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Expanding the Technology Acceptance Model with the Inclusion of Trust, Social Influence, and Health Valuation to Determine the Predictors of German Users' Willingness to Continue using a Fitness App: A Structural Equation Modeling Approach

Ardion D. Beldad^a and Sabrina M. Hegner^b

^aDepartment of Communication Science, University of Twente, Enschede, The Netherlands; ^bFaculty of Business and Health, Department of Economic Psychology, University of Applied Sciences Bielefeld, Bielefeld, Germany

ABSTRACT

According to one market research, fitness or running apps are hugely popular in Germany. Such a trend prompts the question concerning the factors influencing German users' intention to continue using a specific fitness app. To address the research question, the expanded Technology Acceptance Model (with the addition of trust, social influence, and health valuation) was tested with 476 German users of fitness apps. Structural equation modeling results reveal that respondents' intention to continue using a specific fitness app is predicated on three factors, namely perceived ease of use, perceived usefulness, and injunctive social norm. Trust in the app developer and descriptive social norm do not have statistically significant effects on repeat usage intention, but they (alongside perceived ease of use and descriptive social norm) both influence users' perception of a fitness app's usefulness. Furthermore, ease of use and both injunctive and descriptive social norms significantly contribute to users' trust in a fitness app developer.

1. Introduction

Mobile health applications such as those designed for daily nutritional management, assisting fitness and physical activities, and promoting healthy lifestyles inundate the mobile app market. Therefore, it is unsurprising that the number of people who will have downloaded health apps by 2018 is estimated to be 50 percent of approximately 3.4 billion mobile device users (Montgomery, 2016). A recent Accenture survey with 8,000 consumers across seven countries revealed that, within a span of 2 years, the number of people who have used health apps has doubled from 16% in 2014 to 33% in 2016 (Meola, 2016).

A Euromonitor International survey in 2013 found that fitness apps are the most downloaded type of health apps. Approximately 26 and 21 percent of female and male respondents, respectively, have downloaded fitness apps compared to 23 and 9 percent of female and male respondents, respectively, who have downloaded weight management apps (Holmes, 2013). In Germany, where the current study described in this paper was conducted, jogging or running apps, which are clustered under the fitness apps category, are the most popular, with 36.8 percent of the 2,600 participants in Fittkau & Maaß Consulting's research using jogging or running apps (eMarketer, 2015).

Fitness apps' pervasiveness, popularity, and accessibility signify that people who run or jog either for health or sense of accomplishment reasons (Major, 2001) now have easy and less costly ways of monitoring how they exercise. However,

the relative newness of running apps means that the mechanisms behind people's predilection to continue using them are not yet fully understood. Studies into new technology adoption have primarily used the Technology Acceptance Model (TAM) as a central theoretical framework, although the impact of social influence on technology use has been increasingly recognized (Vannoy & Palvia, 2010), subsequently resulting in the expansion of TAM (Schepers & Wetzels, 2007; Yi, Jackson, Park, & Probst, 2006).

Moreover, despite the wide applicability of TAM, the model could still be modified with the addition of factors such as external precursors (for instance, situational involvement, which, in the context of the study, would pertain to people's attitude towards their health) and theoretically justified factors (e.g. trust) that may increase the model's predictive power (King & He, 2006). Given the potential of fitness and running apps to improve users' health condition (Bert, Giacometti, Gualano, & Siliquini, 2014), the role of users' valuation of their health in increasing the use of those apps also merits attention.

Furthermore, considering the many risks (e.g. privacy-related, security-related, information quality-related; Lewis & Wyatt, 2014) associated with the use of mobile health apps, the effect of trust in the app developer on app usage continuance intention must also be understood. This focus on trust in a situation characterized by risks is anchored on the premise that trust would be irrelevant when a specific action could be pursued with absolute certainty (Lewis & Weigert, 1988).

A Nielsen research in 2014 reported that although an average smartphone user has around 42 apps, only 10 of those are used on a daily basis (Nielsen, 2014). With this finding, then, one wonders how people decide on whether or not to continue using apps they have downloaded. Specifically, considering the current research's focus, when a person downloads a fitness app and decides to use it for a couple of times, the question concerning the factors influencing the decision to continue using that app merits attention.

The popularity of fitness apps in Germany (eMarketer, 2015) prompted the current study's interest in the factors influencing German users' intention to continue using fitness apps, specifically by testing the expanded version of the model. The research's novelty lies in its aim of testing the expanded version of TAM with the addition of trust, social influence, and health valuation to identify the factors influencing German users' willingness to continue using a fitness app. This research primarily aims at addressing the research question: 'What are the factors that influence German users' intention to continue using a fitness app?'

2. Theoretical framework

2.1 Predicting people's willingness to continue using a fitness App using the Technological Acceptance Model

The relative newness of mobile fitness apps implies that the factors influencing people's willingness to continue using them still deserved to be adequately understood. Studies into technology adoption have considerably relied on Davis' TAM in understanding the impact of two relevant technology features, namely perceived ease of use and perceived usefulness, on people's willingness to adopt a specific technology (Marangunic & Granic, 2015). Davis (1989) refers to perceived ease of use as 'the degree to which a person believes that using a particular system would be free of effort', while he defines perceived usefulness as 'the degree to which a person believes that using a particular system would enhance his or her job performance' (p. 320).

Given the multiplicity of goals mobile health apps aim at achieving and the various features embedded in those apps to meet their diverse objectives, one might expect that an individual decision to use a specific health app would be predicated on the benefits the app offers and the degree of complexity (or simplicity) in using it. These two considerations suffice to justify the adequacy of TAM in understanding people's inclination to use or continue using a particular app. While research into the use of mobile health app, which uses TAM as a theoretical foundation, is still in its nascent phase, a few studies have confirmed the validity of the model in mobile health app context by highlighting the impact of both perceived usefulness and perceived ease of use on people's actual use of a health app (Wang, Park, Chung, & Choi, 2014) and their intention to continue using a health app (Cho, 2016; Cho, Lee, & Quinlan, 2015). Based on these results, therefore, the first two hypotheses are proposed.

