Is Smartwatch Really for Me? An Expectation-Confirmation Perspective

Completed Research

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Abstract

Internet of Things (IoT) technologies are increasingly transforming user experience. Wearable technologies, smartwatches in specific, are changing user experience in two aspects of utility and hedonism. By explicating prior research in technology acceptance, we propose a framework for discerning users satisfaction based on confirmation/disconfirmation of expectations they have on the smartwatches. We interview 126 students from a university college in the department of IS where, we collect responses based on the expectations they have on smartwatches and their satisfaction upon their confirmation. Our results show that confirmation of expectations based on hedonic uses lead to higher performance perceptions and satisfaction. This study has both theoretical and practical contributions in the sense of; providing a theoretical lens in the diffusion of smartwatch technology and provides implications to managers on the smartwatch features that attract users most. Future research ideas are also provided based on our limitations.

Keywords

IoT, wearables, expectations, smartwatches.

Introduction

Internet of Things (IoT) refers to the internet-connectedness of all kinds of electronic devices in including wearable technologies (Swan 2012). It is estimated that the IoT domain shall have over 50 billion devices connected to the internet by the year 2020 (Jayakumar et al. 2014). The physical distance between computers and humans has been reduced significantly through ubiquitous computing, where wearable technologies have evolved (Jung et al. 2016).

IoT devices have transformed users' experience in technology utilization (Castillejo et al. 2013). Devices ranging from home appliances, to wearable technologies are connected to the internet where they perform computing activities with minimal human involvement (Metcalf et al. 2016). IoT devices have both industrial and societal impacts including development of new models by organizations for performance optimization, and societal impacts of providing support to the aged in terms of health management (Vermesan and Friess 2014).

Among the various applications of IoT technologies, wearable devices stand out as the most popular in application (Meola 2016). Described as technologies that can be attached to the body or clothing, wearable technologies are touted to outperform hand-held devices such as mobile phones and laptop computers (Tehrani et al. 2014). Plausibly, smartwatches are touted as the most popular devices among wearable technologies (Chuah et al. 2016; Deghani 2018; Jung et al. 2016; Kim and Shin 2016). It is predicted that their market growth shall reach 17.8 US billion dollars, with sales forecasts of up to 373 million units by the year 2020 (IDC 2016).

In an empirical review of healthcare technologies, Reeder and David (2016) reported that smartwatches have rapidly penetrated the healthcare industry where they are used for patient management. The multiple functionalities of health management, fashion accessory, and mobile phone compliment make the smartwatch an interesting emerging technology that may have future positive outlook. Despite this fact a

theoretical gap exists in the study of smartwatches. In this research, we aim to fill this gap by dwelling on their continued usage in an expectations confirmation perspective.

Smartwatches are on the forefront of complementing or even substituting the smartphone interface as the world is moving closer to virtual reality (Mike 2016). In recent trends, technology companies are designing smartwatches that are synchronized with wireless headphones for receiving phone calls and ability to view text and email notifications (Jeong et al 2017; Ramon 2016). Smartwatches are also being utilized in health care where, brands such as Apple (Apple S2), Samsung (S3), have applications that help monitor health progress by keeping track of heartbeats and calories when working out in the gym, or jogging outside (Alex 2017). Smartwatches have created a new user experience in the fashion industry as a trend, where users have preferences for various designs (Jung et al. 2016). This shows that smartwatches, like other technologies such as mobile phones attract users based on hedonic or utility factors. Subsequent growth in sales of smartwatches has however been relatively slower than anticipated (Beaver 2016). Extant studies on adoption report that users have high willingness to acquire smartwatches (Chuah et al. 2016; Kim and Shin 2016; Wu et al. 2016). However, the sales growth of smartwatches is reported to be slower than anticipated (IDC 2016). No explanation has been provided about this trend, and it is not known if new users are buying, or if current users are satisfied with the current smartwatches. According to Oliver (1980), satisfaction in a product leads to increased re-purchase behavior. It is not known if current users' low satisfaction level is linked to the slow growth rate of smartwatches as reported by IDC (2016).

