Exploring the factors that support adoption and sustained use of health and fitness wearables

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Abstract

The Internet of Things and, particularly, wearable products have changed the focus of the healthcare industry to prevention programs that enable people to become active and take responsibility for their own health. These benefits will only materialise, however, if users adopt and continue to use these products, as opposed to abandoning them shortly after purchase. Our study investigates how the characteristics of the device, the context and the user can support the adoption and the sustained use of health and fitness wearables. We find that the factors that support the former differ from those that support the latter. For instance, features that signal the device's ability to collect activity data are essential for adoption, whereas device portability and resilience are key for sustained use.

Statement of contribution: The findings contribute to the conceptual understanding of consumers' adoption and sustained use of wearable technology for general health and fitness purposes. The findings also provide valuable guidance to firms investing in the development and marketing of these devices, as well as key insights for government initiatives aimed at combating rising levels of obesity and diabetes.

Keywords: Internet of things, Wearables, Technology adoption, Consumer behaviour, health and fitness

Introduction

Devices that are part of the so called Internet of Things can collect and exchange data with little or no interference from their users. With more than 20 billion objects expected to be connected to the Internet by 2020 (Meulen, 2015), this technology promises a range of benefits. For instance, businesses can use Internet of Things (IoT) data collected at various stages of the customer journey to provide relevant information to their customers, to help them with decision making, to facilitate transactions, or to offer proactive customer support (Groopman, 2015). Governments, too, can use IoT data to design cost-effective transportation or public health systems (Manyika, Chui, Bisson, Woetzel, Dobbs, Bughin & Aharon, 2015); while citizens can use IoT data to make informed decisions about their own well being or that of an elderly relative.

Within the IoT field, wearables have achieved a particular state of '*public awareness … and integration into society*' (Castro & McQuinn, 2015, p. 22), particularly those that support healthy lifestyles. There is, now, a wide spectrum of devices, and associated applications, that offer training plans, assist with activity tracking, and generally collect and process health and fitness related data (McGee, Greenwood, Paterniti, Ward & Soederberg-Miller, 2015; Swan, 2012). This category of wearables also promise to counter-act large demographic trends such as population aging or the increase in chronic diseases, as well as rising healthcare costs (Levy, 2014). The appeal of the health and fitness wearables market is such that even Disney is investing in it, with physical devices and software aimed at young children and their mothers (Farey-Jones, 2016).

For the individual, business and societal benefits of this category of wearables to be realised, however, it is necessary for these products to be widely adopted and used. For the moment, adoption is still relatively low (Sultan, 2015), even though prices are plummeting (Zheng, Ding, Poon, Lo, Zhang, Zhou, Yang, Zhao, & Zhang, 2014). In addition, about half

of consumers abandon their wearables within the first six months (Junaeus, 2015; Ledger, 2014; Levy, 2014). This pattern means that businesses can not harvest the data on which the valuation of the IoT industry is premised, and can not recover their development and marketing costs (Ledger 2014). In addition, individuals may not reap the promised health and fitness benefits; while society is unable to curb widespread health problems such as rising obesity levels. Therefore, research that develops sound understanding of the drivers of adoption, and sustained use, of health and fitness related wearables can have a significant positive impact on managerial practice and society.

In addition, understanding what drives adoption and sustained use of these products is a problem of interest to the marketing discipline in general, and consumer behaviour in particular. While there is some academic and commercial research regarding adoption of health and fitness wearables, most of the work either focuses on expert users such as health professionals, rather than the general public (e.g., Junglas, Abraham & Ives, 2009); or on the management of chronic medical conditions as opposed to general disease prevention and fitness maintenance (e.g., Shareef, Kumar & Kumar, 2014). That is, academic research has neglected exactly the segments with the most growth potential for health and fitness wearables (Meulen, 2015). Accordingly, the goal of this research project is to investigate the drivers of adoption and of sustained use of health and fitness related wearables among the general public, who is interested in health and fitness maintenance.

Specifically, this research project is informed by the following research question: *What factors support the adoption and sustained use of health and fitness related wearables, among the general public who is interested in health and fitness maintenance?*

To investigate this phenomenon, and answer the study's research question, we draw on the consumer technology adoption literature. The next section elaborates on the conceptual framework, identifying the factors relating to the features and utility of the

technology, the context of usage, and the user of the technology, which can help understand adoption and sustained use of wearables. The subsequent section outlines the research design. Given the lack of academic research on this phenomenon, the empirical study followed an exploratory approach. Moreover, as the study aims to go beyond identifying factors, and understand how these factors condition behaviour, qualitative data were collected, in the form of five focus groups conducted in Germany. The empirical findings are presented and, subsequently, analysed revealing differences between drivers of adoption and drivers of sustained use, but also differences between adopting and using devices (e.g., fitness bands) vs. applications (e.g., calorie trackers). The final section of the paper outlines the contributions of this research to theory and practice, and identifies areas where further research is needed.

Before we proceed, it is important to clarify what is meant by health and fitness wearables in this research project, and what is excluded from it. Wearables are a particular form of IoT. Like other IoTs, wearables are embedded with internet connectivity, either directly via sensors embedded in the device (O'Brien, 2015) or indirectly by connecting with a smartphone (Ledger, 2014); and have data collection, storage and transmission capabilities (Weber, 2015). Unlike other forms of IoT, however, wearables are machine to human interfaces (Holdowski, Mahto, Raynor & Cotteleer, 2015) and, so, they ought to be studied from the perspective of the consumer (Groopman, 2015, Hong, 2015). Health and fitness wearables collect and process data related to various aspects of health and fitness management, such as calorie intake or activity levels (McGee et al, 2015), and include consumer electronic devices such as fitness trackers, smartwatches, skin patches, and certain types of smart clothing (Vukovic, 2015). Unlike other consumer electronics, however, most health and fitness wearables have open application programming interfaces (APIs), which allow third-party applications to access the data collected and stored in these devices. For

instance, steps and heart rate data collected by an activity tracking device like Fitbit, can be accessed by a smartphone application like MyFitnessPal, and integrated with food intake data collected via that application to calculate net calorie intake, and to help users make decisions regarding their diet. This ability to integrate devices and third-party applications brings additional benefits to consumers, and drives the growth of health and fitness wearables (Ledger, 2014). Therefore, for the purpose of this study, the definition of health and fitness wearables is extended to include the applications that consumers may use in connection with those devices, to obtain value from them. This definition excludes devices lacking internet connectivity, standalone applications not used in connection with a wearable device, as well as devices and applications used for the specific purpose of managing a chronic illness, such as glucose monitors.

Conceptual development

The literature on the adoption of new technology has investigated various aspects of technology acceptance, and adopted multiple levels of analysis. For instance, while the Technology Acceptance Model (TAM) considers why and how people accept and use a particular technological innovation (Bagozzi, 2007; Davis, Bagozzi & Warshaw, 1989), Innovation Diffusion Theory examines the factors that support the popularisation and subsequent diffusion of a given innovation across a social system (Rogers, 2003). In turn, the Unified Theory of Technology Acceptance and Use of Technology (UTAUT) focuses on individual users (Venkatesh, Morris, Davis & Davis, 2003), whereas the Social Shaping of Technology (SST) model explores the mutual influence of technology and society on each other (Mackenzie & Wajcman, 1998; Williams & Edge, 1996).

However, this literature tends to agree that, to fully understand technology acceptance, we need to consider the features and utility of the technology, the context of

usage, and the user of the technology (Miltgen, Popovic & Oliveira, 2013). This study follows that tradition, considering the features, the context and the users of wearable technology, as discussed next and summarised in Figure 1.

