Nanoimplants that Enhance Human Capabilities: A Cognitive-Affective Approach to Assess Individuals' Acceptance of this Controversial Technology

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Abstract

Nanotechnology enables the miniaturization of complex devices designed to enhance individuals' physical and cognitive capabilities and, in the form of nanoimplants, their integration in the human body. It is unknown, however, whether people are willing or not to accept such devices. To shed light on this issue, this research used an extended version of the well-known Technology Acceptance Model (TAM), adding affective factors to the cognitive components already present in the model. Testing on a sample of six hundred individuals yielded statistically significant effects on attitudes toward nanoimplants and intention to undergo nanoimplantation. Conclusions are drawn and implications are discussed.

Keywords: Emotions, Implantations, Nanotechnology, Perceived ease of use, Perceived usefulness.

INTRODUCTION

The number of biomedical devices implantable into the human body (Fang & Lee, 2011; Mackert & Harrison, 2009) is on a constant rise, ranging from pacemakers to heart valves, hip joints to artificial cochleae (Hill & Sawaya, 2004; Rosahl, 2004). Likewise, the number of people receiving implants has significantly increased (Pray & Jordan, 2010). Case in point: The medical technology leader, Medtronic (2016), which specializes in the production and commercialization of implantable therapeutic devices, recently reported that its net sales grew at a 6% average annual rate over the past five years, reaching $20.26 million in 2015.

The overwhelming majority of implantable devices developed in the past few years serve medical purposes: They restore the control of paralyzed limbs, maintain regular heart rhythm, improve impaired vision or hearing, etc. (Raatikainen et al., 2015). Sophisticated devices, such as a wireless brain-computer interface implantable in the skull of paralyzed people, allow them to control TVs, wheelchairs, or other tools (Regalado, 2015). However, some implantable devices transcend the medical function to increase people's capabilities, such as mental agility, memory, or physical strength, or even enable new ones, such as the remote control of machines (Buchanan, 2011; Gasson, Kosta, & Bowman, 2012; Jotterand, 2008; Lin & Allhoff, 2008; Robitaille, 2008). Hypothetically, these devices should allow for hyper-performing bodies capable of excelling in the workplace and other social contexts.

In this regard, nanotechnology—which is the fabrication of devices with atomic or molecular scale precision (i.e., smaller than 100 nanometers; Wang, 2005)—promises significant progress: It may indeed increase the resistance, biocompatibility, and physiological integration of these new implantable devices (Ach & Luttenberg, 2009; Berger, Gevers, Siep, & Weltring, 2008; Action Group on Erosion, Technology and Concentration, ETC, 2006). The interest in such devices among research centers and companies is already apparent: *MIT Technology Review*, for instance, recently labeled brain implants that will improve memory as one of the most innovative technologies of the near future (Cohen, 2013). Meanwhile, major technological companies such as Google, Facebook, and PayPal are devoting considerable financial resources to start-up companies that are developing new technologies for enhancing human capabilities (Cortina & Serrá Beltrán, 2015)—for example, Calico™ or Vicarious™ (Sánchez, 2015).

The diffusion of nanoimplants for enhancing human capabilities may open new possibilities in the field of nanomarketing, that is, the study of consumer behavior by means of non-invasive, portable or wearable nanotechnological devices that allow the continuous monitoring of consumption experiences (Mileti, Guido, & Prete, 2014). The true breakthrough will occur when consumers shift from wearing external smart devices to implanting nanotechnological devices directly into their bodies (Olarte-Pascual, Pelegrín-Borondo, & Reinares-Lara, 2015). Such a scenario poses significant concerns for modern society, because nanoimplants could split humanity between hyper-performing and normal humans (Deplazes, 2008; Fletcher, 2014; Lai, 2012; Pelegrín-Borondo, Reinares-Lara, Olarte-Pascual & Sierra-García, 2016; Schermer, 2009). However, the first important question is whether people are even willing to accept the implantation of nanotechnological devices to enhance the capabilities of their bodies, and if so, why.

