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Exploring Factors of Acceptance of Chip Implants in the Human Body

Radha D. Chebolu
University of Central Florida

EXPLORING FACTORS OF ACCEPTANCE OF CHIP IMPLANTS IN THE HUMAN BODY

by

RADHA DEDEEPYA CHEBOLU

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ABSTRACT

The technology and telecommunication industries have made significant progress in the past few decades leading to several inventions and designs that have significantly improved efficiency in all aspects of human life. These innovations in science and technology improve our quality of life. Modern technology enables us to access vast amounts of information and services through a network of interconnected computers and machines. Recently, various technologies have been proposed to incorporate the human body into this incorporated network. One of these proposed technologies are chip implants meant to be inserted into the human body at various suitable body parts, such as the human brain or wrist. As they are a relatively recent technological innovation, chip implants are neither popular nor common yet (Caldera, 2020; Michael et al., 2017). Previous research on chip implants has produced limited information regarding the motivation aspects of using this technology. So, this study uses a self-determination theory to see which motivational factors lead to the use and trust of chip implants. This thesis discusses how implantable technology works, to explore which factors affect an individual's willingness to get a chip implant, personality traits associated with implant adoption, motivational factors affecting adoptions, and other user-centered perspectives of the technology.

DEDICATION

First, I would like to thank my amazing parents. Thank you for always believing in me and supporting me through everything. Thank you for encouraging me to pursue my goals. Thanks for patiently listening to me talk and rant about my research, curiously asking questions and being there for me throughout the process. Thank you for giving me the strength to chase my dreams and always reminding me of my worth. I’m forever grateful for you and all that you do. Love you both.

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INTRODUCTION

Implantable technology often uses radio frequency identification (RFID). Most commonly, these devices are known as a technology used for the remote identification (tagging) of animals or persons. Aubert (2011) provides an example of human identification based on an RFID implant. These chips are called the VeriChip and they have numerical codes. These codes are readable and can be scanned up to 10 cm away. One company that is already using this technology is Three Square Market, a provider of self-service, app-based breakroom vending machines out of Wisconsin. At Three Square Market, employees were given the choice of having a digital identity chip implanted between their thumb and index finger (Astor, 2017). Out of 80 employees, 50 volunteered to have the chip implanted, while the others were hesitant. Even though chip implants have not gained so much popularity yet, the RFID technology has been used in everyday life. Some ways this technology is being used is in logistics, inventory tracking, attendee tracking in places that have heavy traffic, race time tracking in marathons, management of materials, door access, IT asset tracking for electronic devices, in the library to check books in and out, and many other applications.

Although implantable technology is not widely popular (Munn et al., 2016), it is used in the medical field for various applications, helping patients around the world improve their health by assisting doctors in diagnosis and treatment. For example, Mills et al. (2017) demonstrated that retinal implants help people with age-related macular degeneration and retinitis pigmentosa by converting light energy to electrical energy, improving vision and then sending those electrical signals into visual perceptual regions of the brain. Similarly, implants are also used in medicine to release drug doses (Stopjakova et al., 2020).

Implantable technology has a lot of potential in various applications. However, individuals may not be comfortable with implantable technology, especially given the lack of information about potential risks, such as security issues (Halamka et al., 2006). Considering the current and proposed usage of chip implants in various industries, understanding individuals' perspectives of implantable technology is important for the development and adoption of the technology.

LITERATURE REVIEW

Technology Acceptance Model

Previous research has used the Technology Acceptance Model (TAM; Venkatesh & Davis, 2000) to explore user perspectives of technology adoption. Although the TAM has been modified over the years, the basic model proposes that an individual's intention to use a technology and their subsequent behavior using the technology is partly dependent on how the user perceives the technology as being easy to use and useful. Perceived usefulness itself is