Technology features and utility

The key driver of consumer technology adoption is its expected ability to satisfy a need (Kim, Kim & Wachter 2013), and to 'provide benefits to consumers in performing certain activities' (Venkatesh et al, 2012, p.159). Early technology adoption work such as TAM and UTAUT conceptualised this attribute as the ability to enhance job performance (see Venkatesh et al., 2003), though later work, which focused specifically on consumer technology, define this more broadly as the ability to perform a certain task. For instance, Kim et al. (2013) considered how mobile phones assist in organising schedules and appointments, Pascual-Miguel et al (2015) examined how the Internet supports shopping activities (i.e., e-commerce), and Miltgen et al (2013) studied how biometrics make it easier to identify oneself.

While these utilitarian benefits may be the key driver of technology adoption, researchers should not underestimate the importance of hedonic needs such as fun, excitement or pleasure (Hew, Lee, Ooi & Wei, 2015; Holbrook & Batra, 1987; Turel, Serenko & Bontis, 2010), or the extent to which the technology affords a feeling of independence and being in control (e.g., Meuter, Ostrom, Bitner & Roundtree, 2003). For instance, Yang (2010) has shown that the extent to which mobile technology was inviting and enjoyable to use was a key determinant in the adoption of mobile shopping services, while Ma, Kim and Kim (2014) demonstrated that pleasurable feelings are strongly associated with the use of online gambling sites and applications.

Not only do technological products need to be perceived to deliver utilitarian and hedonic value, but these benefits need to exceed the costs and the effort of acquiring and using them (Sedon, 1997; Venkatesh et al., 2003; Venkatesh et al., 2012). They also need to be perceived to do so better than their alternatives (Rogers, 2003).

The implication of these literature findings, for our study, is that we need to investigate which utilitarian and hedonic benefits are sought by the buyers of health and fitness wearables, and what are the perceived costs and challenges associated with using these devices. It is also important to note that, for the technology to be deemed useful to achieve a particular goal, it is not enough that certain features be present. Rather, it is necessary that the users perceive that the feature makes a certain behaviour or action possible (Hartson, 2003). For instance, aspects such as colours, graphics and user interface can all help users understand what a mobile application can do, and how it should be used (Hoele & Venkatesh, 2015). Therefore, we should also investigate which features are salient to the adopters and users of wearables.

Context

How a technological product is used, is largely influenced by the technical and the social contexts within which the technology is deployed. The technical context constrains what the technology can do, whereas the social context determines what is acceptable in a particular social system (Liebenau & Harindranath, 2002).

In terms of technical factors, we need to consider the existing infrastructure, and whether it supports the use of the technology. For instance, research into mobile health devices found that device compatibility was key for adoption (Shareef et al., 2014), whereas the ability to access the service anywhere and anytime was needed for sustained use (Akter, D'Ambra & Ray, 2013). Privacy and security concerns are also deemed to be very important,

particularly the lack of transparency about how personal information will be used, and the uncertainty about which other third parties data might be transferred to (Lupton, 2014).

Social factors refer to the extent to which consumer behaviour is influenced by others, and can be so strong that it even overrides dissatisfaction with the technology's performance (Oliver 1999). On the one hand, technology adoption may occur as a result of role modelling, or peer observation, whereby the adoption of innovation is visible to others (Rogers, 2003). Innovation is an uncertain process (Williams & Edge, 1996) with uncertain outcomes. Being able to observe others adopting the new technology decreases perceived risk (Chen, Wang & Xie, 2011). This effect is particularly relevant for technology which supports interaction between peers or where there are network externalities (Dickinger, Arami & Meyer, 2008), as is the case of mobile phones. On the other hand, technology adoption may occur because buyers perceive that relevant others believe that they should use a particular technology (Venkatesh et al., 2012); or that relevant others will view these consumers favourably as a result of using the technology (Venkatesh et al., 2003). For instance, peers, family, mass media and other users have been shown to influence adoption of mobile commerce (Chong, 2013) and mobile payment systems (Yang, Lu, Gupta & Zhang, 2012), as well as the sustained use of mobile data services (Kim, Lee & Kim, 2008).

User

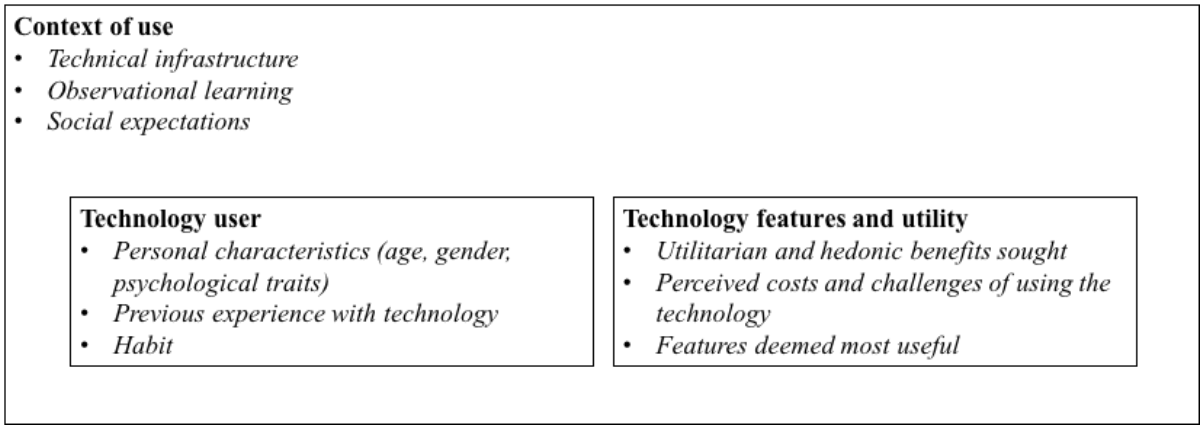
Personal factors influence consumer behaviour in general, and the use of technology in particular (Miltgen et al., 2013; Rogers, 2003; Venkatesh et al., 2003). This includes both the consumers' personal characteristics, as well as their experiences with technology.

In terms of personal characteristics, the literature has considered factors such as age, gender, or the presence of certain psychological traits. For instance, the literature posits that young users are willing to embrace innovation in general (Yi, Jackson, Part & Probst, 2006).

Furthermore, they tend to be more task oriented than older ones and, thus, more willing to adopt technology that facilitates the accomplishment of tasks (Venkatesh et al 2003). Younger users are also susceptible to peer influence (Dickinger et al, 2008). In terms of gender, men are usually deemed to be more willing than women to embrace new technology (Hasan, 2010). However, the effect may vary with the type of salient product features, with men deemed to favour utilitarian features, and women deemed to favour hedonic ones (Venkatesh et al 2013; Venkatesh et al 2012). Yet, other studies suggest that the effect of gender is negligible (e.g., Pascual-Miguel et al, 2015). It should also be noted that any gender effects on the adoption and use of technology arise by virtue of societal roles and expectations (Sorensen, 1992), rather than biological mechanisms. Hence, any differences that may be identified in one context, may not be transferable to another. Finally, as far as psychological traits are concerned, research suggests that tolerance of ambiguity, intellectual ability, motivation, values, and learning style are all likely to support adoption of new technology (Greenhalgh, Robert, Macfarlane, Bate & Kyriakidou, 2004).

Experience with technology is a strong predictor of future technology use (Kim & Malhotra, 2005; Ma et al, 2014). Past experiences with technology in general shape beliefs about its value, and, thus, the decision to adopt a new technology or not (Ajzen and Fishbein, 2015). Experience also provides relevant, transferable knowledge and skills, which can reduce adoption barriers (Notani, 1998; Venkatesh et al 2012). In turn, experience with the specific technological innovation is a key factor in sustained use (Hew et al., 2015; Kim 2009). This is particularly significant where using the technology has become habitual behaviour (Lam & Mizerski, 2009; Ma et al, 2014), and part of the consumer's daily routine (Cotte & LaTour, 2009; Ortiz de Guinea & Markus, 2009).