Despite the continuous development of nanoimplants potentially capable of enhancing human capabilities (e.g., Buchanan, 2011; Gasson, Kosta, & Bowman, 2012), research on their acceptance is practically nonexistent. To fill this gap, this paper proposes and tests a cognitive-affective research framework that extends previous models designed to assess the intention to use a new technology—specifically, the Technology Acceptance Model, or TAM (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989), alongside its extensions, namely the TAM2 (Venkatesh & Davis, 2000) and the Unified Theory of Acceptance and Use of Technology, or UTAUT (Venkatesh, Morris, Davis, & Davis, 2003; Venkatesh, Thong, &

Xu, 2012). These models postulate that the intention to use a given technology largely depends on two main cognitive dimensions, namely the *perceived usefulness* of a technology and its *perceived ease* of use. However, the present research hypothesizes that people's acceptance of capability-enhacing nanoimplants may also be significantly influenced by the positive/negative emotions triggered when thinking about such devices.

The paper unfolds as follows: The following section reviews the cognitive and affective factors likely to affect people's intention to undergo implantation of nanotechnological devices, as well as introduces five research hypotheses. The paper then describes the survey conducted to test these hypotheses. The subsequent sections discuss the results, their implications, and the study's limitations so as to provide directions for future research.

BACKGROUND

Theories that postulate an overlap between the functioning of the human body and that of computational machines (e.g., the Computational Theory of Mind; Putnam, 1975) point out that technological progress ultimately entails integrating miniaturized devices into the human body. Such devices can enhance human capabilities in a variety of fields and trigger substantial changes that will run in parallel with human beings' natural evolution. Thus, many experts consider the progressive merging of human and machine (the so-called "cyborgization" of humans) ineluctable (Bhattacharyya & Kedzior, 2012; Park, 2014). This process, in their opinion, will lead to significant progress, allowing people to exceed their natural abilities (Schermer, 2009; Selinger & Engström, 2008).

Nevertheless, people's acceptance of implantable nanotechnological devices will play a major role in promoting or, conversely, inhibiting their diffusion. Such acceptance or rejection is driven by the dual system of affect and cognition that shapes human behavior (Bigné & Andreu, 2004; Boehner, Depaula, Dourish, & Sengers, 2007; Campbell, 2007; Shiv

& Fedorikhin, 1999). The literature on technology acceptance (e.g., Yang & Yoo, 2004) acknowledged that both cognitive and affective factors simultaneously influence individuals' attitudes toward a certain technology and intention to adopt it. The broader literature on consumer behavior further corroborates the importance of considering both cognitive and affective factors when exploring human attitudes and intentions (Bagozzi, 1982; Laverie, Kleine, & Kleine, 2002; Laros & Steenkamp, 2005; Levav & McGraw, 2009; Van Osselaer et al., 2005; Van Waterschoot, Kumar Sinha, Van Kenhove, & De Wulf, 2008; Zielke, 2011). Thus, this research focused on both factors to investigate the drivers behind people's acceptance of capability-enhancing nanoimplants.

Cognitive factors influencing the acceptance of capability-enhancing nanoimplants

The Technology Acceptance Model (TAM) (Davis, 1989) postulates that the perceived usefulness and perceived ease of using a given technology significantly influence individuals' attitudes toward that technology. *Perceived usefulness* is the degree to which prospective users believe that a given technology will enhance their performance or provide them with an advantage. *Perceived ease of use* is the degree to which prospective users expect that using a given technology will be free of effort (Davis et al., 1989). In this research, perceived ease of use means the extent to which individuals believe that they would feel comfortable with implanted nanotechnological devices.

The medical literature has widely documented the positive influence of perceived usefulness on people's acceptance of implantable medical devices. For instance, Giudici, Carlson, Krupa, Meierbachtol, and VanWhy (2010) showed that the perceived usefulness of submammary defibrillators, cardiac resynchronization therapy devices, Implantable Cardioverter Defibrillators (ICD), and pacemakers favorably influences patients' decisions to implant these devices in their bodies. Christie and Bloustien (2010) established that the usefulness that the deaf ascribe to cochlear implants, in terms of their improved capability to thrive in an oral world, favorably influences their acceptance of such devices. Adams (2010) ascertained that the perceived usefulness of cosmetic surgery is an essential factor in individuals' acceptance of cosmetic body implants. Similarly, existing studies document that perceived ease of use favorably influences people's acceptance of new health care technologies, such as therapeutic tools (Bertrand & Bouchard, 2008) and technologies for electronic medical recording (Handy, Hunter, & Whiddett, 2001).