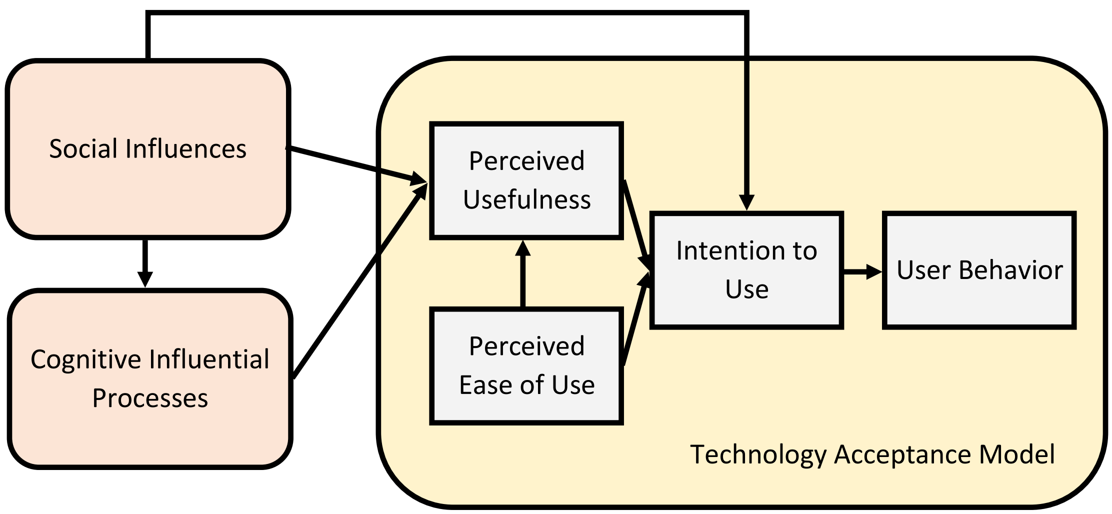


Figure 1. Technology Acceptance Model (Venkatesh and Davis, 2000).

affected by social factors, such as social norms, experience, and whether or not a person is required to use the technology, and cognitive influential processes, such as whether the technology works as it should and is relevant to the task. See *Figure 1* above for Venkatesh and Davis (2000) extension of the TAM, known as TAM 2.

In a previous study, Gangadharbatla (2020) used a modified version of the Technology Acceptance Model (TAM) to show that individual differences like gender, age, technological self-efficacy, and perceived risk predicted an individual's acceptance and willingness to adopt implantable technology. Specifically, the study showed that perceived usefulness, perceived ease of use, and embedded technology self-efficacy were positively correlated with acceptance of implantable technology (Gangadharbatla, 2020). On the other hand, age, perceived risk, and privacy concerns were negatively correlated with acceptance of the technologies. The study also showed that men were significantly more likely to perceive the technology as useful and easy, feel higher self-efficacy towards the technology, have a positive attitude towards it, and be willing to use it than women. Similar research conducted by Pelegrín-Borondo et al. (2017) used the technology acceptance model and structural equation modeling to look into the acceptance of implantable technology. They found that the perceived usefulness and ease of use of this technology was low.

Prior work also looked at differences using self-determination theory (Ryan & Deci, 2000) to show that the intrinsic needs of autonomy, relatedness, and competence also factor into the acceptance of novel technology. While those needs may be relevant to the adoption and use of wearable fitness tracking devices as studied by Rupp et al. (2018), it has yet to be determined whether similar motivational affordances influence the adoption and use of implantable technology. Thus, the proposed study will extend the work of Gangadharbatla (2020) to include modified versions of the motivational affordance scales and trust measurements developed by Rupp et al. (2018).

User Acceptance

One thing that helps determine the motivation of an individual behind using this technology is the Self-Determination Theory (Ryan & Deci, 2000). This theory posits that people have three core psychological needs: autonomy, competence, and relatedness. Autonomy provides a sense of having control over something, competence provides a sense of effectiveness in one's job, and relatedness offers a sense of belonging in a group. These three needs have previously been shown to play a role in one's willingness to accept other technology, such as wearables (Rupp, et al., 2018). However, it has yet to be determined whether these needs can also predict acceptance of implantable technology.

In regards to any form of implantable technology, autonomy may be multi-faceted in nature. For those who support and have already implanted technology into their bodies, autonomy is framed not only in how the user perceives the control they have over the technology, but given that the technology becomes part of their body, it is also framed in terms of how the technology allows them to have control over their own body (Banbury, 2019). In contrast, given the ethical, moral, and legal concerns regarding privacy, security, and other personal freedoms, others may see the use of the technology as a loss of autonomy of their body, personal space, and privacy (Banbury, 2019; Sobot, 2019).

Similarly, given that implantable technology is perceived as being new and controversial (Sobot, 2019), the concept of relatedness may be complex in implantable technology. Certainly, for those who voluntarily chose to implant technology in their body, there may be a sense of small community between members. Banbury (2019) demonstrates that an emergent "voluntary cyborg" subculture exists among those who use the technology, but also warns that members' views of the technology are in sharp contrast with popular media portrayals. In the same way, while widespread corporate use of technologies such as RFID tagging may provide a sense of corporate community, employees may feel an insecure sense of invasive employee monitoring (Voss & Kshetri, 2017) which reduces their sense of self and personal identity.

In terms of the competence, implantable technology may be too novel for non-users to have exposure to the efficacy of the technology. Certainly, users are familiar with RFID technology through the use of contactless payments in credit cards and RFID-equipped identification cards. However, most individuals have not been exposed to implanted versions of the technology (Banbury, 2019). Currently, most popular exposure to implantable technology is framed in terms of the risks it presents to individuals' privacy and security.

Given this, perceived risk and safety of implantable technology may also be a likely factor in its acceptance and use (Gauttier, 2019). When an individual experiences mistrust or has a negative feeling towards the technology they are using, they might not be willing to accept it. As with other forms of controversial technologies, users have considerable concern when it comes to implantable devices and the risk they present (Banbury, 2019; Sobot, 2019; Voss & Kshetri, 2017). The present study will explore individuals' trust in implantable technology, given that it may have important implications to users' willingness to accept the technology.

