Social Obstacles in Context-Aware Technology:

An Exploration in the Measurement of Technological Attitudes

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Author Note

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ABSTRACT

Context aware, the latest construct in emerging technologies, is a leap towards a fully integrated human-digital experience. The vision of a completely programmable world with images, characters, temperatures, colors and scents based on our preferences is imminent. Most of the published research focuses on the architectural or development point of view, but little is known about the attitudes, perceptions and obstacles of technologies being released in the immediate future that push the boundaries on concepts like: filter bubbles, serendipity, intrusiveness, remembering and forgetting and privacy. This study aims to discover a potential scale that identifies attitudes based on the social obstacles in context aware technologies.

INTRODUCTION

Technological advances are slowly shifting our behaviors. Processing speeds are faster, hardware is smaller and our imagination is fueling the next generation of human-computer communication. Each of these technological steps provides a place where individuals can construct single or community-based digital environments, in which images, characters, temperatures, colors and scents are based on set preferences. A digital environment that perceives and responds to the presence of people has been coined, "ambient intelligence" and is characterized by five individual constructs: embedded, context aware, personalized, adaptive and anticipatory (Aarts, Harwig, & Schuurmans, Ambient Intelligence, 2001). This paper focuses on a single aspect of ambient intelligence: context aware.

Context aware is the interaction between humans and computers in physical and social environments as determined by the following factors: people, interaction objectives, as well as time and space (Fischer, 2012). People factor into developing context aware solutions based on their intentions, which is akin to promises. Predicting these intentions is a challenge for context aware and only derived if there’s mass acceptance of the changes to information systems: devices must constantly perceive, record and analyze human behavior. The end analysis of a user’s intention will help systems understand the individual objectives of the desired interaction, which is akin to action. One of the key constructs in determining intentions and objections in context aware intelligent systems is knowledge of ‘Space’ (aka: location). GPS is the most understood and well-known geographic location tool for gathering, filtering and distributing location-specific information. The other construct, ‘time’ is used much the same way as space based on the possibility that a user’s intention and interaction may differ based on time. Time, in this context, is a broad term and can be used to describe the time of day, duration or period in life. As researchers and technologists further refine terminology and understand the cultural and human context within technological constructs, emerging technologies can be shaped and driven towards improving the human condition based upon human needs. Given the complexity of designing a human-centric system built to enhance the human experience is too great for one discipline to carry alone. An interdisciplinary approach to technological solutions is required to fully understand the shape and direction of technology in society and culture. While context aware is often viewed as a human-centric experience, most of the research regarding context-aware is positioned from an architectural or development point of view. There is an increasing need for other scholarly disciplines to explore these topics and work together to shape a fully realized digital human experience. This study aims to discover a potential scale that identifies attitudes based on the social obstacles in context aware technologies and take the initial steps in creating a system towards understanding technological acceptance.

LITERATURE REVIEW

Theoretical Perspectives

There are multiple theories related to the idea of context-aware: realism, constructivism, and simulacra. While it is acknowledged that in realism, the potential for universals exist and are independent of human interpretation (Oulasvirta, Tamminen, & Höök, 2005), social constructivism, simulacra and simulation and personality theories are used to understand how we build our technological realities. Social constructivists claim that technology is a social product; created by the individual understanding of technological systems and demonstrated through the flexibility of its design (Woolgar, 2012). It is this design that reorders the physical world into a system that is deemed useful based on a regional technological style (Hughes, 2012). Context aware seamlessly integrates situational and personal context from the digital and the human world, reorganizing the way humans interact with objects and each other. These new constructs create a layered reality in which technology becomes invisible; meaning it is absent in the minds of its users, but continuously present. As physical devices are shed, the only truly visible information system is the human-human and human-computer communication. Jean Baudrillard would suggest this technological trajectory removes reality and presents the world as a pure simulation; a world where we simulate aspects of reality. For example, science is working on a supersonic plane, which will replace all windows with video screens that interact with recording devices on the exterior of the aircraft whose sole purpose is to stream the outside world inside the cabin (BBC News, 2014). The idea of an unrestricted screen is being used to create fully immersive experiences; Microsoft patented a video game experience in which the game images expand beyond the television screen and integrate with the individual's surroundings (Microsoft Research, 2013). Eventually home interiors will not be physically painted and designed, but digitally programmed with the limitations being only the imagination of the user. These new realities and environments will change the interactions with systems, as people are transformed into the communication tool and in some cases, an affordance, for information systems to perceive and respond to further creating a permanent simulated landscape. Humans become active participants in the use and shape of technology by using behavior as an input mechanism to information systems. Change our behavior, and humans change the direction and predictive future of technology.

Measuring Social Obstacles

Discovering the factors that facilitate acceptance of emerging technologies may have profound impacts on the future research in this area, as research strives to understand what factors account for technological acceptance: a general trait, a specific group of people or the perceived ease of use. This study looks at three possible scales that can best measure the social obstacles in context aware technologies: "Big 5 Inventory (BFI) Trait: Openness," Early Adopters and Perceived Ease of Use.

The Big Five Inventory is a self-report inventory designed to measure on five dimensions, one of which reports on the trait, openness. Openness is one measure that includes people who are more likely to have personality traits that demonstrate preferences for a variety of experiences, interest in novelty as well as intellectual curiosity. Openness, on the low end, indicates someone who enjoys learning and is likely to be correlated with years of education and artistic positions. The high end of openness may indicate someone who is more conservative and may not be interested in novel factors (John, Naumann, & Soto, 2008). The concept of being open to new experiences is a core concept in the process of accepting new and emerging technological ideas.