Compared to interface designs in various technologies, smartwatch usage features contrasts like fashion versus practicality, excitement versus subconsciousness, and noticeability versus subconsciousness (Dunne 2004). Grounded theories based on methods such as ethnography and netnography identify notification functionality, health monitoring, fashion, and habit as some of the factors that influence the continued usage of the smartwatch by owners (Deghani 2018; Haugen 2015). These exploratory studies provide valuable insights, but the absence of theoretical lens provides little guidance on the collection and analysis of empirical observations. For instance, the extant studies mainly focus on current owners, whereas it is important to understand views from potential owners as well to understand differences in perceptions and their confirmation in their influence on continued usage.

This study attempts to understand smartwatch adoption and usage from the expectation confirmation perspective. In addition to practical considerations, it also factors in fashion attributes such as design and price in terms of high-end and low-end products. Survey observations were collected from both existing and potential owners of smartwatches based on actual and scenario-based perceptions. By including the expectation-confirmation process from non-IS artifacts (i.e. traditional watches) that have both hedonic and practical values, the investigation on the formation of people's intention to adopt smartwatches and continue the usage contribute to theory development in wearable technology adoption research. The findings also provide helpful insights on which aspects (e.g. hedonic or utility) industry players should focus on when designing smartwatches to meet customer requirements. Findings from this study shall also advance the Internet of Things literature where, other devices in the wearable categories can be studied for comparison purposes.

Research Background

The smartwatch is categorized as a wearable technology, i.e. "*Wearable computers are electronic devices that function as a computer and can be worn, carried, or attached to the body*." (Buenaflor and Kim 2013 P. 104). Smartwatches vary according to features and functionalities. As shown in Table 1, (Colon 2017) compares and ranks different smartwatches depending on specifications and functions. Apple S2 leads the smartwatch market with advanced features such wireless charging, and long battery life. Samsung S3 comes in second and has a large memory (4GB) as compared to others. Other brands featured include LG and Asus, which both have USB charging features and call, notification features. The featured smartwatches have almost all similar functions but have different designs that may influence consumer choice. Various studies on Smartwatch use have reported users' preferences in; fitness tracking (Cecchinato et al. 2015; Jeong et al. 2017), as a fashion (Jung et al. 2016; Wu and Chang 2016), for text, email, and call notifications (Jung et al. 2016; Kumar and Venkateshwarlu 2017).

Smartwatch	Specifications	Functions
Apple S2	-IOS, Water resistant, Bluetooth, Wi-fi, 2 GB music & 725 MB photo storage, 18hr battery life, Wireless charging	GPS,
Samsung S3	IOS & Android, 4GB Storage, 3-day battery life, wireless charging, Bluetooth, Wi-fi, Tracking	Tracking
LG Watch Style	Android & IOS, Storage 4GB, 24hr battery life, USB Charging, Bluetooth, Wi-Fi	
LG Watch Sport	Android & IOS, 4GB Storage, 16hr battery life, wireless charging, Bluetooth, Wi-Fi	Calls & Data without cell phone, Phone calls with Sim Card (US only)
Asus Zen Watch 3	Android & IOS,	No heart rate sensor
Huawei Watch 2	Android & IOS, 4GB storage, 2-days battery life, wired charging, Bluetooth, Wi-Fi	GPS, Small screen

Table 1. Comparison of Latest Smartwatches (Colon 2017)

