in academic research, where studies have instead focused on the ethical and evolutionary implications of *insideables*. The latter involve the development of *cyborg* theories (i.e., theories related to the notion of creatures that are both part human and part machine), which view *insideables* as an evolutionary success that will allow reasonable people to enhance their capabilities as much as the technology allows (Rosahl, 2004; Schermer, 2009; Selinger & Engström, 2008).

There is evidence pointing to the potential acceptance of *insideables* by a significant portion of humanity. Technological implants that correct for physical disabilities have been accepted, as have non-technological implants that increase the body's innate capacity. For instance, Schermer (2009) found that the use of technological body implants to compensate for physical disabilities, i.e., for health-related reasons, has not only been accepted but has also become a widespread practice. Cochlear implants to assist children with hearing impairments (Pray & Jordan, 2010), pacemakers, cardioverter defibrillators, catheters and heart valves, among others, have all seen rapid penetration worldwide (Hill & Sawaya, 2004; Rosahl, 2004). Likewise, many people have already chosen to modify their body to help them increase their seductive capacities (Lawton, 2004) and achieve their social or personal goals (Adams, 2010). In the U.S. alone, 11.8M cosmetic surgeries were performed in 2007 (Chauhan, Warner, & Adamson, 2010), of which augmentation mammoplasty—the incorporation of (non-technological) physical implants for breast augmentation—seems to be the most popular procedure (Sevin et al., 2006; Siclovan & Jomah, 2008). Moreover, some authors argue that the penetration of (technological) implants in modern society has led to the perception that the body is modifiable (Christie & Bloustien, 2010; Lai, 2012). In this vein, Buchanan-Oliver and Cruz (2011) have noted that the human body is increasingly seen as a machine assembled from multiple parts and systems that can be replaced when broken, and that body performance can be improved using simple prosthetic devices to correct sensory functions (e.g., eyeglasses) or by incorporating technology into the body through sensory prostheses (e.g., neuroprostheses, exoskeletons, deep brain stimulation, and neurofeedback (Schermer, 2009)).

The remainder of this article is organized as follows. Section 2 introduces the model variables and hypotheses. Section 3 describes the methodology. Section 4 presents the statistical analysis resulting from the application of the CAN model, namely, the relative importance of cognitive, affective and normative factors in the acceptance of *insideables*. Section 5 discusses the results and their implications. Section 6 contains the conclusion.

2. Model variables and hypotheses

The CAN model combines the cognitive variables *perceived usefulness* and *perceived ease of use* and the normative variable *subjective (or social) norm* from the TAM models with the affective variables *positive emotions*, *negative emotions* and *anxiety*. The following subsections describe the model variables and underlying hypotheses.

2.1. Influence of perceived usefulness and perceived ease of use on the intention to use a new technology

Davis (1989, p. 320) defines the variable *perceived usefulness* as “the degree to which a person believes that using a particular system would enhance his or her performance.” *Perceived ease of use*, on the other hand, is defined as “the degree to which a person believes that using a particular system would be free of effort” (Davis *ibid*., p. 320). The influence of perceived usefulness and perceived ease of use on attitudes toward the use of a new technology was established by the Technology Acceptance Model (TAM) (Davis, 1989; Davis et al., 1989). Subsequently, Venkatesh and Davis (2000) demonstrated the influence of the variables *perceived usefulness* and *perceived ease of use* on the intention to use a new technology in their TAM2 model. In the field of technology acceptance, the influence of perceived usefulness and perceived ease of use on the acceptance of a new technology has also been proven (e.g., Abdullah, Ward, & Ahmed, 2016; Mohammadi, 2015; Tan, Ooi, Chong, & Hew, 2014). Several studies have empirically confirmed that TAM models consistently explain a substantial part of the variance (approximately 40%) in the intention to use innovative technologies (Venkatesh & Davis, 2000).

With regard to the acceptance of body implants, Adams (2010) already established the importance of the variable *perceived usefulness* as a vital factor in the decision to undergo cosmetic surgery. In addition, Giudici, Carlson, Krupa, Meierbachtol, and VanWhy (2010) showed that the decision to have a submammary defibrillator, cardiac resynchronization therapy device, cardioverter defibrillator or pacemaker implanted is associated with the system's ability to provide greater comfort and better aesthetic results than external body systems. In relation to technological implants, Christie and Bloustien (2010) noticed the perceived usefulness that the deaf community attributes to cochlear implants in providing them with certain key capacities required to thrive in an oral world. Reinares-Lara, Olarte-Pascual, Pelegrín-Borondo, and Pino (2016) showed that the perceived usefulness of capability-enhancing nanoimplants significantly influences people's attitudes toward such devices. Consumers' decisions to adopt wearable technology are affected by perceived usefulness (Choi & Kim, 2016).

Based on the conceptual framework of the TAM models, and the results of studies in the therapeutic arena, we propose the following hypotheses in relation to insideables:

H1. *The perceived usefulness of insideables positively affects the intention to use them.*

H2. *The perceived ease of use of insideables positively affects the intention to use them.*

2.2. Influence of emotions on the intention to use a new technology

Along with cognitive factors, we propose the addition of affective explanatory variables since they enable a better understanding of the assessments subjects make (Campbell, 2007; Laverie et al., 2002; Parreño, Sanz-Blas, Ruiz-Mafé, & Aldás-Manzano, 2013; Shiv & Fedorikhin, 1999; Van Osselaer et al., 2005; Zielke, 2011). In order to define the concept of emotion, we used the Componential Emotion Theory. This theory identifies the minimum common traits required to define the concept of emotion (Ortony and Turner, 1990; Russell, 2003; Richins, 1997; Scherer, 2001, 2005), namely, the need for a stimulus, attribution of the cause of the stimulus, cognitive assessment, physiological reaction, feelings of pleasure-displeasure, a qualitative feeling of uniqueness, a tendency toward a characteristic action, and a short-duration processes.

In terms of how emotions influence behavior, some emotions stimulate action, while others inhibit or change it (Cohen, Pham, & Andrade, 2006; O'Neill and Lambert, 2001; Oliver, Rust, & Varki, 1997; Turner, Love, & Howell, 2008; White & Yu, 2005). In general, objects causing positive emotions are evaluated favorably, whereas objects causing negative ones are evaluated unfavorably (Bagozzi, Gopinath, & Nyer, 1999; Mano, 2004). Moreover, there is a natural tendency to make decisions that minimize the likelihood of negative emotions occurring (Elliott, 1998; Han, Lerner, & Keltner,