



## Wearable technology: What explains continuance intention in smartwatches? ☆



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### ARTICLE INFO

**Keywords:**  
Smartwatches  
Wearables  
Continuance intention  
Expectation-confirmation model (ECM)  
Habit  
Perceived usability

### ABSTRACT

Smartwatch is a recent and significant development in the domain of wearable technology. We study continuance intention and its determinants, using a combination of the expectation-confirmation model (ECM) with habit, perceived usability, and perceived enjoyment, to explain the continuance intention of smartwatches. Based on a sample of 574 individuals collected from the USA, we show that relationships of ECM enhance the continuance intention, such as confirmation, perceived usefulness, and satisfaction, and also the role of habit and perceived usability. Additionally, we find that habit was the most important feature to explain the continuance intention of smartwatches. The paper ends with a discussion of the study's limitations and implications.

### 1. Introduction

The smartwatch is a subcategory of smart wearable devices. It is “a wrist-worn device with computational power, that can connect to other devices via short range wireless connectivity; provides alert notifications; collects personal data through a range of sensors and stores them; and has an integrated clock” (Cecchinato et al., 2015). Smartwatches give people lightweight and immediate access to messages, notifications, and other digital data while on the go. The global market has witnessed sustained growth in the acceptance of wearable devices in the last few years. By Q4 2014, one in every five Americans already owned some wearable device (PwC, 2014a). Wearable technology has a great potential and a growing acceptance as a novelty technology, but it is essential to study the intention of users to continue using it so that both companies and consumers can benefit.

Companies benefit from the continued use of technology not only because the cost of acquiring a new customer is five times that of retaining an existing user (Reichheld and Schefter, 2000), but also because IS success depends on continued use rather than first time use (Bhattacharjee, 2001b; Zheng et al., 2013). In addition, according to Gao et al. (2015), acquiring new customers and promoting usage is only the first step; companies also need to retain existing users and facilitate their continued purchase. While smartwatch sales cycles might be long (typically new devices are released only once per year), one must look at the bigger picture of app sales to understand how the continued use of a device is important. In 2016, developers selling apps on the App Store earned over \$20B (Apple, 2017), and total revenue was likely to

top \$28B as Apple takes a 30% cut (Dignan, 2017). It can be assumed that the longer a user keeps using a device, the more apps they will buy, and the more profit they will generate for the company – hence the importance of studying continued use. Continued use is also important from a loyalty perspective. Earlier research suggests that satisfied customers have a higher probability of returning to the same brand they purchased (Lee et al., 2009).

Consumers benefit from the continued use of a smartwatch because as a novelty technology, the more they use it, the more they can find out how it fits into their life, which is not always immediate: they can buy it for the novelty factor, due to good marketing, because someone else has it, or simply because they are early adopters, but it does not mean that they will immediately find a use (anecdotal evidence from the discussion boards we used in this study supports this belief). Furthermore, the more they use it, the easier it will be for them to use it (Gefen, 2003). Lastly, and most importantly, the more they use it, the more a company is likely to invest back into the product based on user feedback, and the more app developers are likely to develop apps, further benefiting the users.

Wearable technology and especially smartwatch technology, are exciting new technologies to be investigated because they allow for the continuous and reliable collection of data (Rawassizadeh et al., 2015) and the augmentation of human abilities and capabilities (Starner, 2001). The data collected have considerable potential in, for example, mobile health (mHealth) applications, not only for a healthier lifestyle, but especially with care of the elderly. At the same time, studies on this topic are relatively few, and mostly done by non-independent third-

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parties; hence the importance of an independent study to understand the continuance intention of IT.

The contribution of this research is fourfold. First, most extensive research has been conducted on the topic of technology acceptance, but the topic of technology continuance intention has a greater impact on the long-term viability of an information system (Bhattacharjee, 2001b). For this reason, this study aims to extend the knowledge on the latter topic.

Secondly, empirical work regarding wearables and, in particular, smartwatches is scarce. According to Juniper Research (Moar, 2016), an estimated 17.1 million smartwatches were shipped in 2015. Wearables, and in particular, smartwatches, do show potential benefits but are still far from reaching mainstream acceptance that is similar to that of smartphones (Danova, 2014). In fact, according to the PwC report (PwC, 2014b), only one in ten Americans used a wearable device every day in 2014. In 2015, North America accounted for roughly 40% of the global wearables market (Cisco, 2016). With a global revenue of \$750 M in 2012 (Ak, 2014), the smartwatch market is expected to reach \$32.9B in 2020, growing at a compound annual growth rate of 67.6% (Kohli, 2015). Despite this growth, consumers still show some reluctance toward smartwatches (Danova, 2014; PwC, 2014b). With a big market and growth, smartwatches are an interesting technology to be studied. Also, very few studies were found by the authors on the topic of smartwatch continuance intention. A major contribution of this study is, in fact, the extension of the knowledge on this topic.

