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Wearable Technologies: The Role of Usefulness and Visibility in Smartwatch Adoption

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Wearables technologies: The role of usefulness and visibility in smartwatch adoption

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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 about 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 literatures. Empirical results reveal perceived usefulness and visibility as important factors that drive adoption intention, suggesting that smartwatches represent a type of ‘fashnology’ (i.e., fashion and technology). 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.

Keywords: Smartwatches, wearables, Technology adoption, Fashnology, Fashion Technology

“The Apple Watch will play with your attentioneincreasing it in some cases and reducing it in others.”

(*Jeff Carlson, Technology Journalist, 2015)*

1. Introduction

Smartwatches - that is, mini computers - have numerous functions beyond showing time; they are one of the latest developments in the evolution of information technology. The above quote reflects the idea that smartwatches could decrease a consumer's attention given to other devices, such as smartphones, as important information is conveniently displayed on the user's wrist. However, smartwatches could increase the user's attention as they are a hub that gives access to emails, messaging, and much more. In addition, functioning and visibility of a traditional watch can also position it as a luxury good (Carlson, 2015). In other words, rather than hiding a technology, technology and fashion merge to become a prominent part of a user's self.

Markets for smartwatches and other wearables are growing. IDC (2015a) predict the worldwide market for wearables to reach more than 111 million units in 2016, reflecting an increase of 44% compared to 2015. More than eighty percent of these devices will be wrist-worn devices e i.e., smartwatches or smart wristbands. A Google trend-analysis also reflects a tremendous increase in searches for ‘smartwatch’ and related terms, supporting the results of the market research. Although forecasts vary with regard to projected numbers and definitions, immense growth rates are consistently identified for the near future (for a review of forecasts, see Lamkin, 2015). The increased interest in the new technology is also reflected by the huge amount of apps offered for smartwatches, such as more than 10,000 apps for the ‘Apple Watch’, and more than 4000 apps for the ‘Android Wear’ (Curry, 2015).

However, although reports reveal increased demand for smartwatches in the future, current sales estimates are still relatively low (IDC, 2015a,b; Lamkin, 2015). Little is known about what impacts this difference in forecasts as well as sales. Thus, research is needed to more comprehensively understand this gap of a technology that is still in the beginning stages of its product lifecycle. In particular, the question of what drives the adoption of smartwatches remains unanswered. Previous technology acceptance research developed various frameworks to study consumers' acceptance of new technologies, such as the technology acceptance model (TAM) (King & He, 2006). However, with few exceptions (e.g., Choi & Kim, 2016; Kim & Shin, 2015), not much research has been done to study smartwatches through the lens of TAM.

Thus, to fill the gap in the literature and to find answers to the introduced issues, this study investigates elements that explain consumers' intention to use smartwatches. In contrast to prior studies, the current study identifies factors and perceptions that drive adoption behavior among non-users of smartwatches and to discover how consumers classify this new technology.

For example, smartwatches could be categorized as a smaller version of existing devices, such as smartphones or organizers. Thus, traditional technology acceptance factors, such as user-friendliness ('ease of use') and utilitarian benefits ('perceived usefulness') should be core determinants. In contrast, smartwatches could also represent a fashion accessory since they are worn on a user's wrist (Rauschnabel et al., 2016). As a result, additional antecedents - for example visibility - should significantly contribute to consumers' evaluation of smartwatches. For managers, understanding what drives the adoption of a new innovation can aid the design of highly successful products and thus increase diffusion speed. Therefore, this study aims at answering the following research questions:

- What drives adoption intention of smartwatches?
- Do consumers perceive smartwatches as a fashion accessory, a technology, or as both?

- How does the perception of fashion accessory and/or technology influence antecedents of smartwatches adoption?

The remainder of this paper is structured as follows: First, we define smartwatch and discuss its uniqueness compared to other mobile and wearable devices. We then provide a review of the extant literature of smartwatches or related theories. Drawing on the technology acceptance model (TAM), we propose a conceptual model of smartwatch adoption, which is empirically tested with structural equation modeling. Post hoc analyses provide additional insights and findings as well as contributions are discussed.

2. Literature review

2.1. Definition of smartwatches

The academic literature does not provide a profound definition of the smartwatch technology and lacks a clear distinction from related technologies. For example, Kim and Shin (2015) treat several wearables, including Fitbit Flex and Samsung Galaxy Gear, as smartwatches. However, although all of these examples represent wrist-worn devices, several differences do exist that require a more detailed distinction. 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. That is, 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). The presentation of information is very limited (e.g., pulse or time) and smart wristbands do not offer the possibility to install apps. Examples are Fitbit Surge and Nike Fuelband.

