Smartwatches: Accessory or Tool? The Driving Force of Visibility and Usefulness

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Abstract

Although still in the early stages of diffusion, smartwatches represent the most popular type of wearable devices. Yet, little is known why some people are more likely to adopt smartwatches than others. To deepen the understanding of underlying factors prompting adoption behavior, the authors develop a theoretical model grounded in technology acceptance and social psychology literature. Empirical results reveal perceived usefulness and visibility as important factors that drive intention. The magnitude of these antecedents is influenced by an individual's perception of viewing smartwatches as a technology and/or as a fashion accessory. Theoretical and managerial implications are discussed.

1 Introduction

Driven by rising Internet and smartphone penetration as well as increasing focus on fitness, the market for wearable devices is growing exponentially. International Data Corporation (IDC 2015) predicts the worldwide market for wearables to reach more than 111 million units in 2016, which is an increase of 44% compared to 2015. More than eighty percent of these devices will be wrist-worn devices – i.e., smartwatches or smart wristbands. Smartwatches – that is, mini computers – have numerous functions beyond showing time; they are one of the latest developments in the evolution of information technology. Due to its sophisticated functions, a smartwatch can be considered a luxury good that people buy to

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impress others (Carlson 2015). In other words, rather than hiding a technology, technology and fashion merge to becoming a prominent part of a user's self.

Despite the increased demand for smartwatches in the future, current sales estimates are still relatively low (IDC 2015; Lamkin 2015) and little is known about what impacts this difference in forecasts and sales. In particular, the question of what drives the adoption of smartwatches remains unanswered. Thus, research is desperately needed to more comprehensively understand this gap of a technology that is still in the beginning stages of its product lifecycle. For managers, understanding what contributes to the adoption of a new innovation can aid in the design process of highly successful products. While Kim and Shin (2015) have studied smartwatches adoption from the perspective of technology acceptance model (TAM), they include users of several wearables, such as Fitbit Flex and Samsung Galaxy Gear in their sample. We, however, argue that differences might exist between smart wristbands and smartwatches. For example, what is often termed as 'smart wristband,' 'smart bracelets,' or 'fitness tracker' are devices that track a user's physical functions (e.g. pulse) and provide very limited information on small displays. Here, the primary purpose of these devices is collection of data that a user can analyze on a different device (e.g. laptop computer or smartphone). Furthermore, smart wristbands do not offer the possibility to install applications (apps). In contrast, smartwatches have a larger screen than smart wristbands, making it possible to present relevant information (e.g., Facebook notifications, Emails) to the users when they are connected to the Internet (Wifi, mobile Internet or Bluetooth). Moreover, smartwatches allow users to install various applications available in Apple's iOS and Google's Android. Considering the differences between smartwatches and smart wristbands, we define a smartwatch as 'a mini device that is worn like a traditional watch and allows for the installation and use of apps'. Examples are Apple Watch, LG G Watch, and Samsung Gear Live.

Thus, to bridge the knowledge gaps and to increase diffusion speed of smartwatches, this study examines factors that drive adoption behavior among non-users of smartwatches and identifies how consumers classify this new technology. While smartwatches could be categorized as a smaller version of existing devices (e.g., smartphones or organizers), they could also represent a fashion accessory that consumers can wear on their wrists. Therefore, apart from conventional technology acceptance factors (e.g., perceived ease of use and usefulness), perceived visibility is another important element that contributes to the consumers' evaluation of smartwatches. Overall, this study aims at answering three research questions: (1) What drives adoption intention of smartwatches? (2) Do consumers perceive smartwatches as a fashion accessory, a technology, or as both? (3) How does the perception of fashion accessory and/or technology influence antecedents of smartwatch adoption?

2 Literature review and model development

The current research model (see Fig, 1) derives its theoretical foundations from technology acceptance and social psychology literature: the TAM (Davis 1989) and visibility (Fisher & Price, 1992). TAM is one of the most commonly used models to understand the individual

acceptance of emerging information and communication technologies (Kesharwani & Bisht 2012; Kim & Shin 2015) and it has been successfully applied in related mobile and wearable technology studies (e. g., Kim & Shin 2015; Park & Del Pobil 2013; Park & Kim 2014; Rauschnabel & Ro 2016).