Early Adopters make up 13% of the population (Anderson, Reitsma, & Liackman, 2009) and are classified as those who do not have a lot of time, driven and the top users of technology. The love of technology that is virtual or tangible is marked by device ownership and frequency of use. Forrester used three categories: information, novelty and status as the key factors most likely to influence this segment (Garon, McQuivey, Gownder, Wiramihardja, & Hood, 2009). There is a clear overlap of the category, novelty, when reviewing how openness is defined in the Big 5 and this adapted Early Adopter scale, but the remaining two categories of information and status are stand-alone.

Perceived Ease of Use may be used to indicate whether or not specific issues with a context aware device is suitable for the intended audience. The original scale, named the System Usability Scale, measures participants' perceptions of a web-specific feature or website (Sauro & Lewis, 2011). The Perceived Ease of Use Scale elaborates on the idea of measuring a website by presenting a way for researchers to measure the usability of a specific product as it relates to the potential social obstacles. Creating a category of people who perceive technology to be easy to use may be the dominant factor in determining whether or not adoption is likely.

Social Obstacles in Context Aware Technologies

Gerhard Fischer outlined five potential promises and pitfalls of context aware technologies: serendipity, intrusion, filter bubbles, memory and privacy (Fischer, 2012), each of which contribute to the future acceptance or denial of devices and systems that constantly perceive and respond to a person. Current technological devices primarily focus on location and time and do not use the full potential of the context aware construct. Smartphones are the first to enable context aware using location-based technologies. We first began to see tracking based on user-initiated 'check-ins' that relied on the user opening an application and finding their location. The user-initiated function was an original constraint due to the limitations of battery life based on the demand for power based on constant use. For context aware to function properly, it relies on continuous power use to enable constant and automatic tracking of a users location. This transformed the capabilities of the smartphone and created possibilities for personalized communication in safety alerts, entertainment, wayfinding, traffic patterns and advertising.

Serendipity

Serendipity is a form of luck in which the user finds something valuable that they may not have been looking for in the first place. Humans delight in the pleasure (Long, 1974) and with new location-based services, like "Find My Friends" people can experience delight in discovering friends' locations. This type of discovery could revise our interpretation of a serendipitous encounter as people have access to a larger social network and are increasingly mobile. Finding friends in an urban environment may be more complex and some may welcome the intrusion of being notified when a good friend is near. Guthrie (2013) briefly mentions that 'ready information' may make serendipity less likely, but he excludes the emotional feeling of chance. Context aware does not remove the feeling of a serendipitous encounter and the exploration of whether or not users enjoy this feeling is crucial in understanding perception.

Intrusion

Intrusiveness is linked to the emotion of serendipity and is categorized in technology as the degree to which users are reachable or identifiable (Ayyagari, Grover, & Purvis, 2011). The benefits of being identifiable are best shown in radio-frequency identification (RFID) devices, wherein the proximity of a person or object is key. The positive nature of this technology is demonstrated in the case of a home-based inventor who addressed households with multiple pets and differing meal needs by creating a pet bowl that senses the proximity of each unique pet. Each individual pet has access to only their particular quadrant of the bowl based on the RFID device in their collar (Catsnko, n.d.). The harmful nature of the intrusive concept comes in the form of spying. One product, Flexispy, can invisibly monitor another mobile activity to include viewing email, telephone calls, geo-location, web browser and more (Flexispy, n.d.). The ability to quickly and quietly know another's movements and activities using the basic functions of smartphones is incredibly controversial. The personal intrusiveness of technology limits a user's ability to disengage from outside world communication and can infringe on privacy, as such there will be some overlap between intrusiveness and privacy.

Filter Bubbles and Groupthink

A filter bubble is a concept that explores the idea that user behavior and history determines the visibility of information through, for example: computer type, browser and location. The idea of personally tailored information isolates individuals in their own cultural or ideological bubbles (Pariser, 2012), which is similar to the concept, Groupthink. Groupthink refers to a way people think when they are invested in a particular group and strive to obtain uniformity (Whyte, 1989). However, these two views are limited to an old construct of an offline and online experience. Technology is moving in a direction where there is only an online experience and its integrated into our daily lives. Devices, like iBeacon are an indicator of the future interactions. When iBeacon is placed near or on an object and comes in proximity to a smartphone, it initiates a communication via Bluetooth, prompting the smartphone to open an application or send a notification (Roximity iBeacon, n.d.). This microlocation interaction allows users to connect their smartphone with the environment simultaneously (Gottipati, 2013). The fear of microlocation notifications is that all user activities will be filtered based on past behavior and user demographic data, limiting the worldview of an individual. The cause for concern with filter bubbles is the shift to a digitally constructed world that limits the received information that supports the individual's worldview and impedes opportunities for alternative views, openness and critical thought.