In contrast, smartwatches are larger than smart wristbands and are often even larger than most traditional watches. The face of a smartwatch is usually a touchscreen. An operating and app ecosystem allows users to install various apps. For example, more than 10,000 apps are currently available for iOS (Apple) and more than 4000 apps for Android Wear. In contrast to smart wristbands, smartwatches provide the most benefits when they are connected to the Internet (Wifi, mobile Internet or Bluetooth). Furthermore, while the primary purpose of smart wristband is to collect data, presenting relevant information (e.g., Facebook notifications, Emails) is a primary function of smartwatches. Considering the uniqueness of smartwatches in comparison to smart wristbands and aligned with Cecchinato, Cox, and Bird (2015), we define a smartwatch as ‘a mini device that is worn like a traditional watch and allows for the installation and use of applications.’

2.2. Theoretical background and related work

2.2.1. Technology acceptance model

As technologies continue to evolve and merge in an ever changing digital world, a number of theoretical models have been proposed to study the users’ adoption of new technologies. Examples include the innovation diffusion model (Rogers, 1962); technology acceptance model (TAM, Davis,1989) and its extensions (e.g., Venkatesh & Bala, 2008; Venkatesh & Davis, 2000); theory of planned behavior (Ajzen, 1991); unified theory of acceptance and use of technology (Venkatesh, Morris, Davis, & Davis, 2003) and its extension (Venkatesh, Thong, & Xu, 2012).

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). TAM originates from the theory of reasoned action, a wellstudied theory rooted in behavioral psychology (Ajzen & Fishbein, 1980). TAM, in its initial form, explains user's adoption behavior of computer information systems in the workplace (Davis, 1989). Empirical evidence supports the robustness, ease of application, and explaining power of variance in usage intention and behavior of TAM. For example, King and He’s (2006) meta-analysis of relevant TAM publications concludes “that TAM is a powerful and robust predictive model” (p. 751) while Venkatesh and Davis (2000) argue that “substantial theoretical and empirical support has accumulated in favor of TAM” (p.186). Thus, although not without criticism (see Bagozzi, 2007; Benbasat & Barki, 2007 for a discussion), TAM is generally preferred over alternative models, such as the theory of reasoned action and the theory of planned behavior, in a wide variety of user contexts (Davis, Bagozzi, & Warshaw, 1989; Hong, Thong, & Tam, 2006; Mathieson, 1991; Rouibah, Ramayah, & May 2011; Venkatesh & Davis, 2000; Yousafzai, Foxall, & Pallister, 2010).

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. Additionally, TAM proposes that technologies are perceived as more useful when they are easier to use, and that usefulness also directly influences usage intention. 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). Thus, from a motivation perspective, perceived usefulness is a measure of a user's level of extrinsic motivation and outcome expectancy (Kim, Chan, & Gupta, 2007; Venkatesh, 1999). Therefore, perceived usefulness (performance expectancy)is argued to influence adoption intentions of external rewards. 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 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).

Because of its robustness, flexibility, and extendibility, scholars from various disciplines extend, adopt, and apply TAM to other contexts. These include individuals' acceptance and use of new mobile/ smart-based technologies and services, such as long-term evolution (Park & Kim, 2013), mobile payment (Liebana-Cabanillas, Sanchez-Fernandez, & Munoz-Leiva, 2014), mobile cloud services (Park &Kim, 2014), smartphones (Joo & Sang, 2013), smartwatches (Kim & Shin, 2015), smart glasses (Rauschnabel & Ro, 2016), tablet computers (Park & Del Pobil, 2013), mobile learning technologies (Huang, Lin,&Chuang,2007),mobile games (Park,Baek,Ohm,&Chang,2014), wireless technology (Yen, Wu, Cheng, & Huang, 2010), and others.

2.2.2. Related work

Despite the vast application of TAM to investigate new technologies, limited research has investigated the adoption of wearables. This section provides a brief summary of the fragmented research on wearable technologies.