Hypothesis 1: The perceived ease of using a fitness app positively influences users' willingness to continue using a fitness app.

Hypothesis 2: The perceived usefulness of a fitness app positively influences users' willingness to continue using a fitness app.

2.2. Extending TAM with the inclusion of social influence, trust, and health valuation

The role of social influence: Injunctive and descriptive social norms

Venkatesh and Davis (2000) tested the extended version of TAM with the inclusion of social influence as a predictor of technology adoption. The notion that social influence could potentially impact technology adoption, the authors claim, is predicated on the Theory of Reasoned Action's (TRA) thesis that a specific behavioral intention is a function of people's expectation that significant others expect them to perform the behavior (in this study's context, for instance, the adoption of a specific technology). The authors argue that the direct effect of subjective norm (defined as a person's perception of the need to behave in a certain way due to social pressure; Ajzen, 1991) on intention could be due to the likelihood that 'people may choose to perform a behavior, even if they are not themselves favorable toward the behavior or its consequences, if they believe one or more important referents think they should, and they are sufficiently motivated to comply with the referents' (Venkatesh & Davis, 2000, p. 187).

Indeed, Venkatesh and Davis' (2000) research has shown that subjective norm significantly predicts people's intention to use a specific system or technology. However, although it is confirmed that social influence prompts technology adoption, previous studies were somehow constrained by the view of subjective norm as an expression of social influence (Lee, Lee, & Lee, 2006). In fact, when the role of social influence is considered, most studies measured it as conceptually similar to TRA's subjective norm construct (Vannoy & Palvia, 2010).

Reviewing various studies on social influence, Cialdini and Goldstein (2004) underscore that social influence could be differentiated into two, namely injunctive social norms (referring to what most people typically approve or disapprove) and descriptive social norms (referring to what most people normally do). Conceptually speaking, injunctive social norm is closely similar to subjective norm. What is known from previous studies is that subjective norm or injunctive social norm significantly influences people's intention to adopt various forms of technology such as instant messaging (Lu, Zhou, & Wang, 2009), mobile payment services (Yang, Lu, Gupta, Cao, & Zhang, 2012), and anti-spy software (Lee & Kozar, 2008).

The impact of descriptive social norm in an online social networking context (OSN) has also been documented in research into the use of OSN sites (Chen, Yen, & Hwang, 2012; Cheung, Chiu, & Lee, 2011) and OSN use-related behavior (e.g. photo sharing; Beldad & Hegner, 2017). The widespread popularity of newer forms of communication technology such as OSN sites and mobile apps might explain why people's awareness of the massive adoption of these novel technologies could heighten their propensity to use them.

Although the role of social influence in enhancing technology adoption has already been tested in the Unified Theory of

Acceptance and Use of Technology (UTAUT, Venkatesh, Morris, Davis, & Davis, 2003), the theory opted for the operationalization of social influence as an individual belief in what significant others expect that person should do. The emphasis then was simply on injunctive social norms at the expense of descriptive social norms. This is a theoretical limitation that the current study aims at resolving.

The inclusion of both injunctive and descriptive social norms in TAM, specifically when used to explain people's willingness to use a fitness app, could provide app developers with the necessary insight into the role of the aforementioned constructs in augmenting people's uptake of an app. It is highly likely that the trendiness of fitness apps would nudge people to subsequently use them, hence, the third hypothesis.

Hypothesis 3: (a) Injunctive social norm and (b) descriptive social norm positively influence users' willingness to continue using a fitness app.

Does trust matter?

Claiming that people's use of certain systems is associated with unwarranted consequences, Gefen, Karahanna, and Straub (2003) expanded and tested the original TAM with the addition of trust in an e-commerce context, where an actor's (e.g. online shop) behavior could not be easily predicted or understood. Risks and uncertainties also abound in mobile app usage, as some apps could compromise users' information privacy (Giota & Kleftras, 2014; Keith, Thompson, Hale, Lowry, & Greer, 2013; Lewis & Wyatt, 2014), while others might provide erroneous information (Lewis & Wyatt, 2014).

The risks and uncertainties associated with the decision to use mobile apps necessitate trust, given its relevance in situations when the positive outcome of an action could not be readily ascertained (Lewis & Weigert, 1985) and in instances when a specific technology could be exploited to harm its user. Mayer, Davis, and Schoorman (1995) define trust as 'the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party' (p. 712). This definition, when used in the context of the research, strongly suggests that the trust target is not the app per se but the developer of the app.

Although tangible but inanimate entities such as technological artifacts (e.g. computer) have been increasingly deemed appropriate trust targets (Li, Hess, & Valacich, 2008), especially when one subscribes to the notion of 'computers as social actors' imbued with human-like characteristics (Nass, Steuer, & Tauber, 1994), we advance the view that the risks associated with mobile app use do not divinely emerge without human intervention but are precipitated by the actions of those who develop the app.

For instance, considering the need for fitness app users to disclose personal data (e.g. gender, date of birth, weight, height; Higgins, 2016), concerns regarding the privacy of willfully disclosed personal data or surreptitiously extracted

online behavioral information might be aggravated either by app developers' inability to protect users' data or by app developers' morally questionable decision to misappropriate those data for various reasons without data owners' knowledge and consent (Beldad, De Jong, & Steehouder, 2011). This point, hence, prompts the assumption that in a fitness app use context, trust must be predicated on the app developer's actions and inclinations.

Indeed, several studies have shown that trust in parties behind the technology (instead of trust in the technology) impacts people intention to use the technology such as a location sharing application (Beldad & Kusumadewi, 2015) and an online social network site (Wu, Huang, & Hsu, 2014) or to engage in computer-mediated exchanges (Palvia, 2009; Pavlou, 2003).