Figure 1. Factors that might influence the adoption and use of wearables



Research Design

While the literature related to wearables is growing, by and large it has not looked specifically at non-medical use. Hence, it is appropriate to adopt an exploratory approach to this research project, with the aim of refining the conceptual understanding of the phenomenon under investigation. The exploratory approach allows the researcher to investigate social phenomena, and identify the meanings that people give to their actions (Schutt, 2006), and helps to '*focus future research*' (Babbie, 2011, p. 17). It is not uncommon for exploratory studies to be guided by theory, like ours, to give '*coherence to the data collection and analysis phase*' (Shields & Rangarjan, 2013, p. vii). Furthermore, as this study aims to capture how behaviour is shaped by subjective perceptions, it is deemed appropriate to collect qualitative data. Opting for a qualitative approach means that this study considers the detail rather than the aggregate and, hence, it will not be possible to generalise from the findings to the general population (Creswell, 2003). However, this approach offers an emic perspective, and allows the researchers '*to grasp in some way what it is like to be the people under investigation and to go through the experiences as they go through them'* (Thorpe & Holt, 2008, p. 7).

Focus groups are particularly suitable in the context of unexplored but emerging contexts where only limited information about a topic is available (O´hEocha, Wang & Conboy, 2011). Focus groups allow the researcher to identify factors that influence the participants' opinions, behaviours and motivations (Cowton & Downs, 2015; O´hEocha et al, 2011), making them a suitable data collection approach for this study. Furthermore, the group interaction and the individual contributions generate meaningful qualitative insight (Vyakarnam, Bailey, Myers & Burnett, 1997) and open the way for in-depth understanding of trends, and differences in perspectives (Krueger & Casey, 2015). Cowton and Downs (2015) advise using a range of 4-6 group discussions in exploratory research, as this number allows for breadth of insight (Cowton & Downs, 2015). This study used five interviews with groups of four participants each (Table 1), to provide as much opportunity as possible for all participants to voice their views and interact with each other (cf., Krueger & Casey, 2015), and for minority views to be heard (cf., Vyakarnam et al., 1997).

Each focus group lasted between one hour and one hour and a half. After welcoming the participants and describing the project, the moderator asked questions about the interviewees and their past, present and future use of health and fitness wearables (see Appendix 1). The group interviews were recorded to ensure a complete and comprehensive understanding of what had been said during the data collection, as advised by Bryman & Bell (2015). Subsequently, the recordings were transcribed to facilitate data analysis.

The chosen empirical setting for this study was Germany. Germany is the largest economy in Europe and the fourth largest in the world (IMF, 2016; World Bank, 2016) and, therefore, an important consumer market. As such, various studies have considered attitudes and behaviours towards technological innovation among German consumers, from mobile technology (e.g., Kim, Ho, Takahashi, Schellhase, Kim & Lee, 2008), to electric cars and digital cameras (e.g., Klener, Husig & Dowling, 2013). At the moment, adoption of health

and fitness wearables in Germany is still relative low (PwC, 2015). However, there is a growing interest among German consumers in pursuing a healthy and active lifestyle (Euromonitor International, 2014), suggesting that this could become a significant market for wearables. For instance, there is a growing trend, specially among young customers, to present themselves on social media platforms as active, healthy persons (Euromonitor International, 2015); and the government launched a national plan to promote healthy eating and physical activity (Euromonitor International, 2014). German consumers are also being offered incentives to adopt health and fitness wearables, in an attempt to curb the high, and rising, healthcare costs. For instance, various health insurance providers and employers have started offering financial incentives to consumers and employees who use these products (Campbell, 2014). Therefore, the empirical focus on Germany offers researchers the opportunity to study adoption and use of wearables in a market with high potential.

According to market research, the largest group of adopters of health and fitness wearables, in Germany, are under 35 years old and sport enthusiasts (Euromonitor International, 2015). As such, participants were recruited through notices in fitness centres and fitness related online forums. The notices specified that participants had to currently use at least one health and fitness wearable device, so that a minimum of experience with wearable products was guaranteed.

In total, 20 participants were interviewed, of which 9 were female and 11 were male, and with ages ranging between 25 and 32 years old. Focusing on young, sport-enthusiastic adults not only makes sense given the profile of wearables consumers in Germany, but is also relevant for the broader managerial and research community. This is because this segment represents high growth potential for health and fitness wearables (Meulen, 2015). Moreover, health and fitness wearables research has been focusing chronic illness sufferers and older

consumers (Varshney, 2014), thus neglecting a group of consumers which tends to embrace innovation (Yi et al, 2006).

Table 1. Overview of focus groups

#	Location	Participant		
		#	Gender	Age
1	Darmsdtadt	1	Male	29
		2	Male	29
		3	Female	29
		4	Male	28
2	Moerfelden-Walldorf	1	Female	25
		2	Male	31
		3	Male	31
		4	Male	30
3	Frankfurt / Schwanheim	1	Female	25
		2	Male	26
		3	Male	27
		4	Female	25
4	Frankfurt / Main	1	Female	27
		2	Male	31
		3	Male	31
		4	Female	32
5	Darmsdtadt / Arheiligen	1	Female	29
		2	Female	30

3	Male	31
4	Female	25

A code book was developed for data categorization, following the procedures outlined in Weston, Gandell, Beauchamp, McAlpine, Wiseman and Beauchamp (2001). First, the top category codes were defined, based on the conceptual framework depicted in Figure 1, and these codes were applied to the interview transcripts. Appendix 2 provides the full list of top category codes, with examples of their application. Subsequently, the quotes within each category were analysed to identify emerging themes, as exemplified in table 2. Finally, data were analysed within each category and across sub-categories, as per Dey (1993), leading on to the findings presented in the next section.

Table 2. Illustration of the coding process

Source	Quote	Level 1 Code	Emerging themes
FG1-P2	I downloaded the app just to see what is available on the fitness app market and what options there are. Just to create awareness and be conscious of what you eat on a daily basis and how it affects me when doing sports regularly. The Fitbit I bought primarily due to the fact that it had a heart rate monitor integrated. Solely out of interest how heart rates change	Utilitarian benefit Utilitarian benefit Features Utilitarian benefit	*Diet awareness* *Impact of diet on exercise* *Heart rate monitor* *Performance*

	when you exercise regularly.		*monitoring*
	(…)		
FG4–P2	I bought the Polar Loop tracker in order to check my activity and the corresponding calorie consumption, and to reduce calories on akinetic days if necessary. I came across the Freeletics app about a year ago and really liked the concept back then. But I only started using it when I moved to Frankfurt am Main in May 2015 and found a Freeletics training group near my apartment.	Utilitarian benefit Utilitarian benefit Utilitarian benefit Other people's behaviours	 *Monitor exercise* *Monitor calorie use* *Diet awareness* *Training group*

The key findings are reported next. In line with customary practice in the reporting of qualitative research (e.g., Miles and Huberman, 1994), quotes are used to illustrate the breadth of findings emerging from the analysis of the data set.

Findings

The focus group participants were generally active people, who had tried a variety of health and fitness wearables, from dedicated fitness trackers to multi-purpose devices, as well as a multitude of associated applications. All participants were satisfied with the product category in general, and intended to continue using health and fitness wearables, as illustrated by this

quote: '*I am basically very satisfied. I am still waiting for the perfect smartwatch or band, but I will definitely stay an active user'* (FG4-P1).