Kim and Shin (2015) apply TAM to explain intention of continuous use among smartwatch users. The study replicates basic TAM patterns and identifies subcultural appeal and costs of the device as additional antecedents to intention. Moreover, the authors identify various antecedents to perceived ease of use and perceived usefulness. Nevertheless, while the research provides basic insights into wearable technology, it encounters a few issues. For instance, the focus of the study remains on existing consumers, which neglects adoption intention of non-users. In addition, although the sample consists of a broad range of respondents, the authors partially use job-related measures (e.g., 'using the smart watch helps me effectively do my job" or "using this smart watch improves the quality of my work"). These measures imply that all respondents use their smartwatch at work. However, this seems implausible as their survey-definition of smartwatches includes smart bracelets, such as 'Fitbit', which are typically not used for work-related purposes. Finally, findings identify consumers who evaluate their smartwatch as an expensive investment to be less likely to continue their usage. With regards to lock-in costs, this finding seems implausible.

Jung, Kim, and Choi (2016)'s study addresses consumers' reactions to smartwatches using a conjoint approach. Results of their study indicate that standalone communication and display shape represent crucial factors in influencing respondents' smartwatch choice. In contrast, the brand and price of a particular smartwatch seem to be less important.

Additional research by Rauschnabel, Brem, and Ivens (2015) as well as Rauschnabel and Ro (2016) study adoption intention of augmented reality smart glasses among non-users. The findings are in line with TAM research and highlight the role of social factors (e.g., social norms) in wearing augmented reality smart glasses due to their visibility to other consumers. Furthermore, a conceptual paper by Hein and Rauschnabel (2016) examines the adoption of wearables (augmented reality smart glasses) in work-related contexts. The proposed two-step model argues that certain company-, technology-, and environmental factors influence a company's decision to implement smart glasses. TAM factors were proposed to determine employees' usage behavior. In addition, Kuru and Erbug (2013) assess cues of technical constraints and aesthetic as well as functional performance ('qualities') of on-body phones. Based on a qualitative approach, they identify various qualities (such as pleasing aesthetics, wearability, novelty of the technology, interactivity, usefulness, technological appeal, expressiveness, usability) as drivers of usage intention and connect these factors to TAM.

Finally, another stream of research approaches wearables as a combination of fashion and technology (‘fashnology’). In their conceptual work, Rauschnabel, Brem, and Ro (2015, p. 6) argue that wearable technologies are “also a new form of fashion accessories for their users.” Rauschnabel et al. (2016) apply theories from technology, fashion, and mental categorization research in their two studies to outline how people tend to categorize wearables as fashion, technology, or both ('Fashnology'). This categorization is driven by design features and the degree of familiarity with the device category. In addition, their research identifies three segments of consumers: ‘Technologists’, ‘Fashionists’, and ‘Fashnologists’. Choi and Kim’s (2016) model shows that fashion-related factors play an important role in understanding consumers' reactions to smartwatches. However, Choi and Kim (2016) limit their assessment to ‘luxury fashion,’ which potentially limits applicability of their findings to less prestigious smartwatches. The current study contributes to this stream of research by adding a general, fashion related factor to the model e visibility. In addition, we include the explicit perception of smartwatches as a fashion accessory and/or as a technology.

3. Theoretical framework and hypothesis development

The current model is influenced by the TAM framework, which 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).

As discussed above, TAM traditionally defines perceived usefulness in a work-related context with specific task-related outcome expectancies. Since the new technology is studied from a potential consumer's perspective, perceived usefulness needs to be redefined. Drawing on related studies (Kulviwat, BrunerKumar, Nasco, & Clark, 2007; Park & Chen, 2007), 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. 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 above, 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). Users' perceptions of visibility can vary widely depending on type of product, consumption situation, usage conditions, product related conversations, and individual difference variables among others (Bearden & Rose, 1990; Calder & Burnkrant, 1977; Fisher & Price, 1992; Reingen, Foster, Brown, & Seidman, 1984). Visibility is distinct but related to the image construct and the norms construct in prior TAM research (Fisher & Price, 1992; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000). However, image describes a user's believes to what extent using a technology enhances his or her status in a social system (Moore & Benbasat, 1991). Likewise, norms describe the degree to which a user thinks that using a technology is 'common' (e.g., Rauschnabel, Brem & Ivens, 2015) or expected by his or her peers (Verkasalo, Lopez-Nicol as, Molina- Castillo, & Bouwman, 2010). While image and norms focus on estimated or expected evaluation or use of technology by other people, visibility is focused more on the 'physical nature' of the technology and thus can be conceptualized as an antecedent to image and/or norms (Fisher & Price, 1992). We propose that visibility influences the acceptance of smartwatches.