Theoretically, looking into the effect of trust in the adoption of new technological forms such as fitness apps would imply that just focusing on their usefulness and ease of use would hardly suffice, especially if the technology can be exploited by its developer to compromise users' interests (for instance, app developers misappropriating collected data from app users). Investigating the link between trust and fitness app usage continuance intention also has both practical and theoretical relevance as app developers and researchers must subsequently explore ways to secure user trust in those that developed the app, if, indeed, trust is a prerequisite for the individual decision to download a fitness app.

Results of previous research into the impact of trust on technology adoption and use prompt the fourth research hypothesis.

Hypothesis 4: Users' trust in the app developer positively influences their willingness to continue using the fitness app

Health valuation's effect

Health apps, in general, are deemed useful in realizing users' wellness goals such as improving their overall health or quality of life (through proper diet and regular exercise) and monitoring chronic health conditions (Platt, Outlay, Sarkar, & Karness, 2016). Hence, with health apps' function of enabling users to track their health status, the original Technology Acceptance Model when used to understand the adoption of the aforementioned technology could still be expanded with the inclusion of 'health valuation' as a usage intention predictor. This decision is hedged on the premise that when people do not value the positive outcome (e.g. individual health or wellness) that can be derived from using a specific technology (e.g. app), they will see no reason for using it.

We define 'health valuation' as the extent to which individuals view their health and wellness to merit substantial attention and priority when compared to other individual needs and concerns. The concept is comparable to the concept of 'health consciousness', which is defined as the degree to which people are concerned about their health (McGloin, Embacher, & Atkin, 2017) and the level of attention people give to their health (Cho, Park, & Lee, 2014). Health consciousness, based on results of Cho et al.'s research, directly

influences people's decision to use health apps. Specifically, the researchers claim, highly health-conscious individuals are known to be more likely to use health apps than those who are less health conscious.

The inclusion of health valuation in the research model suggests that an attempt to understand the adoption of a technology must also take into account the context governing the use of that technology. For instance, in the case of a fitness app, potential users may not opt to use any fitness app despite its usefulness and usability if they do not entirely value the supposed health benefit that can be derived from using the app. The fifth research hypothesis underscores the potential impact of health valuation on people's willingness to continue using a fitness app.

Hypothesis 5: Users' valuation of their health positively influences their willingness to continue using a fitness app.

2.3. The impact of perceived ease of use, injunctive and descriptive social norms, and trust on the perceived usefulness of a fitness App

While both perceived ease of use and perceived usefulness influence technology adoption, the former is also reported to influence the latter (Davis, 1989). This finding has been supported in several succeeding studies (Davis & Wiedenbeck, 2001; Karahanna & Straub, 1999; Saade & Bahli, 2005; Suh & Han, 2002; Venkatesh & Davis, 1996). Davis (1989) explains the impact of ease of use on usefulness by accentuating how people's belief in the effective functioning of a technology depends on its perceived usability. He further argues that an easy to use technology requires less effort from users, which enables them to direct their efforts on other relevant tasks, thus triggering them to regard the technology as highly useful.

In a fitness app context, understanding the relationship between the two constructs has practical value since app developers must seriously take into account the importance of the app's usability to strengthen people's perception of its usefulness. Findings from previous studies provide the basis for the sixth hypothesis.

Hypothesis 6: The perceived ease of using a fitness app positively influences users' perception of its usefulness.

One's awareness of the extent to which a specific technology is widely used by others would most likely contribute to the belief in the technology's usefulness. Additionally, the social expectation that one should consider using the technology can potentially enhance users' view of the technology's value. These premises are anchored on the central thesis of Social Information Processing Theory (Salancik & Pfeffer, 1978) – that people's social environment provides them with cues they can use to construct or interpret events and situations (or in the context of this study, to assess a fitness app's functionality).

Several studies indicate that social influence significantly impacts users' appraisal of a technology's usefulness. Using the

broad conceptualization of social influence, studies by both Lu, Yao, and Yu (2005) and Karahanna and Straub (1999) show that social influence enhances belief in the usefulness of wireless Internet services via mobile technology and electronic mail, respectively. Moreover, deeming subjective norm as a measure of social influence, Venkatesh and Davis (2000) found that the construct positively influences beliefs in the usefulness of information systems in various organizations.

Despite the reasonable relationship between social influence and people's assessment of a technology's usefulness, there is still scant literature on the impact of the former on the latter. The current study aims at filling this research gap. From a practical standpoint, knowledge about social influence's effect on an app's perceived usefulness should trigger app developer to constantly explore ways to fully capitalize on the positive impact of what people say (especially if it is favorable towards the app) about and do with the app. The seventh hypothesis, therefore is:

Hypothesis 7: (a) Injunctive social norm and (b) descriptive social norm positively influence users' perception of a fitness app's usefulness.

Gefen et al. (2003) and Pavlou (2003) introduced and tested the notion that users' trust in a party behind a technology impacts their perception of the technology's usefulness. Gefen et al. (2003) argue that trust signifies that the party behind the technology will fulfill whatever it promises and sincerely cares about users, and these positive points increase the probability for technology users to reap the benefits of technology use. On the contrary, the authors claim, using a technology from an untrusted party could lead to negative consequences for users. Additionally, as Pavlou (2003) contends, if the party behind a technology could not be trusted to behave in accordance with users' confidence, users have no reason to expect any gain from using the technology.

Despite what we know from these two studies, however, the effect of trust on the subjective evaluation of a technology's usefulness has not been thoroughly understood in the literature. The aim of testing the impact of trust on perceived usefulness will hopefully validate what is already known in the two previously described studies, especially in the fitness app context, in which the trust target is not the app but the app developer. Emanating from results of the two studies is the eighth hypothesis.

Hypothesis 8: Trust in the app developer positively influences users' perception of the fitness app's usefulness.

