The Interpretative Flexibility of Smart Wearables

A critical reflection on the promise of smart wearable technology

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Abstract

This research is commissioned by the Netherlands Environmental Assessment Agency, which is exploring the role and meaning of smart urbanism. One of the smart city developments is the increased employed of smart wearable technologies. These technologies could play an important role in the transition towards a smarter health system that prioritizes preventive care strategies. This research critically investigates the promises and expectations surrounding smart wearable technology by examining how wearable technologies are integrated in daily lives of users. It attempts to discover the interpretative flexibility of the 'practice of wearable technology', identify the main issues surrounding wearable technology and explore the implications for the further diffusion of this technology. The following research question is answered: *What is the interpretative flexibility of smart wearable technology and what are the implications for the social embedding of smart wearable technology?* The Q methodology, a method for examining subjectivity, was employed to inductively identify the different interpretations of Fitbit users. The analysis yielded three social groups, labelled as 'privacy protectors', 'competitive health fanatics' and 'gadgetheads', who each have a different interpretation of wearable technology. The main differences between the interpretations of the social groups are based on three dimensions: data, healthcare possibilities and level of social use. For a successful social embedding of wearable technology, it is essential that the interpretations and issues of each social group are acknowledged and addressed. Each interpretation has different implications for how this technology can be embedded, and understanding these implications helps to devise socially desirable policies. Interviews with key practitioners revealed the main barriers for the social embedding of smart wearable technology. These barriers are issues concerning the Health Insurance Act, data security, data transparency, accuracy, reliability, interoperability, accessibility, awareness and governance. Various pathways have been suggested that can help tackle these issues; stimulating preventive care strategies, creating added value and simplifying wearable technology must be key objectives. This research has demonstrated that wearables have the potential to contribute towards the development of a smarter healthcare system in which preventive care strategies can flourish. However, in order to realize this development, it is important to adapt aspects of the healthcare system, as well as aspects of smart wearable technology. All parties involved must understand and experience the importance of preventive care and acknowledge the role that wearable technology could play in preventive care strategies before they start employing them. If the aim is to increase the use of wearables, it is crucial to assess each situation separately, and tailor-fit the practice of wearable technology to the specificities of the different social groups.

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1. Introduction

The majority of the world's population is concentrated in urban areas, which, on average, are increasing in size (Caragliu, Del Bo, & Nijkamp, 2011; Shelton, Zook, & Wiig, 2015). This rapid urban development is encouraging (local) governments to rethink and reshape urban processes. Numerous ICT businesses such as Cisco and IBM are seizing this opportunity to expand their business by pushing towards technology driven 'smart cities' (Kitchin, 2014a). The notion of the smart city acts like a concept that lumps together various social groups, each of which may have a different interpretation of smart cities. However, an undisputed, distinct characteristic of these prospective smart cities is the collection of big data, which is massive in volume, varied and detailed (Kitchin, 2013). Various stakeholders argue that the collection of big data can be beneficial in urban areas by providing a more sophisticated understanding of urban processes.

Despite the apparent traits of big data and smart cities in general, various scholars are critically reflecting on the implications of big data and smart urbanism (Kitchin, 2014a). First and foremost, smart city advocates seem to forget that a city consists of communities and social relationships (Hollands, 2008). Instead of focusing exclusively on the technological aspects of smart cities, which is what tech companies that are dominant in smart city-related discussion tend to do, we must carefully study the interrelatedness of technologies with communities and social relationships. Without the approval of stakeholders who are willing to participate in smart cities, even the best technologies will not suffice on their own. A second point of criticism is the business-led approach to urban development. The creation of smart cities trough technology could lead to economic polarization as well as spatial, social and cultural division as businesses might have different perceptions on the ownership of data, or the transparency of projects (Hollands, 2008; van Noort, 2015). The smart city literature also lacks detailed empirical studies of specific cities or smart initiatives (Kitchin, 2014b). As Shelton et al. (2015, p.14) state: "Smart city interventions are always the outcomes of, and awkwardly integrated into, existing social and spatial constellations of urban governance and the built environment". Due to the different particularities of different places it is impossible to develop a one-size-fits-all model and use it to establish a smart city.

The overarching principles that can be distinguished in the discussions about smart city initiatives and big data are technological determinism and technological optimism. In technological deterministic thinking technologies emerge and develop autonomously and in the process transform society, thereby implicating that the course of human history is determined by technological developments (Bimber, 1990; Henwood, Wyatt, Miller, & Senker, 2000). Technological optimists assume that technology can and will resolve societal problems whenever and wherever it is called upon (Kilbourne, Beckmann, & Thelen, 2002). In general, smart city advocates have a technological optimistic and deterministic stance, while critics will argue that technology can generate bad, unintended consequences as well as positive ones (Krier & Gillette, 1985). They question the assumption that technology and socio-economic

progress are automatically causally related (Henwood et al., 2000). For instance, Clark, Robert, & Hampton (2015) found that the excessive optimism that technology will result in success and the biased belief about the promise of technology can have negative consequences by impacting individual investment decisions, organizational R&D investment decisions, and societal decisions to search for solutions for various problems.

Part of the smart city development, where reduced costs and increased efficiency are key themes, is the increased deployment of smart devices such as mobile phones, monitoring devices and other wireless technologies in the healthcare system (Solanas et al., 2014). Developments such as an ageing population, the rising number of patients with chronic diseases and the simultaneously decreasing workforce and number of healthcare professionals will place a great burden on the healthcare system (Alpay et al., 2010). A different and smarter approach to providing professional care is required, thereby changing the way healthcare is delivered and stimulating the progression towards a smart health system. This smarter healthcare system can be built on and within the infrastructure and context of the smart city (Solanas et al., 2014).

An evolution in the smart health domain is the development and implementation of wearable technologies. Wearable technologies could be deployed in a preventive care strategy in two ways: as a tool for stimulating a healthier lifestyle and as monitoring device to enhance rehabilitation after care has been provided (Vesnic-Alujevic et al., 2016). They can thus contribute to a healthcare system that is based on prevention instead of curing diseases. These 'wearables' are devices, often worn on the wrist or in the pocket, that acquire specific data about the wearer and its surroundings, and translate this data into health-related information for the user and, if desired, for friends, family and healthcare professionals (Patel, Asch, & Volpp, 2015). The use of wearables could enable a quicker response to health-related problems, allow people to monitor their own health, encourage them to adapt their behaviour, and help hospitals save resources and cut costs. Wearables can also be used for personal tracking, measuring various aspects of daily life with the help of technology. Among other variables, consumers can record their travel distance, quality of sleep and calories burned during the day (Livescience, 2015).

Producers of smart wearables promise their customers a happier and healthier life. Statements claiming that wearables will make a change for the better in one's health, unlock one's potential, and show what life makes worth living are not uncommon (Cass, 2015). The popularity of wearables is obvious, given the fact that the market for wearable technology is rapidly growing, generating a 35% increase in revenues between 2013 and 2014, and topping $20 billion in 2015 (Gilmore, 2015; Harrop, Hayward, Das, & Holland, 2015). On the other hand, research by Ledger & McCaffrey (2014) shows that one third of U.S. consumers have stopped using an activity tracker within six months of receiving it, and eventually more than half has stopped using it altogether. Apparently, wearables do not necessarily live up to the promises and expectations that were initially attributed to them.

Wearable technologies can motivate users to lose weight, be more active, and improve their overall health by setting numerical, quantifiable goals (Gilmore, 2015). However, these structures hinge on the generic definition of healthy behaviour as defined by the tech industry, meaning that a user is constantly monitored and judged by the standards of a third party. As Cass (2015) strikingly formulates: "They [the tech industry] assume that medical advice from a 24-year-old with a degree in computer science and recreational interest in, say, nutrition is appropriate for indiscriminate and broad distribution". There are more reasons for criticizing self-quantification with wearables. Research by Smith et al. (1992) shows that employees who had their performance electronically monitored felt more stressful and reported higher levels of psychological tension, anxiety, depression, anger, health complaints and fatigue. Similar studies show that participants who were electronically monitored demonstrated inferior task performance and satisfaction (Stanton & Barnes-Farrell, 1996; Jeske & Santuzzi, 2015). The effects of constant surveillance and self-quantification by using wearables might thus not be as beneficial as suggested by promises surrounding these technologies.

This research critically investigates the promises and expectations surrounding wearable technologies. From a co-evolutionary perspective, which rests in the observation that technology and society are recurrently related, it has been analysed how wearable technologies are used and what the impacts and implications of the collection of data through such technologies are. To better comprehend this relationship between society and technology and to understand how technology is embedded in society it is essential to investigate how society perceives the technology. It is important to analyse what the technology means for different people, thus what the various interpretations of the technology are. Understanding this 'interpretative flexibility' is valuable for further shaping the design and diffusion of the technology (Pinch & Bijker, 1984). In the case of smart wearable technology the interpretative flexibility will not only be about the technological artefact itself, but also about issues concerning big data. The goal of this research is therefore to not only analyse the interpretative flexibility of the artefact itself, but to analyse the interpretative flexibility of the *practice* as a whole (Shove, Pantzar, & Watson, 2012). To achieve this understanding the following research question is formulated:

What is the interpretative flexibility of smart wearable technology and what are the implications for the social embedding of smart wearable technology?

This research analyses the ways in which wearables become integrated in society at two different levels. Firstly, how users incorporate the technology in daily routines and which meaning they attach to the technology. Secondly, how key practitioners judge the issues and possible pathways of smart wearables. By carefully studying the social aspects of wearable technology through extensive empirical case research using Q methodology and interviews, the call for a better understanding of the human capital side of smart city initiatives has been answered. It contributes to the smart city

literature by exploring the wider social implications of a specific smart city technology (Kitchin, 2014b; Shelton et al., 2015).

The object of analysis is Fitbit's activity tracker, a wearable in the form of a wristband. Fitbit's promise is quite straightforward and in line with the technological optimistic approach: "Find your fit with Fitbit's family of fitness products that help you stay motivated and improve your health by tracking your activity, exercise, food, weight and sleep" (Fitbit, 2015). Being the market leader in wearable wristbands, Fitbit is a widespread technology (Canalys, 2014). This makes it possible to identify and approach different types of users and to perform an elaborate case study. For more information about Fitbit and Fitbit's products see Appendix A.

The research is conducted in the Netherlands. Various healthcare providers and insurance companies in the Netherlands are exploring possibilities for the digitalization of healthcare and increasing the use of wearable technologies (Sprado, 2014). Additionally, the Dutch government has explicitly shown its interest in implementing technological innovations in the healthcare sector, while simultaneously they are criticized for being insufficiently involved with technologies that heavily impact society (Rijksoverheid, 2015; Buitelaar, 2015).

This research is commissioned by the Netherlands Environmental Assessment Agency (PBL). One of the core tasks of PBL is to "identify social issues of importance to environmental, ecological and spatial quality and raise them for discussion" and to "improve the quality of political and administrative decision-making" (PBL, 2015). Concerning smart cities, PBL is exploring the role and meaning of the smart city discourse and pleads for smart urbanism, which is about constant learning, inspiration, measuring, analysing and readjusting (Hajer & Dassen, 2014). Furthermore, they are cautious about the possibility of splintering urbanism. Splintering urbanism is the growing separation between affluent consumers whose wellbeing is desired and sought, and less wealthy consumers who experience the opposite (Graham & Marvin, 2001). PBL is concerned with anticipating and flagging the disruptive effects of technological innovation and determining how policy can adapt to those effects. This research contributes to a better understanding of the role and interpretations of wearable technology and can help formulate policies that are most likely to generate wide acceptance (Barry & Proops, 1999).

This paper is structured as follows. In chapter 2 the theoretical framework used to guide this research will be explained. The methodology section in chapter 3 will be used to describe the research design and the method of data collection and analysis. Thus, it will demonstrate how the research has been performed. The empirical results of the research are presented in chapter 4, followed by the conclusions in chapter 5. Chapter 6 contains the discussion of this research.

2. Theoretical background

This section explains the two strands of literature that have been employed in this research. Shove's interpretation of the practice approach is mobilised to investigate the co-evolution of users and wearable technology (Shove et al., 2012). Pinch & Bijker's social construction of technology (SCOT) theory is used to study the interpretative flexibility of wearable technology and the social embedding of this technology (Pinch & Bijker, 1984). The strengths of these two theories are employed to guide this research.

2.1. Practice theory

The first level of analysis in this research is related to the way in which wearable technologies shape the behavioural routines and health decisions of individual users. There is a large, growing body of literature in different disciplines on consumer behaviour. According to Warde (2005) however, current approaches only provide a partial understanding of consumption. He proposes a fruitful alternative, the *theory of practice,* which explains that consumption is always part of a practice. Practice theory provides better insights in how consumption is socially organized and how it can be analysed. An influential scholar in this field is Giddens, whose structuration theory teaches that human activity and the social structures that shape it are recurrently related. That is, activities or actions are shaped and enabled by structures of rules and meanings, while simultaneously these structures are reproduced and altered in the flow of human action (Shove et al., 2012). Giddens' notion of structuration laid the foundations for modern practice theorists, who argue that we cannot separate individuals from the day-to-day context that they help to create (Brauchler & Postill, 2010).