Third, this study extends the original empirically validated post-acceptance theoretical model, the expectation-confirmation model (Bhattacharjee, 2001b). This model has been tested, for example, with smartphones (Choi and Yoo, 2015), e-learning (Lee, 2010), mobile internet (Hong et al., 2006), and online banking (Bhattacharjee, 2001b). Smartwatches, however, have several different characteristics from these technologies and one should expect the factors that influence their continued use to be different as well. Bhattacharjee's model is a good starting point, but it does not take into account specific smartwatch characteristics (e.g., the hedonic component, the small form factor, the novelty of the technology), and thus an extended model could provide a more complete explanation about users' post-adoption behaviour. Therefore, this study introduces constructs that correspond to those smartwatch specific characteristics, and which might account for more variance than the original model. They are: perceived enjoyment (due to the hedonic component of wearable technology (Wakefield and Whitten, 2006)), perceived usability (due to the small screen of the device (Budi, 2015)), and habit (due to the novelty of the technology (Polites and Karahanna, 2012)). Investigating the habit that moderates the satisfaction and continuance intention may explain users' beliefs and behaviours toward their smartwatches. This study also tests this extended model with the topic of smartwatches for the first time.

Fourth, as a new technology, smartwatches are still understudied. This study may, therefore, help brands to understand the determinant factors that influence the continued use of the technology, and ultimately to develop products that deliver the most value to retain customers.

The structure of the paper is as follows. In the next section the concepts of wearables, smartwatches, continuance theory, and expectation-confirmation model are presented. Then, the research model is conceptualized. Then, the design, methodology, and results of this research are presented. Finally, the results of the study are discussed, including its implications for theory and practice, and possible further research directions are outlined.

## 2. Theoretical background

### 2.1. The concepts of wearable technology and smartwatches

Wearable technology is a form of ubiquitous computing, according

to Weiser (1991), as it weaves itself into the fabric of everyday life until it is indistinguishable from it. It translates the concept of having computing everywhere and anywhere, and also extends the mobile concept, as it can appear on any device, in any format, and at any location. Regarded as the father of wearable computing, Mann (1998) defines it as a computer that is always on and always accessible. Buenafior and Kim (2013) define it as an electronic device that functions as a computer and can be worn, carried, or attached to the body. Some of the most common integrations of wearable technology include clothing (Kosir, 2015), glasses/goggles (such as the Google Glass and the Oculus Rift), bracelets (such as the Fitbit and Jawbone brands), and watches (such as the Apple Watch and the Samsung Galaxy Gear S).

Wearable technology is revolutionary in the sense that it is present at all times, and thereby allows an augmented interaction with the world around the user. For Mann (1998), wearables have a constancy characteristic, meaning that they do not need to be turned on or opened up before use. Salah et al. (2014) suggest that in any industry in which hands-free data collection is highly valued, wearable devices have greater potential than smartphones. In addition, whenever information or communication is required, a hands-free interface is helpful, and consistent monitoring is beneficial. In several application areas of wearable technology, such as the medical industry (Park and Jayaraman, 2003; Pentland, 2004; Salah et al., 2014), wearables are also important in one's work and personal life for managing information (Billinghurst and Starner, 1999) and connecting in new ways (PwC, 2014a).

For Smartwatch Group, a smartwatch is defined by being worn on the wrist, able to indicate time, and being wirelessly connected to the internet (Smartwatch, 2015). For Rawassizadeh et al. (2015) a smartwatch is not just a device that tells time, but a general-purpose, networked computer with an array of sensors. Considering these many definitions, this study narrows those definitions and considers: *Smartwatch to be a device that is worn on the wrist, has a screen, is wirelessly connected to the internet on its own or through a smartphone, contains sensors (such as accelerometers, IR sensors, etc.), and can run either proprietary or third-party apps.*

Smartwatches might be easier to operate in certain work conditions due to their (mostly) water resistance, their battery life that lasts several days to years, and sensors that enable possible gesture interactions (Bieber et al., 2012). As a platform, a smartwatch is only as good as the quality of the apps it has at its disposal (O'Reilly, 2015). Apple is slightly ahead of other major players in the market when considering the number (Curry, 2015) and quality (Mitroff, 2012) of apps. According to the PwC (2014a) report on wearables, the Apple Watch is the sleek device that will help mainstream the entire wearable category, and users will adopt this technology, but only if it is useful, interesting, and/or fun. The growing amount of recent smartwatch studies reveals the increasing interest in this field. The target of these recent studies is purchase intention (Hsiao and Chen, 2018), continuance intention (Hong et al., 2017), behavioural intention (Choi and Kim, 2016; Wu et al., 2016), and adoption (Chuah et al., 2016). In the current study we focus on continuance intention of smartwatch, applying ECM model combined with perceived enjoyment, perceived usability, and habit to explain users' beliefs and behaviours to the continuance use.

### 2.2. Continuance theory

Technology acceptance and use has been covered extensively by the information systems (IS) literature (Davis, 1989; Venkatesh et al., 2003). However, according to Bhattacharjee (2001b) and Zheng et al. (2013), IS success depends on continued use rather than first time use. Besides, companies benefit from the continued use of technology because the cost of acquiring a new user is five times that of retaining an existing user (Reichheld and Schefter, 2000). Furthermore, according to Gao et al. (2015), acquiring new customers and promoting usage is only the first step; companies also need to retain existing users and facilitate

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