2.4. The impact of perceived ease of use and injunctive and descriptive norms on users' trust in the App developer

Online trust, according to Beldad, De Jong, and Steehouder (2010), is predicated on various factors. In a review of various research into online trust creation, the authors highlighted the critical role of a system's ease of use in fostering trust in the entity behind the system. In several studies (e.g. Bart, Shankar, Sultan, & Urban, 2005; Chau, Hu, Lee, & Au, 2007; Chen & Dibb, 2010),

it is reported that websites with easy to use functionalities can effortlessly acquire their users' trust. The ease of using a system might be indicative of the organization's competence and goodwill to provide their clients with a gratifying interaction experience. Both competence and goodwill, McLain and Hackman (1999) underscored, are necessary ingredients for trust generation.

Previous studies (primarily employing TAM) into the adoption of mobile health apps have not tested the impact of perceived ease of use on trust in the app. Delving into the causal relationship between the two constructs is theoretically and practically relevant for two reasons. First, research into trust in mobile apps is not entirely clear about the contribution of mobile app ease of use in ameliorating trust. Second, the premise that making an app relatively easy to use will boost its trustworthiness and that of its developer, will underscore the need for developers to increasingly design and produce user-friendly apps. The ninth research hypothesis, then, is:

Hypothesis 9: The perceived ease of using a fitness app positively influences users' trust in the app developer.

In the absence of any objective information about a trust target, a trustor might rely on second-hand information about that target to decide whether or not to trust. Such a situation exemplifies the notion of transference-based trust, in which 'trust is transferred from a trusted proof source to another individual or group with which the trustor has little or no direct experience' (Doney, Cannon, & Mullen, p. 606). Based on the central thesis of Social Information Processing Theory (Salancik & Pfeffer, 1978), one can also assume that a person who knows nothing about a trust target would be inclined to use the knowledge of other people's continuing interaction with that target as an indication of the target's trustworthiness.

In a mobile app context, users' inclination to trust an app developer would most likely be anchored on the widespread use of the app and on being confronted by significant others' expectation that the app should be used. This is one assumption worth testing given mobile app's susceptibility to the impact of word-of-mouth (e.g. people can talk about an app either in an online environment or in the physical world). Knowledge of social influence's effect on trust should trigger app developers to capitalize on app users as spokespersons for the app in an effort to help establish the app developer's (and the app's) trustworthiness.

The last research hypothesis is anchored on the points previously discussed.

Hypothesis 10: (a) Injunctive social norm and (b) descriptive social norm positively influence users' trust in the app developer.

Figure 1 graphically summarizes the critical points discussed in this section and illustrates the hypothesized relationships among the research constructs.

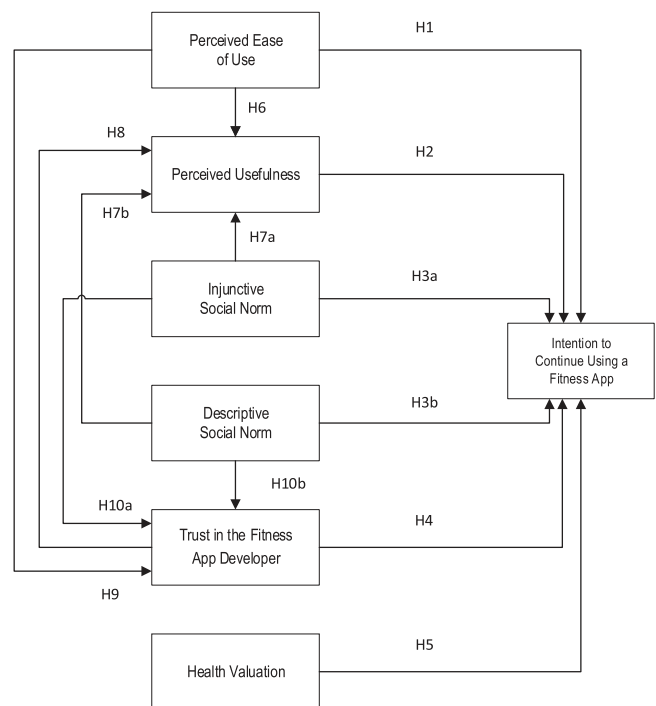


Figure 1. Complete research model.

3. Methodology

3.1. Research design

Data were collected through a self-administered online survey with the help of a professional research agency in Germany, resulting in 476 usable responses. In terms of gender, participants were evenly split with 50% females and 50% males. The researchers opted to collect data from individuals in the 18–35 age cluster ($M = 26.7$, $SD = 5.04$) since they have the highest fitness usage rate in Germany (eMarket, 2015). Only respondents who indicated to be using fitness apps at the time of the study were considered for the study. If they indicated not to use any fitness app on either their smartphones or tablets the survey was terminated.

If respondents indicated to use a fitness app, they were then asked to name the app. The most used fitness apps in this study are Runtastic (43.4%), MyFitnessPal (8.5%), Freeletics (4.0%), and 7 Minutes Workout (3.4%). Approximately 80.6% of the installed fitness apps were for free, while those who indicated to have paid the fitness app they were using paid an average of 1.94 euros.

3.2. Measures

The seven constructs used for this study were measured with a total of 26 items. All items were translated and back-translated to German, following the method proposed by Brislin (1970). The initial version of the questionnaire used for the survey was first pretested with a convenience sample to identify formulation- and language-related issues with the items.

The dependent variable 'intention to continue using a fitness app' was measured with four originally formulated items. Two typical examples of these items include 'I will continue using this fitness app whenever I am engaged in a fitness activity' and 'I don't see any problem in continuing to use this fitness app'.

The first independent variable 'perceived usefulness' was measured with 6 items that were primarily inspired by the scale of Davis (1989). However, considering context differences in Davis' study (focused on the adoption of a file editor and a software package) and of the current study, contents of the 6 items were substantially different from those of Davis'. Examples of items used to measure the construct include 'I find this fitness app useful for my effort to stay fit' and 'This fitness app enables me to regularly exercise'.