Memory (Remembering and Forgetting)

Remembering and forgetting refers to the limitations of our human memory. Technology, in this sense, is an extension of the human sense or body part (Eede, 2010) and works autonomously to digitally store human memories, allowing individuals to temporarily (or permanently) forget information while maintaining the ability to retrieve or modify the information at a later date. One product moving in the direction of autonomous function is a smart thermostat, Nest, which launched in 2011. Nest contains multiple sensors within the unit that detects temperature, humidity and user proximity in addition to direct access to temperature data from the Internet. Nest uses its sensor-collected data in conjunction with user input and modifications to program itself to regulate the temperature in the household (Nest, 2014). Nest is autonomous as the device learns over time and removes the need for constant user interaction, essentially replacing the human need to remember low-level tasks. The other side of memory is from the viewpoint of unlimited data storage. In this context, there is no need to delete or remove information; individuals continually add new information to the ever-expanding data storage. The fear in this process is that humans will become immersed in building connections with the past and through the autonomy of technology that people will distance themselves from the present (Fischer, 2012).

Privacy

Privacy is defined as being free from intrusion or disturbance in one's private life, but Salecl (2002) suggests the concept of privacy is a "distinctly modern phenomenon" that has evolved due to technology. One product that is currently in privacy disputes is Google Glass. Google Glass is a portable heads-up display that integrates the digital and physical world by providing notifications and user-stored preferences based on the user's physical surroundings and the voice commands given to the device (TechLife, 2014). The backlash around Google Glass however, it not about the user's rights to privacy, rather the controversy stems from the surrounding public. The right to individual privacy is now those in the field of Google Glass' vision, which has sparked policy debates about its use in public (Moreno, 2013). The discussion can be attributed to what Fischer's claims is the potential misuse of the collected user data. However, devices that depend on context aware require the continuous collection of user data from multiple sources in order to ensure the individual is receiving relevant and personalized information. The public limitations pushed on technology are essentially based in the current perception and the limitations on human ingenuity to control and program desired technological functions. There are limited rules in defining how and when you can use location-based services and there is increased difficulty in approaching privacy when the fast-paced nature in the field of technology makes rules obsolete when a new function or device is invented. One of the most interesting concepts regarding privacy is the nature of user-initiated information (pull) or system-initiated information (push). Research suggests users will trade their privacy for the benefits of technology, but recommend that push-based systems receive additional regulations as it contains more intrusive behavior for users (Xu, Teo, Tan, & Agarwal, 2010).

Separating the five promises and pitfalls appears to be an impossible task. They are intertwined, creating layered challenges in the invention and proliferation of emerging technologies. Understanding user behavior and cultural differences in perception of the five promises and pitfalls has the potential to be the key differentiator for successful devices and products.

Research Questions

RQ1: How does the Big Five Inventory trait, Openness, relate to the social obstacles?

RQ2: How does Early Adopter scale relate to the social obstacles?

RQ3: How does Perceived Ease of Use scale relate to the social obstacles?

RQ4a: How does age factor into each of the three scales?

RQ4b: How does education level factor into each of the three scales?

RQ4c: How does employment factor into each of the three scales?

RQ4d: How does type of organization factor into each of the three scales?

METHODS

Sample

The population of interest for this study is all adults. The population that is accessible to this study consists of all persons who have Internet access between the dates March 10 and April 3, 2014 and are over the age of 18. The recruiting process used a nonprobability convenience sample as the survey participants were within the researcher's personal social network. Recruitment messages were sent through Facebook, LinkedIn, Twitter and email and as a result a small degree of snowball sampling occurred as in-network participants forwarded the survey communication to their friends and family members. If a probability sample had been used on this population, the standard of error would be 9.22%, which means this survey data is limited in the possibility of generalizing the data due to potential bias. The recruitment process resulted in a sample size of 114 valid participants.

Participants were segmented into four distinct age categories: Millennial (18-28), Generation x (29-44), Boomers (45-63) and Silent (over 64). Demographic data on education, employment status and organizational affiliation were collected to verify equal representation. The majority of participants fall between 29 and 63 years old (56.4%), are employed full time (51.3%) or part time (15.9%), are working in the field of technology (40.8%) and have a bachelor's degree (44.2%), master's degree (21.2%) or a doctorate degree (7.1%).

When compared to the statistics in the United States, the median age is 37.6 (Central Intelligence Agency, n.d.), unemployment (U6) rate is 12.7% (United States Department of Labor, 2014), 11.99% of the total workforce are in the technology industry (National Science Foundation, 2014), and 30.9% have a bachelor's degree (National Center for Education Statistics, 2012). As a result, this study is not representative of the population of United States therefore generalizability will be limited to this survey's niche population.

Measures

This study included three measures: one well known psychological measure from the Big Five Inventory and two adapted measures, Perceived Ease of Use and Early Adopter.

The first measure used the Big Five Inventory (BFI) trait, Openness, to organize the survey findings. Openness is a ten-item, five-point self-reporting scale numbered from 1 (anchored with strongly agree) to 5 (anchored with strongly disagree). Two questions were recoded to ensure validity. The BFI trait, openness, measures an individual’s openness to experience, meaning the degree to which an individual self-reports on their intellectual curiosity, creativity and preference for a variety of experiences. Scoring low on openness in the Big Five Inventory characterizes an individual as “imaginative, curious, and exploratory” (Boyle, Matthews, & Saklofske, 2008). A high score indicates an individual with conventional interests and appreciate more familiar situations. The Cronbach’s alpha reliability coefficient for the original Openness subscale ranged from 0.84 to 0.98 (Goldberg, 1992). The internal consistency reliability estimate for this survey using Cronbach's alpha reliability coefficients is .807, which is slightly under the original reported range.