Despite multiple disagreements among practice theorists, most would agree that a practice is composed of an array of activities (Shatzki, Knorr-Cetina, & Von Savigny, 2011). A practice is "a routinized way in which bodies are moved, objects are handled, subjects are treated, things are described and the world is understood. […] A practice is social, as it is a 'type' of behaving and understanding that appears at different locales and at different points of time and is carried out by different body/minds" (Reckwitz, 2002, p.249).

Although practices are at the centre of analytical attention, the human individual has an important role in practice theory as it is the nexus wherein practices are embedded; the individual is the carrier of many different practices, wherein routinized bodily actions and at the same time mental activities take place (Ibid.). For example, a practice such as 'playing tennis' consists of a routinized set of bodily performances, like running, hitting the ball etc. However, these bodily performances are connected with mental activities, such as emotional tension when you can score a breakpoint, or knowing how to hit the ball to surprise your opponent.

At the same time, human bodies or agents are embedded in the social world. The practice of playing tennis is performed within a structure of rules and regulations (the ball may only bounce once), a specific scoring system with games and sets, different player rankings etcetera. Thus, according to practice theory, the social world is

populated by various social practices, which are carried by agents (Ibid.). Although social practices are a set of routinized activities, they are internally differentiated, which means that different individuals will perform a practice differently. Various empirical studies indicate that there are differences between groups of people in terms of their understanding of a practice, procedures they follow and values they consider important (Warde, 2005).

Shove & Pantzar (2005, p.44.) argue that practice theory is more than just a social theory by stressing that practices "involve the active integration of materials, meanings and forms of competence". These three elements (materials, meanings, competences) are the constitutive elements of a practice and they are subject to change. The element 'materials' refers to the material structures of a practice, the products and technologies that are used. Products (i.e. materials) however, only have value when they are integrated in a practice, where forms of meaning and competences are being attached to it. 'Meanings' refers to the image of the practice and the values and themes that are associated with the practice, while the element 'competences' describes the skills and knowledge that is required to carry out the practice. Above all, what matters is how these elements come together, as the emergence, survival and downfall of practices have to do with assembling and failing links between products (materials), images (meanings) and skills (competences) (Ibid.).

Additionally, innovations in practice are continuous processes that must be reproduced, meaning that people have to take part in the practice. In other words, what a practice really is or what it is becoming, depends partly on who does it and on when, where and how it is done (Ibid.). It is for these reasons that theories of practice can be used to describe dynamic processes of change. In practice theory the heroic individuals, such as entrepreneurial engineers are not the only agents of change. All practitioners are agents of change who combine, relate and organize separate components in novel ways. Essentially, those people that fish, play tennis or use wearables, are the ones who integrate, and in the process transform the elements of which fishing, playing tennis, or using wearables are made (Pantzar & Shove, 2010).

As practice theory is primarily interested in the 'practitioners', the users who participate in a practice, in this research practice theory has been mobilized to study the co-evolution of users and wearable technology. It is crucial to investigate how wearable technology impacts the routines of its users in order to understand how the 'practice of using wearables' takes shape and thus to understand how the practice can evolve. The goal of this research is to also explore the wider social implications of the ways in which users are using wearable technologies and to study how wearables and big data become embedded in healthcare and society in general. Therefore, the Social Construction of Technology (SCOT) has been employed, which highlights the importance of social groups in the process of technological innovation.

2.2. Social construction of technology

As opposed to technological determinists, constructionists do not perceive technological change as an independent phenomenon. Instead, they argue that there is a more

complex, interactive and interdependent relationship between science, technology, economy, politics and culture (Hughes, 1986; Freeman, 1997). Technologies are embedded in a "seamless web" of technical, organizational, legal, political and scientific elements (Hughes, 1987). Lundvall (1988) stresses the importance of users in the innovation process as he argues that consumers tend to become passive beneficiaries or even victims of new technology, instead of taking an active part in the innovation process, which could lead to unsatisfactory innovation. By strengthening the competence and power of final users unsatisfactory innovation might become less frequent. Undoubtedly, the environment heavily influences the designs of technical artefacts, as inventors and engineers will try to incorporate the preferences of users in their products and take into account the limitations of rules and regulations. Thus, technology is socially constructed and society shaping (Hughes, 1987).

An important area in the scholarship of social shaping of technology is the social construction of technology (SCOT), developed by Pinch & Bijker (1984). They argue that as technology design is an open process, depending on social circumstances, different outcomes can be produced. Their multi-directional view acknowledges the importance of unsuccessful stages in the development of a technology, and can be used to show why some variants of a technology survive while others become extinct. The concept of interpretative flexibility is crucial in this framework; not only the way (heterogeneous) actors think of or interpret artefacts is flexible, there is also flexibility in the way artefacts are designed (Ibid.).

That is where the notion of relevant social groups is introduced: "the term is used to denote institutions and organizations […], as well as organized or unorganized groups of individuals. The key requirement is that all members of a certain social group share the same set of meanings, attached to a specific artefact" (Ibid. p.414). What, then, makes a social group relevant? Obviously, the artefact must have a meaning of some sorts for the members of the social group under investigation. However, it is also possible to identify groups that are less obvious. In the case of wearables for instance, one could think of those who are critical about the technology and the collection of big data. Additionally, within a specified social group there might be variations in the meanings given to an artefact. For example, the group 'wearable-users' could be further split into 'moderate-users' and 'extreme-users', each giving a different meaning to the artefact.

Actors in social groups will have a certain degree of inclusion in the technological frame. A technological frame is a fixed pattern of interaction that structures the interaction between actors in a social group. Bijker (2001, p.122) states that: "People with a high degree of inclusion in a technological frame will find it difficult to imagine other ways of dealing with the world, of using these things radically differently or even not using them at all". When actors in social groups have a low level of inclusion, they will have little opportunity to modify an accepted technology, and their rejection of the technology will have little consequence.

The design process continues while it is influenced by the various social groups who experience different problems. However, at some point the design is satisfying for all relevant social groups, as the artefact no longer poses a problem to any of them. The

multigroup process achieves closure and the artefact stabilizes in its final form (Klein & Kleinman, 2002). Two closure mechanisms can be identified: rhetorical closure, when a consensus is reached that all problems are resolved and that no additional design adjustments are necessary, and closure by redefinition, when unresolved problems are redefined after which the social groups no longer experience a problem (Ibid.). Closure and stabilization is a process that can be reached because of design changes, but also due to changing preferences of relevant social groups.

2.3. Combining Practice theory & SCOT

The SCOT approach has positively contributed to understanding technological development by providing a consistent methodology for studying technology design and it reveals the various social forces that influence and shape the life-course of a technology (Prell, 2009). Additionally, it offers clear guidelines for performing case studies of technological innovation (Winner, 1993). However, it has largely remained committed to an agency-centred approach and thereby fails to illuminate how new technologies become part of social structures and how the development of technology is influenced by social structures (Klein & Kleinman, 2002). Although Bijker (1995) addresses this issue by introducing the semiotics perspective into his work, this expansion is criticized for being limited to the linguistic aspect of semiotics (referred to as 'semiology') and still does not deal with materiality, the semiotics of objects (Knappett, 2011, p.76). Additionally, the snowball sampling proposed by Bijker (1995) is inadequate for fully comprehending the scope of social groups and social structures. The notion of 'closure' is also criticized, as it is unclear why and how a stabilized artefact is sustained over time (Klein & Kleinman, 2002).

Practice theory can be used to remove some of the shortcomings of SCOT. Shove et al. (2012) state that practices evolve, and that in the process the competences and materials change. Therefore, they argue, practices are only temporarily stabilized when constitutive elements are consistently integrated through repeated similar performances. Practice theory thus acknowledges the notion of stabilization but treats it differently. The role of social structures is also more apparent in practice theory, as practice theory emphasizes sociotechnical structures as the basis for analysing consumer practices and opportunities for change (Shove, 2014). A limitation of practice theory however, is that it mainly focuses on users and thereby neglects to investigate different actors that are not users of technology, but do impact its development. Additionally, Watson (2012) argues that practice theory has a limited ability to move beyond a micro-level focus on doing things, which reduces its usefulness for understanding socio-technical processes.

In this research practice theory has been used alongside SCOT, with both theories complementing each other. The SCOT approach provides a consistent approach for performing socio-technical research, it recognizes that there are various relevant social groups and it employs the useful notion of interpretative flexibility. Practice theory on the other hand has been employed to better understand how a technology is integrated into daily life through analysing the constitutive elements of the accompanying practice.

The main concepts of these two theories that are used in this research are summarized in table 1.

Table 1: Main theoretical concepts

Practice theory		Social Construction of Technology	
Practice	A routinized way in which bodies are moved, objects are handled, subjects are treated, things are described and the world is understood	*Relevant social group*	Members of a certain social group share the same set of meanings attached to a specific artefact
Materials	The material structures of a practice, the products and technologies that are used	*Interpretative flexibility*	There is flexibility in the way actors think of and interpret artefacts
Meanings	The image of the practice and the values and themes that are associated with the practice	*Closure*	The design of the artefact is satisfying for all relevant social groups, as the artefact no longer poses a problem to any of them
Competences	The skills and knowledge that is required to carry out the practice		

2.4. Conceptual model

SCOT research is usually concerned with analysing how the relevant social groups interpret a certain artefact. The goal of this research is slightly different, in the sense that in this research the analysis is not on the interpretative flexibility of the artefact, but on the interpretative flexibility of the *practice* as a whole. Thus, this research reveals how the practice of smart wearable technology is interpreted and perceived by the different social groups. It shows which elements of the practice are satisfactory for the different social groups, which elements are still under discussion, and what the obstacles are before (temporary) closure can be achieved. The conceptual model (figure 1) broadly visualizes how the main themes of the two theories have been used alongside in this research. Different social groups have different perspectives, different interpretations, about the practice. Only when the design of the *practice* is satisfactory for all groups, (temporary) closure can be achieved.

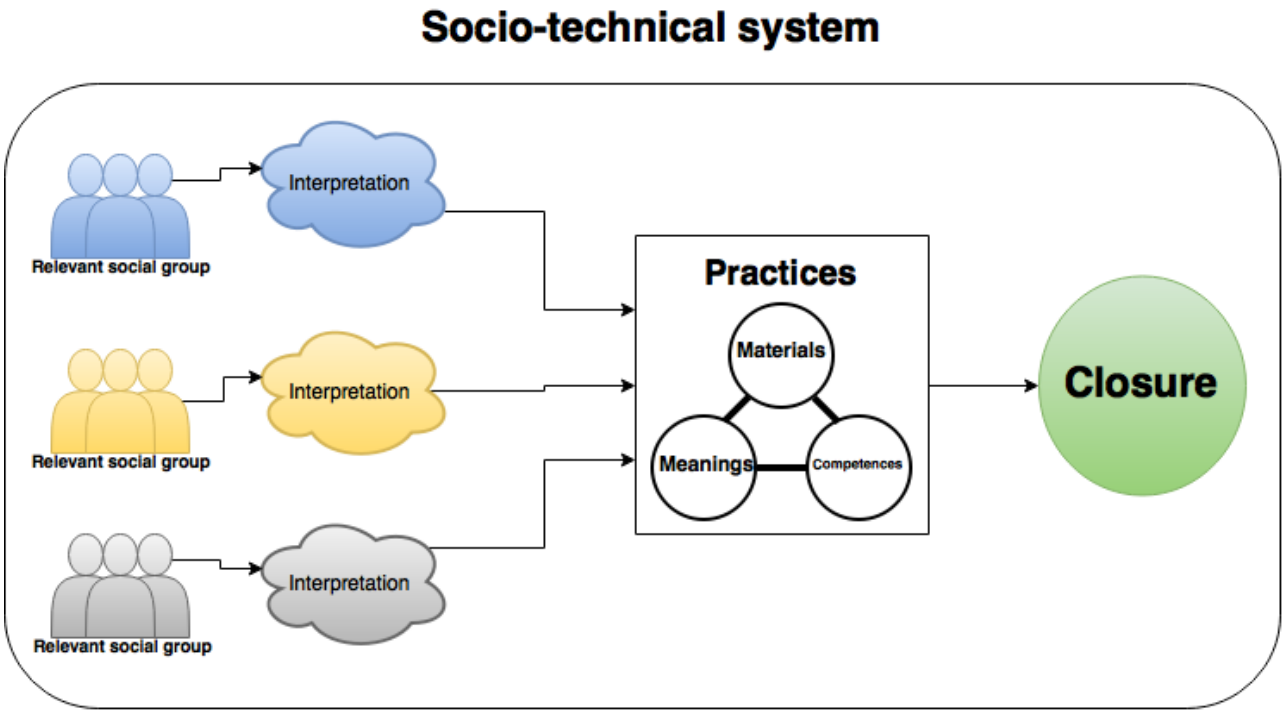

Figure 1: Conceptual Model

3. Methodology

In this section the methods used to guide this research are presented. It is also explains and justifies the methodological choices.