Davis' (1989) scale for 'perceived ease of use' was also used as an inspiration for the formulation of three items used to measure the second independent variable. Examples of items used for the 'perceived ease of use' construct include 'Learning to use this fitness app was easy for me' and 'I find this fitness app easy to use'.

'Injunctive social norm' and 'descriptive social norm' were each measured with three items. Examples of items for 'injunctive social norm' include 'People who are important to me would recommend this fitness app' and 'People who influence my behavior recommend using this fitness app'. Both items were based on the scale by Venkatesh, Thong, and Xu (2012). Originally formulated items to measure 'descriptive social norm' include 'This fitness app is currently used by a lot of people' and 'Most users of this fitness app recommend its use'.

The fourth independent variable, 'trust in the fitness app developer', was also measured with originally formulated items. 2 of the 4 items formulated for this construct include 'I am confident that the developer of this fitness app takes my interests into account' and 'I am confident that the developer of this fitness app will not exploit my personal information'.

'Health valuation', the last independent variable, was measured with three originally formulated items. Examples of items for this construct include 'Staying healthy is very important for me' and 'I value my health more than anything else'.

3.3. Scale validity and reliability

The model proposed for this research was tested using structural equation modeling (SEM) technique. We used SEM as it provides us with the flexibility to model the proposed relationships among several predictors and criterion variables that are based on unobservable latent variables (Chin, 1998). Latent variables are connected to observable variables by a measurement model (Edwards & Bagozzi, 2000). SEM allows the analysis of the dependencies of latent variables, offering the opportunity to analyze the relationships of psychological constructs without measurement errors (Nachtigall, Kroehne, Funke, & Steyer, 2003).

Model testing subscribed to the two-step approach recommended by Anderson and Gerbing (1988), in which the

measurement model was first assessed using confirmatory factor analysis (CFA) prior to hypotheses testing with SEM.

Based on the recommendations by Hu and Bentler (1999) and Schreiber, Stage, King, Nora, and Barlow (2006), four indices were used to assess the fit of the measurement model and the full structural model: comparative fit index (CFI) and Tucker-Lewis index (TLI) to determine the model's incremental fit (values for both CFI and TLI must be higher than .90; Hair, Black, Babin, & Anderson, 2006), root-mean-square error of approximation (RMSEA) as a measure of absolute fit (RMSEA value must be lower than .08; Hair et al., 2006), and normed chi-square (X^2/df), whose value must not exceed 5 for the model to be interpreted as acceptable (Wheaton, Muthen, Alwin, & Summers, 1977). Test of the fit of the measurement model indicates that it has an acceptable fit: $X^2 = 1,096.77$, $df = 278$, $X^2/df = 3.95$, $RMSEA = .08$, $CFI = .92$, $TLI = .91$.

Values for the average variance extracted (AVE) and the composite reliability (CR) were also calculated, as both are good indicators of the constructs' convergent validity, with the recommended values for both higher than .50 (Fornell & Larcker, 1981) and .60 (Bagozzi & Yi, 1988), respectively. AVE measures the amount of variance captured by the construct in relation to the amount of variance that is attributed to the measurement error (Fornell & Larcker, 1981). CR is preferred over Cronbach's alpha at the construct level when SEM is used (Hair et al., 2006). Presented in Table 1 are the AVE and CR values for the research constructs.

Inter-correlations among the seven constructs were also determined using correlation analysis before the structural model was tested. Values in Table 2 indicate that strong correlations (correlation values between .70 and .90; Burns & Burns, 2008) among the constructs do not exist.

Table 1. Average variance extraction and composite reliability for the research constructs.

Construct	Items	Factor Loadings	AVE	CR
Intention to continue using a fitness app (INT)	INT1	.934	.823	.949
	INT2	.938		
	INT3	.849		
	INT4	.905		
Perceived ease of use (EQU)	EQU1	.918	.864	.950
	EQU2	.941		
	EQU3	.930		
Perceived usefulness (USE)	USE1	.895	.606	.901
	USE2	.882		
	USE3	.681		
	USE4	.828		
	USE5	.680		
	USE6	.666		
Injunctive social norm (INJ)	INJ1	.908	.718	.883
	INJ2	.916		
	INJ3	.701		
Descriptive social norm (DES)	DES1	.814	.674	.861
	DES2	.888		
	DES3	.755		
Trust in fitness app developer (TRU)	TRU1	.698	.700	.902
	TRU2	.846		
	TRU3	.923		
	TRU4	.863		
Health valuation (HVA)	HVA1	.876	.741	.895
	HVA2	.892		
	HVA3	.812		

Table 2. Mean scores, standard deviation values, and inter-correlations of the research constructs.

	Mean (SD)	INT	EOU	USE	DES	INJ	TRU	HVA
INT	3.93 (1.15)	1						
EOU	4.18 (0.99)	.61**	1					
USE	3.59 (0.93)	.56**	.46**	1				
DES	3.66 (0.95)	.46**	.52**	.54**	1			
INJ	3.39 (1.09)	.48**	.45**	.52**	.52**	1		
TRU	3.57 (0.97)	.44**	.39**	.61**	.44**	.51**	1	
HVA	3.63 (0.97)	.30**	.30**	.32**	.23**	.23**	.33**	1

** Correlation significant at 0.01; * Correlation significant at 0.05; N = 476

4. Results

4.1. Structural equation modeling using the original model

It is initially hypothesized that German users' intention to continue using a fitness app is influenced by six factors, namely perceived ease of use, perceived usefulness, injunctive social norm, descriptive social norm, trust in the app developer, and health valuation (as shown in Figure 1). The model further indicates that perceived ease of use, perceived usefulness, injunctive and descriptive social norms, and trust in the app developer relate with one another. Test of this model shows that it has an acceptable fit: $X^2 = 1,036.00$, $df = 278$, $X^2/df = 3.71$, $TLI = .92$, $CFI = .93$, $RMSEA = .08$.