Race and demographics, religion, and spirituality of the participant also alter users' perspective towards this technology. Perakslis et al. (2014), investigated the perceived barriers to RFID (radio frequency identification) within four countries (Australia, India, UK, and the USA). Results indicated that the main concerns were religious, social, and cultural issues. A participant might not accept the implantable technology if it is against their religion and culture, as the society and their social environment have an effect on what they do and how they think.

In addition, ethical issues play a significant role in technology, with important themes emerging in areas such as privacy, safety, and potential harm. Gauttier (2019) highlighted two important issues regarding acceptance and ethical issues. First, the role of ethical acceptability in implantable technology, which needs to be researched more. Second, the ethical problems that are elevated in the workplace with chip implants are more than just privacy. Two possible concerns with this technology is whether it is possible for anyone to get rid of the chip and whether an employee may find ways to misuse it. Can the employers trust their employees with these chips? In contrast, can the employees trust their employer? Is there a chance of the employer misusing this technology in a way it lets them obtain personal information and track what the employers do outside of work? Although, an employer might not be misusing this technology, could the perceived risk of being spied on affect the employee's productivity, comfort level, and creativity in the workplace or at home (Voas & Kshetri, 2017)? The concerns and others raise important questions as to whether or not individuals would trust implantable technologies even if they are task relevant and effective.

Finally, another important consideration before getting a chip implant are health issues (Banbury, 2019). People might question if having a foreign object in their body is safe. Individuals might weigh any potential perceived health risks, whether scientifically backed or not, when choosing to accept or use the technology. If individuals perceive the use of the technology as physically dangerous, adoption of implantable technology will likely be limited.

Using the Technology Acceptance Model (Venkatesh & Davis, 2000) as the underlying exploratory framework, the present study seeks to determine whether individuals perceive implantable technology as beneficial and the factors for adoption of the technology. Most importantly, the goal of this study is to systematically clarify the relationship between individual differences and attitudes about and intention to use implantable technology.

Overall, the proposed study focuses on self-determination theory and will use the TAM to predict whether people will accept and adopt this technology. Therefore, the findings of this study will contribute to an understanding of the factors influencing why users may or may not choose to adopt and use implantable technology, which may in turn help shape the future development of implantable technology to be better attuned to the needs of users, as well as perceived to be beneficial and user-friendly.

HYPOTHESES

H1: People who think that technology will satisfy their motivational needs will have more positive attitudes towards the technology.

H2: People who trust technology will have more positive attitudes towards its use.

H3: People who feel more capable with technology will have more positive attitudes towards the technology.

METHOD

Participants

Undergraduate students (*N* = 111) at the University of Central Florida (UCF) were recruited for this study. The distribution of biological sex is n_{female} = 60, n_{male} = 51. Students volunteered to participate in this study using UCF's research participation system and were awarded class credit, for their participation. Participants were over 18 years of age. 51 males (45.9%) and 60 females (54.1%) were sampled, age range between 18 to 63 (M = 21.09, SD = 6.41). The entirety of the study was completed online using Qualtrics research participation software.

Materials

Demographics Scale.

Questionnaire containing items regarding the participant's gender, age, race, ethnicity, education, and religion and spirituality.

Big 5 Personality Inventory.

Five personality factor survey which measures self-reported extraversion vs. introversion, agreeableness vs. antagonism, conscientiousness vs. lack of direction, neuroticism vs. emotional stability, and openness vs. closedness to experience (John & Srivastava, 1999). The survey assists in examining individual differences related to acceptance, use, or perception of implantable technologies. A 44-item version of the 5-factor personality scale will be used in this study.

Computer self-efficacy scale.

A 12-item measure which measures the participants' ability and confidence in using computers and other digital devices. The results help us determine the participant's perceived proficiency using technology (Howard, 2014).

Motivation Scale and Trust Scale.

Participants were tasked to imagine wearing a chip implant and answer the questions from the motivation and trust scale. This scale seeks to explore the motivational aspect of the participant in the context of self-determination theory. Then, participants answered questions regarding their trust in the technology, including trust with data security, as well as their opinions on functionality and accessibility (Rupp et al., 2018).

System Usability Scale.

Participants were tasked with imagining using the implantable technology and then completed the System Usability Scale. The self-report scale assesses participants perceived usability of the technology, with themes such as how comfortable the participants feel about chip implants, the ease of use, and learnability aspects (Brooke, 1996). The use of technology was analyzed using the use question in system usability scale as it lets the participant rate themselves based on how likely they are to use the technology. The first item from this scale asks participants whether they would be likely to use the technology, and this item was used as a key dependent measure of intended use of implantable technology.