TAM postulates that perceived usefulness and perceived ease of use are two cognitive belief dimensions that shape the (potential) users' attitude, which then determines intention to use and actual use. Traditionally, perceived usefulness is defined as "the extent to which a person believes that using particular technology will enhance his/her job performance" (Davis 1989, p.320). However, since the new technology is studied from a potential consumer's perspective, we redefine perceived usefulness of smartwatches as the extent to which a consumer believes that using smartwatches increases his or her personal efficiency, such as being more organized and more productive (adapted from Kulviwat et al. 2007; Park & Chen 2007).

Perceived ease of use describes "the degree to which a person believes that using a technology will be free from effort" (Davis 1989, p. 320). Conceptually, perceived ease of use reflects an aspect of technology (e.g., low levels of complexity, high levels of user-friendliness) and is driven by a user's level of efficacy, which is a person's self-assessment of the estimated competence in using a technology (Venkatesh & Davis 1996). Furthermore, attitude toward using a technology is defined as a person's overall judgment of using a technology and the technology itself. Related to that, the intention to adopt a technology reflects a person's desire to start using a technology (Davis 1989). Additionally, TAM proposes that technologies are perceived as more useful when they are easier to use, and that usefulness also directly influences usage intention. Aligned with prior TAM research, we propose that:

> **H1.** *Perceived usefulness is positively related to attitude towards using smartwatches.*
> **H2.** *Perceived usefulness is positively related to intention to adopt smartwatches.*
> **H3.** *Perceived ease of use is positively related to attitude towards using smartwatches.*
> **H4.** *Perceived ease of use is positively related to perceived usefulness of smartwatches.*
> **H5.** *Attitude is positively related to intention to adopt smartwatches.*

As discussed previously, smartwatches are a technology that a user wears on his or her wrist and thus can be recognized by others. Visibility is defined as a person's believes of the extent to which smartwatches are noticed by other people (Fisher & Price 1992). In today's societies characterized by brief social contacts, fashion aspects, including clothes, trinkets, and makeup, are important aspects in individuals' impression formation (e.g., Holman 1980; Tunca & Fueller 2009). Bierhoff's research (1989) further outlines first person judgments as immediate responses during first encounters and assumes visible components of one appearance to be a stronger influence on impression formation than less-visible cues. Research on possessions and brands supports the idea of using them to impress and to gather information about others (e. g., Belk 1980; Fennis & Pruyn 2007). Thus, a person utilizing a

brand, product, or possession to reveal a particular facet of him or herself to others, needs to ensure that the other individual recognizes such a possession. As concluded by Belk (1978, p.39), "[i]n virtually all cultures, visible products and services are the bases for inferences about the status, personality, and disposition of the owner or consumer of these goods". As consumers tend to purchase high-status products (as smartwatches are) for symbolic reasons (Wilcox et al. 2009), we propose that individuals who are aware of the have a more positive attitude towards using them:

H6. *Visibility is positively related to the attitude towards using smartwatches.*

Furthermore, factors that influence other people (such as visibility) also have a direct effect on adoption intention. That is, even if people have a negative attitude towards a technology, other people's influence might still increase adoption intention (Sawang et al. 2014). In line with this prior finding, we hypothesize:

H7. *Visibility is positively related to the intention to adopt smartwatches.*

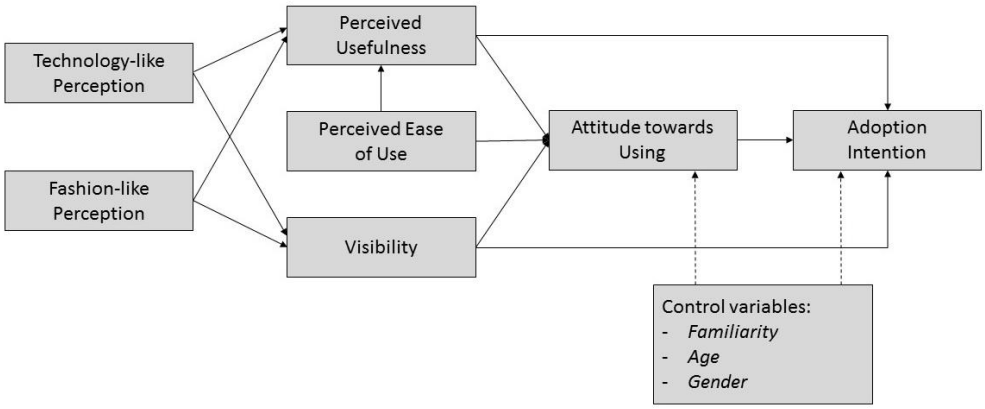

Figure 1. The research model

3 Methodology and research design

A survey was administered to business students at a Malaysian University in November 2015. A total of 226 usable paper-pencil questionnaires were collected. Malaysia represents a qualified market for this study since the penetration of smartwatches is still extremely low ruling out alternative explanations such as expected social conformity (Rauschnabel, Brem, & Ivens, 2015). Furthermore, a relatively homogenous student sample allows the exclusion of additional exogenous variables. The sample of respondents is representative of the student population of the university with 77.9% females and an average age of 21.4 years.