Based on these findings, it can be reasonably advanced that perceived usefulness and perceived ease of use can favorably influence individuals' acceptance of capability-enhancing nanoimplants. However, because these devices are not actually available to people interested in enhancing their capabilities, this research focused on the impact of perceived usefulness and ease of use on people's attitudes toward such devices, rather than on their behavioral intentions. Thus, the following hypotheses are proposed:

> H1. The perceived usefulness of nanoimplants that enhance human capabilities has a positive effect on individuals' attitudes toward these devices.
>
> H2. The perceived ease of using nanoimplants that enhance human capabilities has a positive effect on individuals' attitudes toward these devices.

Emotions triggered by considering capability-enhancing nanoimplants

Because medical implants may help impaired people solve chronic problems and improve their quality of life, they are often well accepted (Mackert & Harrison, 2009). In many cases, people experience a positive affective state after undergoing implantation (Hoogwegt, Widdershoven, Theuns, & Pedersen, 2014; Wismeijer, Van Waas, Vermeeren, Muldel, & Kalk, 1997). However, feelings of apprehension, anxiety, and even fear may arise from the blurred boundary between the medical device(s) and the human body (Buchanan-Oliver & Cruz, 2011). For example, previous research has shown that about 20% of ICD patients suffer from anxiety during the first year after implantation (Magyar et al., 2011). For certain people, the implantation of medical devices may engender a fear of dehumanization (Lai, 2012). Most, Wiesel, and Blitzer (2007) observed that cochlear implants, for instance, could lead to a loss of identity in young deaf people. The loss of identity may, in turn, negatively influence these people's attitude toward cochlear implants.

Based on the above, it seems reasonable to suppose that capability-enhancing nanoimplants may trigger ambivalent emotional reactions that could, in turn, affect people's attitudes toward these devices in both positive and negative ways. Whereas objects that arouse positive emotions are generally evaluated in a favorable way, objects that arouse negative emotions are generally evaluated in a negative way (Bagozzi, Gopinath, & Nyer, 1999; Mano, 2004). Consequently, the following hypotheses are proposed:

H3. Positive emotional reactions to nanoimplants that enhance human capabilities have a positive effect on individuals' attitudes toward these devices.

H4. Negative emotional reactions to nanoimplants that enhance human capabilities have a negative effect on individuals' attitudes toward these devices.

Attitudes toward and intention to adopt capability-enhancing nanoimplants

Empirical applications of the well-known Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975) and its extensions—namely, the Theory of Planned Behavior (TPB) (Ajzen, 1991) and the Technology Acceptance Models (TAMs) (Davis, 1989)—suggest that favorable attitudes toward a given technology positively influence people's intentions to use it (Bhattacherjee & Premkumar, 2004; Lee, Cheung, & Chen, 2005; Shih, 2004). This influence has been confirmed for common technologies—e.g., Internet technology (Fogelgren-Pedersen, Anderson, & Jelbo, 2003; Lu, Yaob, & Yua, 2005) and mobile advertising (Izquierdo-Yusta, Olarte-Pascual, & Reinares-Lara, 2015; Soroa-Koury & Yang, 2010)—as well as for medical technologies, such as home medical technology (e.g., blood glucose monitoring devices; Gaul & Ziefle, 2009), biomedical technologies (e.g., tissue engineering; Park, Kim, & Kwon, 2016), and genetic testing (Wade et al., 2011).

As regards implantable medical devices, limited attention has been paid to the relationship between patients' attitudes toward these devices and their intention to implant them into their bodies. Because such devices aim to deal with (or possibly solve) patients' health problems, one might expect that both patients' attitudes toward and intentions to adopt these devices would be positive. This might not be true for implantable devices that aim to increase human capabilities, as some people may fear that such devices could alter human nature and produce controversial social and economic effects. It is plausible, then, that individuals' favorable attitudes toward capability-enhancing nanoimplants will play a crucial role in determining their intention to implant these devices into their bodies. Formally:

> H5. Individuals' attitudes toward nanoimplants that enhance human capabilities have a positive effect on their intention to undergo implantation of these devices.