The second measure was adapted from the System Usability Scale (SUS) (Lewis & Sauro, 2009) and reports a Cronbach’s alpha reliability coefficient of 0.91 (Sauro & Lewis, 2011). The original SUS is a 10-item, 5-point scale numbered from 1 (anchored with strongly agree) to 5 (anchored with strongly disagree) and is used to measure the perceived usability of a website. The adaptation of this scale, renamed Perceived Ease of Use, reduced the number of items to six, but retained the same five-point scale and is used to measure the perceived ease of use of technological devices. Two questions were recoded to ensure validity and one question was removed to gain reliability. A low score on this scale has the potential to indicate that technology (in general) is easy to use. Likewise a high score would indicate the participant perceives technology to be difficult to use. The internal consistency reliability estimate for this survey using Cronbach's alpha reliability coefficients is .803.

A third measure was adapted from a corporate market research company to identify and compare early adopters (Dennis, Osborn, & Semans, 2009). No reliability measure was reported on the original scale. The original survey included nominal questions regarding comfort level, social networking site usage, and online survey completion and five early adopter interval questions on five-point scale. The adapted measure, renamed Early Adopter Scale, removed all questions with exception to the five-item early adopter measure and maintained the five-point scale numbered from 1 (anchored with strongly agree) to 5 (anchored with strong disagree). No recoding was performed. A low score on this scale would indicate the participant views themselves as a person who often obtains the latest technologies. A high score on this scale could indicate the participant views themselves as someone who does not tend to own the latest technologies. The internal consistency reliability estimate for this survey using Cronbach's alpha reliability coefficients is .90.

RESULTS

The three measures are significantly positively correlated with one another, indicating the Big Five trait, Openness, is positively significantly correlated to the adapted Perceived Ease of Use and Early Adopter scales (Table 1).

Table 1
Pearson Correlation of Measured Scales

Scale		Big 5 Openness	Perceived Ease of Use	Early Adopter
Big 5 Openness	Pearson Correlation	1	.254**	.326**
	Sig. (2-tailed)		.006	.000
Perceived Ease of Use	Pearson Correlation		1	.597**
	Sig. (2-tailed)			.000
Early Adopter	Pearson Correlation			1
	Sig. (2-tailed)			

Note. N = 114
** Indicates a significant correlation

RQ1: How does the Big Five Inventory trait, openness, relate to the social obstacles?

The Big Five Inventory trait, openness, is not significantly correlated with the survey questions influenced by Fischer's promises and pitfalls: filter bubbles, intrusiveness, remembering and forgetting and privacy. However, using Pearson's correlation coefficient, one significant positive correlation was discovered between openness and the enjoyment of chance encounters ($p < .001$, $r = .395$). Openness shows a statistically significant difference between frequencies as determined by one-way Anova: Laptop use ($p < .0001$, $F = 20.873$) and Internet use ($p < .0001$, $F=34.749$), meaning those who are more open tend to use their laptops and internet more frequently.

RQ2: How does the Early Adopter scale relate to the social obstacles?

The Early Adopter scale shared the most significant positive correlations with the social obstacles. The results indicate this group demonstrates a moderate correlation with enjoyment of being reminded of past purchase decisions ($p < .001$, $r = .405$). This group shows a low correlation with: wants retail stores to know their preferences ($p < .01$, $r = .303$), likes access to past work and deliverables ($p < .01$, $r = .286$), shares name and email address with websites ($p < .01$, $r = .255$), enjoys seeing ads related to search ($p < .05$, $r = .212$), thinks websites use their information to help make decisions ($p < .05$, $r = .202$) and typically purchases impulse items ($p < 0.05$, $r = .216$). There is a low negative correlation with the ability to modify the options and settings features on devices ($p < 0.001$, $r = -.338$) and being a target of fraud at least twice in the past year ($p < .01$, $r = -.250$). Early Adopters shows a statistically significant difference between frequencies as determined by one-way Anova: smartphone use ($p < .01$, $F = 2.540$), wearable technology use ($p < .05$, $F = 2.089$) and networked system use ($p < .01$, $F = 2.797$) meaning those who adopt emerging technologies are more likely to use emerging technologies, like smartphones, wearables and networked systems frequently.

RQ3: How does the Perceived Ease of Use scale relate to the social obstacles?

The Perceived Ease of Use Scale shared a low positive correlation with ease of sharing names and email addresses with websites ($p < 0.00$, $r = .261$), being reminded of past purchase decisions ($p < .005$, $r = .191$) and a negative moderate correlation with modifying options or settings on devices ($p < .001$, $r = -.474$). Perceived Ease of Use shows a statistically significant difference between frequencies as determined by one-way

Anova: Smartphone use ($p < .0001$, $F = 3.054$). Wearable technology use is approaching significance ($p = .055$, $F = 1.705$), meaning those who are find technology easy to use are more likely to use smartphones and potentially wearable technologies frequently.

RQ4a: How does age factor into each of the three scales?

The scales show a statistically significant difference between age groups as determined by one-way Anova: BFI trait, Openness ($p < .01$, $F = 4.122$), Perceived Ease of Use ($p < .01$, $F = 10.922$) and Early Adopter scale ($p < .01$, $F = 4.319$). The means between groups revealed that Boomers are the most open ($M = 1.91$, $SD = .503$), Generation X finds perceives technology to be the easiest to use ($M = 2.13$, $SD = .641$) and consider themselves to be Early Adopters ($M = 2.88$, $SD = .734$). On the other end of the spectrum, the Silent Generation is the least open ($M = 2.41$, $SD = .581$), finds technology the most difficult to use ($M = 3.29$, $SD = .571$) and is the least likely to be Early Adopters ($M = 3.82$, $SD = .628$).