The survey began with a short outline of the purpose of the survey (e.g., "research project on new technologies") and guaranteed anonymity. Then, a brief description of smartwatches was added ("Smartwatches are small wearable computers that are worn like traditional watches on a user's wrist. Smartwatches run mobile apps and have similar as well as additional features like smartphones. Examples: Apple Watch, LG G Watch, and Samsung Gear Live"). None of the users stated to own a smartwatch.

Afterwards, respondents answered various measures representing the constructs of interest. All measures used seven point Likert scales (1= totally disagree, 2, 3, 4 = neither agree nor disagree, 5, 6, 7 = totally agree). Following the tradition of technology acceptance research (e.g., Homburg et al. 2010), we use predominantly multi-item measures that were adjusted to the context of smartwatches. An overview of the research constructs, measurement scales, and sources are presented in the appendix. We surveyed demographic variables and thanked the respondents for their participation.

4 Results

4.1 Assessment of the measurement and structural models

We apply the two-step procedure of Anderson and Gerbing (1988) to analyze the data. First, the measurement model was assessed using Mplus 7.2. Overall, the results demonstrate satisfactory level of internal reliability, convergent validity, and discriminant validity as all Cronbach's alpha and composite reliability (CR) values exceed the suggested threshold of .70 (Hair et al. 2006; Nunnally 1978). Further, factor loadings for fifteen items and average variance extracted (AVE) values are above .70 (Hair et al. 2006) and .50 (Fornell & Larcker 1981) respectively. In addition, discriminant validity is present as the AVE values of each pair of latent variables are higher than their squared correlation (Fornell & Larcker 1981). Detailed results of measurement model assessment will be provided upon request.

Upon establishing the measurement model, the analysis shifts to the structural model. Again, the model is estimated using a MLR estimator in MPlus 7.2. An inspection of the overall model reveals a satisfactory model fit (χ^2 (104) = 154.902; p<.001; CFI =.971; TLI = .963, SRMR=.050; RMSEA = .047). In line with the hypotheses, perceived usefulness (β=.458; p<.001) and visibility (β=.290, p<.001) are positively related to attitude toward using smartwatches and attitude positively influences adoption intention (β=.498; p<.001). Thus, H1, H5, and H6 were supported. Although the direct effect of perceived ease of use on attitude is not significant (β=.113, p=.447, H2 is not supported), the results of additional analysis shows that the indirect effect of perceived ease of use on attitude through perceived usefulness is significant (β_{ind} = .350, p=.001). In support of H4, the positive relationship between perceived ease of use and perceived usefulness is significant (β=.765, p<.001). The new construct, visibility, is positively associated with adoption intention (β=.248; p=.017), supporting H6.

None of the control variables are significantly related to intention (β_{gender}=.008, p=.882; β_{age}= -.049; p=.354; $\beta_{familiarity}$=.086, p=.235), and only gender reflects a significant path to attitude (β_{gender}=-.102, p=.039; β_{age}= -.046; p=.375; $\beta_{familiarity}$=.104, p=.169).

4.2 Technology or fashion?

The post hoc analysis focuses on whether smartwatches are perceived as a fashion item or a technology. Therefore, descriptive statistics of items measuring consumers' perception of smartwatches as a technology versus as a fashion are inspected. In general, consumers widely agree that smart glasses are a technology (m=5.61) rather than a fashion accessory (m=4.88, SD=1.30) with significantly lower values (Δ=-.73; paired t-test: t(225) = -8.07; p<.001).

A technology vs. fashion score was then created by subtracting each consumer's fashion score from the technology score. Values below zero (above zero) indicate that a consumer perceives smartwatches predominantly as a fashion (a technology). A value of zero implies that a consumer values both aspects equally. As already indicated by the t-test, only a small amount (8%) of the respondents perceive smartwatches predominantly as fashion accessory. 43.5% of the respondents value both fashion and technology equally, and 49.5% identify smartwatches predominantly as a technology.