To test these hypotheses, the present research proposes a theoretical model that integrates the cognitive and affective variables likely to influence people's attitudes toward and intentions to adopt capability-enhancing nanoimplants (Figure 1). It is expected that, compared to previous models used to assess technology acceptance, this model will better explain people's behavioral intentions toward the studied devices.

(Insert Figure 1 about here)

METHOD

An online survey was conducted on a representative sample of people, aged 16 and over, residing in Spain. To access this population, 3,500 invitations were sent out via e-mail to a national consumer panel. The invitations were equally distributed by gender and age. The final sample consisted of 600 people equally divided into five age brackets (less than 20; 21–30; 31–40; 41–50; over 50), with each bracket including an equal number of males and females. At the beginning of the questionnaire, respondents received the following explanation regarding the topic of the survey:

> *We are surveying people's acceptance of nanoimplants that enhance human capabilities. Nanoimplants are extremely miniaturized electronic devices that could be embedded in the human body to enhance physical and cognitive capabilities. Several capability-enhancing nanoimplants have already been developed by scientists: from nanoimplants that enhance physical strength, physical speed, and computational speed, to nanoimplants that delay aging or enable the remote control of machines.*

Then, respondents were presented with three scales in a random order that respectively rated the perceived usefulness of capability-enhancing nanoimplants, the perceived ease of using them, and the positive and negative emotions elicited by these nanodevices. Respondents also rated their attitudes and intentions toward such devices. Specifically, the perceived usefulness of nanoimplants was assessed using four 7-point items derived from Davis et al. (1989) (e.g., "Nanoimplants would improve my performance"; "Nanoimplants would be useful for performing my daily activities"; 1 = disagree strongly, 7 = agree strongly). Analogously, the perceived ease of using nanoimplants was assessed using four 7-point items derived from Davis et al. (1989) (e.g., "Learning how nanoimplants work would be easy for me"; "I could easily become knowledgeable about how nanoimplants function"; 1 = disagree strongly, 7 = agree strongly).

To assess the positive and negative emotions associated with nanoimplants, the questionnaire instructed respondents to think for a moment about these devices and imagine that they had the opportunity to implant one of them into their bodies. Then, the questionnaire assessed their positive and negative emotional reactions on the PANAS scale (Watson, Clark, & Tellegen, 1988), which allows respondents to rate the extent to which they experience ten positive emotions (e.g., "enthusiastic", "interested") and ten negative emotions (e.g., "distressed", "scared") on a 7-point scale (1 = not at all, 7 = very much).

Respondents' attitudes toward nanoimplants were assessed using four bipolar items rated on a 7-point scale ("I think that nanoimplants are..." "bad-good", "foolish-wise", "ineffective-effective", "negative-positive") derived from Bhattacherjee and Premkumar (2004). Respondents' intention to undergo implantation of the studied devices was measured using two 7-point items adapted from Venkatesh and Davis (2000) (e.g., "I would undergo implantation of a nanotechnological device in order to improve my cognitive and/or physical capabilities"; "I would willingly implant in my body a nanotechnological device designed to enhance my cognitive and/or physical capabilities"; 1 = disagree strongly, 7 = agree strongly). Respondents' socio-demographic data (gender and age) were also recorded.

To test the proposed hypotheses, the dimensionality of the studied constructs was first assessed by means of an exploratory factor analysis. Next, the measurement model was assessed by testing the reliability and validity of the extracted measurement scales. Finally, partial least squares structural equation modeling (PLS-SEM) was used to test the proposed hypotheses.