Especially 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., Douty, 1963; Holman, 1980; Judd, Bull, & Gahagan, 1975; Tunca & Fueller, 2009). Bierhoff's (1989) research 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 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, Kim, & Sen, 2009), we propose that individuals who are aware of the visibility 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 (Eckhardt, Laumer, & Weitzel, 2009; Nysveen, Pedersen, & Thorbjørnsen, 2005; Sawang, Sun, & Salim, 2014). Following this prior research, we hypothesize:

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

3.1. Control variables

Three control variables are also included in the basic model to take account for individual difference variables, namely familiarity with smartwatches, age, and gender. Familiarity with smartwatches acts as a control variable, which is defined as the degree of a person's direct and indirect experience with smartwatches (Coupey, Irwin, & Payne, 1998; Kent & Allen, 1994). Thus, familiarity with smartwatches captures user's mental knowledge structure. While familiarity with existing technologies (such as smartphones) is generally high (as most consumers either have direct experience by using a smartphone or indirect experience by observing peers using them), more variation is expected among new technologies. Rauschnabel, Brem, and Ivens (2015), for example, conclude that individuals scoring high (as compared to low) on 'openness to experience' and 'conscientious' personality traits have more product knowledge about wearable smart glasses technology. Thus, including familiarity as a control variable can parcel out variations in acceptance based on differences in knowledge about the technology. Additionally, age and gender have been shown to relate to technology usage and represent common control variables in related research (Chang & Zhu, 2012; Correa, Hinsley, & De Zuniga, 2010).

4. Methodology and research design

A survey was administered to business students at a Malaysian University. A total of 226 usable paper-pencil questionnaires were collected. Malaysia represents a qualified market for this study since smartwatch penetration is still extremely low ruling out alternative explanations such as expected social conformity (Rauschnabel, Brem, & Ivens, 2015). Recent market research studies show similar patterns with regard to the demand and use of smartwatches in Malaysia, other East Asian countries, Europe, and North America; thus, ensuring generalizability of findings across other regions (Global Industry Analysts, 2015; IDC, 2015b; Statista, 2016). Furthermore, a relatively homogenous student sample allows 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 (SD = 1.8).

The survey began with a brief description of the purpose of the project (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 constructs of interest. All measures used seven point Likert scales (1 = totally disagree to 7 = totally agree). Following the tradition of technology acceptance research (e.g., Homburg, Wieseke, & Kuehnl, 2010), we use predominantly multi-item measures that were adjusted to the context of smartwatches. An overview of the constructs, items, references, and psychometric characteristics are provided in Table 1. We surveyed demographic variables and thanked respondents for their participation.

5. Results

We apply a three-step procedure to analyze the data including 1) establishing a measurement model using confirmatory factor analysis (CFA), 2) testing the theoretical and extended smart glasses adoption model, and 3) implementing post hoc analyses to examine the perception of smartwatches being a technology or fashion.

5.1. Measures and model inspection

Overall, the measurement model demonstrates 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 0.70 (Hair, Black, Babin, Anderson, & Tatham, 2006; Nunnally, 1978). Further, factor loadings for fifteen items and average variance extracted (AVE) values are above 0.70 (Hair et al., 2006) and 0.50 (Fornell & Larcker, 1981) respectively. These values as well as descriptive statistics are summarized in Table 1. In addition, discriminant validity is established as AVE values of each pair of latent variables are higher than their squared correlation (Fornell & Larcker, 1981). The table in Appendix A lists AVE values of each latent variable on the diagonal axis and squared correlations in the upper triangle of the matrix. As reflected in the results, discriminant validity is given. Furthermore, a Harman single factor test eliminates the possibility of substantial common method variance. Therefore, comparison of the proposed model to a common latent factor model, in which all items load on a single factor, reveals significantly worse model fit, as reflected by a significant χ^2 -difference.

5.2. Hypotheses testing

Upon establishing the measurement model, the analysis shifts to the structural model. Again, the model is estimated using a maximum likelihood estimator with robust error terms in MPlus 7.2 (Muthen & Muthen, 2013). An inspection of the overall model reveals a satisfactory model fit (χ^2 (104) = 154.902; $p < 0.001$; CFI = 0.971; TLI = 0.963, SRMR = 0.050; RMSEA = 0.047). The standardized coefficients of the structural model are presented in Fig. 1.