However, regression estimates indicate that of the six proposed predictors of fitness app usage continuance intention, only three factors have a statistically significant effect on the dependent variable of interest: perceived ease of use ($\beta = .43$), perceived usefulness ($\beta = .30$), and injunctive social norm ($\beta = .14$), hence hypotheses 1, 2, and 3a are supported. Descriptive social norm, trust, and health valuation have no significant effects on usage continuance intention, hence hypotheses 3b, 4, and 5 are not supported, respectively.

As it is very likely that the extent to which people value the possible impact of using a technology (e.g. being healthy) could contribute to their perception of the technology's usefulness, the path from 'health valuation' to 'perceived usefulness' was also tested (model fit: $X^2 = 1,034.60$, $df = 278$, $X^2/df = 3.72$, $TLI = .92$, $CFI = .93$, $RMSEA = .08$). Analysis indicates that health valuation has no statistically significant effect on perceived usefulness.

Analysis also reveals that the perceived usefulness of a fitness app is significantly influenced by perceived ease of use, injunctive and descriptive social norms, and trust in the app developer, thereby supporting hypotheses 6, 7a, 7b, and 8, respectively. Furthermore, hypotheses 9, 10a, and 10b are also supported as perceived ease of use, injunctive social norm, and descriptive social norm significantly influence trust in the app developer. Table 3 shows the standard path coefficients and levels of significance for the relationships among the research constructs.

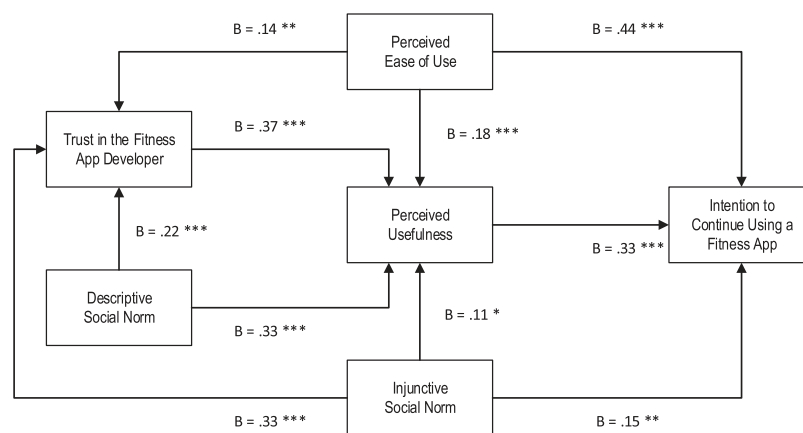
4.2. Structural equation modeling using the modified model

As both, descriptive social norm and trust in the app developer have no statistically significant effects on usage continuance intention, but significantly predict perceived usefulness, the model was consequently modified by removing the paths from the two predictors to the dependent variable (INT).

The fit of the modified model was again tested. Model fit did not improve substantially, although the fit is still acceptable: $X^2 = 837.43$, $df = 213$, $X^2/df = 3.93$, $TLI = .92$, $CFI = .94$, $RMSEA = .08$. Perceived ease of use ($\beta = .44$), perceived usefulness ($\beta = .33$), and injunctive norm ($\beta = .15$) remained statistically significant predictors of 'intention'. Figure 2

Table 3. Standard path coefficients and levels of significance for the relationships among the constructs.

Dependent Variable	Independent Variable	β /sig.
Intention to Continue Using a Fitness App	Perceived Ease of Use	.43***
	Perceived Usefulness	.31***
	Injunctive Social Norm	.14*
	Descriptive Social Norm	.01
	Trust in App Developer	.02
	Health Valuation	.07
Perceived Usefulness	Perceived Ease of Use	.17 ***
	Injunctive Social Norm	.11*
	Descriptive Social Norm	.33***
	Trust in App Developer	.37***
Trust in App Developer	Perceived Ease of Use	.14**
	Injunctive Social Norm	.33***
	Descriptive Social Norm	.22***

**Figure 2.** Modified research model with standardized path coefficients.

shows the modified model with the standard path coefficients for the relationships among the constructs.

5. Discussion of results, implications, and recommendations for future research

5.1. Discussion of results

Fitness apps' popularity and ubiquity could not be disputed, as evidenced by results of a worldwide survey on fitness trends, in which smartphone exercise app use is identified as a noteworthy fitness trend alongside traditional fitness activities such as bodyweight training and weight loss programs (Walter, 2016). The availability and accessibility of fitness apps might be rightfully considered a boon to fitness-conscious individuals, especially in economically developed countries where staying fit and healthy is increasingly becoming a norm as manifested by the size of fitness markets in those countries (e.g. Germany, United Kingdom, France; Deloitte, 2016).

In Germany, where this research was conducted, it is reported that approximately a third of smartphone users use fitness apps (eMarketer, 2015). A recently published study revealed that the use of fitness apps among Germans is predicated on two reasons, namely (a) achieving fitness goals and (b) improving enjoyment for physical activities, for instance, by sharing fitness results with social contacts (Klenk, Reifegerste, & Renatus, 2017).