RQ4b: How does education level factor into each of the three scales?

There are no statistically significant differences between the scales and level of education ($p > .05$).

RQ4c: How does employment factor into each of the three scales?

The scales show a statistically significant difference between employment as determined by one-way Anova: BFI trait, Openness ($p < .01$, $F = 3.617$), Perceived Ease of Use ($p < .01$, $F = 9.347$) and Early Adopter scale ($p < .01$, $F = 3.960$). The means between groups revealed that people employed part-time are the most open (M = 1.85, SD = .488), people employed full-time perceive technology to be the easiest to use (M = 2.16, SD = .615) and consider themselves to be Early Adopters (M = 2.76, SD = .985). On the other end of the spectrum, the people that are the least open categorized themselves as retired (M = 2.43, SD = .598) or homemakers (M = 2.57, SD = .821), find technology the most difficult to use: retired (M = 3.21, SD = .702), homemaker (M = 3.30, SD = .452) and are the least likely to be early adopters: retired (M = 3.68, SD = .816), homemaker (M = 3.56, SD = 1.18).

RQ4d: How does the type of organization factor into each of the three scales?

There are no statistically significant differences between the scales and type of organization ($p > .05$).

DISCUSSION

Big Five Inventory Trait: Openness results clearly showed a gap in the definition of openness and the questions designed within the each of the categories in Gerhard Fischer's social obstacles. However, a strong relationship existed between the scale Openness and serendipity and this measure could be used to establish attitudes regarding serendipity in the future. This scale is not a good measure of openness towards emerging technologies as it appears only to measure openness to existing tangible ideas and a new scale is needed to meet this need.

The Early Adopter scale is adapted and requires additional tests for reliability; it demonstrated the highest internal reliability and significantly correlated with more of the social obstacles than any of the other scales and those who self-reported as early adopters demonstrated a high frequency of use of emerging technologies. This implies a strong correlation between use and attitude, thus discovery of a scale to measure stages of technological adoption would benefit further study in this area. The possible constraints are the social-obstacle questions in this survey were geared towards a person who has a high interest in technology as demonstrated through the strength of the positive correlation between comfort levels and emerging technologies (Table B4). An interesting discovery is the ease with sharing personal information and acceptance of having related information display during Internet sessions. This reveals a concept not covered by Gerhard Fischer's promises and pitfalls: 'digital trust.' Following John Stuart Mill, 'digital trust' is defined in this study as the belief that the Internet is reliable and inherently good. Further investigation into why there is more technological trust with Early Adopters would enhance this area of thought.

The Perceived Ease of Use scale is positively correlated with people who do not mind sharing their basic personal information and are okay with being reminded of past purchase decisions. This again indicates a need for a level of expected 'digital trust' between humans and computers, although the extent to which trust is shared with technology in this study is unknown. This group is the most comfortable with smartphones and has potential to enter into the wearable technological category. The reasonable conclusion of easy access is also seen in the concept that users should not have to modify the settings or features on their devices. This speaks to the future direction of technological integration and autonomy necessary in context aware technologies. Despite the unique findings, this scale is not sufficiently linked to the social obstacles as outlined by Gerhard Fischer and perceived ease of use of technologies is not a basis for the potential promises and pitfalls of context aware technologies.

Rationale

Identifying early adopters as a select group is not the key to predicting future adoption. Early adopters can abandon a technology when it is too popular and may not be representative of the entire population now or in the future. A technological adoption scale to understand social issues with technology will allow researchers to effectively scan the population for early warning signs and make corrections to technology prior to public release. For example, Google could have avoided the public outcry against its Google Glass device had it performed a basic survey of features against a technological adoption scale and understood the significant obstacles it faced with the release of a highly complex and risky construct.

Limitations

Methodological Limitations: This study surveyed only people with Internet access on a small scale (N=114). This limits the reach of the study and is therefore not generalizable.

Demographic Limitations: The participants were from the researcher's personal network and the questions lacked the option of demographic segmentation of race or sex.

Scale Limitations: Two scales were adapted from Internet sources and requires additional reliability tests before either can be considered conclusive.

Conclusion and Future Research

Results from this survey indicated that trust plays a larger role in the acceptance of emerging technologies and Early Adopters are a likely group to have a higher levels of trust in devices. Future research should consist of (1) additional research and validation of the Early Adopter Attitudinal scale and (2) the degree to which trust impacts adoption of emerging technologies.

If this study is to be duplicated there are many areas in which changes should occur in order to provide more fruitful results. (1) A pretest of the survey could identify fundamental issues with the content. (2) Using a semantic differential scale instead of a Likert scale for Gerhard Fischer's promises and pitfalls may have been more appropriate to gauge attitudes in this area. (3) It may have been beneficial to create questions within each of Fischer's categories based on existing measures to increase accuracy in the data. (4) For the items that pertain to comfort level, frequency, and perceived ease of use, it may have been more appropriate to create categories based on device-type or situation along a Likert scale in order to have a baseline and thus, a more useful comparison. (5) Enhancing demographic questions, such as including male and female options would help in understanding if a gender bias or other demographic bias exists in perceptions of social obstacles. Finally, (6) an in-depth look at construal level theory would enhance the research in this area; exploring psychological distance as it relates to the acceptance of new technologies would be revealing in the choices people will make today regarding the devices of tomorrow.