Jian Trust in Technology Scale.

Self-report measure which evaluates the trust between the participant and technology. Participants were provided with 12 descriptions and reported on their impression on implantable technology (Jian et al., 2000). This helps study the participant's feeling of trust or impression of the system while using implantable technology.

Procedure

This study was conducted online using Qualtrics research participation software and can was completed by the participant at any location of their choosing. Participants provided informed consent before progressing to the survey instruments. First, participants answered demographic questions.

Participants were then presented with a description of chip implants to read. The description provided information on how implantable technology works. Then, participants were asked to imagine themselves with a chip in their body and how they would feel about the implant.

Participants then moved forward to answering self-report questions related to their personality, trust, computer self-efficacy, motivation, system usability, and acceptability

RESULTS

Correlational analyses were used to address the hypotheses and explore the relationships between variables. Table 1 includes the correlations between age, autonomy, competence, relatedness (self-determination theory), various measures of trust, system usability, computer self-efficacy, and intended use. There was a significant correlation between trust, usability, and computer self-efficacy and use of technology. Additionally, the autonomy and relatedness components of the motivation scale were also positively correlated with intended use. Table 2 includes the correlations of the big five personality traits and implantable technology use.

Table 1. Self-Determination Theory and Trust Correlations

Summary of intercorrelations for Self-Determination Theory, Trust, and Intended Use

Measure	1	2	3	4	5	6	7	8	9	10	11	12
1. Age	-											
2. Autonomy	-0.040	-										
3. Competence	0.015	0.052	-									
4. Relatedness	0.055	0.587[3]	0.123	-								
5. Privacy	0.042	0.309[3]	0.140	0.323[3]	-							
6. Validity	-0.018	0.484[3]	0.104	0.421[3]	0.520[3]	-						
7. Reliability	0.026	0.531[3]	-0.004	0.579[3]	0.594[3]	0.661[3]	-					
8. Sys_Capability	-0.060	0.561[3]	0.017	0.581[3]	0.322[3]	0.561[3]	0.710[3]	-				
9. Sys_Transperency	<.001	0.378[3]	0.022	0.414[3]	0.336[3]	0.400[3]	0.443[3]	0.410[3]	-			
10. SUS_Total	0.056	0.280[2]	0.404[3]	0.298[2]	0.395[3]	0.211[1]	0.252[2]	0.233[1]	0.285[2]	-		
11. Jian_Trust_Total	0.009	0.416[3]	-0.015	0.448[3]	0.645[3]	0.593[3]	0.724[3]	0.523[3]	0.465[3]	0.344[3]	-	
12. CSE_Total	-0.161	-0.060	-0.025	0.013	-0.040	0.045	-0.015	0.094	0.132	-0.082	0.089	-
13. Use	0.082	0.324[3]	0.026	0.261[2]	0.392[3]	0.265[2]	0.324[3]	0.288[2]	0.314[3]	0.407[3]	0.526[3]	0.196[1]

([1]p<.05; [2] p<.01; [3]p<.001)

Table 2. Summary of intercorrelations of the Big Five Personality Traits and Intended Use

Measure	Extraversion	Agreeableness	Conscientiousness	Neuroticism	Openness
Use	0.005	-0.068	-0.057	-0.062	0.106

(No significant correlations)

Differences in biological sex

A t-test was used to see the differences in computer self-efficacy between men and women. Results indicated that men (M = 67.78, SD = 12.57) have higher computer self-efficacy than women (M = 56.53, SD = 14.62; t (108.98) = 4.36, p <.001, d = 0.82. Results of this analysis show a strong effect size and was the only significant difference between men and women.

76 participants identified themselves as White, 17 identified themselves as Black or African American, 10 as Asian, and 8 as other. Compared to other groups, Latino/a/x or Hispanic participants Showed higher autonomy motivation than the other participants, t(78.99) = 1.52, p = .04, d = .34

Differences in Race/Ethnicity

One-way ANOVAs were used to analyze trust between race/ethnicity. Least significant difference (LSD) post-hoc tests were conducted to examine significant differences. Significant differences in privacy were found between Race/Ethnicity, $F(3,107) = 3.78$, $p = .01$; $\eta^2 = .10$, indicating a moderate to large effect size. The difference in the privacy aspect of trust between participants who identified themselves as White and participants who identified themselves as Black or African-American was significant (p = .008) and differences in trust between Black or African-American and other races were also significant p = .02. Similarly, differences in system transparency between Race/Ethnicity, $F(3,107) = 4.96$, $p = .003$; $\eta^2 = .12$, indicating a moderate to large effect size. Results indicated that the Black or African-American participants have more system transparency aspect of trust in technology than white $p = .002$, Asian $p = .001$ and other races $p = .04$.

Even though the results show a significant difference in trust between groups, it is important to mention that our study had unequal groups.