Willingness to continue using a fitness App as a function of perceived ease of use, perceived usefulness, and injunctive social norm

Results of the current study with 476 German fitness app users indicate that the two TAM constructs – perceived ease of use and perceived usefulness – significantly predict app usage continuance intention, supporting findings of various studies into the impact of the two constructs on the adoption of various forms of technology (e.g. Carter & Belanger, 2005; Chau & Lai, 2003; Gefen et al., 2003; Kwon & Wen, 2010; Wu & Wang, 2005) and, specifically, on people's inclination to continue using health apps (Cho, 2016; Cho et al., 2015)

While previous studies have indicated that the effect of perceived usefulness on technology adoption is stronger than that of perceived ease of use (e.g. Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; Lederer, Maupin, Sena, & Zhuang, 2000; Pavlou, 2003; Venkatesh & Davis, 2000), even after an initial interaction with the technology (Gefen et al., 2003), in this research, German users' intention to continue using a fitness app is predicated primarily on its perceived ease of use and secondarily on its perceived usefulness. The nature of the technology investigated in this research could provide the first explanation for this finding. Given mobile apps' tendency to frequently undergo updates, recurring modifications in those apps might render them troublesome to use, as they could crash or malfunction.

Additionally, fitness apps might require their users to perform seemingly tedious procedures (e.g. data entry) for optimal use. In fact, it is reported that people stopped using fitness apps due to the difficulty of using them (Mastroianni, 2015). In another qualitative study with American

participants, Wang et al. (2016) found that the amount of time and effort needed to use health apps deter users from continuing to use those apps. These points could partly explain why the impact of perceived ease of use on usage continuation intention is slightly stronger than that of perceived usefulness.

This finding clearly means one thing: the interface of a fitness app matters. People do things with the app by 'clicking' its relevant sections. For users to fully experience what the app primarily offers, the interaction with the app must not be cumbersome. As a qualitative study by Tang, Abraham, Stamp, and Greaves (2015) reveals, weight loss app users value not only an attractive app interface but also a structured interface that facilitates ease of use: factors that users consider crucial in their decision to continue using a health app. Additionally, interview participants in a study by Gowin, Cheney, Gwin, and Wann (2015) noted that they would be less inclined to download apps that require so much data entry for registration, those with complex procedures, and those having features requiring instructions.

However, the way perceived usefulness, as a construct, was measured might also provide an explanation for the finding. In this study, the emphasis in the operationalization of perceived usefulness is on a fitness app's primary role of encouraging users to stay fit or to regularly exercise. Although fitness apps are designed to principally realize the role previously mentioned, such apps could also perform gamification (Hamari & Koivisto, 2015) and social interaction (Lee & Cho, 2016) functions.

In fact, as previously mentioned, people use fitness apps not only to meet their health-related goals but also to engage in exchanges with other app users (Klenk et al., 2017). Hence, the current study's exclusive focus on the primary goal of fitness app – to stay fit – as an indicator of an app's usefulness has sidelined gamification and social interaction functions, which could have augmented perceptions of a fitness app's value. Indeed, as Eysenbach (2013) posits, mobile apps' appeal and usefulness depend on users' intentions and motivation, thereby implying that users' estimation of a fitness app's usefulness is anchored on the reasons people have for using an app and the ways they use it.

The points above could also explain for the statistically insignificant effect of health valuation on usage continuation intention. This finding fails to confirm what is already known in a previous study – that health conscious individuals are more inclined to use health apps than those that are not health conscious (Cho et al., 2015, 2014). It should be noted, however, that in that study, the impact of health consciousness on health app usage intention was tested alongside factors that do not focus on users' attitude towards the app (e.g. health information orientation instead of the two TAM constructs).

Although respondents indicated to relatively value their health, their decision to use a fitness app may not be fully predicated on the app's primary function but rather on its possibly peripheral functions (e.g. enjoyment) and the uncomplicated nature of using that app. An implication of this result is that even health conscious individuals might opt not to use an app that demands so much time and effort from its users.

That health valuation or consciousness does not predict people's intention to continue using a fitness app, however, concurs with the finding of another study – level of health consciousness does not influence the use of a fitness app (distance tracker; McGloin et al., 2017). A possible explanation, according to the researchers, is that highly health conscious individuals may not really regard distance tracking apps to substantially contribute to their goals of achieving a healthy lifestyle. We can also speculate that people who highly value their health might have other strategies and facilities for maintaining their health conditions.

Another noteworthy finding of the study is that users' cognition of significant others' expectation (that is, for users to use a fitness app) – currently labelled as injunctive social norm – also contributes to the former's decision to continue using a fitness app. Such a belief that relevant referents expect users to use a system causes the latter to assume the former's expectation, consequently generating a sense of belonging on the users' part (Schepers & Wetzels, 2007).

Interestingly, however, the other aspect of social influence (descriptive social norm) does not have a statistically significant effect on usage continuation intention. It is very likely that the direct effect of descriptive social norm on technology use is present only in a situation when users have no prior experience with the technology, and not after users have already interacted with the technology, as prior experience might already suffice to shape continuous use decisions. Injunctive social norm's impact on usage continuance intention somehow indicates that after an initial encounter with a fitness app, views from significant others would matter more for decisions to continue using it than behavioral cues from unconnected, unrelated individuals.

Perceived usefulness as an outcome of descriptive social norm, injunctive social norm, and trust

Despite the statistically insignificant effect of descriptive norm on app usage continuance intention, the former is found to influence people's perception of an app's usefulness. The fact that this type of social influence increases evaluation of the app's usefulness conforms to the Social Information Processing Theory's central thesis (Salancik & Pfeffer, 1978) – that other people's action provides an individual with the necessary cues to interpret the value of an artifact. People's awareness of an app's popular use might instigate them to regard the app as useful. Furthermore, the widespread use of the app might also indicate the level of confidence or trust people have in the app developer.

Additionally, people's appraisal of a fitness app's usefulness is also predicated on the knowledge that their strong ties expect them to use the app. Such an expectation might be interpreted as a positive assessment of the app's value, and people tend to value and be persuaded by messages from strong ties (Gotlieb & Sarel, 1992).

Although trust in the app developer does not have a statistically significant effect on app usage continuance intention, the construct appears pivotal in increasing users' perception of the app's usefulness, confirming results of previous studies (Gefen et al., 2003; Pavlou, 2003). An implication of this result, therefore, is that people are inclined to regard a

technology beneficial if its developer could be trusted, as lack of trust could raise concerns regarding the potential of that technology to endanger its users, subsequently prompting users to focus more on the technology's supposed threats instead of its potentials and to eventually abandon it for good.