This feeling was present even among those interviewees that expressed frustration with particular devices, or whose health and fitness goals had changed, as in this case:

> *'I started using (health and fitness) wearables 1 or 2 years ago (…) I got a Jawbone fitness band for Christmas. I used it for 2 months and then it became annoying… it didn't work properly, so I gave up and since then it has been laying in my drawer (…) But I am still using Runtastic. (…) I would also like to try calorie tracking, if someone tells me which one is really good. (…) And maybe a heart rate monitor, if I have a specific goal in mind. Only for training purposes.*' (FG5-P4).

This quote also illustrates that, for the interviewees, there was not a clear separation between health and fitness devices and applications. Rather, they were all seen as part of a eco-system that helped them achieve their goals. Some interviewees had started using a device (e.g., Fitbit to monitor physical activity), then downloaded an app associated with that device and, after that, started connecting that app with other apps (e.g., MyFitnessPal to monitor calories intake) to obtain a more holistic view of their health and fitness. Still others had experimented with an application on their phones before buying a dedicate device (e.g., a Polar smartwatch). Hence, there wasn't one singular journey into and within this product category. Having said that, there were some clear factors influencing the adoption vs. sustained use of health and fitness wearables, as described next and summarised in table 4.

Adoption

The majority (specifically, 18 out of 20) of the participants had a specific goal in mind, when first adopting one of these products. Some participants wanted to lose weight, others wanted to move more, others still were training for a marathon or other event, and some wanted to

quit smoking. The remaining two participants had purchased the wearable product out of general interest in technology, as in this example: *'I purchased the Sony smartwatch because it was a new technology, and I like new technology. It was not because of a special interest in fitness. Though, sometimes I like to run, and I use it to track the route'.* (FG1-P4)

Given these drivers, it is perhaps unsurprising to see that, when acquiring a device, interviewees attributed significant weight to those features that signalled a particular functionality, such as being able to count steps, or having a heart rate monitor, as in these quotes:

> *'I got a Fitbit because of the heart rate monitor'* (FG1-P3)
>
> *'I had, and still have, a band, but I don't use it. It´s called Polar Loop and it could count steps, calories and showed the time'* (FG3-P3)
>
> '*(Some years ago) I got a Polar (smartwatch) and an anti-smoking app (…) I wanted to see how many cigarettes…how much money I saved'* (FG5-P1)

Participants also mentioned valuing the ability to easily access data:

> '*To me, the functions that were most important before the purchase… that I see the distance everywhere. (…) And that the user interface is simple: time, average pace, kilometres.'* (FG3-P2)
>
> '*This function I found **very, very** practical, because you have all your data inside the app and in return it tells you exactly what you have burned.*' (FG3-P1)

We asked participants whether the ability to share data or workout programmes with others had been an influencer, but none seemed to have taken that into consideration when adopting the product: '*No way. I get annoyed when someone posts something like this on Facebook'*. (FG5-P1)

The look and feel of the product was also mentioned by the interviewees. Both men and women mentioned that they valued an 'unobtrusive' and 'elegant' design, as in these examples:

> *'I, as a woman, find it important that it is not a huge thing around my wrist'*. (FG3-P1)
>
> *'Mainly the design. Especially the older versions of smartwatches, or the Apple watch, (are) ugly and way too big'*. (FG1-P2)

Though, the importance of such hedonic features might be related to the pattern of use, as illustrated by these two quotes:

> *'Design is of course also important. I don't want an ugly whopper around my wrist all the time'*. (FG5–P2)
>
> *'Design doesn't matter to me. My watch is completely red and it doesn't bother me because I don´t wear it in my daily life, only for the training or running.* (FG3-P2)

Another device-related aspect explored during the interviews was the role of cost and effort in adoption. The overall view can be encapsulated in this quote: '*Of course, you always somehow consider the price-benefit ratio*' (FG3-P1). For fitness wearables, interviewees were interviewees tended to either expect applications to be free; or to be able to have access to some functions for free, before deciding to upgrade. And, even then, they would often look for a promotion or discount. The following quotes illustrate these differences:

> *Price (of smartwatch) was secondary, because I really wanted these things (monitor distance and average pace) and to achieve this goal' (FG3-P2).*
>
> '*I started with the free version (of the app). I was really excited… thrilled. So, I upgraded (…) paid for one year*' (FG2-P4).

'*I got the paid version (of the app) with a special offer'* (FG1-P1)

In terms of the role of contextual factors in adoption, the interviewees did not mention any aspects relating to the infrastructure. However, the social context seemed to play a significant role. Specifically, observational learning influenced both acquisition of devices and applications, as mentioned in these quotes:

'*The watch, I bought it because a colleague of mine had the smaller version*' (FG5-P2)

'*My boyfriend used it. I saw it and I wanted to try it out*' (FG5-P2)

'*I got it to track down speed, time, distance… because my friends recommended it*' (FG4-P3)

A couple of interviewees also mentioned social expectations. For instance: '*I started using the app due to group hype'* (FG2-P2). As mention previously, the German government has launched a national incentive to promote healthy lifestyles, and there has been a rise in the number of health insurance providers and employers offering financial incentives to use wearables. Hence, one of the themes explored in the interviews was whether the interviewees felt motivated to acquire wearables as a result of such financial incentives. One interviewee had been offered an incentive but rejected it: '*My health insurance would pay my Yoga lessons. They would contribute a certain amount. But I didn't accept it. It's the wrong direction*' (FG5-P1).

In contrast, another interviewee reported that his employer financed the cost of weight loss initiatives such as training, counselling and fitness trackers, and that he and some of his colleagues had taken advantage of this offer: '*I got the weightwatchers app and steps tracker at work, with my colleagues. My employer was willing to pay 50% of the costs*' (FG2-P2)

The others had not been offered financial incentives, but seemed to welcome the idea, as exemplified by these quotes:

'Payment through health insurances and employers sounds awesome! Or to offer (government subsidies), or even free… especially for students and schools' (FG4-P3)

'It is nice to get rewarded when you do sports' (FG5-P2)

'(Name of company) did that. They offered a Polar Loop to their employees. They just gave it to them. So they can get active and avoid illnesses' FG3-P3

However, all interviewees were adamant that they would only accept those offers if they did not have to share data with employers or insurance companies.

'*I am especially critical of the health insurance knowing the data. I also don´t want to share data with my employer. I am afraid that people might get fired! No. It is something that your health insurance shouldn't have. Maybe in the future, the premium for the health insurance will depend on how much sports a person is doing. But that wouldn't be fair or right.*' (FG5-P2)

'*I am not sharing any kind of data with my employer EVER. It can be interpreted negatively. If they see a pattern that they don't like (for instance, you don't sleep well), they can fire you*' (FG2-P2)

'Sharing with my employer? That is none of their business' (FG3-P1)

'I agree with (FG3-P1). Sharing with employer? No, not at all!' (FG3-P4)

The interviews also explored the characteristics of the user, and how they influenced product adoption. Appendix 3 summarises the characteristics, including self-reported levels of technology affinity. Four of the participants had smartwatches, of which two were males and two were females. Of the sixteen remaining, one (FG2-P4) wasn't interested in a

smartwatch because of its technical limitations, but the others were deterred mostly by the cost. The focus groups moderator asked the interviewees whether they saw themselves as early adopters of innovations, and this led to a variety of answers, as captured in Table 3.

Table 3. Self-described level of technology affinity

	Early	**Medium**	**Late**	**Laggard**	**Don't know**
Female	1	0	5	2	1
Male	5	4	0	1	1
Total	6	4	5	3	2

The women were more likely to describe themselves as late adopters or even laggards, whereas the men tended to describe themselves as innovators. Though, this is not reflected in the type of device that they used (e.g., smartwatches, or specific brands).