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APPENDIX A: DESCRIPTIVES

Table A1
Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-28	16	14.0	14.0	14.0
	29-44	37	32.5	32.5	46.5
	45-63	44	38.6	38.6	85.1
	Over 64	17	14.9	14.9	100.0
	Total	114	100.0	100.0	

Table A2
Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No formal schooling completed	1	.9	.9	.9
	High school diploma or equivalent (GED)	17	14.9	14.9	15.8
	Associate degree	13	11.4	11.4	27.2
	Bachelor’s degree	50	43.9	43.9	71.1
	Master’s degree	24	21.1	21.1	92.1
	Professional degree	1	.9	.9	93.0
	Doctorate degree	8	7.0	7.0	100.0
	Total	114	100.0	100.0	

Table A3
Employment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Employed full time	59	51.8	51.8	51.8
	Employed part time	18	15.8	15.8	67.5
	Unemployed	3	2.6	2.6	70.2
	Student	11	9.6	9.6	79.8
	Homemaker	6	5.3	5.3	85.1
	Retired	17	14.9	14.9	100.0
	Total	114	100.0	100.0	

Table A4
Organization

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Advertising/Marketing	4	3.5	5.2	5.2
	Technology	32	28.1	41.6	46.8
	For profit (General)	10	8.8	13.0	59.7
	Non-profit (religious, arts, social assistance, etc.)	4	3.5	5.2	64.9
	Government	4	3.5	5.2	70.1
	Education	10	8.8	13.0	83.1
	Other	13	11.4	16.9	100.0
	Total	77	67.5	100.0	
Missing	System	37	32.5		
Total		114	100.0		

APPENDIX B: CORRELATIONS

Table B1
Pearson Correlation of Big Five Inventory and Social Obstacles

Social Obstacles			Big Five Inventory Openness
Filter Bubble	I enjoy reading information that aligns to my own worldview.	Pearson Correlation	.090
		Sig. (2-tailed)	.342
		N	114
	I unfriend people online who post content I don't agree with.	Pearson Correlation	.019
		Sig. (2-tailed)	.839
		N	114
	I don't tend to voice my opinion, even when I disagree.	Pearson Correlation	-.114
		Sig. (2-tailed)	.229
		N	114
Memory	I enjoy seeing advertisements that are related to my Internet search.	Pearson Correlation	.008
		Sig. (2-tailed)	.931
		N	114
	I like having access most of past assignments, work or deliverables.	Pearson Correlation	.151
		Sig. (2-tailed)	.109
		N	114
	I am often reminded of my past mistakes.	Pearson Correlation	-.132
		Sig. (2-tailed)	.162
		N	114
Privacy	I have no problem sharing my name and email address with most websites.	Pearson Correlation	.041
		Sig. (2-tailed)	.665
		N	114
	I believe most websites use my information and past purchases to help me make decisions.	Pearson Correlation	.034
		Sig. (2-tailed)	.716
		N	114
	I have been the target of fraud at least twice in the past year.	Pearson Correlation	-.168
		Sig. (2-tailed)	.074
		N	114
Intrusiveness	I turn off work email notifications on vacation.	Pearson Correlation	-.009
		Sig. (2-tailed)	.922
		N	114
	I like being reminded of past purchase decisions.	Pearson Correlation	.149
		Sig. (2-tailed)	.114
		N	114
	I want retail stores to know my preferences before I walk in.	Pearson Correlation	.013
		Sig. (2-tailed)	.895

		N	114
Serendipity	I enjoy chance encounters or situations.	Pearson Correlation	.395**
		Sig. (2-tailed)	.000
		N	114
	I generally buy impulse items even though I don't need them.	Pearson Correlation	.051
		Sig. (2-tailed)	.591
		N	114
	I typically modify the options or settings features on most of my devices.	Pearson Correlation	-.158
		Sig. (2-tailed)	.094
		N	114

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table B2
Pearson Correlation of Perceived Ease of Use and Social Obstacles

Social Obstacles			Perceived Ease of Use
Filter Bubble	I enjoy reading information that aligns to my own worldview.	Pearson Correlation	-.029
		Sig. (2-tailed)	.757
		N	114
	I unfriend people online who post content I don't agree with.	Pearson Correlation	-.167
		Sig. (2-tailed)	.075
		N	114
	I don't tend to voice my opinion, even when I disagree.	Pearson Correlation	-.118
		Sig. (2-tailed)	.209
		N	114
Memory	I enjoy seeing advertisements that are related to my Internet search.	Pearson Correlation	.149
		Sig. (2-tailed)	.114
		N	114
	I like having access most of past assignments, work or deliverables.	Pearson Correlation	.174
		Sig. (2-tailed)	.064
		N	114
	I am often reminded of my past mistakes.	Pearson Correlation	-.150
		Sig. (2-tailed)	.111
		N	114
Privacy	I have no problem sharing my name and email address with most websites.	Pearson Correlation	.261**
		Sig. (2-tailed)	.005
		N	114
	I believe most websites use my information and past purchases to help me make decisions.	Pearson Correlation	.093
		Sig. (2-tailed)	.324