Prior studies have focused more on smartwatch adoption, where people are showing willingness to acquire smartwatches for various reasons. According to Jung et al. (2016), on a study about consumer valuation of wearables, reported that consumers had more preference for display features of screen shape and size. According to Wu et al. (2016), enjoyment superseded ease of use in user preferences. This portrays a smartwatch as a form of fashion. More consumers value Apple smartwatches as compared to Samsung due to the brand reputation of Apple, which is known for its sleek designs in its products (Jung et al. 2016). In a longitudinal study about smartwatch wearing behavior, Jeong et al. (2017) reported high usage of smartwatches for email and call notifications. Respondents saw it as a fast way of responding to emails and text messages. Users were also satisfied by the efficiency of sorting important messages that needed urgent attention (Jeong et al. 2017). A study by Kumar and Venkateshwarlu (2017), reported that consumers rated alert notification as an important feature in a smartwatch. Potential users' expectation of notification capability significantly influenced intention to acquire smartwatches. Smartwatches are used for health-related activities such as tracking and fitness monitoring. Satisfaction in performance of smartwatches for health-related activities has been reported in prior studies. Both current and future users are satisfied by the ability of the smartwatch functionality of tracking their steps when walking or jogging (Cecchinato et al. 2015; Jeong et al. 2017).

Although these studies focus on future ownership of smartwatches, it is equally important to understand if current owners are satisfied with the smartwatches through confirmation of prior expectations. We build on an expectations-confirmation perspective to understand current and future owners' expectations they have on the smartwatches. As the smartwatch is a fairly new technology among IoT and wearable technologies (Meola 2016), future owners can only form expectations based on the traditional watches. Also, current owners are experiencing a new technology and may find some limitations based on prior expectations. These limitations set a basis for forming new expectations on future design or utility features of the smartwatch to achieve satisfaction.

According to Oliver (1980), future sales of products are dependent on confirmation /disconfirmation of perceptions that they have on a product, thus, it is important for manufacturers to have such information to manufacture smartwatches that meet customer expectations. To the best of our knowledge, only one study (Deghani 2018) has attempted to understand the continued usage of smartwatches after adoption. This shows that the smartwatch is an emerging technology that has not been widely explored in research. In a netnography study of users' opinions in Amazon, Deghani (2018) users were satisfied with the smartwatch due to features such as; health management, fashion product, performance quality, and as an enabling technology in terms of long battery life, and compatibility. This study however lacks has two major limitation; 1) it lacks a theoretical explanation of the continued intentions in smartwatch usage, and 2) the factors identified are based on text analysis, and not directly from consumers. To fill these gaps, and those identified in smartwatch adoption studies, we include a theoretical model of expectation confirmation model whereby, we get responses directly through a survey to explain intentions towards adoption and continued usage among future and current owners respectively.

Research Model

Figure 1 shows the research model developed based on the Expectation Confirmation Theory (ECT). ECT has its roots from Oliver's (1980) Expectation Disconfirmation Theory, which is primarily based on consumer satisfaction and dissatisfaction. The theory circumnavigates around customers experience after using a product, which is measured by the expectations by consumers about a product, and it is through this evaluation that satisfaction/dissatisfaction is experienced, leading to continuance/discontinuance in usage (Oliver 1980). Perceived performance was later incorporated into ECT by Churchill and Surprenant (1982), who argued that perceptions based on the extent to which a product meets the expectations may as well have influence on customer satisfaction (Thong et al. 2006).