Table 1 - Measurement model.

Items	λ	Mean (SD)	α	CR	AVE
Perceived Usefulness (adapted from Kulviwat et al., 2007; Park & Chen, 2007)					
Smartwatches could make my life more effective.	0.87	4.58 (1.14)	0.91	0.92	0.78
Smartwatches could help me organize my life better.	0.96				
Smartwatches could increase my productivity.	0.81				
Perceived Ease of Use (adapted from Kim & Shin, 2015; Kuo & Yen, 2009)					
Learning to use smartwatches is simple.	0.79	4.50 (1.01)	0.82	0.82	0.61
Using smartwatches is self-explaining.	0.71				
Smartwatches are easy to use.	0.84				
Attitude Towards Using Smartwatches (adapted from Cheong & Park, 2005; Kim & Shin, 2015)					
I like the idea of using a smartwatch	0.86	5.02 (1.13)	0.82	0.82	0.69
Overall, I have a positive attitude towards the smartwatches technology.	0.81				
Intention to Adopt Smartwatches (adapted from Kim & Shin, 2015)					
I intend to buy a smartwatch in the near future.	0.89	4.78 (1.41)	0.85	0.86	0.74
Given I have the financial resources to afford a smartwatch, I would buy one.	0.84				
Visibility of Smartwatches (ad hoc scale, inspired by Fisher & Price, 1992)					
Generally speaking, other people would notice it if I wear a smartwatch.	0.83	4.57 (1.16)	0.86	0.86	0.68
Smartwatches are a technology that is very visible to other people.	0.84				
Smartwatches are technology that is recognized by people who see me.	0.80				
Familiarity with Smartwatches Technology (adapted from Shehryar & Hunt, 2005)					
I know a lot about smartwatches.	0.91	3.66 (1.42)	0.87	0.87	0.77
I am familiar with the smartwatches technology.	0.84				
Fashion-Technology Perception (ad hoc scale)					
Smartwatches are a fashion accessory.	n/a	4.88 (1.30)	n/a	n/a	n/a
Fashion-Technology Perception (ad hoc scale)					
Smartwatches are a technology.	n/a	5.61 (1.18)	n/a	n/a	n/a

λ = factor loading; α = Cronbach's alpha; overall CFA: $\chi 2 = 108.407$, df = 75; RMSEA = 0.044; SRMR = 0.036; CFI = 0.980; TLI = 0.972.

In line with the hypotheses, perceived usefulness ($\beta = 0.458$; $p < 0.001$) and visibility ($\beta = 0.290$, $p = 0.003$) are positively related to attitude toward using smartwatches and attitude positively influences adoption intention ($\beta = 0.498$; $p < 0.001$). Thus, H1, H5, and H6 are supported. Although the direct effect of perceived ease of use on attitude is not significant ($\beta = 0.113$, $p = 0.447$, H3 rejected), results of the additional analysis shows that the indirect effect of perceived ease of use on attitude through perceived usefulness is significant ($\beta_{ind} = 0.350$, $p = 0.001$). In support of H4, the positive relationship between perceived ease of use and perceived usefulness is significant ($\beta = 0.765$, $p < 0.001$). The new construct, visibility, is positively associated with adoption intention ($\beta = 0.248$, $p = 0.017$), supporting H6. Finally, both perceived usefulness and visibility show a positive effect on adoption intention. However, while the effect of visibility is significant ($\beta = 0.248$, $p = 0.017$, supporting H7), the effect of perceived usefulness did not reach signicance ($\beta = 0.133$, $p = 0.447$, rejecting H2).

None of the control variables are significantly related to intention, and only gender reflects a significant path to attitude.

5.3. Fashnology: Fashion and/or technology?

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 fashion are inspected. In general, consumers widely agree that smartwatches are a technology (m = 5.61, SD = 1.18) rather than a fashion accessory (m = 4.88, SD = 1.30) with significantly lower values ($\Delta = -0.73$; paired t-test: $t(225) = -8.07$; $p < 0.001$).

A technology vs. fashion score is 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. Rauschnabel et al. (2016) propose the term 'fashnology' for this effect. Finally, 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 e in other words, being 'useful.' Second, if consumers perceive smartwatches as fashion accessory, smartwatches should reflect characteristics of traditional fashion accessories - namely being visible to others.