3.1. Research design

As mentioned earlier, the aim of this explorative research was to gather insights in how wearable technology is used and how it impacts society and to thereby provide directions for future research. The theories explained in the previous chapter were used to guide the research. The concepts from practice theory (materials, meanings, competences) were used to provide guidance for approaching the bulk of empirical data, thereby functioning as a starting point for the qualitative study. Reckwitz (2012) explains that practice theory has not offered a theoretical 'system' but should be understood as a heuristic device that opens up a certain way of seeing and analysing social phenomena. Similarly, SCOT is not perceived as a fixed theory but rather as a conceptual framework that structures the overall approach. It provides researchers with a set of heuristics, which can be employed to study technological development (Bijker, 1995).

In this research the 'practice of wearable technology' was the unit of analysis. An elaborate case study was conducted where the object under investigation was Fitbit's activity tracker, a wearable in the form of a wristband. However, as continuously stressed by Shove & Pantzar (2010), it is of great importance that, when studying innovations, to not analyse the products but what people do. Therefore, while the activity tracker was the object under study, the technology itself is only part of the 'practice of using wearables'. It was essential to collect detailed data about this practice to understand why people do what they do and how do they do those things in the way they do in order to investigate how the practice emerges and evolves (Shove et al., 2012). It was expected that various actors would have different viewpoints about the characteristics, competences and meanings concerning the technology. To gain insight in the dynamics of the practice and to systematically analyse how the different actors perceive, experience and interpret the situation a combined qualitative and quantitative research strategy was chosen. A specific mixed methods research design, which will be further explained in the next section, was employed in this research.

3.2. Data collection

In this research different types of data were required. Firstly, it was essential to understand how the 'practice of wearable technology' takes shape. Important to note is that practices consist of both doings and sayings. Warde (2005) therefore suggests that analysis must be concerned with both practical activity and its representations. Thus, it was required to gather data about how people perceive and use wearables, the meanings they attach to them, what kind of skills and competences they need to use them and the importance of the materials itself, the physical characteristics of the Fitbit.

The next step was to understand what the implications of these viewpoints are for the social embedding of wearables. To explore these implications it was necessary to

speak with various relevant practitioners in the Dutch health care system. For these two different research stages two methods of data collection are employed: Q methodology with its accompanying procedures and semi-structured interviews.

3.2.1. Q methodology

Q methodology, initially introduced by the psychologist Stephenson, is useful for examining the relationship between social phenomena and subjective interpretation (values, opinions and meanings) (Robbins & Krueger, 2000). "Q methodology is a qualitative but statistical approach that enables discovery of a variety of discourses concerning how individuals understand their behaviour, and how they understand the social and environmental worlds in which they live" (Barry & Proops, 1999, p.337). Q methodology focuses on the range of viewpoints that are favoured or shared by specific groups of participants (Watts & Stenner, 2005). It pursues constructions and representations of a social kind (Moscovici, 1981). In Q methodology the respondents are the variables and the items are the cases, which means that the researcher examines the traits of a single person, instead of matching traits across individuals (Robbins & Krueger, 2000). Q methodology has often been used in researches to measure attitudes towards various issues, particularly in the field of healthcare, and public opinion about varying topics (Cross, 2005; Webler, Tuler, & Krueger, 2001).

Several researchers recommend Q methodology due to its potential of combining qualitative and quantitative research. Q methodology shares many of the focuses of qualitative research, such as building theory, developing meaning, and discovering and understanding perspectives held by a person or groups of people (Newman & Ramlo, 2010). Simultaneously, Q methodology utilizes the type of statistical analyses typically found in quantitative studies to make these discoveries, which ensures the relationship among themes within the data by minimizing the impact of the researcher's frame of reference (Ramlo & Neman, 2011; Stainton Rogers, 1995). Important to note is that Q-methodology is primarily an exploratory technique and thus cannot prove hypotheses. However it has the potential to bring a sense of coherence to research questions that may have complex and socially contested answers (Stenner, Dancey, & Watts, 2000).

There are various reasons for using Q methodology in this specific research. Newman & Ramlo (2010, p.508) state that Q methodology "allows researchers to investigate research questions that involve determining the various views within a group about a specific topic, as well as using those views to investigate how they affect some other aspect of the study". The main objective of this part of the research was to understand how people perceive and interpret the 'practice of wearable technology', or more specifically the practice of Fitbit, what the different viewpoints about this topic are, and how the different groups can be described. This methodology could be employed to structurally identify and characterize groups of people who share the same viewpoints about Fitbit. Pinch & Bijker (1984) argue that people who share a similar interpretation belong to the same social group. In this research Q methodology was thus employed to identify these social groups.

3.2.2. Application of Q methodology

In the first part of this research Q methodology was used to identify groups of respondents with the same viewpoints. These respondents were all users of Fitbit. Firstly, a Q set was developed. The Q set is a collection of statements, which is broadly representative for the discourse about the subject under investigation (Watts & Stenner, 2005). This means that the various discussions about the subject are incorporated in the set. The statements used in this research are about the materials, meanings and competences of Fitbit, thus about the constitutive elements of the practice. Ideally, a Q set consists of 40 to 80 statements, but is also dependent on the subject matter itself (Ibid.). The statements in the Q set can be acquired from various sources. In this research they were elicited from literary and popular texts, such as magazines and newspaper articles, and online forums and blogs (Ibid.).

As this research was conducted in the Netherlands, only articles from Dutch national newspapers and magazines in the LexisNexis database were used. All articles written in 2014 and 2015 with search term 'Fitbit', yielding 65 results, have been analysed through a sentence-by-sentence open coding process, as it ensures the identification and verification of categories and reduces the risk of overseeing an essential category or becoming too focused on specific issues (Holton, 2010). Additionally, forums and blogs have been analysed to ensure that the set was representative for the opinion domain of Fitbit.

This process resulted in the first draft of the Q set, which consisted of 80 statements. By discussing the statements in the Q set with three domain experts, who also had in-depth knowledge of the research goals and methods employed in this research, the Q set was reduced to 59 statements. Finally, I tested the modified Q set by performing three pilot interviews with independent outsiders, which caused a further narrowing down of the Q set. This process of discussing and piloting enabled the removal of redundant items and ambiguous wording while ensuring that the set still covered the whole discourse. The definitive Q set consisted of 50 statements. All of these statements were allocated to a certain category. These categories were formed during the previously described analysis of popular texts. Subsequently, each of the categories was assigned to one of the three constitutive elements of the practice. Thus, ultimately every statement was assigned to a specific category and to a specific element. The developed categories are: healthcare, healthier lifestyle, motivation, fun, overall wellbeing, sharing of data, product characteristics, utilizing Fitbit, and required competences. The list of statements, including the category and element they belong to, can be found in Appendix B.

The next step of Q methodology is called the Q sort. During the Q sort respondents rank-order the various statements about the subject, based on their preference, feeling or judgement about them, using a score sheet that ranges from 'most disagree' on the left to 'most agree' on the right (Van Exel & de Graaf, 2005). There is not a specific guideline for the shape of this score sheet, and the shape thus varies between different Q-studies (Brown, 1971; Peter, Visser, & de Jong, 2008). Typically, the shape roughly resembles the shape of a normal distribution and is designed arbitrarily to

accommodate the number of statements in the Q set; hence this shape is referred to as a 'quasi-normal distribution' (Addams, 2000). In this research a quasi-normal distribution is used, which forced the respondents to carefully arrange the statements, as they only had limited space for the exterior positions (see figure 2).

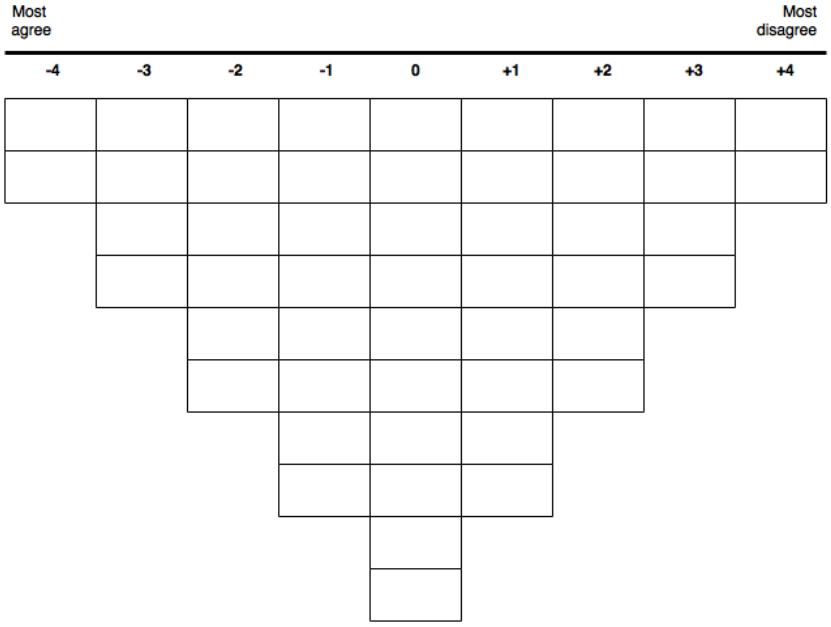

Figure 2: Quasi-normal distribution Q sort consisting of 50 statements

A purposive sampling strategy was used to obtain the data. This ensured that the selected interviewees were relevant and contributed to answering the research question (Bryman, 2008). The shared characteristic of these respondents that makes them theoretically relevant for this research is that they are Fitbit users, and thus that they have a clear opinion regarding the subject matter, based on experience (van Exel & de Graaf, 2005). A prerequisite of Q methodology is that the P set, the set of respondents, is as varied as possible so that the respondents are potentially representative for the various issues under study (Shabila et al., 2014). Therefore, respondents from different backgrounds and with varying profiles were selected. Men and women from different age groups, with varying levels of education, employment in different lines of work and from various geographical areas in the Netherlands were recruited to participate in this study.

Additionally, it was ensured that the respondents had varying reasons for using Fitbit by approaching them through different channels. Some respondents were approached via their employer as they had received Fitbit from their employer. Others were approached through Fitbit's online community, where people regularly participate in challenges and competitions. Health forums were used to approach people who employ Fitbit for health related purposes. Some respondents were approached individually, as they had wrote a blog or review about their experiences with Fitbit. Finally, a number of respondents were recruited through personal channels.

Q methodology does not require large numbers of participants (Watts & Stenner, 2005). Generally, the aim in Q methodology is to have four or five persons defining each

viewpoint or interpretation. According to van Exel & de Graaf (2005) there are usually two to four viewpoints on a certain subject, and rarely more than six. Thus, ideally the size of the P set should be between 8 and 30 respondents. In this research the P set consisted of 25 respondents, whose identities will remain confidential.

The final statements were all printed on separate, numbered cards and presented to the respondents. Initially, the respondents were asked to read all the statements and arrange them in three piles: disagree, neutral, and agree. Then they were asked to take the 'disagree' pile and assign the statements to the positions in the disagree section of the sorting grid. The process continued with assigning the statements of the 'agree' pile, and finally those of the 'neutral' pile. When all statements fitted in the distribution the respondent was asked to critically review whether the arrangement represented their opinion and if they needed to make amendments.

The respondents were requested to think out loud during the whole Q sort process. Additionally, they were questioned about their reasons for this specific distribution and how their opinion on this topic had been formed. The Q sort provided focus to the interview by demonstrating which topics in the Q set were most relevant to discuss (Brown, 1993). Obviously, it was interesting to elaborate on those statements that were ranked highest and lowest, but it could also be valuable to discuss those scored more neutrally, as there could be unexpected reasons for the apparent neutrality of these statements. Altogether, the respondent could elaborate on his or her point of view, thereby providing a better understanding of the rationale behind his or her choices (Peter et al., 2008). This whole process of sorting and discussing took approximately 45 minutes to complete. The conversations were recorded and summarized.

3.3. Data analysis

3.3.1. Analysis Q methodology

Q methodology is composed of two aspects, which are applied in combination: the previously described Q sort and the Q technique factor analysis (Watts & Stenner, 2005). A special free software package that is developed for conducting Q methodology, called PQMethod, was used to perform this analysis.