Table 3. Differences in trust between races

Trust	White	Black	Asian	Other
Privacy	*M* = 10.59 *SD* = 4.69	*M* = 14.12 *SD* = 4.64	*M* = 13.50 *SD* = 4.79	*M* = 9.00 *SD* = 6.41
System Transparency	*M* = 15.46 *SD* = 2.82	*M* = 17.18 *SD* = 2.35	*M* = 15.90 *SD* = 3.25	*M* = 16.50 *SD* = 3.25

DISCUSSION

The goal of this study was to explore the factors of acceptance of chip implantation technology in human body. This study was designed to explore user perspectives, acceptance, and attitudes of implantable technology from a future use perspective. H1 and H2 were supported because autonomy and relatedness correlated positively with each of the trust subscales as well as intended use. Trust in technology was high as the self-ratings on trust subscales were high. Since the participants could not use the implantable technology and experience it, self-ratings of competence were likely low for this reason and not significantly correlated with endorsement of use. However, it is important to note that System Usability Scale is not an excellent measure of usefulness. Therefore, a better measure is needed to measure usefulness aspect of the technology. But it is a good measure of perceived ease of use.

Self-determination theory:

Self-determination theory was very important in regards to use. Autonomy was positively correlated with all the measures of trust but there is a weak correlation between autonomy and use. Results show that autonomy, relatedness and trust correlated with each other, stating that people would use the technology. Lastly, relatedness correlated with autonomy since autonomy proposes the need to feel in control of one's goals (goal of use in this case) and the need to relate goals with others. These findings indicate that users were motivated to use the technology.

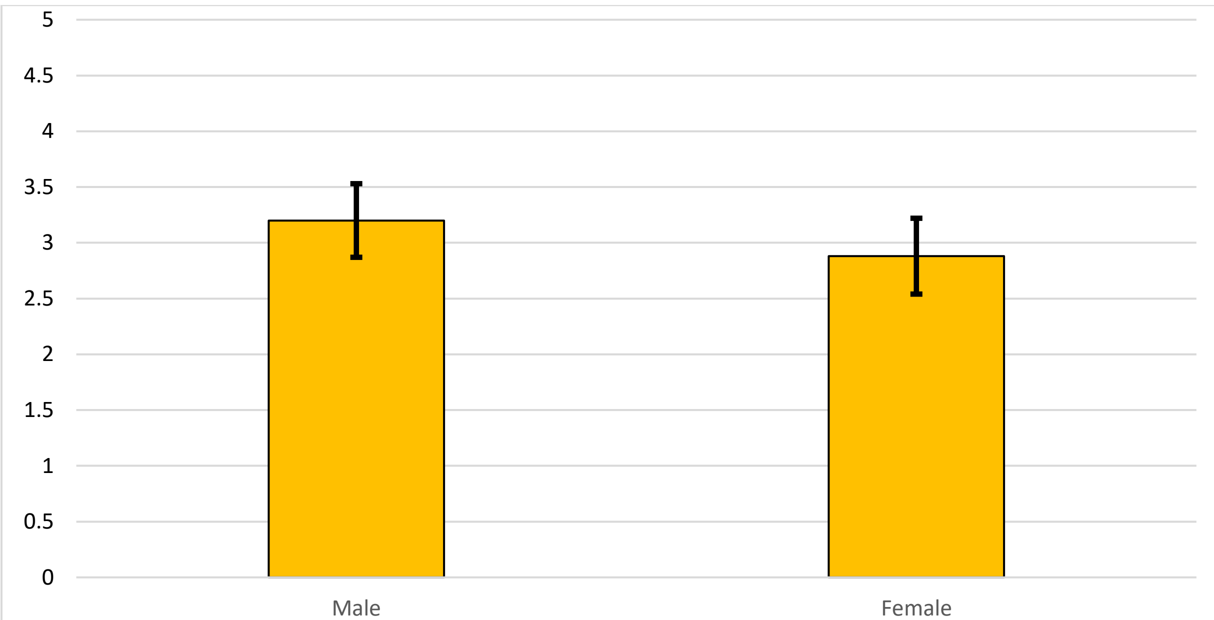
Trust and motivation:

The significant correlations in Table 1 indicate that trust in technology is an important factor in use of implantable technology, consistent with the Technology Acceptance Model and prior research on attitudes on implants (Gangadharbatla, 2020; Pelegrin-Borondo et al., 2017).

Thus, it is shown that the more trust an individual has in the technology, the more likely they are willing to use it.