The findings allow a few conclusions about consumers' perceptions of smartwatches: First, if consumers perceive smartwatches as a technology, smartwatches should be recognized as more useful since technologies are means to increase one's efficiency – in other words, being 'useful'. Second, if consumers perceive smartwatches as fashion accessory, smartwatches should reflect characteristics of other fashion accessories – namely being visible to others.

To test these two assumptions, we assess the effect of perception of smart glasses (1) as a technology and (2) as a fashion accessory on perceived usefulness (a technology variable) and on visibility (a fashion variable). To parcel out any additional or other variance, age, gender, familiarity, and perceived ease of use are included as control variables. Due to reasons of model complexity, a separate model without attitude toward use and adoption intention constructs is estimated[1]. An inspection of model fit again did not indicate any concerns (χ^2(74)= 130.26, p<.001; RMSEA = .058; CFI=.967; TLI = .955; SRMR = .039).

The results of the post hoc analysis are in line with the proposed relationships. First, those consumers who perceive smart glasses as a technology tend to attribute higher levels of perceived usefulness to smartwatches (β=.172; p<.001), but not significantly different levels in visibility (β=.013; p=.810). Likewise, consumers who perceive smartwatches as being more of a fashion accessory attribute significantly higher levels of visibility to them (β=.419; p<.001), but do not perceive them as being more useful (β=.13; p=.859).

[1] We also ran a model in which we included the two single item measures and all proposed control relationships of the initial model. This analysis replicated the effects; however, this model did not meet the standards and suggestions for sample size and model fit, yet still underlines stability of findings.

5 Discussion and conclusion

The objective of this research is to study a recent technological development – the use of smartwatches. Therefore, we aim at (1) understanding drivers that influence the adoption of smartwatches among non-users while controlling for various factors and (2) to shed additional light into mechanisms and categorizations of processing smartwatches.

5.1 Summary of Findings

Building on established TAM research, findings confirm that perceived usefulness and visibility drive attitude toward using smartwatches, which translates to adoption intention. Two hypothesized relationships did not reach significance. First, perceived ease of use is not directly but indirectly related to attitude towards using smartwatches. Second, perceived usefulness is not a significant predictor of adoption intention. However, the new construct visibility is significantly related both to attitude toward using smartwatches and to adoption intention. Further analyses indicate that consumers who perceive smartwatches as a technological attribute higher levels of usefulness (rather than visibility) to them. In contrast, respondents who perceive smartwatches as a fashion accessory identify visibility as more valuable (rather than usefulness). These strong effects are estimated while controlling for various potential alternative explanatory variables. These findings lead to several important theoretical and managerial implications regarding new technologies, such as smartwatches.

5.2 Theoretical contributions

The theoretical contribution of this research is three-fold. First, research on smartwatches is still scarce, so this study adds to the limited body of research. Particularly, it identifies usefulness and visibility as antecedents of adoption and attitude toward smartwatches, which are influenced by perceived ease of use and general consumer perception of the new technology.

Second, although the TAM is recognized as a very robust framework, some of the previously established TAM hypotheses could not be replicated: While Kim and Shin (2015) find a direct effect between ease of use and attitude toward using smartwatches, this direct effect is not validated in the current study. A potential explanation is provided by Rossiter and Braithwaite (2013), who support this direct effect for users of a technology (as studied in Kim & Shin 2015), but not for potential users (as in this study). Furthermore, in line with Kim and Shin (2015), the direct effect of usefulness on intention was not significant. In addition, the relationship between ease of use and perceived usefulness is significantly stronger for non-user than for users, as examined by Kim and Shin's (2015) study. Non-users might expect smartwatches to be easy to use and thus perceive them as more useful since the new technology is replacing existing devices, such as smartphones. In contrast, users might have experienced issues when operating the new technology leading to lower positive attitude levels. These differences among consumer groups highlight the importance of conducting research with users and non-users of new technologies. Finally, existing theories

and models, such as the TAM, need to be adjusted to fit the new context of wearable technologies.