Every respondent's Q sort was entered into the software program. All 25 Q sorts were correlated, using a Pearson's r correlation. This resulted in a 25x25 correlation matrix that showed the degree of correspondence between respondents (Peter et al., 2008). Important to understand is that not the variables (the statements), but the respondents were correlated. In other words, this correlation provided information about the level of difference or similarity in how the respondents arranged their Q sorts (Van Exel & de Graaf, 2005).

The correlation matrix was subjected to a centroid factor analysis. This analysis revealed "factors that represent points of view and internally coherent schemes of relational claims about the domain" (Robbins & Krueger, 2000, p.639). The next step in Q methodology is to perform factor rotation, as rotated factors are more useful for scientific purposes than the unrotated factors, which only consist of "raw materials"

(Brown, 1993). In this research a varimax factor rotation was performed because it is reliable and automatically reveals the most mathematically informative solution (Watts & Stenner, 2005). Thus, the objective of the factor analysis was to find groups of respondents that represent a similar point of view. If the analysis reveals significant factors, it is likely that individuals within that factor share some sort of common viewpoint. These factors of people with the same viewpoint are operant, meaning that the categories are formed during the process, and are not imposed by the investigator (Stephenson, 1977).

The software program only extracts factors that have an eigenvalue higher than 1.00. According to Watts & Stenner (2005), this is a means of safeguarding the reliability of factors. Any factor with an eigenvalue lower than this amount is of too little interest, as it will not explain more of the overall study variance than any single Q sort will do. For similar reasons, all factors must consist of at least two pure loadings. Pure loadings are respondents who only load significantly on that specific factor. Factor loadings of 0.45 and higher are considered significant in this study (Brown, 1993).

In Q methodology a factor is a certain perspective, a certain vantage point about the research subject. In other words, every factor is an interpretation. As explained earlier, people who share a similar interpretation belong to the same social group (Pinch & Bijker, 1984). In this research Q methodology was thus employed to identify these social groups. The different social groups, with corresponding interpretations, can be described in terms of their representative sort and characterizing statements. The representative sort is created from the Q sorts of those who belong to that social group and represents the view of these respondents. This representative sort is a list of all the statements, in rank order of most positive to most negative (Newman & Ramlo, 2010). Characterizing statements are those statements that are placed on the most outwards positions of that factor's sorting grid (Paige, 2015). Thus, in this research the statements with scores of +4, +3, -3 and -4 are characterizing statements, and were used to enable the labelling of each social group. After completing the Q method it was possible to identify the different perspectives, the different interpretations of Fitbit in the Dutch society, based on a small sample. In table 2 an overview is provided of the main concepts of Q methodology.

Table 2: Overview of main concepts Q methodology

Q set	Set of statements that is representative for the issue domain
P set	Set of research participants that are relevant for the research subject
Q sort	A rank-order of the Q set in the quasi-normal distribution
Characterizing statements	Statements that are placed on the most outwards positions of that factor's sorting grid
Representative statements	A list of all the statements, in rank order of most positive to most negative, representing the view of that factor

3.3.2. Interviews with key practitioners

After analysing the results of the Q method, various key practitioners who hold different positions in the Dutch healthcare system were interviewed. It was expected that these key practitioners had different views about wearable technology, as they had different experiences and positions in the healthcare system. By questioning them about issues they had encountered in their work, it was possible to identify the potential problems that will arise when wearable technologies are actively embedded in the social system.

Additionally, the results of the Q method were presented and discussed with these practitioners. They were asked about the implications of the existence of different social groups with different interpretations. Subsequently they were asked to think about coping with these differences. By discussing the results and identifying potential issues these interviews aided the exploration of how wearable technology could be embedded in the social system and in the Dutch healthcare system.

The in-depth interviews were conducted in a semi-structured way and were guided by discussing several topics: (1) background and activities concerning wearables in their work, (2) their overall perception of wearables, (3) the position of wearables in the healthcare system, (4) discussing analytical results Q method, (5) other experienced and expected issues concerning wearable technology. See Appendix C for a more elaborate interview script. This interview script was used as a guide to structure the interviews; possible follow-up questions were based on the answers of the interviewees and were not incorporated in this script. The following practitioners have been interviewed:

- Health insurer - Program manager health care innovation at a large health insurance company
- Leadership professional in healthcare - Consultant who improves and optimizes various healthcare organizations
- Healthcare professional – Developer of innovative solutions for healthcare problems
- Vitality program developer – Coach who aids people to improve their lifestyle
- Smart health researcher – Expert in the smart health domain who conducts researches in this area of expertise

Important to note is that these interviews are not representative for the entire domain. However, the various issues that the practitioners identify and the ways that they deal with these issues helps to explore the possibilities for embedding wearables in society. The interviews took approximately 45 minutes on average and were recorded, transcribed and coded to enable a thorough analysis of the data. They were anonymised to prevent the interviewees' identity to be connected to sensitive information.

4. Results

In this section the results obtained in this research are presented. First the results from the Q study are presented and explained, thereby demonstrating the interpretative flexibility of the practice of smart wearable technology. Then an overview of the interviews with key practitioners is provided, which examines the issues and pathways for the social embedding of wearables.

4.1. Results Q-method

The findings of the Q study are presented and explained. The procedures employed for the Q analysis are described in section 3.3, which also explains the methodological considerations and justifications. Firstly, the statistic characteristics of the three social groups are discussed briefly. Secondly, the interpretation of the three social groups is presented by evaluating each group individually. The results of the Q study will be further supplemented by using illustrative quotes and comments of respondents.

4.1.1. Factor analysis

The Q factor analysis yielded three dominant factors. Respondents who score high on the same factor belong to the same social group. This means that respondents within a social group have a similar interpretation about the 'practice of wearable technology'. Table 3 shows how much each respondent scores on each of the three social groups. Higher scores represent a higher affiliation with that social group. Boldfaced scores are significant (>0.45), meaning that these respondents exemplify the shared value pattern that is characteristic for that specific social group (Watts & Stenner, 2005). The four respondents who do not have significant scores or who score significantly on two social groups are not accounted for in the statistic results of the Q analysis (Valenta & Wigger, 1997).

Table 3: Matrix of scores

	Social group		
Respondents	**1**	**2**	**3**
1	0.1733	0.1911	**0.7950**
2	**0.5908**	0.0681	0.1622
3	**0.7650**	0.0378	0.2025
4	0.3801	0.1298	**0.6118**
5	0.5152	0.4456	0.2856
6	0.4419	0.2368	0.1717
7	**0.5519**	0.3627	0.3988
8	**0.5151**	0.2346	0.2990
9	0.2992	**0.6287**	0.1458
10	0.5379	0.5941	0.2594
11	-0.1681	**0.7321**	0.3108
12	0.0558	0.2692	**0.4994**
13	**0.5014**	-0.0043	0.3011
14	0.3631	-0.1308	**0.7132**

15	0.4384	**0.4871**	0.1106
16	**0.6311**	0.1903	0.2922
17	**0.6791**	0.3969	0.2601
18	**0.7310**	-0.0938	-0.0347
19	**0.6767**	0.2777	0.2159
20	0.1277	0.1021	0.2239
21	**0.5393**	0.2280	0.4379
22	0.2874	**0.5648**	0.3856
23	0.1258	**0.7609**	-0.0962
24	0.2164	0.2964	**0.5566**
25	0.4349	0.1041	**0.5470**

4.1.2. Differences and similarities

There are similarities between the interpretations of the three social groups but there are also some key differences. In table 4 these differences and similarities are presented. The topics are based on the different categories to which the statements were originally assigned (appendix B). However, the Q analysis revealed that these original categories could not sufficiently explain the differences and similarities between the social groups, and they are therefore fine-tuned to better illustrate these differences and similarities. The topics that are extremely important for at least one of the social groups are incorporated in the table. The ratings in the table are based on the representative sort of each group, the list of all statements in rank order of most positive to most negative.

Table 4: Overview of the main differences and similarities

Topic	**Social group**		
	1	**2**	**3**
Fitbit is used daily	+++	++	+++
Data must be secured well	+++	++	-
Data can be used by strangers	---	---	0
Data is shared to compete with friends	--	+++	++
Fitbit is motivating	++	+++	+
Fitbit is fun	++	+	+
Fitbit is stressful	--	-	---
Fitbit has health care potential	--	+++	-

Table 4 shows that the three social groups have some similar opinions. All of them use Fitbit every day, implying that it is a technology that is firmly embedded in their daily

routines. They also agree, on a certain level, on the fact that Fitbit is fun to use and that it motivates them to exercise more often. None of the social groups feel stress when they use Fitbit.

However, there are also some distinct differences. The three social groups primarily differ on three dimensions. There is disagreement about the level of data privacy and security. While for social group 1 and 2 it is essential that data is secured and private, social group 3 does not regard this as an important issue. Another dispute is whether the technology is used individually or socially. Social group one primarily uses Fitbit to monitor their own activity. Social group 3 and social group 2 share their data with friends and often challenge other people. They enjoy the competitive, social aspect of Fitbit. Furthermore, there is an argument between those that are convinced of the health care potential of wearables and those that primarily perceive it as a gadget. Especially social group 2 believes that Fitbit can be employed for health care related purposes.

4.1.3. Interpretative flexibility

For each social group the characterizing statements are presented and discussed. These characterizing statements are the statements that are rated most negatively and most positively by that social group. Thus, these statements reveal the dominant value pattern of each social group.

Social group 1: Privacy protectors

The interpretation of social group 1 can be summarized as follows:

It is crucial that Fitbit data remains private. Fitbit is primarily a fun, personal tool that can stimulate the user to exercise more often.

The characterizing statements of interpretation 1 are presented in table 5, where the statement's position in the sorting grid (+4, +3, -4, -3) and the statement number (ranging from 1 to 50) are displayed in brackets.

Table 5: Characterizing statements interpretation 1

Positively rated statements	Negatively rated statements
I use Fitbit every day (+4, 41)	Insurances may be adjusted based on Fitbit data (-4, 33)
I primarily use Fitbit for measuring activity (+4, 38)	Firms are allowed to use Fitbit data for commercial purposes (-4, 32)
Fitbit helps me to exercise more (+3, 10)	Employers are allowed to see all my Fitbit data (-3, 30)
Using Fitbit is fun (+3, 19)	I can become stressed by using Fitbit (-3, 24)

Fitbit is easy to use (+3, 46)	I only use Fitbit during sporting activities (-3, 42)
My Fitbit data has to be secured well (+3, 27)	Using Fitbit will help me decrease my healthcare costs (-3, 5)

This interpretation is characterized by a clear opinion about data: it has to stay private. The three most negatively rated statements [33, 32, 30] are all about third party data usage. Employers, insurance companies and other interested firms are not permitted to observe Fitbit data, let alone be able to gain control over the data and use it for their own purposes. Therefore, it is important that Fitbit data remains private and is secured well [27]. Respondents within this social group are very outspoken about the data issues:

"No personal data whatsoever may be used for any other purpose than for my own understanding. It is private data; I'm using the technology purely for my own benefit, that's it." (Respondent 19)

"Perhaps people will jump to conclusions when they see my data. I would definitely not want that." (Respondent 18)

"Even though I do not think that Fitbit data would be very interesting for anyone, it is private, and I can't imagine someone doing positive things with it." (Respondent 2)

There are varying reasons for this reluctance towards data sharing and third party data usage. Some respondents doubt whether Fitbit's measurements are accurate and reliable enough to attach certain consequences to the produced data. They argue that it is impossible to, for example, assess someone's health with this kind of data. It would be rudimentary if third parties would use inaccurate data to make decisions with possible profound consequences. Others voiced their concerns about the interpretability of data, which is seen as extremely subjective in nature. It is crucial to understand why the data looks the way it does, implying that every case has to be evaluated individually before any conclusions, based on data, can be made. The respondents do not believe that this will be done correctly. A third objection to the openness of data is based on the argument of restricted liberty and exclusion. One of the respondents describes it as follows:

"*Health is something that can partly be influenced, but for a large part it is something that you inherit. It would mean that certain people are excluded from society. I would absolutely oppose that." (Respondent 17)*

Thus, the concern is that the data produced by wearables would be shared with and utilized by other parties, who could use this data to place people in a certain category. Assessing people based on Fitbit data is perceived as undesirable in this social group.

The arguments for not wanting to share data are also used to support the opinion within this social group about the role of wearables in healthcare. Due to the lack of accuracy, the subjectivity of (health-related) data interpretation, and the (unjust) social exclusion of people labelled as 'unhealthy', this technology is perceived as inadequate for being used for healthcare purposes. Respondents in this social group believe that it will not help to achieve reduction in healthcare costs [5], as it does not measure enough variables to conclude anything about health-related issues, it will not help to detect health problems earlier and it doesn't sufficiently inform the user about his or her health. The only way that it could possibly be deployed is if the data would be monitored over a long period of time in order to spot certain patterns, but even then it would be very difficult to attach meaning to these patterns. Thus the respondents in this social group do not believe that a wearable technology like Fitbit can play a significant role in healthcare.