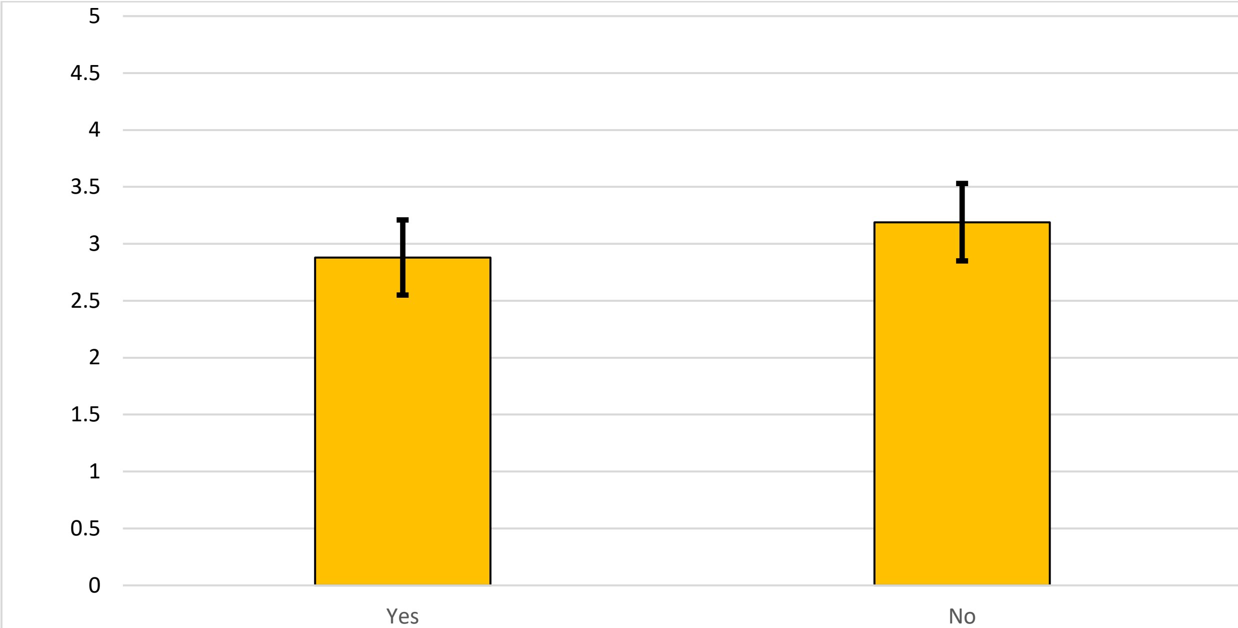
With regard to individual personality, there were no significant relationships between the five personality traits and intended use as shown. Similarly, biological sex, religion, education, race/ethnicity did not have any significance in terms of use as shown in the figures below:

Figure 2. Differences in use across biological sex



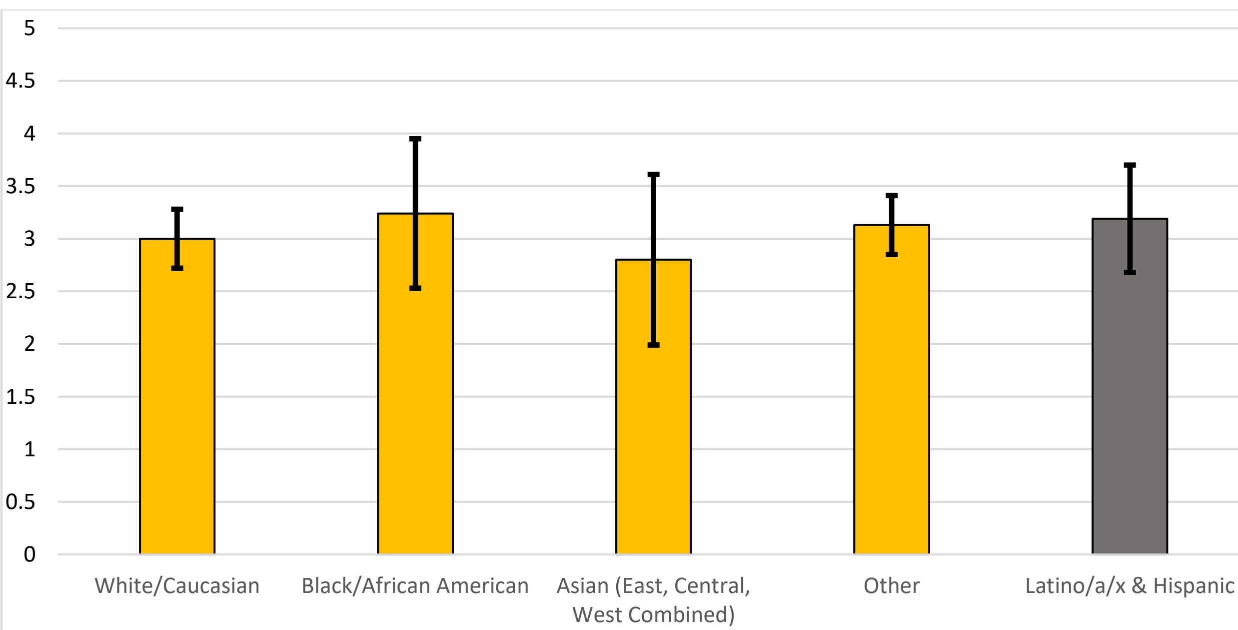
($t(109) = 1.31$, $p = 0.19$)