Sustained use

The focus group participants were all current users of health and fitness wearables, had been using their devices for some time, and intended to continue using them, as illustrated by these quotes:

'*I use all the products relatively often*' (FG5-P2)

'*To me, it's compulsory*' (FG4-P1).

This is not to say that they had always used the same product, or that they used the current products consistently. For instance, when the wearable had been acquired to help achieve a specific goal, such as training for a marathon or quit smoking, its usage decreased when the goal was achieved. This interviewee, who had been using wearables for two years, explains: '*Now that I ran my marathon, maybe the next few times I will run without it,*

because I am just not that interested anymore in how fast I run. I need less control and pressure' (FG5-P4).

The interviews explored the device characteristics associated with sustained use, including for those wearables whose use might fluctuate overtime, as illustrated by the previous quote. A key factor in ensuring sustained use was the perception that the device provided useful and accurate data, consistently:

> *'I use it because of calorie tracking, while training. Yes, the machine (at the gym) can do it too, but it would not be correct for me. (The machine calculates calories) for the average weight person. I burn many more calories than the others, because it is more exhausting for me. (…) Sure, the (wearable) data is also only an approximate value. It varies about 5 to 10%. But it is still more accurate than the information in the gym equipment'* (FG3-P1)
>
> *'This smartwatch has a GPS, and that is important because it is more accurate'* (FG1-P4)
>
> *'The other one… the GPS didn't track properly, and the kilometres were* ***completely*** *wrong. So I got this one.'* (FG5-P4)

An important enabler was that the device was with you, and working, all the time. So, factors such as battery life, size, look and feel, and working in all environments, were all important:

> *'It works everywhere. Even in the woods'* (FG3-P2)
>
> *'It's always with you'* (FG2-P4)
>
> *'The one I have is relatively unobtrusive. It could be a bit slimmer and fine, and just could look a bit nicer. (…) But battery life is not a problem. It lasts for a week. You just very rarely charge them.'* (FG3-P1)
>
> *'I have just used it the entire day because it looks cool'* (FG3-P3)

Another enabler was that data could be easily transferred to other devices, or aggregated with other sources, as this interviewee explained:

> *'In order to check the really interesting data and information like calorie consumption, detailed movement profile and so on, I first had to synchronise data via Bluetooth or USB cable with the Polar systems. Additionally, I had to wear a heart rate belt to get really accurate measurements. The whole thing was really complex. This one is simple and intuitive to use. And I don´t need another accessory to use it to the full extent. It is an easy appliance. Easy handling.'* (FG4-P2)

Another theme mentioned during the group discussions was that workout applications allowed users to save time. Using wearables to exercise could also result in more pleasant, and thus sustainable, exercising experiences. The following quotes illustrate these perceptions:

> *'I like to have short workouts which are really tough so I am powered out. In the past, I had to go to the gym, which was very time-consuming. This way, I can fit fitness in my daily life'* (FG2-P4)
>
> *'Now, I don't need a gym. I can do everything outdoors… with little expenditure of time. I get the same results in 20 minutes, as after 180 minutes (at the gym). And I can do it outdoors. It is nice to be outside (…) Or something at short notice. If you had a busy day, you don't want to go to the gym.'(*FG5-P3)

Participants also mentioned the importance of enjoyment while using the wearable, as exemplified by this quote: *'(If) I don't have fun then I am not convinced, and it's not good to me.*' (FG2-P2). In terms of what made it fun to use wearables, the interviewees mentioned features such as supportive messages, new features, games, badges, as illustrated by these quotes:

‘*The design. The whole user experience. I like enthusiastic updates. The training becomes better. I do more. And it is fun to have new workouts.*’ (FG2-P4)

‘Group competitions with a joint goal is a nice idea’ (FG1-P2)

‘I think fun is important… Games. Gamification of the app and the hardware (…) Motivates the couch-potato. (…) Funny animation effects.’ (FG1-P3)

For many participants, such a fun and enjoyable experience was achieved through the community of users around the application or device. For instance, they arranged to meet with others using a particular fitness application to exercise together. Some liked to compete against others, be it real friends or virtual ones. Participants also liked to share achievements and motivate each other:

‘*I think the apps work best if you have some kind of community around it. It is easier in*

the long-run if you have the appropriate group with whom you can share it. If one of you guys used the same app as I do, and the app told me that you just ran 10 kilometres,

then I would maybe run 10 kilometres, as well’ (FG1-P4)

‘I share my results… so that others can tell me “Finally, you have done something”. (…) This is the only way I will exercise’ (FG2-P3)

‘*It is a community thing. You can follow others and can see what they have done, and that I check several times a day. A colleague of mine is using it too and when I see that she has already done something on a day I think “Oh damn it, she has already been active, now I have to do something as well”’* (FG5-P2)

It should be noted, however, that the ability to engage with others was not valued by interviewees who prefer to train by themselves. For instance, participant 2 in focus group 1,

was very sceptical of people who '*only get motivated when they see others being more active or better (than them)*'.

Indeed, there seemed to be two types of users among our interviewees. On the one hand, there were those for whom the wearables were key motivators for a healthy, active life. On the other hand, there were those that were sporty and active, already, and for whom the wearables were about fine-tuning performance, as expressed by these two participants:

> *'When someone has a motivation problem in general regarding fitness activity, I think it is quite nice to be able to see what the friends are doing, because you will be a bit under pressure to also get active. For example, MyFitnessPal, where you can see what your friends have done during the day, and if you have just chilled on the couch, then you still might do something in the evening. But if you don´t have a motivation problem, then you probably don´t care. Well, that's the case for me, at least. I think real sports people don´t need that.*' (FG3-P1)
>
> *'I think that all the technology is worth nothing when the person doesn´t have the right attitude. But the providers suggest that the technology itself will improve people's health. (…) I think that the technology is able to help many people… it simplifies the entry, if they have the right attitude*' (FG4 – P3)

Another important contextual factor was compatibility between devices and applications, as stated by this interviewee: '*I could connect all the three apps in order to gather data as precisely as possible*' (FG4-P1).

Table 4 summarises the various factors mentioned by the interviewees.

Table 4. Summary of factors

Type	Adoption	Sustained use

Device	Goal oriented	Sustained use of wearables, but not of specific products depending on goals
	Importance of functional feature (e.g., steps counter, GPS and heart rate monitor)	Useful, accurate, consistent data
	Easy access to data	Portable device, which works in all environments
	Look and feel (namely size; possibly moderated by pattern of use)	Ability to transfer and aggregate data
	Willingness to pay for devices; very low willingness to pay for apps	Saves time
		Pleasurable workouts
		Fun to use
Context	Observational learning – friends	Community of users
	Social influence of members of fitness group	Sharing workouts and achievements (for some users)
	Receptive to financial incentives from employers and insurance providers, provided that they do not have access to the data	
User	Broad range of perceived levels of technology affinity	Different attitudes towards health and fitness, reflected in different uses

Discussion

The participants in this study had adopted wearables voluntarily, rather than having to use them as a means of managing a chronic illness. They were enthusiastic about the product category and, generally, keen to try new technology (e.g., smartwatches) or experiment with new applications to augment their devices. Nonetheless, they still exhibited a certain level of judiciousness in their purchases. They represent a market with significant growth potential

(Meulen, 2015), in terms of needs and motivations, even if the demographic profile (25 to 32 years old) is somehow narrow. Given the visibility of the use of these devices (e.g., band around the wrist), and the importance of observability of a new technology in its dissemination and popularisation (Rogers, 2003), it is extremely valuable for marketers to understand what these consumers like about the product, and what supports sustained use.