However, interpretation 1 is definitely not only characterized by negative opinions about Fitbit. Fitbit is a technology that is firmly embedded in the respondents' daily routines, given the fact that they use Fitbit every day, not only during sporting activities but throughout the whole day [41, 42]. It is also apparent for what purpose people in this social group use Fitbit on a daily basis: to motivate themselves to exercise more in a way that is fun and stress-free [10, 19, 24, 38]. By showing the user how active he or she has been the user becomes more aware of their (lack of) movement, thereby constantly reminding him or her to move more. In addition, the respondents feel that Fitbit provides a positive incentive to be more active by enabling and encouraging the user to achieve certain goals.

Even though the respondents in this social group are rather critical about the trustworthiness and accuracy of Fitbit data, it is still a technology that is firmly embedded in daily life. One of the respondents accurately formulates why this is the case:

"A lot of people like to compare different technologies and different datasets. I only use Fitbit for myself so it does not really matter. What Fitbit says is the truth for me."
(Respondent 21)

This quote illustrates that this social group interprets Fitbit as a personal, motivating tool. There is no point in sharing the data with others because Fitbit is mainly used to get a global understanding of the user's activity pattern.

Social group 2: Competitive health fanatics

The following label summarizes the interpretation of social group 2:

Fitbit is a meaningful technology that produces meaningful data and raises awareness about health issues. The competitive element is a huge trigger to adopt a healthier lifestyle and this technology is therefore suitable for being used for healthcare purposes.

The characterizing statements of interpretation 2 are shown in table 6. On first sight there appear to be quite some similarities with interpretation 1. Especially the reluctant stance towards data sharing seems rather familiar. However, when looking closely at the data it becomes evident that there is a different reasoning behind this opinion. While interpretation 1 mainly opposes the idea of private data being used or seen by others *in general*, interpretation 2 has more complicated underlying motives for their rating of statements about data privacy and security [27, 30 31, 32]. These motives are explained later; first it is important to understand how this social group perceives the relationship between health and Fitbit.

Table 6: Characterizing statements interpretation 2

Positively rated statements	**Negatively rated statements**
Fitbit helps me to exercise more (+3, 10)	Firms are allowed to use Fitbit data for commercial purposes (-4, 32)
Competition with others helps me to exercise more (+4, 12)	The human body is too complex for private digital monitoring (-4, 3)
Without reward I exercise less (+3, 14)	Employers are allowed to see all my Fitbit data (-3, 30)
Fitbit can be deployed as a preventive device to remain healthy (+3, 2)	Fitbit is primarily a toy (-3, 18)
My Fitbit data has to be secured well (+3, 27)	Fitbit data can be overwhelming (-3, 25)
Insurances may be adjusted based on Fitbit data (+3, 33)	It is not a problem that strangers can see my activity- and sleeping pattern (-3, 31)

Respondents in this social group do not believe that Fitbit is just a nice gadget that should solely be used for fun [18]. On the contrary, it is a very serious tool that can be beneficial for one's health.

"Fitbit is not a toy. I use it in a serious way, and I can see that the results are serious as well." (Respondent 23)

Furthermore, respondents have a very clear viewpoint on the health-related opportunities that Fitbit can provide. They absolutely disagree with the statement that the human body is too complex for private digital monitoring [3]. On the contrary, the dominant opinion in this social group is that by measuring certain variables at home you can perfectly capture the functioning of the human body. This implies that wearable technology can be employed in various situations to monitor people from a distance. For instance, patients who regularly visit their therapist for check-ups would be able to do their own check-ups more often, thereby decreasing the number of times they would

need to see their therapist. This would increase efficiency and decrease healthcare costs, both for the patient and for society in general.

Another related viewpoint is that Fitbit can contribute to remaining healthy longer [2]. The respondents in this social group are advocates of preventive care strategies, wherein wearables such as Fitbit can play an important role. One of the respondents, a Fitbit user, who is also the director of a health care provider, argues that:

"In the long run, for an entire population, the use of wearables will definitely help to reduce costs." (Respondent 11)

This line of thought could be a plausible explanation for the fact that this social group agrees with the statement that suggests that insurances can be adapted based on Fitbit data [33]. Respondents believe that the benefits could be substantial, as people are encouraged to adopt a more active and healthy lifestyle if they would receive significant discounts on their health insurance. An important disclaimer however, is that insurances may only be decreased to award active or healthy people; increasing insurance premiums for unhealthy or inactive people would not be appreciated. The respondents in favour of insurance adjustments did acknowledge that it would be a challenging endeavour to realise this, especially in the Dutch welfare state that is based on the principle of social solidarity. They also doubt whether the reliability of the measurements is high enough and they recognize that wearable data is susceptible to fraud.

It was previously demonstrated that respondents in this social group are rather protective about their data. It is also evident that they perceive Fitbit as a serious, health-related technology. This explains why privacy, data protection and data security are such big issues in this social group: people believe that the produced data is very valuable, and that it is possible to attach meaning and consequences to this data. The technology is deemed valuable because it will contribute to lower healthcare costs and a healthier society in general.

The key to achieving this healthier lifestyle is reflected in the positively rated characterizing statements: by increasing activity through competition and reward [10, 12, 14]. The stories told by respondents in this social group capture the imagination:

"I started jumping in front of the television, or found myself walking circles around the table, simply to achieve my goals. I just couldn't go to sleep before all the lights on my bracelet were on." (Respondent 10)

"My husband was looking at me in confusion when I was walking around the house to beat my mother. Now he owns a Fitbit himself… and guess what? It is extremely motivating." (Respondent 9)

"Competition is so much fun! I don't really like team sports and I prefer to walk alone. But because I can see what others are doing I just have to take more steps. People are

programmed to try harder when they compete with others, and it really helps to move more." (Respondent 23)

The focus on competition with others stresses the importance of the connection with social media channels and online communities. Respondents declare that without this stimulus, Fitbit would not be as effective as it is now.

Social group 3: Gadgetheads

The interpretation of social group 3 can be labelled as follows:

Fitbit is an extremely user-friendly gadget, which is used to gain insight in daily activities. It is not necessary to go to great lengths to ensure data privacy, mainly because the data produced by this gadget is not really interesting.

The first notable pattern in the characterizing statements of interpretation 3, presented in table 7, is that the statements about ease of use [46, 47] and daily use [44, 41] are rated very high on the positive exterior.

Table 7: Characterizing statements interpretation 3

Positively rated statements	Negatively rated statements
I wear my Fitbit bracelet day and night (+4, 44)	I can become stressed by using Fitbit (-4, 24)
Fitbit is easy to use (+4, 46)	I primarily use Fitbit for monitoring my sleeping pattern (-4, 37)
I use Fitbit every day (+3, 41)	Fitbit data can be overwhelming (-3, 25)
Competition with others helps me to exercise more (+3, 12)	Competition with others is stressful (-3, 16)
If I am physically healthy, I am happy (+3, 23)	I primarily use Fitbit for measuring my heart rate (-3, 39)
Fitbit is easy to install (+3, 47)	Fitbit helps me to eat healthier (-3, 8)

Respondents in this social group experience and appreciate the fact that Fitbit is extremely easy to install and to use. It is essential that the technology functions smoothly and without complications, as for them it is the most important element of the discourse about Fitbit. Besides that, Fitbit is used every day and every night [41, 44]. Obviously, the technology works perfectly fine and the product does what people expect of it.

The fact that respondents in this social group use Fitbit every day and every night proves that the bracelet is sufficiently comfortable to wear for longer periods of time.

The only negative remark about comfort was about the size of the bracelets. Fitbit bracelets only come in two sizes, which both did not fit pleasingly. In general, users are fairly positive about the rather minimalistic design of Fitbit, which is based on watches and bracelets. Especially the simplicity is lauded. For example, on the Fitbit Flex, a row of blinking lights is the only physical user-interface, which is elegant and still provides enough information. There are some respondents who believe that the design could be more aesthetically pleasing, but also for them it is not a reason to not wear it. There was one respondent who argued that it would be better to have an activity tracker in the form of an ankle bracelet so that he could still wear his favourite watch. The explicit focus on ease of use and user-friendliness in this social group demonstrates the importance of these matters; respondents mentioned that without these assets the technology would quickly end up in the cupboard.

Respondents do not experience any stress and do not feel uncomfortable in any way when they use Fitbit [16, 24, 25]. It is therefore slightly odd that the statements about how Fitbit is used are rated so high in the negative segment [37, 39]. One would logically assume that people do not use Fitbit for these purposes. However, this is not the case. The respondents in this social group use all the functions of Fitbit, but there is not one particular function that is most important. Fitbit is perceived as a multifunctional gadget, which is not acquired for one specific purpose. Therefore, the statements about how Fitbit is used are rated negatively.

In fact, based on the results from the Q analysis, it appears that there is not even a clear reason for using Fitbit at all. People do experience that through competition they can be motivated to exercise more [12]. Other statements about the added value of Fitbit however, are rated rather neutral, whereas respondents of the other two social groups rated them positively. For the respondents in this social group Fitbit is not necessarily a motivating tool, but more of an enabler to gain insights in what they already do. Fitbit does not specifically help them to loose weight, to sleep better or to be more aware of their health. Therefore, paradoxically, even though Fitbit is used rather extensively every day, it is not indispensable. The interviews with the respondents elucidate that there are other reasons for using Fitbit.

"I do not have a specific reason for using Fitbit. It is interesting to see the results and it can be useful to get a global idea of my activity. But more than that… no. I was just curious."
(Respondent 25)

"It is useful to see my activity on my phone. But more importantly, for my job I believe that it is crucial to remain up-to-date. I want to know what happens in the 'world of data'."
(Respondent 1)

These remarks illustrate that Fitbit is primarily perceived as a gadget. The respondents in this social group want to stay updated and well informed about new developments. They are interested in new technologies and are eager to experience them first-hand.

The fact that most of the statements about 'utilizing Fitbit' are characterizing statements is typical for this social group's value pattern. It is a technology with various functions that are all used, every day. Therefore it is important that it works without flaws or hiccups. It also implies that respondents in this social group are more indifferent about other issues that are rather dominant in the value pattern of the other social groups. It appears that social group 3 is the only one where data sharing and data security seems to not be such a big issue at all.

"Sharing is not a problem for me. Also, I wouldn't really mind if this kind of data would be seen by others, it is not that interesting." (Respondent 20)

"I don't really care about all those discussions about privacy. I think we are too late anyway, everyone knows everything, and so I stopped worrying about it." (Respondent 24)

"Sometimes you should just go with the flow, it is a development that we can't stop. As long as I can see what happens with my data, I'm fine with it. Transparency is much more important than all that political correct talk about privacy." (Respondent 1)

While some respondents believe that their data is not worth protecting or seem to have stopped caring at all about what happens with their data, others have a slightly different opinion about it. Even though they know that they cannot prevent the flow of data, they do want to know where the data goes. For them it is essential that there is transparency about how the data is used and that they have insight in how their data is analysed. Overall, the shared opinion in this social group is that the respondents accept the fact that data does not remain private and that third parties have access to their personal data.

4.2. The transition to a smarter health system

The previous section has demonstrated that there are different interpretations of Fitbit. This section discusses the implications of these three interpretations. Furthermore, it shows the major issues that can obstruct the social embedding of smart wearables. For smart wearable technology to be embedded successfully in the healthcare system, the major issues have to be dealt with properly. Therefore, three possible pathways are suggested. Each pathway is an integral approach that can help tackle multiple issues, and enables the transition to a smarter health system wherein wearables can play a key role. The most important conclusions of the interviews with key practitioners are presented here.

Overall perception of wearables

All practitioners had been confronted with wearables in their work in different ways. They mentioned that various parties are becoming more interested in using wearable applications in the health care sector. All interviewees were, in one way or another, positive about the opportunities that wearables can provide as a tool for preventive care. Wearables can motivate people to adopt a healthier lifestyle, help healthcare

providers to better monitor patients and empower elderly people by enabling them to live at home longer. Therefore, they believe that it is a technology that deserves further diffusion. However, they also argued that there are various obstacles that must be overcome before wearable technology can be embedded in society.

4.2.1. Major issues

The Health Insurance Act

As the Q analysis showed, wearables can stimulate people to live healthier and can thereby be deployed as a tool for preventive care. The competitive health would like to be rewarded for adopting a healthier lifestyle. However, it is difficult to implement preventive care strategies in the Netherlands due to the current insurance system. The Dutch health system is based on the principle of social solidarity: everyone contributes to the overall cost of healthcare. The Health Insurance Act (Zvw) prescribes that all Dutch citizens are obliged to take a basic health insurance package from a private health insurer of their own choice. Health insurers are not allowed to deny anyone who applies for the basic insurance package (see Appendix A for a more elaborate explanation of the Dutch health system). The rules and regulations formulated in the Zvw make it difficult for health insurances to implement new programmes or introduce radical changes. Especially when those changes are going to distinguish people based on personal data. As the consultant describes:

"The basic principle of our insurance system is that we all share the costs when someone is unlucky. Showing solidarity. If you are going to individualize people based on data, you are going to face a difficult ethical challenge."