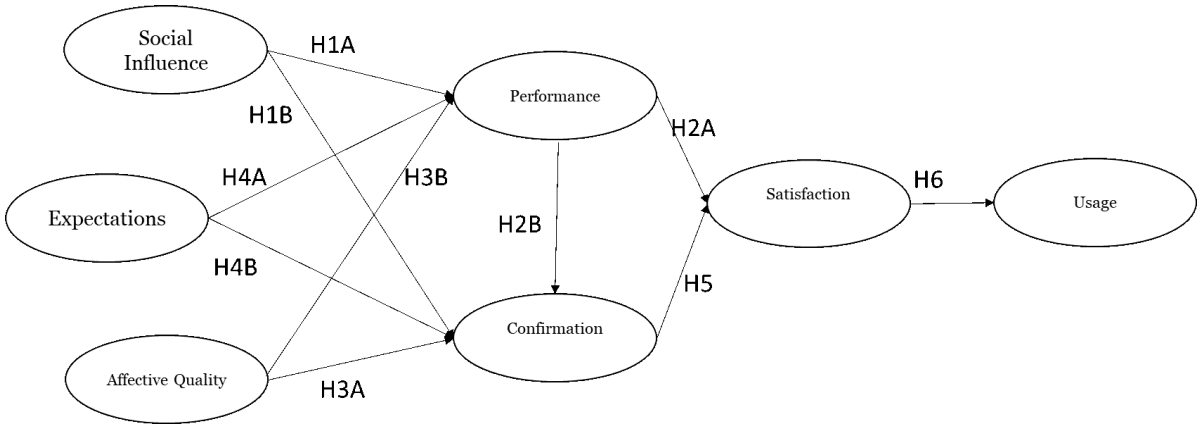

Figure 1. Research Model

ECT has been extensively used in marketing research (Hossain and Quaddus 2012), as well as in IS research (Bhattacherjee 2001; Brown et al. 2012; Chen et al. 2010; Coursaris et al. 2012). Bhattacherjee (2001) in a study about understanding continuance in I.S. usage substituted customer loyalty for IS continuance. He argued that same as loyalty, a customer's intention of continuance in IS usage is influenced by confirmation of performance expectations (Bhattacherjee 2001; Venkatesh et al. 2003). Satisfied consumers of a technology product develop loyalty, which positively influences their willingness to re-purchase the technology (Hossain and Quaddus 2012).

Social Influence is a perception that a user generates based on what people they consider important view about them adopting a behavior (Venkatesh 2003). It has been used as 'subjective norm' in TAM and TRA, before the theory was incorporated into UTAUT (Venkatesh et al. 2003). In a study about online shopping behavior, Hsu et al. (2006) reported that users were influenced by external and interpersonal factors in their decision of shopping online. In a smartwatch study context, Wu et al. (2016), reported that users' willingness to acquire smartwatches was dependent on the approval of their peers. Similarly, high social approval on the use of smartwatches is conducive to positive performance perception and confirmation of expectations.

H1a: Social Influence has a positive effect on Perceived Performance.

H1b: Social Influence has a positive effect on Confirmation.

In the original ECT model, Oliver (1980) posits that consumers form perceptions about a product before acquisition. Coursaris et al. (2012) posits that performance is based on utility whereby, after acquisition and use, customers evaluate the product's utility with expectations to form perceptions about performance. High performance, leads to confirmation and satisfaction, resulting to continued use (Bhattacherjee 2001; Oliver 1980). In a study about usage of an e-learning system, Chou et al. (2012) found that high performance led to confirmation and satisfaction, leading to continued use of the system. Therefore, perceived performance in smartwatch functions is likely to lead to high confirmation of expectations as well as satisfaction.

H2a: Perceived Performance has positive effect on Satisfaction

H2b: Perceived Performance has positive effect on Confirmation

Affective Quality has been described in psychology research as a physical feature that acts as stimuli that influences human perceptions about a product (Zhang and Li 2005; Zhang et al. 2006). This construct has been successfully used in expectations confirmation studies to predict continuance in technology usage (Kim and Shin 2015; Sanchez-Franco 2010; Zhang et al. 2006). In a study about adoption of web technologies, Sanchez-Franco (2010), found that affective quality moderates users' perceptions in usefulness and ease of use of the web technologies. Users' confirmation of affective quality in smartwatches stimulate affective emotions that lead to high performance and satisfaction (Kim and Shin 2015; Zhang and Li 2005; Zhang et al. 2006). Hence, the following hypotheses.

H3a: Affective Quality has a positive relation with Confirmation

H3b: Affective Quality has a positive relation with Perceived Performance

Expectations are perceptions formed by users of a technology before use (Bhattacherjee 2001; Brown et al. 2012; Venkatesh et al. 2003). The ECT follows a step by step process whereby, users before product acquisitions form expectations which if confirmed after product acquisition lead to satisfaction and repurchase behavior (Bhattacherjee 2001; Coursaris et al. 2012; Hossain and Quaddus 2012). According to Coursaris et al. (2012) in a study of mobile devices, expectations of efficiency and effectiveness was positively related to confirmation leading to satisfaction and continued usage. In a study based on usage of an e-learning healthcare system, Chou et al. (2010), reported that high expectations of simplicity of the system was positively related to high confirmation and continued usage. Therefore, user' expectations of advanced designs and new features in smartwatches as compared to traditional watches may lead to positive perceptions of performance and likelihood of confirmation.