Figure 3. Differences in use across religion



$t(109) = 1.30$, $p = .20$

Figure 4. Differences in use across race/ethnicity



$F\ (3{,}107) = 0.29$, $p = .83$

LIMITATIONS

There are a few limitations for this study. Structural equation modeling is a suitable analysis strategy to examine the relationship between variables using a Technology Acceptance Model framework. Since the sample size of this study was 111 participants, structural equation modeling was not used as it requires a larger sample size of this study. Another limitation would be that the participants did not get to use and experience the implantable technology, which limits our ability to generalize results to actual implantable technology users. It is predicted that if the participants use the technology instead of imagining what it would be like, there might have been a difference in the correlation between competence and use given that they may form different self-perceptions of competence.

CONCLUSION

The current study demonstrates that there is a relationship between trust, motivation, and use. Hence, results support the hypotheses as results indicate trust in technology and high motivation correlate use of technology. This thesis helps developers consider aspects of trust, motivation, and competence while developing implantable technology as results show that trust and motivation correlate and are significant to use.

APPENDIX A: BLURB

Technological implants are electronic devices embedded in the body (such as pacemakers or cochlear hearing implants). Several companies are currently developing technological implants to increase the innate capabilities of human beings for reasons other than medical need (e.g., implants to enhance a person's strength, speed, or speed of thought and calculation, implants to delay aging, or implants for the remote control of machines).

APPENDIX B: DEMOGRAPHIC AND EXPERIENCE QUESTIONNAIRE

Demographics Survey:

1) What is your age?

______

2) What is your ethnicity/race (If Hispanic, indicate “yes” in the next survey question)?

a. White

b. Black or African American

c. Native American or American Indian

d. Asian; Please indicate your Asian country of origin/identity: ____________.

e. Pacific Islander

f. Other (Please use this if you do not identify as any of the above or wish to specify it further): _______________.

3) Are you Hispanic?

a. Yes:

i. Please indicate your (or your family’s) country of origin: ____________.

b. No.

4) What is the highest degree of school you have completed? If currently enrolled, highest degree received.

a. No schooling completed.

b. Pre-K/Nursery School to 8th Grade

c. Some high school/no diploma.

d. High school graduate diploma, diploma, or the equivalent (i.e. GED).

e. Some college credit, no degree. (First year/Freshmen students – do not select).

f. Trade/Technical/Vocational Training.

g. Associate Degree.

h. Bachelor's Degree

i. Master's Degree.

j. Professional Degree.

k. Doctorate Degree.

5) What is your biological sex?

a. Male

b. Female

c. Other

APPENDIX C: 5-FACTOR PERSONALITY SCALE

The Big Five Inventory (BFI)

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who likes to spend time with others? Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement.

Disagree strongly	Disagree a little	Neither agree nor disagree	Agree a little	Agree Strongly
1	2	3	4	5

I see Myself as Someone Who...

____1. Is talkative

____2. Tends to find fault with others

____3. Does a thorough job

____4. Is depressed, blue

____5. Is original, comes up with new ideas

____6. Is reserved

____7. Is helpful and unselfish with others

____8. Can be somewhat careless

____9. Is relaxed, handles stress well

____10. Is curious about many different things

____11. Is full of energy

____12. Starts quarrels with others

____13. Is a reliable worker

____23. Tends to be lazy

____24. Is emotionally stable, not easily upset

____25. Is inventive

____26. Has an assertive personality

____27. Can be cold and aloof

____28. Perseveres until the task is finished

____29. Can be moody

____30. Values artistic, aesthetic experiences

____31. Is sometimes shy, inhibited

____32. Is considerate and kind to almost everyone

____33. Does things efficiently

____34. Remains calm in tense situations

____35. Prefers work that is routine

____14. Can be tense

____15. Is ingenious, a deep thinker

____16. Generates a lot of enthusiasm

____17. Has a forgiving nature

____18. Tends to be disorganized

____19. Worries a lot

____20. Has an active imagination

____21. Tends to be quiet

____22. Is generally trusting

____36. Is outgoing, sociable

____37. Is sometimes rude to others

____38. Makes plans and follows through with them

____39. Gets nervous easily

____40. Likes to reflect, play with ideas

____41. Has few artistic interests

____42. Likes to cooperate with others

____43. Is easily distracted

____44. Is sophisticated in art, music, or literature

Scoring:

BFI scale scoring ("R" denotes reverse-scored items):