The insurer confirms that insurance companies are bound by regulations that hinder new developments.

"In the Zvw there is almost no room for preventive care strategies, such as the employment of wearables. If a wearable could be used to replace the costs of current healthcare, it would be possible. Or if wearables could compensate healthcare costs. But these costs only exist when there is a claim: when someone is ill. If someone is healthy there is not much the Zvw can do."

Thus, there is some space for experiments and trials, but even then there are many considerations to be made. Insurances are not going to invest money in projects that will potentially show positive effects, but will not have viability in the long run. For instance, in the current situation it will not be possible to adapt insurance premiums based on wearable data. It is not probable that these regulations will change drastically in the near future. This is a challenging situation because all practitioners do see the benefits of wearable technology.

Data security and transparency

The Q analysis revealed that there are people who do not want to share their data. The privacy protectors and competitive health fanatics voiced their concerns about what would happen with their data and who would be able to see it. Data security and transparency are therefore major issues for these people. When wearables are going to be employed in the health care sector, where meaning is attached to the data they produce, it is extremely important for them that the data is secured properly. Recently this issue has become even greater because the Dutch Data Protection Authority (DPA) has forbidden employers to hand out wearables to their employees and look into the data of those who wear them, even if the employees agree on it. The vitality coach is very unhappy with this verdict.

"It is relatively easy to spread the message about health and energy through a firm or organisation. And most people appreciate the fact that their employer initiates such programmes. Now, due to this law, it is going to be very difficult to stimulate the use of wearables in organisations. I think nobody wants that."

Apart from this law that will probably hamper the diffusion of wearables, all practitioners agreed that the topic of data security is an important one.

"Data security is absolutely essential for the diffusion of wearables. And I believe that it is feasible to guarantee it." (Healthcare professional)

"Although data privacy and security is an important and complex subject, I would not necessarily call it the biggest obstacle." (Researcher)

"Security is a priority. There has to be a moment that you can say: the data is secured and we have adhered to the privacy rules. Then it should not be a problem." (Insurer)

Thus, although data security is essential, it does not seem to be a major obstacle because it is feasible to realize it. Data transparency is perhaps more important than the security of data. Confronted with the views of respondents in this research, the insurer repeatedly stressed that they will not put people in a situation where they are uncomfortable about. If the insurer would do something with the data, it must be extremely clear who is able to see it and what will happen with it. Besides that, the healthcare professional argues that patients should have full control of their data. This is not yet the case.

Accuracy, reliability, interoperability

During the Q analysis it became clear that many respondents doubt whether the measurements of wearables are accurate and reliable. According to the practitioners this will have negative consequences for the diffusion of these technologies. The coach has experienced that people stop using certain functions when they realize that they are

not reliable. Additionally, when the measurements are not valid, a general practitioner will not be able to attach consequences to the data. The consultant described a situation where this would be the case.

"If someone goes to the doctor because of severe headaches, the doctor could tell the patient to do a sleep study. The patient could say: 'I've tracked my sleep for 5 years, here is the data'. The doctor would not be able to use the data because it is not validated."

Thus, in a situation where it is not clear if wearables are accurate or reliable, apart from notifying the user of certain patterns, wearable data will not have value in the healthcare system, as it will not contribute to decreasing the length or costs of the healthcare process.

It will be even more problematic if wearables are unreliable or inaccurate when they are actively implemented in the healthcare system, for example when they are being used to monitor patients. The care provider will not be fully confident that the patient's variables are measured correctly, while the patient will not feel comfortable when he doubts whether he is monitored correctly. Eventually, this would decrease the quality of health care and seriously hamper the diffusion of wearables. For healthcare providers it is also confusing that there is a lot of competition in the market of wearable technology. For them it is not clear which technology they can use best, and it is difficult to determine the technology that will benefit their patients the most.

A related issue is that of interoperability. Different healthcare providers employ different systems with different software. Wearable technology runs its own software and generates a new data stream. According to the healthcare professional the information systems must be able to communicate with each other so that the patient and other relevant parties all have access to the same data; currently, this is not the case. Subsequently, there is the dilemma of which data is relevant to share. A wearable continuously measures variables and thus continuously generates data. Not all parties want these huge amounts of data in their system because it is impossible to manually analyse the data. It requires advanced algorithms to determine and filter out the relevant data. This is a crucial point of attention.

Accessibility and awareness

The issues of accessibility and awareness were logically not revealed by the Q analysis, as the respondents were all users of wearable technology. However, the practitioners did voice their concerns about these topics. The researcher stressed the fact that wearables are rather expensive. People who do not have much money will usually not spend their money on these kinds of gadgets. Wearables are thus mainly used by relatively wealthy people, while it would be desirable that people with a lower income would also have better access to wearable technologies. The risk of splintering urbanism, an issue described by Graham & Marvin (2002), is a serious challenge that must be addressed accordingly.

Closely related to this issue is that people are not sufficiently aware of the importance of a healthy lifestyle. Why spend money on a tool that improves your lifestyle if you do not see the need to do so? The consultant argues that it must be a focal point to convince people to eat and live healthier. Only when there is awareness about these issues, it will be possible to employ wearables as a tool to aid people to change their lifestyle. The coach has a slightly different opinion.

"Everyone knows that it is bad to sit all day. I think that 95% of the people are aware of the importance of exercising and most of them have the intention to do something about it. But in the end there are only a few people who really start sporting because they face different barriers that they cannot overcome."

He believes that there is enough information about the importance of a healthy lifestyle. The clue is to motivate people to do something with that information; wearables can be useful instruments to achieve this. What follows is to encourage people to keep using their wearable. All practitioners experienced that there are people who buy a wearable, use it for a few weeks, and then are done with playing with it. It is crucial that there is an incentive for the users to not give up after a certain amount of time.

Governance

Clearly, the embedding of wearables in society faces various challenges. The practitioners have converging views about who is responsible for tackling these challenges. The coach thinks that, due to the various interpretations of this technology, it is impossible for the government to stimulate the embedding of wearables. There are many different people with different views and different needs, making it difficult to devise one general policy. Instead, various market players should take the lead to develop coaching programmes, based on a sustainable business model.

The insurer, researcher, consultant and healthcare professional propose a more integrated approach, where insurances, healthcare providers and the government should collaborate to create a system that facilitates the employment of wearables. However, it remains a complex matter to determine the level of responsibility of the different parties for tackling the various issues.

4.2.2. Possible pathways

After identifying the various obstacles for the embedding of wearable technologies, the next challenge is to formulate possible pathways that address these issues and enable the transition towards a smarter health system.

Stimulating preventive care strategies

Despite the challenges, the insurer is convinced that there are possibilities within the Zvw to employ wearables for preventive purposes. She explains that there are different types of preventive strategies where the use of wearables will not be possible, but that wearables can be stimulated through one specific preventive care strategy: through 'specified prevention'. This type of preventive care is meant for people who have an

increased risk of developing chronic diseases such as heart diseases or vascular diseases, but who are not yet ill. For that particular group of people there is a small margin to mobilise the Zvw through coaching. People could get a free wearable that would motivate and stimulate them to live healthier.

In the long run it may also be possible to develop new additional insurance packages. For instance, clients could choose an insurance package where they get a free Fitbit if they reach a certain goal. This type of insurance would serve various purposes. Clients could receive free products, which would motivate them to be more active, while insurances actively contribute to prevent diseases caused by an unhealthy lifestyle, which may be beneficial for the insurer in the long run.

Additionally, the various practitioners mentioned that data privacy and security is essential. Therefore the key in this would be that clients could choose to participate or not. Probably people belonging to the second social group identified in this research are most likely to participate in this kind of challenge. However, people belonging to other social groups may also show interest in these programmes; after all they are positive about the wearable, and it would be an easy way to obtain one for free.

Another advantage is that it tackles part of the problem of awareness and accessibility. People will automatically become aware of the importance of a healthy lifestyle when they read the yearly insurance offers containing these new programmes. Simultaneously it will provide the opportunity for less wealthy people to acquire a high-end wearable; something that otherwise would not be possible.

There is a clear responsibility for health insurances, but other parties can also put effort in prioritizing preventive care. General practices could (temporarily) equip clients with wearable technologies. Care organisations could develop new business models that are based on prevention instead of curing. Or, as the coach recommends, various market parties could manufacture new, more specialized apps or programs. In doing so, they would better serve the specific needs of people, and thereby stimulate the use of wearables in a preventive care strategy. Thus, multiple parties can contribute to preventing diseases related to lifestyle. However, it all starts with an individual choice: the choice to start living healthier. Only when there is enough awareness, when people have made this choice, it will be possible to realize the use of wearables in the health care system as a preventive tool.

Creating value

As the Q analysis revealed, only the competitive health fanatics perceive the wearable as a valuable tool that can be used for healthcare purposes. The other social groups primarily perceive them as gadgets. There are also non-users, who will probably not see the value of wearables. The consultant argues that it is impossible to force healthcare innovations top-down. If the user does not see the advantages, innovation will not work. Therefore it is crucial that there is some kind of reward for the users. For some people, such as the competitive health fanatics, the competition and reaching goals are satisfying rewards. For others however, this does not suffice and other rewards must be offered.

According to the researcher it starts with better designs and better software. The platforms and apps must become much more robust and attractive and must provide better services. In doing so, the reliability and accuracy of wearables will increase, while simultaneously it could retain current users and attract new ones. The coach agrees and adds that people need to be motivated personally.

"We never initiate team competitions because some people like it and others don't. For people who struggle to reach 3000 steps it is frustrating to see others easily hitting the 12000 mark."

There is also criticism about the criterions that are being used in health education. For some people it simply is impossible to reach those goals due to their full schedules. Wearables should be part of a larger programme, where people are coached individually. It is important that these people also feel that they are on the right track and do not get demotivated because they cannot live up to the norm.

The healthcare professional confirms that for wearables to be firmly embedded, they must be part of a broader service, and argues that education is crucial. Especially when wearables are being used in the process of rehabilitation, clients must understand their value. Besides that, it is necessary to continuously collect feedback from the users and to continuously improve the services. This will contribute to higher accuracy and reliability of the product, while it also creates support and involvement of clients. However, it is not just the client who has to experience the benefits. Also the doctors must understand how they can provide better care with these technologies before they are willing to use them. Again, it is crucial to create support through education.

Furthermore, organisations in the field of health care will need to benefit from the employment of wearables.

"If organisations are going to lose revenues and face higher costs they will start doubting. Even if they are enthusiastic about wearables." (Healthcare professional)

It is a problem when users and health organisations see the value of wearables, but the employment of wearables is not economically viable for the organisation itself. The same goes for insurances; if there is no sustainable business model, they will not support the employment of wearables. It is crucial that organisations do research on how wearable technologies can be employed to replace current processes or costs. If sustainable business models can be developed, it would deal with the problem of responsibility, as organisations would reap the benefits of the employment of wearables.

Simplifying wearable technology

The first part of the research has shown that if wearables are going to be embedded in the health system it is crucial that people understand what is going to happen with their data. According to the healthcare professional and the researcher this is too unclear. Current user agreements are too detailed and too long. Organisations that work with

wearables must provide extremely clear and concise instructions about the variables that the wearable measures, who gains insight in the data, and for what purposes the data is used. This is a crucial step to improve data transparency.

Transparency of data is important, and so is the transparency about the quality of the wearable. The consultant and insurer plead for quality labels that immediately show that the wearable is medically validated. These labels will help healthcare providers to easily identify adequate and high-quality wearables, which will lower the barrier for employing them in their system. Simultaneously, the interoperability between different systems can be increased. A downside of using quality labels is that it could hinder innovation, as producers must meet requirements that they previously did not have to.

However, the researcher claims that it is impossible to steer these technological developments.

"I don't think that we should believe that we can steer technological developments. Fitbit, Google and Microsoft are large firms who have their own strategies and vision about healthcare; there is not much we can do about that."

It is good to think about standards, but it is much more important to critically analyse how to employ wearables in specific situations and to ensure that all parties involved know exactly what they can and cannot do with it.