H4a: Expectations have positive relationship with performance

H4b: Expectations have positive relationship with confirmation

Derived from the construct of disconfirmation in the earlier version of ECT, Expectation-Disconfirmation Theory, the confirmation of an expectation leads to satisfaction (Oliver 1980). Technology consumers form expectations, which they evaluate after technology acquisition (Bhattacherjee 2001). Confirmation of perceptions leads to satisfaction and post-purchase, and continued usage (Bhattacherjee 2001; Oliver 1980). Confirmation of simplicity was found to be positively related satisfaction in the use of an e-learning platform for patients (Chou et al. 2010). Thus, users' confirmation of smartwatch expectations is likely to enhance user satisfaction.

H5: Confirmation of expectations has a positive relation with Satisfaction.

Satisfaction is an affective state of mind that arises from confirmation expectations that a user had on a product (Oliver 1980). Users of a technology will make post-usage decisions based on the satisfaction they get using it (Bhatterchajee 2003). Satisfaction with efficiency of mobile devices leads to users having high intentions of using wireless data service (Coursaris 2012). Satisfaction with the e-learning platform prompted users to show a high intention of continuance in usage (Chou et al. 2010). In the same token, smartwatch users may have a high intention of continuance in usage if they are satisfied with the devices.

H6: Satisfaction has a positive relation with Smartwatch usage.

Methodology

The measures of all constructs were adapted from prior studies, as reported in Table 2. Most instruments adopted 7-point Likert-scale, which has been described as useful for accurate mapping of neutral, moderate, and extreme attitudes (Krosnick and Presser 2010). In addition, Satisfaction used seven-level semantic differential scale, and Expectations used seven-level rating scales on the importance of various smartwatch features including; design, health activity tracking, and notification alerts as shown in Table 2.

Construct	Measurements	Source
Affective quality	1: My smartwatch is attractive and pleasing. 2: I would miss my smartwatch if I no longer have it. 3: I feel excited when using my smartwatch.	(Kim and Shin 2015; Zhang and Li 2005)
Perceived Performance	1: My smartwatch is helpful to my daily activities. 2: The advantages of using my smartwatch outweigh the disadvantages. 3: My smartwatch offers functions useful to me	(Chou et al. 2012)
Confirmation	1: The experience with my smartwatch was better than what I expected. 2: The benefit provided by my Smartwatch was better than what I expected. 3: Overall, most of the expectations from using my smartwatch were confirmed	(Limayem et al. 2007)
Satisfaction	How do you feel about your overall experience of smartwatch use? 1: Dissatisfied … satisfied 2: Displeased … pleased 3: Frustrated … contented 4: Terrible … delighted	(Limayem et al. 2007)
Social Influence	1: People who influence my behavior think that I should continue using my smartwatch. 2: People who are important to me think that I should continue using my smartwatch 3: In general, my friends and family have never objected my use of smartwatch.	(Vanketesh et al. 2003)
Usage	1: I intend to continue using my smartwatch rather than another product. 2: My intention is to continue using my smartwatch rather than another product. 3: If I could, I would like to continue my use of smartwatch.	(Limayem et al. 2007)
Expectations	Based on the regular watch, what are your expectations from a smartwatch? 1: Old fashion design vs More stylish design 2: No activity tracking vs activity tracking 3: No alerts, call/text notifications vs alerts, call /text notification	(Bhattacherjee 2001; Coursaris et al. 2012)

Table 2. Measurements

Survey questionnaire was distributed online through links sent by email to respondents. Participants include 125 students of who 60% were male (75) and 40% female (50) from the IS department in a university in the southern region of U.S. The ages for most of them (94%) falls between 18 years to 34 years. Credits were awarded in class points to those who completed the survey distributed online.