The third contribution is a deeper understanding of what smartwatches are perceived as from a cognitive-psychological perspective. Results show that most respondents perceived smartwatches as both technology and fashion-like. Also, the visibility of smartwatches is a determinant of attitude and intention. TAM has not yet addressed this visibility aspect, although related aspects, such as image (i.e., the degree to which the use of a technology is perceived to enhance a user's status in his/her social system), have been shown to be relevant in some contexts. This study, however, clearly supports the notion that consumers perceive and process wearables on two dimensions: technology and fashion. This additional fashion component might be a reason why not all TAM effects were replicated and might require a more 'fashnological' thinking of smartwatches, or wearable devices in general. For example, a smart T-shirt (e.g. a T-shirt that includes some sensors that send a user's heart rate to his/her smartphone) might be perceived as more fashion-like and less technology-like. Thus, fashion adoption theories might be more appropriate in this case. Epson's large and cabled Moverio smartglasses, however, might be perceived as more technological and less fashion-like, and thus, TAM and related theories could perceive better results here.

5.3 Managerial contributions

As smartwatches include a fashion and a technology component, they need to fulfill functional, hedonic, and even social needs of their target groups. While most smartwatches offer to customize technical needs (e.g., by installing particular apps), customization of the design is somehow limited. Some manufacturers offer different colors or wristbands, while others advertise different 'virtual' backgrounds of the screen. Including these fashion-functions and communicating them to potential consumers is a promising strategy by focusing on both identified dimensions: fashion and technology. Moreover, the two-dimensionality of consumers' perceptions can be used as a segmentation criterion to more efficiently target specific consumer needs and demands. Although the focus of this research was on smartwatches, managerial implications are expected to be transferrable to other wearable devices, such as smart clothing, smart wristbands, or smart glasses.

5.4 Limitations and future research

As any study, the present research is constrained by limitations that offer venues for future research. First, while the use of a student sample of one country allows us to control for various exogenous factors and thus increase the internal validity, generalizability might be limited. However, prior research demonstrates TAM (King & He 2006) and theories related to visibility (Nueno & Quelch 1998; Vigneron & Johnson 2004) to be relatively stable among different contexts and samples, as such this limitation is unlikely to threaten the results substantially. Further, the use of a non-brand specific description of smartwatches allowed respondents to freely express influences of attitude formation without being potentially biased by a specific product. However, this advantage corresponds with the limitation that brand related factors, such as brand attitude or loyalty, were not included or

controlled for. For example, one could argue that a person with high brand attachment (Belaid & Bahi 2011) or brand love (Batra et al. 2012) towards Apple, would just buy any product of Apple regardless of the specific item.

Future research should focus on addressing these limitations. In addition, further research could investigate the question how smartwatches are perceived by other people. Likewise, further assessment of the importance of visibility and usefulness is warranted. For example, specific design characteristics (e.g., size, shape, color) could be investigated to determine the optimal strategy to enhance desired visibility. Similarly, the functionality of smartwatches should be further explored to enhance perceived usefulness. Here, 'Uses & Gratification Theory' provides frameworks that could be applied to identify a gratification potential of smartwatches.

With the continuous advancement of the technology industry, understanding consumers' perception of, and reaction to, smartwatches and other wearables is an important step to better understand media and technology use. The current study is an important step in furthering the development of this unique literature stream by providing insights into smartwatch usage and perceived importance of technical or fashion attributes.

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Appendix

Research construct	Measurement scale	Source
Perceived Usefulness	1. Smartwatches could make my life more effective. 2. Smartwatches could help me organize my life better. 3. Smartwatches could increase my productivity.	Adapted from Kulviwat et al. (2007); Park and Chen (2007)
Perceived Ease of Use	1. Learning to use smartwatches is simple. 2. Using smartwatches is self-explaining. 3. Smartwatches are easy to use.	Adapted from Kim and Shin (2015); Kuo and Yen (2009)
Attitude towards using smartwatches	1. I like the idea of using a smartwatch. 2. Overall, I have a positive attitude towards the smartwatches technology.	Adapted from Cheong and Park (2005); Kim and Shin (2015)
Intention to adopt smartwatches	1. I intend to buy a smartwatch in the near future. 2. Given I have the financial resources to afford a smartwatch, I would buy one.	Adapted from Kim and Shin (2015)
of Smartwatches	1. Generally speaking, other people would notice it if I wear a smartwatch. 2. Smartwatches are a technology that is very people who see me. 3. Smartwatches are technology that is recognized by people who see me.	Ad hoc scale, inspired by Fisher and Price (1992)
Familiarity with smartwatches technology	1. I know a lot about smartwatches. 2. I am familiar with the smartwatches technology.	Adapted from Shehryar and Hunt (2005)
Fashion-Like Perception	1. Smartwatches are a fashion accessory.	Ad hoc scale
Technology-Like Perception	1. Smartwatches are a technology.	Ad hoc scale

Table A1: Measurement items