5. Conclusion

There is a fervid discussion between smart city advocates and people who are more hesitant about the advantages of smart technologies. This discussion is often not based on empirical evidence. The goal of this research was to critically investigate the promises and expectations surrounding smart wearable technology and to thereby provide empirical evidence about one specific smart city technology. This research examines how wearable technologies are integrated in daily lives of users. It attempts to discover how users perceive the 'practice of wearable technology', to identify the main issues surrounding wearable technology and to explore the implications for the further diffusion of this technology. The following research question was answered:

What is the interpretative flexibility of smart wearable technology and what are the implications for the social embedding of smart wearable technology?

The Q methodology, a method for examining subjectivity, was employed to inductively identify the different social groups and their interpretations of wearable technology. More specific, 25 Fitbit users were subjected to Q methodology to identify these different interpretations. The statements in the Q set were based on an elaborate desktop research in order to fully capture the scope of possible opinions about Fitbit.

The analysis yielded three social groups who each have a different interpretation of the technology. The main differences and similarities of the three social groups, labelled as privacy protectors, competitive health fanatics and gadgetheads, are presented in table 8.

Table 8: Differences and similarities between the social groups

Topic	**Social group**		
	1: Privacy protectors	**2: Competitive health fanatics**	**3: Gadgetheads**
Fitbit is used daily	+++	++	+++
Data must be secured well	+++	++	-
Data can be used by strangers	---	---	0
Data is shared to compete with friends	--	+++	++
Fitbit is motivating	++	+++	+
Fitbit is fun	++	+	+
Fitbit is stressful	--	-	---
Fitbit has health care potential	--	+++	-

All of the respondents use Fitbit every day, implying that it is a technology that is firmly embedded in their daily routines. They also agree on the fact that Fitbit is a technology that is fun and stress-free and motivates them to exercise more often. The main differences between the interpretations of the social groups are based on three dimensions: data, healthcare possibilities and level of social use.

For the privacy protectors it is crucial that Fitbit data is secured well and remains private; not because the data is valuable but because the data is personal. They primarily perceive Fitbit as a fun, personal tool that enables them to monitor their own activity and can stimulate them to exercise more often. They do not share their data with friends or family. For the competitive health fanatics it is also essential that data is secured and private because they perceive Fitbit as a meaningful technology that produces meaningful, valuable data. For them the competitive element, the function to participate in online challenges, is a huge trigger to adopt a healthier lifestyle. The competitive health fanatics are the only ones that are convinced that wearable technology is suitable for being used for healthcare purposes. The gadgetheads primarily focus on the user-friendliness of Fitbit; for them this is the most important characteristic. The technology is used to gain insight in daily activities but above all, it is perceived as a gadget. The gadgetheads therefore do not believe that data security is necessary. The main reason for using Fitbit is to stay up-to-date in a world where technology develops rapidly.

Thus, the analysis has revealed that indeed there is interpretative flexibility about the practice of smart wearable technology. This means that closure has not yet been achieved. It is impossible to predict whether there will be a dominant interpretation in the course of time, let alone to determine which interpretation is going to be prevailing. Therefore, it is not certain how the practice of wearable technology is going to take shape in the future. However, for a successful social embedding of wearable technology, it is essential that the current interpretations and issues of each social group are acknowledged and addressed. Each interpretation has different implications for how this technology can be embedded, and understanding these implications helps to devise socially desirable policies. During the interviews with practitioners the implications of the results from the Q analysis were discussed and issues for the social embedding of wearable technology were identified.

This research has demonstrated that wearables have the potential to contribute towards development of a healthcare system in which preventive care strategies can flourish. However, in order to realize this development, it is important to adapt aspects of the healthcare system, as well as aspects of smart wearable technology. The Q analysis and interviews showed that the main barriers are issues concerning the Health Insurance Act, data security, data transparency, accuracy, reliability, interoperability, accessibility, awareness and governance. These issues are elaborated on in table 9.

Table 9: Main issues for the social embedding of smart wearable technology

Issue	Description
The Health Insurance Act	The rules and regulations formulated in the Zvw make it difficult for providers of health insurances to implement new programmes based on preventive care
Data security	If wearables are to be employed in the healthcare sector, where meaning and consequences are attached to the data they generate, data security must be a number one priority
Data transparency	If personal data is being shared with health care organizations, it must be extremely clear who has access to it and what will happen with it. Currently, this is not the case and patients do not have full control of their data
Accuracy and reliability	The accuracy and reliability of wearables cannot be safeguarded yet. Lack of accuracy and/or reliability becomes problematic when they are actively implemented in the healthcare system
Interoperability	Wearable technology generates new data streams. Information systems must be able to communicate with each other so that the patient and other relevant parties all have access to the same data; currently, this is not the case
Accessibility	There is a risk of splintering urbanism when only the relatively wealthy population benefits from wearable technology. It would be desirable if all people, including those with a lower income, gain access to this technology
Awareness	Only when there is sufficient awareness about the importance of a healthy lifestyle it will be possible to employ wearables as a tool to aid people to change their lifestyle
Governance	Many stakeholders are involved. It is difficult to determine the level of responsibility of the different parties for tackling the issues listed above

Three pathways can help tackle these issues and enable the transition to a smarter health system in which wearables can play a key role. Firstly, it is essential to stimulate preventive care strategies through new business models. Current business models offer limited opportunities for insurance companies or health professionals to actively encourage the use of wearables for preventive care. Secondly, value creation requires more attention. There must be added value for users and other stakeholders and they must experience certain benefits before they start employing wearable technology. Thirdly, wearable technology should be further simplified. Progress has been made, but special focus should be given to the integration of technology of different providers. In this way the use and accessibility can be enhanced for the parties involved.

In conclusion, all stakeholders must understand and experience the importance of preventive care, and acknowledge the role that wearable technology could play in preventive care strategies. As this research has shown, the perception and value of wearable technology is different for different social groups. If the aim is to increase the use of wearables, it is crucial to assess each situation separately, and tailor-fit the practice of wearable technology to the specificities of the different social groups.

6. Discussion

This final chapter reflects on the research design and the results obtained. The limitations, theoretical implications, policy implications and recommendations for further research are addressed.

6.1. Limitations of the research

The main limitation of this research is that it focused on understanding perceptions of wearables amongst users. Because of this, the research sample consisted of active users who had a relatively positive stance towards smart wearable technology. Users of Fitbit were subjected to the Q methodology; if these people were not positive about this technology the chance would be small that they would still use it. Similarly, the key practitioners who were interviewed in the second part of the research were all positive about the opportunities that smart wearable technology offers. This research therefore does not reveal the entire scope of opinions and viewpoints about wearable technology; it does for example not include people who have never used wearable technology or have stopped the use of this technology.

6.2. Scientific implications

6.2.1. Theoretical implications

In this research a novel combination of theories and methods was employed. The main concepts of practice theory and SCOT were combined in order to broaden the basis of the SCOT framework. Generally in practice theory research, researchers perform an extensive analysis of the three constitutive elements of a practice by conducting in-depth interviews with users (Halkier & Jensen, 2011). In this research however, the concepts of practice theory were primarily used to supplement the SCOT framework developed by Pinch & Bijker (1984). Instead of focussing on the artefact as main research object, the whole practice surrounding the artefact was examined. There is not only interpretative flexibility about the artefact itself, but about the meaning people attach to the artefact, the competences required to use the artefact and the material aspects of the artefact. Thus, by employing practice theory a more structured and comprehensive analysis of the interpretative flexibility of users can be performed. Additionally, the use of practice theory can help to create a better understanding of the integration of artefacts in daily routines. Williams & Edge (1996) criticize SCOT by arguing that technologies are not only defined by the social arrangements in which they are embedded and used but that these social arrangements are also defined by technology. It is therefore impossible to separate the social and technical aspects from one another. By expanding the concept of interpretative flexibility to the three dimensions of practice theory (materials, meanings, competences), which enables a simultaneous analysis of the social and technical aspects of an artefact, this research has contributed to broadening the scope of traditional SCOT research.

Furthermore, by mobilizing Q methodology, an alternative method was employed for studying interpretative flexibility and identifying social groups in SCOT research. This approach enabled an inductive, systematic identification of social groups. The

identification of social groups by carefully studying the data is a core principle of SCOT. However, SCOT research is criticized for the rigid selection of social groups and neglecting power asymmetry within groups, causing the elite's interpretation to dominate the whole group (Klein & Kleinman, 2002; Williams & Edge, 1996). Q methodology reduces the risk of such neglect. According to Newman & Ramlo (2010), Q methodology can be used to group people in a more refined way using profiles that go beyond surface characteristics. It "provides a unique opportunity to distinguish salient groupings within the population with similarly structured attitudes toward an image object" (Peter et al., 2008, p.518). Thus, instead of segmentation based on pre-specified characteristics, Q methodology results in inductive segmentation based on the research data. This inductive approach helps to uncover the range of important viewpoints and interpretations that are present in a certain sample, and thereby enables a more robust determination of social groups. Additionally, this systematic approach has the advantage that it can easily be replicated, thereby ensuring the external reliability of this research (Bryman, 2008). The combination of Q methodology and SCOT thus ensures a more reliable empirical identification of social groups, limiting the bias introduced by the researcher.

The use of practice theory to broaden the concept of interpretative flexibility has highlighted which elements are most important for the different social groups and has provided a deeper understanding of their value patterns. For the competitive health fanatics, all characterizing statements were statements belonging to the element 'meaning', which means that the statements belonging to the elements ´competences´ and ´materials´ were allocated to the more neutral positions of the Q sort. In Q methodology the respondent is asked how *strong* his or her opinion about a statement is. The competitive health fanatics apparently have a stronger opinion about the meaning of the practice than about the other elements. The supplementing interviews with users confirmed that 'meaning' was indeed the most important element. Even though the competitive health fanatics were also positive about the materials, and none of them complained about lacking the required competences, these matters were less important. The characterizing statements in the other social groups were from varying elements. The privacy protectors and gadgetheads positively rated statements about user-friendliness (competences) and other material aspects.

These results provide valuable information about closure mechanisms. The respondents of all three social groups are rather satisfied about the technology itself. They use it every day, find it easy to use and to install and they like the design. Therefore, it can be argued that for users of this technology there is almost closure about the materials and about the competences; there is hardly any discussion between the different social groups about these issues. In contrast, there is still controversy about the meaning of the artefact, thus there is no closure yet about this issue (Pinch & Bijker, 1984). It shows that for the interpretative flexibility of the practice of wearable technology, 'meaning' is the most important element. However, this does not imply that this will be the case for all technologies. The controversy about the meaning of smart wearable technology is primarily based on the role of data. There is discussion about

what can and cannot be done with the data but also about the value of this data. Also, the technology is not overly complex. In this sense smart wearable technology is different from other technologies such as smart grids or electric driving, where data also plays a role, but may be in a less personal manner or in a less intrusive way. For these technologies the interpretation between social groups may therefore primarily differ on the more complex material and competence aspects. Likewise, for people who do not use wearable technology the other elements may be more important than the element 'meaning'.

6.2.2. Smart city debate

This research commenced with describing the discussion between smart city advocates and those who are more critical about smart city initiatives. The main controversial themes are the lack of detailed empirical studies, technological optimism and technological determinism and the business-led approach of smart cities. This explorative research has provided insights in these themes by analysing one specific smart city technology. Additionally, it has produced a methodology that can be employed in future research to gain a better empirical understanding of the perception of smart city initiatives.

Lack of empirical studies

Smart city literature is criticized for the lack of detailed empirical case studies of specific smart city initiatives (Kitchin, 2014b). Critics argue that due to the different particularities of different places and technologies it is impossible to develop a one-size-fits-all model and use it to establish a smart city (Shelton et al., 2015). The empirical case study performed in this research has contributed to better understanding the impact of a specific smart city technology. Instead of developing and implementing policy guidelines based on intuition or prior studies and situations, it was analysed how wearable technology is actually integrated in daily routines and which issues are relevant for the further embedding of this technology. With this knowledge it is possible to develop more socially desirable and broadly supported policy guidelines and strategies. The type of empirical study applied in this research, which reveals value patterns within social groups concerning a smart technology, can be employed to gather valuable empirical evidence about other specific smart city initiatives.

This research has shown that in the case of smart wearable technology there is a risk of splintering urbanism, where social and spatial inequality can lead to polarization. There are concerns that the people who cannot afford wearables will not be able to benefit from them and will have less access to new care strategies based on prevention. Additionally, this research has shown that all users have the required competences to employ wearable technology. However, it is possible that there are people who do not have these competences and will thus not understand or benefit from this technology. This could in the long run lead to social division or even exclusion, as the financial gap and experience gap between the groups become too big.

The risk of splintering urbanism is also hidden in the value pattern of the competitive health fanatics (social group 2). For them, it would not be a problem if

insurances would be adapted based on personal data. However, if certain clients are permitted to pay less, the revenue has to come from another place, implying that other clients will have to pay more. This is a typical example of splintering urbanism: healthy people will have lower costs, thereby easing their way of life, while unhealthy people will carry a heavier financial burden, which will further complicate matters for them. Thus, even though this is a hypothetical situation, this empirical case research has illuminated that these problems could arise. It shows that concerns about possible undesirable consequences of smart city initiatives are justified and must not be ignored.