The role of user characteristics in wearables' adoption and sustained use

The age group interviewed in this study tends to embrace innovation (Yi et al, 2006). Yet, curiously, less than a third of the participants described themselves as early adopters of technology. From the conceptual and methodological perspectives, this raises an interesting question as to whether self-perception is a suitable way of assessing technology adoption consumer types. In turn, from a practitioner perspective, this insight can inform marketing communications, as well as distribution strategies.

Gender played a significant influence in whether the interviewees perceived themselves to be earlier adopters of technology or not. In line with popular stereotypes and many technology adoption models (e.g., SST or UTAUT2), nine out of eleven men described themselves as early adopters or early majority users, whereas only one out of nine women described herself in that way. However, and revealingly, there were no noticeable differences in terms of actual products used by each gender. This could be because of the product category (i.e., health and fitness). Though, it could also be an indicator of a broader trend, given that, as noted in the literature review, other researchers are finding that gender does not play as significant a role as previously thought on the use of technology (see Pascual-Miguel et al, 2015). Unlike suggested by the literature (e.g., Venkatesh et al, 2013), there was no marked gender difference in preference for utilitarian vs hedonic features, though that could

also be a result of the data collection approach, which was focused on eliciting factors rather than comparing or valuing them.

Based on the broad range of self-reported user attitudes towards innovation (Table 3), we posit that this is not a significant driver of wearables acquisition. However, there is a possible halo effect of the increasing quantification of daily life (the so called quantified-self phenomenon) and even the ubiquitous presence of technology in most gyms, in normalising the desire to monitor one's activities and health (Lupton, 2014). Hence, this insight needs to be taken with care, when looking at wearables adoption by users who do not frequent gyms or are not exposed to the quantified-self trend.

Attitudes towards health and fitness, on the other hand, seem to influence how wearables' consumers use their products, what they expect from them and, hence, what they value. This finding, which is line with previous research on consumer behaviour (e.g., Ajzen and Fishbein, 2015) is valuable for product developers, in that it can inform market segmentation initiatives. It is also important for policy makers, in that it suggests that giving away, or even prescribing, wearables may be an unsuccessful initiative, unless it is accompanied by work on shaping attitudes towards health and fitness.

The role of context in wearables' adoption and sustained use

The observability of the devices seems to be important for adoption, whereas observability of physical activity via postings on social media or within an online community, was important for sustained use. This is in line with previous research, such as Chen et al's (2011) work on observational learning and adoption of consumer goods, or Roger's (2003) work on role modelling and innovations diffusion. Given that observational learning and word of mouth are so important for initial adoption, developers should not risk launching inferior versions of their products, as negative word of mouth is likely to have a

detrimental effect on sales. This is even more important for those users that value peer interaction (Dickinger et al, 2008), for instance running groups. Our finding suggests that increasing visibility of wearables is important for expanding adoption of the product, for instance by designing distinctive devices that consumers feel proud to wear, and which are also ergonomic and comfortable, so that the consumers do not feel compelled to take it off. Moreover, product manufacturers should make it very easy for consumers to share their activities within the relevant communities (e.g., automation), or encouraging and rewarding that behaviour.

Social expectations and social influence in the form of peer pressure were relevant for adoption; though not for sustained use. The role of social influence in the form of insurer or employer incentives was a bit more complex. All but one interviewee said that they would be receptive to financial incentives from employers or insurance providers, in exchange for using wearables. However, they rejected the idea of sharing activity data with those providers, which is line with previous research on the sharing of wearables data with third-parties (e.g., Lupton, 2014). This is an important finding as, in recent years, there have been suggestions that employers and insurance providers should incentivise the use of wearables (Ambacher, Carl & Knapp, 2015). According to this study, such initiatives will only be successful if they are not contingent on data being shared with the sponsor.

The technical context was mentioned for sustained use, only. In line with previous research (e.g., Akter et al, 2013) and the emphasis on data accuracy, the interviewees valued infrastructure that enable wearables to capture data anywhere and anytime, and facilitate data aggregation.

The role of wearable products features in adoption and sustained use

The empirical findings reveal that the adoption of health and fitness wearables is largely utilitarian, in line with previous research on consumer technology adoption (e.g., Kim et al, 2013). Specifically, adoption is driven by the belief that wearables will help consumers achieve goals, such as losing weight or preparing for a marathon. This is in line with findings from commercial market research on adoption of health and fitness wearables, (e.g., Junaeus, 2015; Ledger, 2016). Our research goes further, though, by showing that the type of goal has a role in sustained use, and on pattern of use. Specifically, we found that general fitness goals (e.g., moving more) was associated with sustained and stable use; specific fitness goals (e.g., prepare for marathon) was associated with loyalty but changing patterns of use; and nutrition related goals (e.g., lose weight) was associated with product switching and irregular use.

In terms of the use of wearables for nutrition purposes, our interviewees attributed inconsistent use to features such as clumsy data inputs, or limited visualisation and analysis capabilities. Indeed, it is challenging for current technology to effectively store, retrieve and analyse the vast amount of data collected by wearables in a meaningful way (Kaplan & Stone, 2013). There is also limited opportunity to provide immediate feedback (Levy, 2014) or cues, nudges and rewards (Ledger 2016). Another issue mentioned by our interviewees was that consumers may have specific dietary needs that are not sufficiently captured by the wearable's dashboard. For instance, consumers preparing for a long distance run (e.g., marathon) have very different nutritional needs from those preparing for a short run.

Still, we should not underestimate the possibility that consumers have inflated expectations about the ability of wearables to change nutritional habits. Consumers blame the technology for the unsatisfactory outcome, whereas the issue may be their expectations. Indeed, it is well established in the customer satisfaction literature (e.g., Malle, Guglielmo & Monroe, 2014; Oliver, 1999), that satisfaction is a process of appraisal of the extent to which

perceived performance exceeds expected performance such that if expectations are unmet they lead to a dissatisfied customer.

Given the utilitarian nature of the demand for wearables, it is not surprising that utilitarian performance and functional features emerged as key determinants of adoption (Kim et al, 2013). The salient features prior to adoption were those that signalled the ability to capture health and fitness data: counters, monitors, etc. However, for sustained use, the key was that data were accurate and useful; so, device portability and resilience became important features. Portability suggests, to consumers, that they can use their wearables anytime and anywhere, and capture data consistently. Being able to easily integrate the new technology into existing routines, as opposed to requiring a behavioural shift, is a key factor in supporting the diffusion of technological innovations (Rogers, 2003). Furthermore, it helps routinize the use of the new product, which is essential for the formation of habits (Limayem, Hirt & Cheung, 2007) and, therefore, of sustained use (Hew et al, 2015; Venkatesh et al, 2012).

In turn, the ability to access data easily is key for adoption, whereas the ability to transfer and aggregate data with inputs from other devices or applications are key for sustained use. This desire to obtain a holistic view of one's health and fitness is reflective of broader societal trends, such as the adoption of proactive approaches to health (Wiederhold, 2015) or the engagement in decision making regarding own well-being (Varshney, 2014). Hence, this attribute is likely to be valued by a broad range of consumers.