That trust does not directly influence people's willingness to continue using a fitness app is not an indication that its relevance should be downplayed. As previously noted, people's trust in the app developer contributes to people's positive appraisal of a fitness app's usefulness, which significantly influences their willingness to continue using the fitness app. App developers, therefore, are still faced with the challenge of identifying ways to fully win potential and current app users' trust. Since this research did not intend to comprehensively determine the factors influencing users' trust, a complete discussion of how trust should be generated could not be provided. However, trust in an app developer, according to previous studies and based on the results of this research, could also be influenced by factors included in the expanded TAM.

Injunctive social norm, descriptive social norm, and perceived ease of use as predictors of trust in the App developer

People's trust in an app developer emerges from users' awareness of the extent to which their close ties expect them to use the app and from their assessment of the app's popularity, as indicated by the breadth of its uptake by unrelated individuals. The positive things people say about an app and that app's popular use could already serve as cues for its trustworthiness, as people would hardly promote the app (in words and in deeds) if it is known to compromise its users' interests.

Furthermore, analysis reveals that users' trust in the app developer is a function of the perceived ease of using the app. Several studies have already noted that easy to use or usable systems can enhance users' trust in parties behind those systems (Bart et al., 2005; Chau et al., 2007; Chen & Dibb, 2010), as system usability could signify developers' competence and goodwill to provide users with a pleasant usage experience with the system.

5.2. Implications and future research directions

An important point that resonates from the research results is for fitness app developers to seriously ensure that fitness apps they launch in the market are uncomplicated and not burdensome to use. Additionally, fitness apps must deliver the benefits people expect from using those apps. However, as it is known that users' valuation of fitness apps' usefulness is contingent on how and why they would use those apps, fitness app developers need to be constantly cognizant of the dynamic relationship between users and fitness apps to adequately provide users with the desired functionalities that must be embedded in those apps.

Trust does not directly influence app usage continuation intention, although it significantly predicts perception of the app's usefulness, which is partly affected by beliefs in the ease of using the app. The ease of using an app also contributes to users' trust in the app. The absence of trust's direct effect on

usage continuation intention, however, should not be viewed as an indication of the irrelevance of trust in people's decision to use an app. As several risks are associated with fitness app use, the role of trust in whoever develops the app must not be undermined. Although this study shows that trust's contribution to usage continuation intention is not direct, its impact on the adoption of mobile apps for the first time is already known (Beldad & Kusumadewi, 2015).

While interesting insights can be gleaned from the study's results, the research is not spared from a few limitations. First, with the narrow operationalization of perceived usefulness, future research into fitness app usage intention should seriously consider measuring it as a multidimensional construct, focusing not only on the health-related (e.g. staying fit) and behavioral change-related benefits (e.g. engage in fitness activities) but also on supposedly peripheral functions such as gamification and social interaction. An important implication of this point, hence, is the need to take into account the role of the hedonic aspect of using a fitness app in understanding app repeat usage intention.

Second, TAM when used in the context of technology use after an initial encounter could still be expanded with the inclusion of 'quality of experience in using a technology' as a predictor of repeat usage intention. The probability that one's satisfaction with a fitness app after being used once or a few times might induce people to continuously use the app is not a far-fetched notion.

Additionally, broadening the operationalization of 'trust' as a concept is a point worth pursuing, given the primary function of fitness apps (to provide users with information that helps users to monitor and improve their health and fitness, such as information in the form of feedback and personalized coaching; Higgins, 2016). An important thing to take into account then is the impact of users' trust in the information provided by the fitness app they use. Trust when included in the expanded Technology Acceptance Model, therefore, must consider not only the app developer as the trust target but also the app that is being used.

Third, since the sample used for the study came from a single national group, caution must be exercised in interpreting the research results, especially when one looks at the role of social influence and trust on fitness app usage intention. For instance, while descriptive social norm appears to have no effect on highly individualistic German users' (Hofstede, 2001) decision to continue using a fitness app, it is possible that the impact of this social norm type would be stronger among users from a more collectivistic society (e.g. Asians) where the need to conform is high (Young, 2009).

While the research results might provide an indication of the factors German users consider when deciding whether or not to continue using a specific fitness app (given the researchers' decision to use a somewhat representative sample), the findings described in this paper might also reflect the mechanisms behind Western Europeans' (e.g. Dutch, Swiss) proclivity to maintain loyalty to a fitness app. A meta-analysis of TAM studies shows that culture somewhat moderates the relationship between TAM variables and technology adoption, as Western Europeans regard perceived usefulness critical for their technology adoption decision, while individuals from

non-Western cultures take ease of use as a more important consideration (Schepers & Wetzels, 2007).

However, despite cultural similarities (either substantial or slight) among most Western Europeans with regards to certain cultural characteristics (e.g. level of individualism, beliefs in equality, degree of uncertainty avoidance; Hofstede, 2001), the group must not be viewed as a monolithic cluster in which variations among individual members are entirely non-existent. Researchers and app developers, therefore, must take a nuanced view when integrating cultural elements and the cultural characteristics of target users when understanding fitness app adoption and when designing a fitness app.

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About the Authors

Ardion D. Beldad is an assistant professor at the University of Twente, the Netherlands. His primary research interests include organizational trust creation and maintenance, determinants and consequences of online trust, information privacy and confidentiality in online and offline context, crisis communication, and prosocial behaviours.

Sabrina M. Hegner is a professor at the University of Applied Science in Bielefeld, Germany. She holds a PhD from the University of Bremen in Germany. Her primary research interests include the creation of brand relationships, crisis communication, online and offline word-of-mouth communication, and socially responsible behaviours.