RESULTS

Exploratory factor analysis

Exploratory factor analysis was used to verify the factor structure of the observed variables, namely perceived usefulness (PU), perceived ease of use (PEU), attitude toward nanoimplants (ATT), and intention to undergo nanoimplantation (INT). For each variable, the results showed a single factor that explained a satisfactory percentage of the variance of the original data (expl. $var._{PU}$ = 91.90%, expl. $var._{PEU}$ = 91.97%, expl. $var._{ATT}$ = 87.78%, expl. $var._{INT}$ = 97.48%). For all scales, Bartlett's sphericity test resulted in significance at the 0.01 level. With regard to the emotions associated with nanoimplants, the exploratory factor analysis (Kaiser-Meyer-Olkin measure = 0.931) identified three factors that explained 71.53% of the variance. The first factor, loaded by the items "enthusiastic", "strong", "proud", "inspired", "determined", "active", "interested", and "excited", represented positive emotions. The second factor, loaded by the items "afraid", "scared", "jittery", "alert", "nervous", and "attentive", represented anxiety-related emotions. The third factor, loaded by the items "hostile", "upset", "irritable", "distressed", "ashamed", and "guilty", represented negative emotions.

Validation of the scales

PLS was used to verify whether the loadings of all the standardized parameters were greater than 0.7 (Hair, Ringle, & Sarstedt, 2013). The items "alert" and "attentive" had values lower than 0.7 and *t*-values lower than 1.96. As greater model convergence can be obtained by respecifying one or more problematic indicators from different constructs or excluding them entirely (Anderson & Gerbing, 1988), these variables were eliminated. The items "ashamed" and “guilty” also had standardized loadings lower than 0.7, but with *t*-values well over 1.96. Because these indicators contributed to content validity, they were retained in accordance with Hair, Ringle, & Sarstedt’s (2011, 2013) suggestions.

The rest of the variables had standardized loadings greater than 0.7 and *t*-values greater than 1.96. Therefore, all variables achieved satisfactory reliability. All constructs exhibited satisfactory composite reliability and Cronbach’s alpha values (nearly equal to 0.9 or higher). The convergent validity of all constructs was confirmed by the average variance extracted (AVE) being greater than 0.5 (Table 1). Discriminant validity was also confirmed, as the square root of each construct’s AVE was greater than the correlations between each pair of variables (Roldán & Sánchez-Franco, 2012). Furthermore, each item’s loading on its corresponding factor was greater than the cross-loadings on the other factors.

(Insert Table 1 about here)

Structural model

Bootstrapping with 5,000 resamples was used to assess the significance of the path coefficients yielded by the PLS-SEM (Hair et al., 2011). The proposed cognitive-affective model worked satisfactorily (Table 2): It explained 65.9% of the variance in attitude toward the studied devices and 58.4% of the intention to undergo implantation. The model also achieved satisfactory predictive power, with Stone-Geisser’s Q^2 values of 0.53 for respondents’ attitudes and 0.57 for their intentions. Q^2 values greater than zero indicate that an exogenous construct has predictive relevance for the endogenous construct under consideration (Hair et al., 2011). The positive emotions aroused by nanoimplants explained the highest percentage of variance in attitude toward these devices (31.09%), followed by their perceived usefulness (24.56%). Anxiety-related emotions explained the lowest percentage of variance in attitude scores (1.72%).

Table 2 presents the model's fit, path coefficients, and variance explained by the examined relationships. The results confirmed all hypotheses with the exception of H2, and moreover revealed an unpredicted relationship: Anxiety over the idea of nanoimplants had a negative effect on attitude toward these devices (path coefficient = -0.09, $p < .05$). Finally, it is worth noting that, while previous technology acceptance models (e.g., Venkatesh & Davis, 2000; Venkatesh et al., 2012) explained, on average, about 44% of the variance of the original data, the inclusion of the emotional dimension allowed the proposed model to explain more than 58% of the variance.

(Insert Table 2 about here)

GENERAL DISCUSSION

The results of this research suggest that the perceived usefulness of capability-enhancing nanoimplants significantly influences people's attitudes toward such devices. In turn, people's attitudes toward nanoimplants positively affect their intention to undergo implantation of these devices. Perceived usefulness is critical for the introduction of new technologies and innovations (Davis, 1989), as people will be unwilling to adopt them if the possible advantages are not sufficiently salient, or if the concrete advantages seem negligible relative to the amount of time and energy needed to understand and utilize them appropriately.

Unlike perceived usefulness, perceived ease of use did not influence respondents' attitudes toward nanoimplants. The most plausible explanation for this finding is that, because of the devices' miniaturized scale and ability to work autonomously within the human body, individuals do not need information about their function or the difficulty of wearing them.