Despite the utilitarian nature of the demand for wearables, consumers still value hedonic aspects, echoing previous research in technological environments such as self-service (e.g., Meuter et al, 2003), mobile shopping (e.g., Yang, 2010), or mobile services (e.g., Chen, Meservy & Gillenson, 2012). The look and feel of the product was key for adoption, particularly size. While bulky and heavy devices might have appealed to

innovators, today's buyers look for devices with an elegant design. This factor is likely to be even more important for late adopters, and is informing the launch of various fashionable accessories and smart jewellery (e.g., Best, 2015). As for the hedonic features that are relevant for sustained use, they are: an enjoyable user experience, and enabling users to save time or do enjoyable workouts. Participants emphasised the need for intuitive user interfaces and having fun while using the device, in line with previous research (e.g., Hew et al, 2015; Holbrook & Batra, 1987; Turel et al., 2010). Clearly, consumers are not prepared to go through steep or long learning curves. Designing intuitive user interfaces is also important from the point of view of perceived effort, given that more and more consumers access information on their mobile phones or smartwatches, which have small screens. Screen sizes have been shown to be a significant deterrent in the adoption of mobile services (e.g., Yang, 2010). For some users, it was particularly enjoyable to participate in virtual competitions. This suggests that gamifying the wearable experience can help with improving long term use (Robson, Plangger, Kietzmann, McCarthy & Pitt, 2015). Mechanisms such as challenges, badges and leader boards can provide additional motivation to perform well (Huang & Soman, 2013).

Overall, for our sample, wearables were deemed to be superior to alternatives such as gym calorie counters or chest straps, which is essential for innovation diffusion (Rogers, 2003). Therefore, they were prepared to pay for these devices. However, they were very reluctant to pay for applications. It is important to note that, even though the price of wearables has been decreasing steadily (Zheng et al, 2015), price elasticity does increase for later adopters (Rogers, 2003). Therefore, other segments may be more-price sensitive than ours.

Conclusion

This study investigated the factors that support the adoption and sustained use, among the general public, of one particular type of IoT, namely health and fitness wearables.

By 'general public' we mean consumers that opt to use the product for general health and fitness purposes, rather than having to use it for medical reasons. Non-medical consumers are the source of growth in this market (Meulen, 2015), and have been the subject of various commercial market research studies (e.g., Junaeus, 2015; Ledger, 2016). Yet, they have been neglected by academic research in the field.

Given that the current, core, non-medical user of health and fitness wearables in Germany is interested in sports and fitness (Euromonitor International, 2015), we recruited participants in fitness centres and online forums. As our study is exploratory, and the goal was to study current users, this was a suitable approach. Moreover, as such users play an important role in the growth of this market, because they increase the observability of the new technology and educate others in their networks (Rogers, 2003), the findings are important not only in terms of filling a research gap, but also in terms of supporting marketing practice in this industry. For instance, our findings regarding the role of perceived technology affinity, the role of gender, and the role of type of goal on technology adoption and use, all advance research on consumer behaviour. In turn, our findings that the factors that support adoption are different from those that support sustained use can inform consumer acquisition and retention initiatives in the industry.

However, our data collection approach does mean that we did not obtain insight from other potential segments – namely, those consumers not currently using a gym or a fitness online discussion forum. Those users may, for instance, be older than our sample and, thus, value hedonic features more heavily (Venkatesh et al, 2003), or be less susceptible to peer influence (Dickinger et al, 2008), than our sample. Or, as they are not comparing wearables' data with those provided by gym equipment as is the case with our sample, they may have a

different perception of wearables' relative costs and benefits. Therefore, future research should endeavour to recruit a broader sample of wearables users; for instance, by means of intercept interviews, or by means of a longitudinal study.

It should also be noted that this study focused on the early adopters of wearables in Germany, resulting in a sample that was both young and motivated to use these products for fitness optimisation. However, in other countries, early adopters may have different demographic characteristics and/or be driven by different motivations. For instance, the US has a significant cohort of current users who, like our sample, are less than 35 years old and are largely driven by fitness-related goals; but they also have a significant cohort who are older (55-64 years old) and who are driven by overall health benefits (Ledger, 2014). Different countries may not only have different demographic profiles of users, but will also have different cultural contexts and norms which are highly consequential for technology adoption and use (Sorensen, 1992). For instance, a study conducted in China (see Gao, Li & Luo, 2015) found that general privacy concerns were a significant deterrent of adoption of wearables, whereas our sample only had concerns regarding use of data by third-parties. Therefore, future research should consider consumers in diverse geographical contexts, ideally performing a cross-cultural comparison.

The definition of wearables used in this study was in line with the general understanding in industry and academia. That is, that wearables are machine to human IoT devices, embedded with internet connectivity, and with the capability of colleting, storing and transmitting data. This definition was extended to include applications which are used in conjunction with the device. This is a definition focused on product features and with fairly clear boundaries. Yet, consumers in our study tended to focus on what the device enabled them to do – for instance, general fitness goals vs. specific goals vs. nutrition-related goals. The focus on goals is not new in the consumer technology adoption literature (see Kim et al,

2013; Miltgen et al, 2013; Pascual-Miguel et al, 2015), but is absent from the general, practitioner literature on wearables and on the Internet of Things (e.g., Groopman, 2015; Manyika et al, 2015; Meulen, 2015). As a consequence, it may lead industry players to develop marketing messages that fail to resonate with potential consumers, because they are focused on what the technology is (e.g., sensors and smart meters at home), rather than how it can add value to consumers (e.g., lower energy bills).

Another consequence is that it may lead to a narrow view of competition. Not only did our interviewees think in terms of an eco-system of devices and applications, but they also considered and used multiple devices and applications, and switched between them (specially, between apps). Moreover, their smartphones played a significant role in merging and visualising data from the various products that they used. Indeed, the valued placed by our sample on portability and data accessibility suggest a competitive advantage for smartphones and associated mobile applications, as not only are these devices web-enabled already, but consumers may already be comfortable with using them. At the moment, dedicated fitness wearables are still very popular, and seeing increasing market share. However, their popularity may wane as wearables progress into other stages of their product life cycle, and start being used by groups less enthusiastic about having an additional device.

The use of the smartphones for health and fitness purposes may be bad news for the manufacturers of wearable devices, but should be an advantage for public health programmes. This is because compatibility and triability are essential for the diffusion of innovations (Rogers, 2003), and it would be easier for consumers to experiment with health and fitness monitoring with a device that they already own and are familiar with, than if they have to buy a new one. It should also reduce perceived effort, and assist with routinisation, which are essential for sustained use (Hew et al, 2015; Venkatesh et al, 2012).

While our participants had all been using wearables for various months to various years, during this period they had tried multiple devices and applications. Moreover, even those that stayed loyal to one wearable product, might have stopped using it for a while, or decreased frequency of use. This is a more nuanced understanding of sustained use than that adopted by commercial reports, which tend to focus on one product, rather than the product category. This means that commercial market research (e.g., Junaeus, 2015; Levy, 2014) may be over-estimating the rate of abandonment of wearables. This is good news for public health initiatives, as it means that consumers did not give up monitoring their general health and fitness, even if they abandoned a particular device. It is also good news for the providers of applications which work across multiple devices, as it means that they can continue to collect data on which the valuation of the IoT industry is premised (Ledger, 2014). For device manufacturers, it suggests the need to offer a portfolio of products that consumers may change to, if they are no longer satisfied with their existing one.

The finding that consumers are loyal to the product category even if they abandon specific devices also has methodological implications. Future research should consider product category rather than specific devices, and should adopt a broad definition of sustained use which accommodates temporary changes in patterns of use.

Our research showed that the factors that drive wearables' adoption are different from those that drive sustained used. While this finding echoes the broader literature on consumer technology adoption and use, it does so at a more detailed level than previous work. For instance, according to the UTAUT2 the only factors that impact directly on sustained use are facilitating conditions and habit (see Venkatesh et al 2012). However, our study showed that there are other factors that impact directly on sustained use (e.g., observational learning). Moreover, while some factors impact both on adoption and sustained use, the effect results from different attributes – for instance, utilitarian features related to monitoring activity vs.

features related to data accuracy. This finding is relevant for marketers, who can use this insight to offer proactive customer support (Groopman, 2015), and adapt their messages to the stage of the customer journey. Given the rising obesity levels, future research should explore the factors and features that support the sustained use of nutrition-related wearables, as this seems to be a sub-category with limited behavioural loyalty.