In the questionnaire logic, respondents answered common questions related to demographics and smartwatch ownership. Those owned smartwatches proceeded to answer questions related to smartwatch use experience and intentions to continuance in usage. Future owners were exposed to one of two smartwatch images (one high-end, and another low-end) at random. The images had smartwatch information such as; design features, functionalities, and price.

Results

Table 3 reports the results of measurement validation in terms of convergent validity. The Cronbach's alpha (α) and composite reliability (CR) coefficients for all the constructs were above the recommended value of

.07, indicating that the instruments were reliable in eliciting internally consistent responses. Also supporting convergent validity, the square roots of average variance extracted (AVE) on the diagonal of correlation matrix were greater than 0.7, which indicated that AVE values were greater than the recommended value of 0.5(Bagozzi and Yi 1988). As far as divergent validity is concerned, Fornell and Larcker (1981) posit that square root of AVE should be larger than the inter-factor correlations in question. The largest correlation coefficient was lower than the smallest square root of AVE, supporting discriminant validity.

	CR	α	1	2	3	4	5	6	7
1. Affective Quality	.912	.856	**.881**						
2. Confirmation	.925	.879	.706	**.897**					
3. Expectations	.909	.867	.310	.215	**.846**				
4. Performance	.949	.920	.775	.754	.292	**.928**			
5. Satisfaction	.956	.938	.407	.448	.159	.371	**.919**		
6. Social Influence	.894	.819	.628	.732	.070	.630	.303	**.860**	
7. Usage	.956	.931	.718	.819	.188	.710	.439	.715	**.937**

Note: CR= Composite Reliability; α= Cronbach Alpha; Bolded are square roots of AVE.

Table 3. Measurement Validation

After measurement validation, the structural model was evaluated with SmartPLS3 (Ringle et al. 2015). Figure 2 reports model estimates. The *R*-squared values indicated that the model explained 19% of variation in usage, 69% in confirmation, 64% in performance, and 20% in satisfaction. Most of the research hypotheses were supported, except for H2A and H4B. There was a mediated route linking Expectation, Performance, Confirmation and Satisfaction. This link reveals the importance of performance perception from personal exposure to the smartwatch technologies in the expectation-confirmation process. In addition to the main constructs, gender, age, and income were tested as control variables but there were no significant effects.

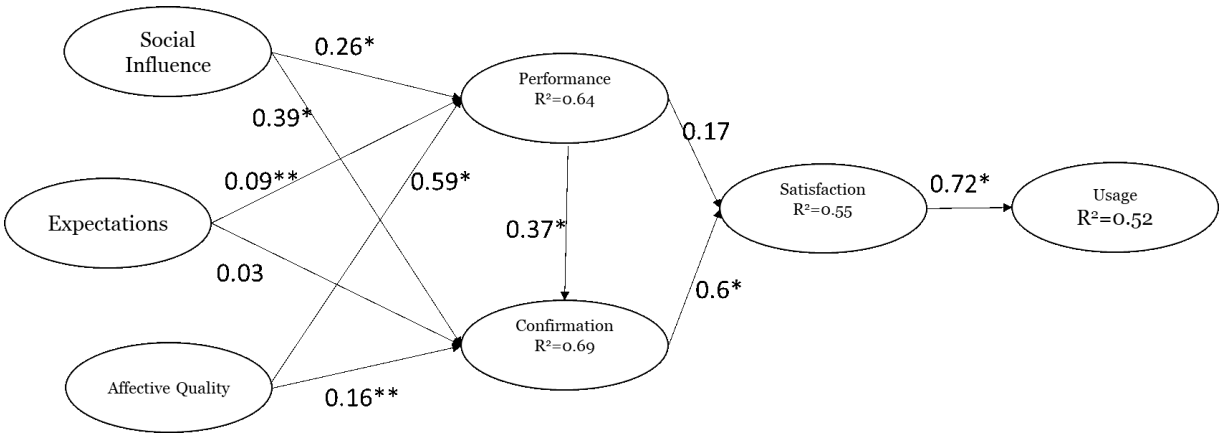

Figure 2. Measurement Results (* - sig. at 0.05 level; **- sig. at 0.01 level)