This result implies that established models, such as the TAM (Davis et al., 1989), are of limited applicability to individuals' acceptance of nanoimplants. At the same time, this result calls for further investigation of people's beliefs about how comfortable living with nanoimplants would be and the possible need to modify their habits in order to adapt to these devices.

Positive emotions were the strongest predictor of respondents' attitudes toward nanoimplants. The obtained results suggest that people's attitude toward these devices may become more favorable as the intensity of their positive feelings (e.g., feeling strong, active, excited, etc.) increases. In particular, the positive emotions triggered by contemplating nanoimplants appear even more important than their perceived usefulness in determining people's favor toward such devices. From a theoretical point of view, this finding provides further support for previous studies showing that cognitive and affective factors together afford greater insight into people's evaluation of objects, actions, situations, etc. (Campbell, 2007; Cohen, Pham, & Andrade, 2006; Levav & McGraw, 2009; Pieters & Van Raaij, 1988; Zielke, 2011).

In keeping with the results regarding positive emotions, negative emotions (feeling irritable, ashamed, distressed, upset, etc.) negatively affected respondents' attitudes toward nanoimplants. The predictive effect of these latter emotions was smaller than the effect of positive emotions, which indicates that the positive feelings aroused by these devices may easily offset negative ones. It is important to note, however, that anxiety-related emotions (feeling nervous, jittery, afraid, scared, etc.) also exerted a small, but significant, negative effect on attitude toward nanoimplants. This latter result aligns with the findings of studies that detected a similar effect for attitudes toward medical implants (e.g., Scheuber, Hicklin, & Brägger, 2012) and organ transplants (e.g., Annunziato, Fisher, Jerson, Bochkanova, & Shaw, 2010). Thus, individuals who are more likely to feel anxious about nanoimplants should have their negative feelings of stress, fear, and anxiety assuaged through communication aimed, for example, at turning their attention to the devices' possible benefits.

IMPLICATIONS AND CONCLUSIONS

This research suggests that arousing positive emotions about capability-enhancing nanoimplants and simultaneously underscoring their usefulness could serve to increase public acceptance of these new devices. To this end, marketing communication aimed at promoting these devices should emphasize their practical and psychological benefits: from enhanced cognitive functions and the ability to perform demanding tasks, to the possibility of mitigating the effects of aging and enhancing pleasant sensations, such as a greater sense of energy, determination, or vitality. Public acceptance of these devices, however, will also depend on marketers' ability to mitigate the negative and anxiety-related emotions that these devices may produce in prospective consumers—especially those who tend to be worried about possible changes in their bodies' characteristics, or possible health risks connected with nanoimplantation. Greater media coverage of the benefits of nanoimplants could help reduce such negative feelings, thereby instilling more confidence in these devices.

This research features limitations that indicate avenues for future investigations. First, it should be noted that lay people's knowledge about nanoimplants is particularly limited at the moment. As a result, the findings of this research likely reflect respondents' beliefs about nanotechnologies and/or implants at a general level. Thus, future research could investigate whether providing respondents with additional information about nanoimplants —for instance, through video-documentaries, pictures, or expert interviews—affects their perceptions, emotions, attitudes toward such devices and intentions to adopt them.

Second, respondents in this study self-assessed their positive/negative emotions. This technique has been broadly employed in previous studies (e.g., Mandel, 2004; Soscia, 2007). However, future research could use modern technologies, such as the Noldus Face-Reader™

(e.g., Schulz-Zander, Pfeifer, & Voss, 2008), to more deeply investigate the intensity and type of affective responses elicited by considering nanoimplants.

Finally, considering the controversial nature of nanoimplants (Baumgartner, 2008; Berger et al., 2008; Siep, 2008), future studies could extend the presented model by investigating the ethical aspects of adopting these devices and using them for marketing purposes. Because nanoimplants allow researchers to monitor people continuously in their daily lives (Ahmadi & Ahmadi, 2014), they may yield a better understanding of people's decision-making processes (Mileti et al., 2014). While this could be an unprecedented opportunity for marketing practice, it also raises important debates about consumer privacy and manipulation.