Extraversion: 1, 6R, 11, 16, 21R, 26, 31R, 36

Agreeableness: 2R, 7, 12R, 17, 22, 27R, 32, 37R, 42

Conscientiousness: 3, 8R, 13, 18R, 23R, 28, 33, 38, 43R

Neuroticism: 4, 9R, 14, 19, 24R, 29, 34R, 39

Openness: 5, 10, 15, 20, 25, 30, 35R, 40, 41R, 44

APPENDIX D: COMPUTER SELF-EFFICACY SCALE

12-Item Computer Self-Efficacy Scale

1. I can always manage to solve difficult computer problems if I try hard enough.

2. If my computer is ‘‘acting-up,’’ I can find a way to get what I want.

3. It is easy for me to accomplish my computer goals.

4. I am confident that I could deal efficiently with unexpected computer events.

5. I can solve most computer programs if I invest the necessary effort.

6. I can remain calm when facing computer difficulties because I can rely on my abilities.

7. When I am confronted with a computer problem, I can usually find several solutions.

8. I can usually handle whatever computer problem comes my way.

9. Failing to do something on the computer makes me try harder.

10. I am a self-reliant person when it comes to doing things on a computer.

11. There are few things that I cannot do on a computer.

12. I can persist and complete most any computer-related task.

APPENDIX E: MOTIVATION AND TRUST SCALE

Implantable Technology Motivation Scale

Using this device, I can take an active role in completing the goals I have for using it

Using this device, I am in charge of my activity

Using this device, I can make meaningful choices about how I use it

Using this device, I can choose how to apply the information it gives me

Using this device, I would not be able to use effectively

Using this device, I can be successful creating goals for what I would do with it

Using this device, I would face too many challenges to meet my goals

Using this device, I can better communicate my goals with others

Using this device would allow me to motivate others to be share these goals

Using this device would allow me to share my achievements with others

Using this device would help me interact with others

Implantable Technology Trust Scale

I feel this device will keep my data secure

I feel I can limit the access to others to my data, if I choose

I feel this device will only share my information with people I choose

I feel that information provided by this device is valid or correct

I feel this device measures what it is supposed to measure

I feel this device is measuring what it says it measures

I feel this device is reliable

I feel this device will give me consistent readings over time

I feel that I can depend on this device

I feel this device remains stable over time

I feel this device has the ability to do what I want it to do

I feel this device has the functionality I need

I feel this device is very capable

I understand how this device works

I know what the limitations of this device are

It is easy to follow what this device does

APPENDIX F: SYSTEM USABILITY SCALE

1. I think that I would like to use this system frequently

1	2	3	4	5
Strongly Disagree	Disagree	Neither	Agree	Strongly Agree

2. I found the system unnecessarily complex

1	2	3	4	5
Strongly Disagree	Disagree	Neither	Agree	Strongly Agree

3. I thought the system was easy to use

1	2	3	4	5
Strongly Disagree	Disagree	Neither	Agree	Strongly Agree

4. I think that I would need the support of a technical person to be able to use this system

1	2	3	4	5
Strongly Disagree	Disagree	Neither	Agree	Strongly Agree

5. I found the various functions in this system were well integrated

1	2	3	4	5
Strongly Disagree	Disagree	Neither	Agree	Strongly Agree

6. I thought there was too much inconsistency in this system

1	2	3	4	5
Strongly Disagree	Disagree	Neither	Agree	Strongly Agree

7. I would imagine that most people would learn to use this system very quickly

1	2	3	4	5
Strongly Disagree	Disagree	Neither	Agree	Strongly Agree

8. I found the system very cumbersome to use

1	2	3	4	5
Strongly Disagree	Disagree	Neither	Agree	Strongly Agree

9. I felt very confident using the system

1	2	3	4	5
Strongly Disagree	Disagree	Neither	Agree	Strongly Agree

10. I needed to learn a lot of things before I could get going with this system

1	2	3	4	5
Strongly Disagree	Disagree	Neither	Agree	Strongly Agree

APPENDIX G: JIAN TRUST IN TECHNOLOGY SCALE

Below are a series of statements. Please rate how each of these statements apply to the intensity of your feelings regarding implantable technology.

(**Note**: not at all=1; extremely=7)

1. The technology is deceptive
2. The technology behaves in an underhanded manner
3. I am suspicious of the technology's intent, action, or outputs
4. I am wary of the technology
5. The technology's actions will have a harmful or injurious outcome
6. I am confident in the technology
7. The technology provides security
8. The technology has integrity
9. The technology is dependable
10. The technology is reliable
11. I can trust the technology
12. I am familiar with the technology

APPENDIX H: INFREQUENCY ITEMS

Infrequency Scale

(Note: These are all True/False)

There have been a number of occasions when people I know have said to hello to me.

I cannot remember a single occasion when I have ridden on a bus.

I find that I often walk with a limp which is the result of a skydiving accident.

There have been times when I have dialed a telephone number only to find that the number was busy.

I visited Easter Island last year.

I go at least once every two years to visit either northern Scotland or some parts of Scandinavia.

Sometimes I feel sleepy or tired.

On some occasions I have noticed that some other people are better dressed than myself

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