A post-hoc comparison was made on the model based on two factors; smartwatch ownership, and brand. We classified high-end and low-end brands as Apple and LG/other brands respectively. Using IBM SPSS, we carried out independent sample T-test for; ownership and brand separately. Levene's test of equality of means and variance reported lack of significant differences observed as p-values for all tests were above the satisfactory levels (P-values > 0.05, at 95% confidence level). Hence there were no differences in responses based on ownership or brand.

Discussion and Conclusion

The aim of this study is to explore the theoretical gap that exists in understanding of users' satisfaction in confirmation of smartwatch expectations. The results confirmed three significant routes in the research model: 1) confirmation of affective quality leads to satisfaction and continued usage, 2) high expectations in smartwatches in terms of fashion, notifications, and health management leads to high perception in performance and confirmation, enhancing satisfaction and continued use, and 3) social influence leads to high perception in performance and confirmation, enhancing satisfaction and continued usage.

Described by Zhang (2005) as an attribute of a technology that influences cognition, reflex, and perception, Affective Quality stands as the antecedent to continued use. Based on this study, expectations and confirmation of advanced design features in smartwatches strongly influences user perceptions on performance of smartwatches and continued usage. This is in consistency with prior studies on smartwatch adoption, where users show high intentions of adoption of smartwatches as fashion accessories (Chuah et al. 2016; Deghani 2018; Jung et al. 2016; Wu et al. 2016). Also, in consistence with prior smartwatch adoption studies, high perception of social influence is positively related to high confirmation and satisfaction, leading to continued usage. Social influence is based on smartwatch features that make users' peers rate the smartwatch. It may be related to the functionality of the smartwatch in terms of notifications, health management, or fashion. This shows that current and future users have high preference for both utility and hedonic features of smartwatches. As far as utility is concerned, current owners are mostly using smartwatches for notification (calls, emails, and texts), followed by health and fitness purposes.

On the utilitarian side, people use smartwatches as a compliment of the smartphone due to their ability to make calls and receive message notifications. In addition, new developments are emerging in the healthcare sector, where wearable applications are utilized in monitoring and diagnosis. On the hedonic side, the design of smartwatches makes them fashion icons among users. By capturing both sides of influences, the findings provide a more complete picture of wearable technology diffusion in the smartwatch context.

Also, as demonstrated by the study, smartwatch users are highly interested in the hedonic features of smartwatches. Manufacturers hence, should design smartwatches that have advanced designs such as large screen size, and curved displays, which make smartwatches unique and fashionable (Choi and Kim 2016). In utility, current owners are using the smartwatches more for notification purposes. This is important knowledge for practitioners as they should consider adding complementary features such as, additional memory and larger screens for advanced user interfaces.

This study makes contributions in the IoT literature, being first among others to provide a theoretical lens towards understanding acceptance-confirmation in wearable technologies in the context of smartwatches. We also fill the theoretical gaps left by prior studies in the diffusion of smartwatch technology e.g. (Deghani 2018) by proposing and successfully testing an expectation confirmation framework to explain users' satisfaction.

Few limitations are observed, e.g. the single focus on smartwatches in a wide array of other IoT technologies. As the diffusion of IoT technologies is taking place rapidly, future studies should examine other devices in terms of users' expectations-confirmation. Future studies should also pursue diverse IS contexts such as privacy and security and health information technology. Smartwatches have computational power and can relay personal information over the internet. Future studies can expand on this to understand the information privacy risk concerns that face users, and their perceptions about them. Other limitations include a small sample size, composed of students in one location. Future studies may as well carry cross-sectional studies to understand the smartwatch technology diffusion. Different smartwatch treatments can also be considered for future studies.

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