		N	114
	I have been the target of fraud at least twice in the past year.	Pearson Correlation Sig. (2-tailed) N	-.169 .072 114
Intrusiveness	I turn off work email notifications on vacation.	Pearson Correlation Sig. (2-tailed) N	-.030 .751 114
	I like being reminded of past purchase decisions.	Pearson Correlation Sig. (2-tailed) N	.191* .041 114
	I want retail stores to know my preferences before I walk in.	Pearson Correlation Sig. (2-tailed) N	.169 .072 114
Serendipity	I enjoy chance encounters or situations.	Pearson Correlation Sig. (2-tailed) N	.167 .076 114
	I generally buy impulse items even though I don't need them.	Pearson Correlation Sig. (2-tailed) N	-.042 .659 114
	I typically modify the options or settings features on most of my devices.	Pearson Correlation Sig. (2-tailed) N	-.474** .000 114

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table B3
Pearson Correlation of Early Adopters and Social Obstacles

Social Obstacles			Early Adopter
Filter Bubble	I enjoy reading information that aligns to my own worldview.	Pearson Correlation Sig. (2-tailed) N	.069 .467 114
	I unfriend people online who post content I don't agree with.	Pearson Correlation Sig. (2-tailed) N	-.104 .272 114
	I don't tend to voice my opinion, even when I disagree.	Pearson Correlation Sig. (2-tailed) N	-.059 .531 114
Memory	I enjoy seeing advertisements that are related to my Internet search.	Pearson Correlation Sig. (2-tailed)	.212* .024

		N	114
	I like having access most of past assignments, work or deliverables.	Pearson Correlation Sig. (2-tailed) N	.286** .002 114
	I am often reminded of my past mistakes.	Pearson Correlation Sig. (2-tailed) N	-.154 .101 114
Privacy	I have no problem sharing my name and email address with most websites.	Pearson Correlation Sig. (2-tailed) N	.255** .006 114
	I believe most websites use my information and past purchases to help me make decisions.	Pearson Correlation Sig. (2-tailed) N	.202* .031 114
	I have been the target of fraud at least twice in the past year.	Pearson Correlation Sig. (2-tailed) N	-.250** .007 114
Intrusiveness	I turn off work email notifications on vacation.	Pearson Correlation Sig. (2-tailed) N	.091 .335 114
	I like being reminded of past purchase decisions.	Pearson Correlation Sig. (2-tailed) N	.405** .000 114
	I want retail stores to know my preferences before I walk in.	Pearson Correlation Sig. (2-tailed) N	.303** .001 114
Serendipity	I enjoy chance encounters or situations.	Pearson Correlation Sig. (2-tailed) N	.100 .288 114
	I generally buy impulse items even though I don?t need them.	Pearson Correlation Sig. (2-tailed) N	.216* .021 114
	I typically modify the options or settings features on most of my devices.	Pearson Correlation Sig. (2-tailed) N	-.338** .000 114

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table B4
Pearson Correlations of Scales and Comfort with Technology

Comfort Level		Big 5 Inventory Openness	Perceived Ease of Use	Early Adopter
Computer/laptop	Pearson Correlation	.370**	.485**	.351**
	Sig. (2-tailed)	.000	.000	.000
	N	114	114	114
Internet	Pearson Correlation	.391**	.443**	.327**
	Sig. (2-tailed)	.000	.000	.000
	N	114	114	114
Cell phones	Pearson Correlation	.308**	.492**	.450**
	Sig. (2-tailed)	.001	.000	.000
	N	114	114	114
Smartphones	Pearson Correlation	.337**	.561**	.562**
	Sig. (2-tailed)	.000	.000	.000
	N	114	114	114
Wearable technology (e.g., google glass)	Pearson Correlation	.183	.601**	.534**
	Sig. (2-tailed)	.051	.000	.000
	N	114	114	114
Smart TVs	Pearson Correlation	.294**	.510**	.534**
	Sig. (2-tailed)	.002	.000	.000
	N	114	114	114
Networked systems (e.g., Internet-connected thermostat)	Pearson Correlation	.180	.622**	.551**
	Sig. (2-tailed)	.055	.000	.000
	N	114	114	114
A drone-delivery system	Pearson Correlation	.071	.538**	.618**
	Sig. (2-tailed)	.452	.000	.000
	N	114	114	114

**. Correlation is significant at the 0.01 level (2-tailed).

Table B5
Pearson Correlations of Comfort with Technology and Frequency of Use

Comfort Level		Laptop / Computer	Internet	Cell phones (not Internet-enabled)	Smartphones	Wearable technology (e.g., Google Glass)	Networked systems (e.g., Internet connected thermostat)
Computer/ laptop	Pearson Correlation	.605**	.628**	-.068	.486**	.069	.177
	Sig. (2-tailed)	.000	.000	.473	.000	.463	.059
	N	114	114	114	114	114	114