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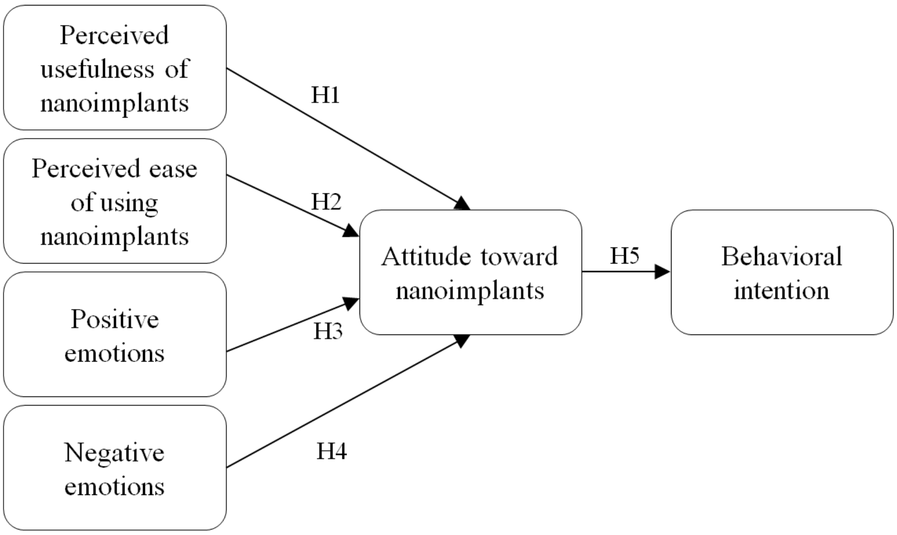

Figure 1. Theoretical model of acceptance of nanoimplants that enhance human capabilities.

Table 1. Construct reliability, convergent validity, and discriminant validity.

Construct	CR	Alpha	AVE	PU	PEU	PE	NE	AE	ATT	INT
PU	0.98	0.97	0.92	*0.96*						
PEU	0.98	0.97	0.92	0.66	*0.96*					
PE	0.95	0.94	0.72	0.64	0.54	*0.85*				
NE	0.91	0.89	0.63	-0.15	-0.12	-0.05	*0.79*			
AE	0.93	0.91	0.76	-0.06	-0.04	0.08	0.73	*0.87*		
ATT	0.97	0.95	0.88	0.70	0.55	0.70	-0.32	-0.20	*0.94*	
INT	0.99	0.97	0.97	0.63	0.54	0.75	-0.26	-0.15	0.76	*0.98*

Note: Figures in italics are the square root of the variance shared between the constructs and their measures. CR: Composite reliability, AVE: Average Variance Extracted, PU: Perceived Usefulness, PEU: Perceived Ease of Use, PE: Positive Emotions, NE: Negative Emotions, AE: Anxiety-related emotions, ATT: Attitudes toward nanoimplants that enhance human capabilities, INT: Intention to undergo nanoimplantation.

Table 2. Results of the structural model.

	R^2	Q^2	Path coeff.	t	Low CI	High CI	EV	Hypotheses
ATT	65.93%	0.533						
PU → ATT			0.349***	8.18	0.26	0.43	24.56%	H1: Accepted
PEU → ATT			0.057^{ns}	1.62	-0.01	0.13	3.13%	H2: Rejected
PE → ATT			0.444***	11.30	0.36	0.52	31.09%	H3: Accepted
NE → ATT			-0.172***	4.33	-0.25	-0.09	5.43%	H4: Accepted
AE → ATT			-0.086*	2.05	-0.16	-0.01	1.72%	- Accepted
INT	58.40%	0.569						
ATT → INT			0.764***	42.42	0.73	0.80	58.40%	H5: Accepted

Note: ATT: Attitude, PU: Perceived Usefulness, PEU: Perceived Ease of Use, PE: Positive Emotions, NE: Negative Emotions, AE: Anxiety-related emotions, INT: Intention; EV: Explained Variance; One-tailed based on t(4999): *: $p < 0.05 \rightarrow t > 1.645$; **: $p < 0.01 \rightarrow t > 2.327$; ***: $p < 0.001 \rightarrow t > 3.092$; ^{ns} : not significant.