Finally, it is important to note that the type of goal pursued by wearables' consumers influences behaviour, which is line with previous research (e.g., McGregor and Little, 1998). Intrinsic goals are satisfying to pursue, while extrinsic ones lead to stressful behaviour with unsatisfactory outcomes (Schmuck, Kasser & Ryan, 2000). Hence, consumers are more likely to stay motivated to pursue intrinsic goals than extrinsic ones. From a societal benefit perspective, as well as from a commercial perspective, this means that, rather than emphasising extrinsic goals such as weight loss or saving money, social marketers should focus in intrinsic benefits such life style changes or improving fitness levels. Future research should explore the various goals driving adoption of this technology, given that, as the market expands, it is likely to become more heterogeneous.

Future research could also build on the attributes identified in this study, and the meanings and language used by these early adopters of wearables, to develop instruments for quantitative data collection, in order to identify segments and nuances in this market. For instance, Table 4 lists a range of functional features mentioned by the participants in our study, and future descriptive studies may wish to quantify the proportion of users that value each feature as part of a segmentation strategy exercise. Likewise, explanatory studies might wish to explore the relative importance of the various items listed in Table 4 for different groups of users.

Appendix 1. Focus groups outline

Stage	Topics
Welcome	• Purpose of the meeting • About the study • Confidentiality • Recording the interview • Informed consent forms • Discussion rules
Introductions	• Names & age • Health and fitness wearables in use (and associated applications); since when.
Discussion	1) What was the reason for buying X? • E.g., Specific goals vs. general health & fitness 2) What aspects did you consider before buying X? Why? • E.g., battery life, price, design, size, interface, ease of use, fun and enjoyment, quality of information or service, … • Probe for perceived meaning of specific attributes • Probe for recommendations – what and whom 3) Would you describe yourself as a person who is interested in new technological trends, in general? • Ask for examples 4) When do you usually use X? • Routine use vs. specific times or occasions 5) How do you usually use X? • Key / most valued functions used • Link with other devices or applications • Automated vs. user intervention 6) How important and/or helpful are social sharing functions? • What is shared, with whom, and why? • E.g., work out programmes, achievements, competitions, etc… 7) What data are collected by the device X, and what happens to them? 8) What data would you not want to share, and with whom? 9) To what extent are data security and privacy important for you? 10) Overall, how satisfied are you with the use of X? • Probe for factors mentioned in question 2 vs. new factors 11) How do you think your own usage pattern of X will change in the next six months? • Increase vs. decrease use • Planned upgrades • Planned purchase of other products / apps
Wrapping-up	• Views on the role and likely evolution of wearables in health and fitness • Thank you • What happens next

Appendix 2. List of *a priori* codes

Type	Factor	Item	Example
Technology	Benefit sought	Utilitarian benefit	*The Fitbit I bought primarily due to the fact that it had a heart rate monitor integrated. Solely out of interest how heart rates change when you exercise regularly*. (FG1-P2)
		Hedonic benefit	*'(If) I don't have fun then I am not convinced, and it's not good to me.'* (FG2-P2).
	Using the technology	Perceived cost	*Considering the smartwatch, I would consider functions, price comparison, because the Apple watch is not that cheap. iPhone compatible with Apple watch?* (FG3-P3)
		Perceived effort	*I found using the Polar Loop very complex. In order to check the really interesting data and information… I, first, had to synchronise the data via Bluetooth or USB cable with the Polar systems. (And), I had to wear a heart rate belt to get really accurate measurements. The whole thing was relatively complex.* (FG4–P2)
	Useful features	Feature	*For me, it is calorie tracking while training.* (FG3-P1)
Context	Technical	Infrastructure	*Sometimes I have problems with GPS in the woods, but that's normal I guess.* (FG5-P2)
	Social	Other people's behaviours	*The watch, I bought it because a colleague of mine had the smaller version of Polar and I wanted to track my daily routine and how much I move daily.* (FG5-P2)
		Social expectations	*'I started using the app due to group hype' (FG2-P2)*
User	Personal characteristics	Age	*I am 29 years old. I have tried a few apps but stooped using them after 1 week. I am currently using a step tracker… for three weeks now.* (FG1-P1)
		Gender	Generally, noted by the interview moderator. Occasionally, mentioned by the interviewees, too – for instance: *I, as a woman, find it important that it is not a huge thing around my wrist.* (FG3-P1)
		Psychological traits	*I find it too exhausting. I let the*

			others try (an innovation) first. I only get it when everyone else has it, too. (FG5-P4)
	Previous experience	Technology affinity	*I am a computer scientist and I work with technology*. (FG4-P2)
		Habit	*I actually did not include it at all in my daily life. I only wore it when I trained. Afterwards, I took it off again. Once or twice, I wore it during the day but I don´t wear watches that often, and only wanted to check my resting heart rate when I do nothing, just to compare values.* (FG3-P2)

Appendix 3. User characteristics

Group	Participant			Smartwatch	Self-described level of technology affinity
	#	Gender	Age		*(Quotes)*
1	1	Male	29		*I am like [FG1-P3]. I am interested, but generally not willing to spend much money on technology.*
	2	Male	29		*I am rather an early adopter regarding these things*
	3	Female	29		*I am a late adopter. When everyone else has already tried it out, and it is safe, I will get it.*
	4	Male	28	Y	*I am an early adopter. Absolutely. It is also the reason why I bought the smartwatch. I purchased the Sony smartwatch because it was a new technology, and I like new technology. It was not because of a special interest in fitness. (…) I don't spend very much money on (new technology), but I am generally interested.*
2	1	Female	25		*Not that much. I don't have the newest TV or smartphone. But when purchasing a phone, now, I would like to buy the newest one. But I don't want to spend too much money.*
	2	Male	31		*Moderate. I make solid purchases. I am willing to spend a bit more for a good product.*
	3	Male	31		*Medium. I always need to have the newest phone.*
	4	Male	30		*I follow the newest technology trends. I inform myself. I am very interested, and I chase trends. (…) But I did not purchase the Watch yet because of its technical limitations. It only works with the iPhone. (…) But when I am convinced about a concept, I am willing to pay for it.*

3	1	Female	25		*I don´t know. Our generation is generally interested in what happens regarding to that. I mean if you have the money for such technologies.*
	2	Male	26	Y	*[not captured]*
	3	Male	27		*One wants the newest mobile phone generally. At least I want. Or I also would like to have a smartwatch. Just to test what is possible, but only the one from Apple because I also have an iPhone.*
	4	Female	25		*I would not describe myself as such. Surely with smartphones. I don´t attach importance to it completely.*
4	1	Female	27	Y	*Oh yes, totally!*
	2	Male	31		*I am a computer scientist and I have been working in technology companies for many years. I basically need to know about technical topics, also outside of my working space.*
	3	Male	31		*Yes. I would be interested in glasses with augmented reality.*
	4	Female	32		*No, not really.*
5	1	Female	29		*I am a rather late adopter. I am not that up-to date with technology.*
	2	Female	30	Y	*I, too, am a rather late adopter. But I find it generally interesting. For example, the Apple watch. But I would never buy it because it is way too expensive.*
	3	Male	31		*I think it's not fun if you have to care about that.*
	4	Female	25		*I am definitely a laggard. I am not that interested because I find it too exhausting to be interested in it, and I let the others try first. I only (get) it when everyone else has it, too.*

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