Internet	Pearson Correlation	.580**	.689**	-.120	.516**	.043	.147
	Sig. (2-tailed)	.000	.000	.202	.000	.648	.119
	N	114	114	114	114	114	114
Cell phones	Pearson Correlation	.427**	.502**	-.053	.524**	.159	.203*
	Sig. (2-tailed)	.000	.000	.573	.000	.092	.030
	N	114	114	114	114	114	114
Smartphones	Pearson Correlation	.300**	.375**	-.256**	.824**	.188*	.236*
	Sig. (2-tailed)	.001	.000	.006	.000	.045	.011
	N	114	114	114	114	114	114
Wearable technology (e.g., google glass)	Pearson Correlation	.222*	.180	-.004	.431**	.516**	.547**
	Sig. (2-tailed)	.018	.056	.964	.000	.000	.000
	N	114	114	114	114	114	114
Smart TVs	Pearson Correlation	.177	.257**	-.003	.490**	.275**	.370**
	Sig. (2-tailed)	.060	.006	.975	.000	.003	.000
	N	114	114	114	114	114	114
Networked systems (e.g., Internet-connected thermostat)	Pearson Correlation	.216*	.223*	-.010	.430**	.388**	.482**
	Sig. (2-tailed)	.021	.017	.918	.000	.000	.000
	N	114	114	114	114	114	114
A drone-delivery system	Pearson Correlation	.170	.134	.022	.339**	.369**	.450**
	Sig. (2-tailed)	.071	.154	.812	.000	.000	.000
	N	114	114	114	114	114	114

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

APPENDIX C: ONE-WAY ANOVA

Table C1
One-way ANOVA of Scales and Age

Scale		Sum of Squares	df	Mean Square	F	Sig.
Big 5 Inventory Openness	Between Groups	3.490	3	1.163	4.122	.008
	Within Groups	31.047	110	.282		
	Total	34.538	113			
Perceived Ease of Use	Between Groups	15.798	3	5.266	10.992	.000

	Within Groups	52.701	110	.479		
	Total	68.499	113			
Early Adopter	Between Groups	11.339	3	3.780	4.319	.006
	Within Groups	96.264	110	.875		
	Total	107.603	113			

Table C2

One-way ANOVA of Scales and Employment

Scale		Sum of Squares	df	Mean Square	F	Sig.
Big 5 Inventory Openness	Between Groups	4.954	5	.991	3.617	.005
	Within Groups	29.583	108	.274		
	Total	34.538	113			
Perceive Ease of Use	Between Groups	20.688	5	4.138	9.347	.000
	Within Groups	47.811	108	.443		
	Total	68.499	113			
Early Adopter	Between Groups	16.670	5	3.334	3.960	.002
	Within Groups	90.933	108	.842		
	Total	107.603	113			

Table C3

One-way ANOVA of Early Adopters and Frequency of Use

Frequency		Sum of Squares	df	Mean Square	F	Sig.
Laptop / Computer	Between Groups	9.739	19	.513	1.261	.228
	Within Groups	38.200	94	.406		
	Total	47.939	113			
Internet	Between Groups	9.173	19	.483	1.458	.120
	Within Groups	31.117	94	.331		
	Total	40.289	113			
Cell phones (not Internet-enabled)	Between Groups	112.168	19	5.904	.699	.812
	Within Groups	794.323	94	8.450		
	Total	906.491	113			
Smartphones	Between Groups	186.498	19	9.816	2.540	.002
	Within Groups	363.187	94	3.864		
	Total	549.684	113			
Wearable technology (e.g., Google Glass)	Between Groups	107.051	19	5.634	2.089	.011
	Within Groups	253.554	94	2.697		
	Total	360.605	113			
Networked systems (e.g., Internet connected thermostat)	Between Groups	204.304	19	10.753	2.797	.001
	Within Groups	361.319	94	3.844		
	Total	565.623	113			
	Total	572.491	113			

Table C4

One-way ANOVA of Perceived Ease of Use and Frequency of Use

Frequency		Sum of Squares	df	Mean Square	F	Sig.
Laptop / Computer	Between Groups	7.589	17	.446	1.062	.402
	Within Groups	40.350	96	.420		
	Total	47.939	113			
Internet	Between Groups	7.389	17	.435	1.268	.230
	Within Groups	32.900	96	.343		
	Total	40.289	113			
Cell phones (not Internet-enabled)	Between Groups	161.517	17	9.501	1.224	.261
	Within Groups	744.974	96	7.760		
	Total	906.491	113			
Smartphones	Between Groups	192.922	17	11.348	3.054	.000
	Within Groups	356.763	96	3.716		
	Total	549.684	113			
Wearable technology (e.g., Google Glass)	Between Groups	83.634	17	4.920	1.705	.055
	Within Groups	276.971	96	2.885		
	Total	360.605	113			
Networked systems (e.g., Internet connected thermostat)	Between Groups	120.716	17	7.101	1.532	.100
	Within Groups	444.907	96	4.634		
	Total	565.623	113			

Table C3

One-way ANOVA of Big 5 Inventory Trait Openness and Frequency of Use

Frequency		Sum of Squares	df	Mean Square	F	Sig.
Laptop / Computer	Between Groups	40.010	22	1.819	20.873	.000
	Within Groups	7.929	91	.087		
	Total	47.939	113			
Internet	Between Groups	36.004	22	1.637	34.749	.000
	Within Groups	4.286	91	.047		
	Total	40.289	113			
Cell phones (not Internet-enabled)	Between Groups	191.184	22	8.690	1.106	.356
	Within Groups	715.307	91	7.861		
	Total	906.491	113			
Smartphones	Between Groups	154.154	22	7.007	1.612	.061
	Within Groups	395.530	91	4.346		

	Total	549.684	113			
Wearable technology (e.g., Google Glass)	Between Groups	69.809	22	3.173	.993	.481
	Within Groups	290.796	91	3.196		
	Total	360.605	113			
Networked systems (e.g., Internet connected thermostat)	Between Groups	74.546	22	3.388	.628	.893
	Within Groups	491.077	91	5.396		
	Total	565.623	113			