To test these two assumptions, we assess the effect of the 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 does not indicate any concerns (χ^2 (74) = 130.26, $p < 0.001$; RMSEA = 0.058; CFI = 0.967; TLI = 0.955; SRMR = 0.039). The standardized path coefficients are presented in Fig. 2.

Fig. 2 depicts effects that are clearly in line with the proposed relationships. First, consumers who perceive smart glasses as a technology tend to attribute higher levels of perceived usefulness to smartwatches (β = 0.172; $p < 0.001$), but not significantly different

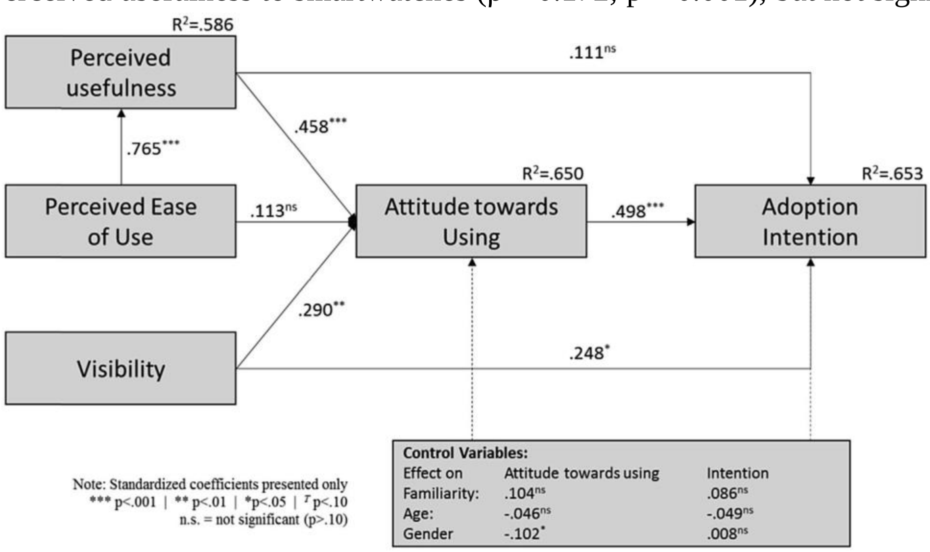

Fig. 1. Structural equation modeling.

levels to visibility (β = 0.013; $p = 0.810$). Likewise, consumers who perceive smartwatches

[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.

as being more of a fashion accessory attribute significantly higher levels of visibility to them ($\beta = 0.419$; $p < 0.001$), but do not perceive them as being more useful ($\beta = 0.13$; $p = 0.859$).

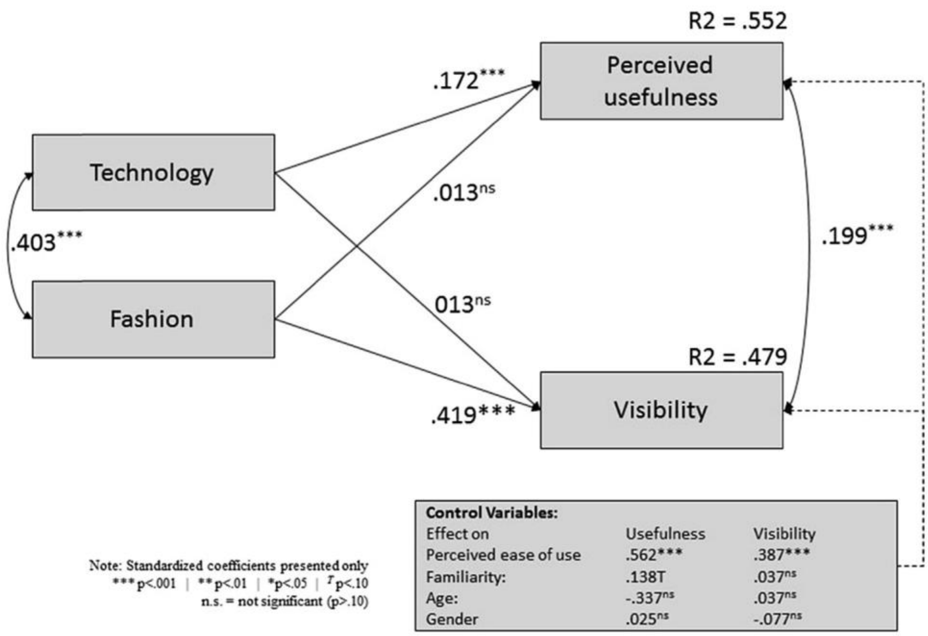

Fig. 2. Structural equation modeling

6. Discussion and conclusion

The objective of this research is to study a recent technological development e 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 the psychological mechanisms and categorization of processing smartwatches.

6.1. Summary of the 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 do 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 contributions regarding smartwatches as outlined below.

6.2. 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, this research introduces 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 TAM is recognized as a very robust framework, some of the previously established TAM hypotheses could not be replicated: While Kim and Shin (2015) found 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 is not significant. In addition, the relationship between ease of use and perceived usefulness is significantly stronger for non-user than for users. 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 Technology Acceptance Model (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-psychology perspective. Results show that most respondents perceive smartwatches as both technology and fashion-like. Also, 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, as suggested by prior research (Choi & Kim, 2016; Rauschnabel, Brem, & Ro, 2015). This additional fashion component might be a reason why not all TAM effects are replicated and might require a more 'fashnological' thinking of smartwatches or wearable devices in general (Rauschnabel et al., 2016). For example, a smart T-shirt (e.g., a T-shirt featuring 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 produce better results here (Rauschnabel et al., 2016).

6.3. 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 wristband, 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 is on smartwatches, managerial implications are expected to be transferrable to other wearable devices, such as smart clothing, smart wristbands, or smartglasses.

6.4. 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 student sample of one country allows us to control for various exogenous factors and thus increase 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 allowes 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 & Behi, 2011) or brand love (Batra, Ahuvia, & Bagozzi, 2012) towards Apple, would buy any product of Apple regardless of the specific item.

Future research should focus on addressing these limitations. In addition, further research could investigate how smartwatches are perceived as by others. 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. Finally, future research could also apply resistance theories (e.g., Spreer & Rauschnabel, 2016) to understand the adoption and resistance to wearables. These theories could be particular important in situation where smartwatches replace traditional watches.

Findings also support the idea that smartwatches, and other wearables, combine technology and fashion elements (Rauschnabel et al., 2016). While the variance of these two dimensions shows differences in consumers' perception of wearables (see Table 1), future researchcanidentifyvariablesthatexplainthisvariation.Particularly, what type of consumers will perceive smartwatches as technology or fashion driven? The correlations reported in this research (see Appendix A) do not show any significant effects for age and gender, although males are generally more technology (Chang et al., 2014; Huffman, Whetten, & Huffman, 2013) and females more fashion (Handa & Khare, 2013; Pentecost & Andrews, 2010) focused. Finally, while the focus of the current study remains on smartwatches, visibility should also be an important factor in explaining consumers' reaction towards other wearable technologies. Comparisons of the importance of visibility in influencing consumers reactions among other wearables, such as smart wristbands, smart glasses, or smart textiles, is another outlet for future research.

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 A: Correlation, average variance extracted, and squared correlations.

	1	2	3	4	5	6	7	8	9	10
1 Perceived usefulness	***0.78***	0.53	0.56	0.44	0.35	0.23	0.08	0.18	0.00	0.02
2 Perceived ease of use	0.73	***0.61***	0.45	0.26	0.31	0.32	0.09	0.18	0.00	0.01
3 Attitude towards using	0.75	0.67	***0.69***	0.61	0.42	0.22	0.09	0.32	0.01	0.00
4 Adoption intention	0.67	0.51	0.78	***0.74***	0.45	0.21	0.10	0.16	0.01	0.00
5 Visibility	0.60	0.56	0.65	0.67	***0.68***	0.12	0.30	0.12	0.00	0.00
6 Product familiarity	0.48	0.57	0.47	0.46	0.35	***0.77***	0.02	0.01	0.00	0.01
7 Smartwatches are fashion	0.28	0.31	0.29	0.32	0.55	0.14	n/a	0.16	0.00	0.00
8 Smartwatches are technology	0.43	0.42	0.57	0.40	0.35	0.07	0.40	n/a	0.00	0.00
9 Age	−0.05	−0.03	−0.07	−0.10	−0.03	0.03	−0.04	0.00	n/a	0.00
10 Gender (0 = female)	0.13	0.10	−0.01	0.04	0.06	0.08	−0.01	−0.02	−0.03	n/a

Diagonal (bold): AVE (n/a for single item measures); lower triangle: correlations; upper triangle: squared correlation.