Technological optimism and technological determinism

This research has shown that there is some reason for optimism about the benefits that wearable technology provides. Many respondents noticed that they exercise more often since they use Fitbit. Furthermore, there are respondents who say that their wearable helps them to adopt a healthier lifestyle. This implies that wearable technology can indeed be deployed to resolve health related issues.

However, it has also become clear that this is not true for all people. Various respondents did not see the value of these technologies and primarily used it as a gadget and not as a problem-solving or preventive care device. Currently not all stakeholders are convinced about the potential of this technology. This research thus shows that the technological optimistic and deterministic views are not fully accurate. There are different interpretations of wearable technology, meaning that the technology can develop in different ways. Policy makers can use the information about these interpretations to devise balanced policy measures regarding wearable technology. Instead of imposing regulations top-down, an approach should be based on the varied perceptions of the respective social groups. Additionally, the research has revealed that there are various barriers for the social embedding of this technology. This implies that the diffusion of wearables will not occur automatically and that the employment of these technologies will not by default result in a better healthcare system. Again, this confirms that the criticism on technological optimism and technological determinism is justified.

Business-led approach

Multiple businesses are trying to benefit from the smart city development. Critics voice their concerns about the increasingly larger role that private firms will play in the public domain (Hollands, 2008). This empirical study has shown that some of the inhabitants of the smart city, in this case the users of wearable technology, share this concern. Especially the privacy protectors and competitive health fanatics are worried about what happens with their data, as they perceive data privacy and data security as extremely important themes. Obviously, their personal data is sensitive and may not be shared with strangers; this will be difficult to achieve when private firms hold key positions in the healthcare system or in the smart city in general. On the other hand, this research also revealed a social group with a very different perception. The gadgetheads are not concerned about data; for them the business-led approach of smart cities may not be a problem. However, as for the other two groups it is crucial to ensure the privacy, security and transparency of data, this must be a priority for the government in

order to serve the public interest. The results thus confirm the legitimacy of the reluctant stance towards the business-led approach of smart cities, but also places some nuances by showing that this is not problematic for the entire population.

6.3. Policy implications

The core tasks of the Netherlands Environmental Assessment Agency (PBL) are to "identify social issues of importance to environmental, ecological and spatial quality and raise them for discussion" and to "improve the quality of political and administrative decision-making" (PBL, 2015). Furthermore, PBL is concerned with anticipating and flagging the disruptive effects of technological innovation and determining how policy can adapt to those effects.

The methodology applied in this research is highly recommendable to PBL for realizing these goals. The distinction of audience segments based on their own perspectives on the research object is an important step towards targeted interventions (Peter et al., 2008). Furthermore, Shove et al. (2012, p.2) argue that: "policy initiatives to promote certain ways of life could and should be rooted in an understanding of the elements of which practices and systems of practice are formed, and of the connective tissue that holds them together". By gathering and analysing rich qualitative data about the practice of wearable technology, this research has contributed to expanding this understanding and to help formulate policy initiatives. For PBL it must be a key objective to keep learning about these interpretations in order to understand the latent needs in Dutch society. This process of empirical case research must be repeated to remain informed about opportunities and risks of smart wearable technology. From their independent position, PBL can then better support the Dutch government by advising them about issues that are identified through sound empirical research.

This research has demonstrated that, even in a small sample of relatively early adopters, there is interpretative flexibility about smart wearable technology. It is therefore plausible that the Dutch population at large encounters some of the identified issues and has diverging opinions about the technology. Furthermore, as mentioned earlier, non-users may have different views on and interpretations of wearable technology. Due to these different interpretations, it is unwise to apply a broad-brush approach in this matter. Instead, it is essential to devise specific policy measures that satisfy different groups of people.

Currently, only a fraction of the Dutch population uses a wearable. This research has shown that one of the reasons for this could be that not everyone sees the value of preventive care. Therefore, emphasis must be placed on creating value for those who are not immediately convinced and ensuring that the practice of wearable technology makes sense in everyday lives of people (Munnecke, 2007). This starts with developing additional, personalized rewards for people who are not enthusiastic about the technology in order to encourage them to start using wearable technology. Besides that, people may not be aware, or convinced, about healthy living. There is a role for government to further increase this awareness through campaigns or programmes.

It is also essential to create more support for preventive care strategies. For now it is not clear who will profit from preventive care. For instance, currently hospitals profit from treating patients who are ill and for these organisations it is not attractive to employ preventive care strategies. It is essential to create incentives for organisations that motivate them to develop preventive care strategies. It is recommendable to start by investing in groups with high risks of disease. For these groups of people it is possible to mobilize the Zvw, and thus care organizations will not immediately have to develop new business models. Starting from there, it may be possible to nurture and further expand preventive care strategies.

It is expected that wearable technology will develop exponentially. Given the fact that this will empower private firms, it is essential to adapt to these changes. A possibility would be to influence technological development through standardisation. The Dutch government could set standards to promote designs that are favourable to their national interests. However, it will be difficult to influence the products and strategies of these large multinationals. In the case of wearable technology the government could design quality labels that are only granted to certified technologies. These labels would include requirements about data privacy and security, as well as validity and reliability. This would make it easier for healthcare providers to determine which wearables to employ, while users can see more easily which technologies safeguard their data and are of high quality. It might be a trigger for wearable technology developers to come up with products that meet these requirements, thereby meeting the needs of privacy protectors as well as competitive health fanatics and gadgetheads.

6.4. Recommendations for future research

Science and Technology Studies (SCOT & Practice theory)

By using the constitutive elements of a practice to expand the concept of interpretative flexibility, this research has sought to combine the SCOT framework and practice theory. In order to assess the value of this combination it is necessary to conduct more research wherein these theories are further integrated. By performing comparative studies, with and without the integrated framework, it will be possible to judge whether research with this framework indeed yields more profound results.

By employing Q methodology, this research also explores an alternative, more structured method of identifying social groups. To determine the usefulness of this inductive approach in other situations, it is recommendable to perform more SCOT research using this methodology. Again, it would be advisable to perform various case studies and compare the results of the conventional approach and the approach proposed in this research. By doing so, one can better assess the value of this alternative approach.

The Q methodology was useful in showing the most important viewpoints of the respondents. However, the constitutive elements of practice were all incorporated in the same Q set, resulting in respondents having to compare statements about different elements to each other. A recommendation for future research would be to create a Q set

for each element separately. The respondents would not have to compare statements from different elements and by doing so the researcher would obtain more detailed information about the most important themes of each element. This would provide an even more detailed understanding of the practice of smart wearable technology.

Smart city research

For a more elaborate understanding of the impact of various smart city initiatives, it is necessary to perform more similar researches about specific topics. By doing so, more rich theoretical insights can be obtained that are embedded in empirical data. As Klein & Kleinman (2002) argue, there are often groups of people who for various reasons are not participating in the design process. When formulating politically and socially desirable guidelines for smart city development, it is important to understand the motivation of people for not participating. In the case of smart wearables, it would be valuable to discover why people stop using wearables after a certain amount of time or the reasons for not using wearables at all. This could provide new insights in matters such as exclusion and resistance (Wyatt, 2003).

Smart wearable technology is only a part of the larger smart city development. This research has demonstrated that data privacy and security is important for many inhabitants. As big data is a key trait of the smart city, one can safely assume that data security and privacy will pose a major challenge in other smart initiatives. Further research on the importance of data privacy and security in other smart technologies is recommended.

Wearables and health

In this research Fitbit's activity tracker was selected as the object of analysis. This served the purpose of this research, which was to identify the different interpretations of wearable technology within a sample of users. However, to better understand the impact and effectiveness of other wearables it is crucial to perform more specific case studies. It would be valuable to conduct experiments or trials where wearables are employed for a specific purpose. For example, for distant monitoring of patients so they can go home sooner after an operation. This kind of research could provide new information about how people use and interpret wearable technology.

Furthermore, this research has shown that for the social embedding of wearables it is crucial that the validity and accuracy of these technologies are improved. More research on technological developments is therefore essential. As stated earlier, imposing standardisation and simplification of technology can contribute to this.

Finally, it is important that all stakeholders not only see the health care potential but also the economic benefits of wearable technology. Therefore, more research is required about how multiple parties can financially benefit from this technology. By developing new sustainable business models it might be more attractive for different organisations to stimulate the progression towards more preventive care strategies.

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Appendix A: Background information

Developments in the Dutch Health System

The Dutch health system consists of various healthcare providers (hospitals, therapists, pharmacies etcetera) and healthcare insurers, who are monitored and supervised by the NZa, the Dutch Healthcare Authority. The NZa ensures that the healthcare market functions properly and that access to high-quality healthcare is guaranteed for all consumers (NZa, 2016). There are two major laws through which health care is arranged in the Netherlands: the Health Insurance Act (ZVW) and the Chronic Care Act (Wlz) (Rijksoverheid, 2016a).

The Health Insurance Act prescribes that all Dutch citizens are obliged to take a basic health insurance package from a private health insurer of their own choice. Health insurers are not allowed to deny anyone who applies for the basic insurance package. Furthermore, they must charge all applications the same premium, regardless of their age, lifestyle and state of health (Ibid.). On top of this basic premium, everyone must pay an income-related contribution: the ZVW contribution. The Chronic Care Act is meant for those who are chronically ill and need constant monitoring or care, e.g. elderly with dementia or people with a severe handicap (Rijksoverheid, 2016b). All people in the Netherlands with a basic insurance package are insured for this type of healthcare. The Wlz is organised by the government and local municipalities. Similarly to the ZVW contribution, the premium for this insurance is automatically collected by withholding a fixed percentage of one's income (Rijksoverheid, 2016c). Besides these two compulsory insurance packages, all citizens are free to choose additional packages. These packages can be bought for insuring healthcare costs that are not (totally) covered by the basic package, e.g. physiotherapy, eye care etcetera. Here however, the health insurer can choose to decline the applicant's request for insurance or change the height of the premium (Rijksoverheid, 2016a).

It is clear that the Dutch health system is based on the principle of social solidarity: everyone contributes to the overall cost of healthcare (Ibid.). This system is acclaimed both nationally as internationally and according to annual research by Health Consumer Powerhouse the Netherlands provides the best healthcare service in Europe (NOS, 2015). However, healthcare in the Netherlands is also very costly. In 2014, 11,8 per cent of the gross domestic product was spent on health care, more than in any other European country (Rösken, 2014). This expenditure has increased significantly over the past 15 years; both total healthcare costs as per capita healthcare costs have more than doubled since 1998 (CBS, 2015). There are several reasons for this increase: population ageing, increased life expectancy, health care reforms, medical innovations, cultural changes and various economic factors (Rolden, 2013).

In order to deal with the rising healthcare costs the Dutch government is formulating policy measures that are all related to the concepts 'independence' and 'active citizenship' (Ibid.). Independence is the ability to take responsibility for oneself, and active citizenship is the act of taking responsibility for others in your family or community. Goals of these policies are to enable people to live in their own environment

longer and to receive more effective, specialized care while staying at home. The in the introduction of this paper discussed progression towards a smarter healthcare system, where the use of smart wearables would be an important instrument, could contribute to creating more independence and active citizenship, as desired by the Dutch government.

Fitbit

Fibit Inc. is a San Francisco based company that was founded in 2007 by James Park and Eric Friedman (Fitbit, 2016a). They started their entrepreneurial journey with a very clear goal: to create a wearable product that would change the way people move. Park and Friedman attempt to empower and inspire people to live a healthier, more active life by designing products and experiences that fit seamlessly into people's life so they can achieve their personal health and fitness goals (Ibid.). Park and Friedman were inspired by the Nintendo Wii, introduced in 2006, which combined hardware and sensors with great software and made gaming something active, fun and positive (Yakowicz, 2015). According to the founders this is also what makes Fitbit special: the combination of excellent hardware and software, which enables the datafication of physical activity and subsequently the sharing of this data, thereby enabling competition with family and friends (Ibid.). Park describes Fitbit as "the world's largest fitness social network that has been monetized by the sales of hardware" (Ibid.). "We are never going to be an advertising- or marketing-driven company," Park said. "That has earned us a lot of trust with our users. That is primary" (New, 2013).

This image is reflected in every detail of Fitbit's merchandise. Fitbit's slogan is formulated as follows: "Find your fit with Fitbit's family of fitness products that help you stay motivated and improve your health by tracking your activity, exercise, food, weight and sleep" (Fitbit, 2015). The company's website provides a "motivational interface where users can share their progress, compare themselves against similar people and work toward virtual goals with their friends, family and co-workers" (Crunchbase, 2015). Additionally, on the website users can manually enter their consumption, weight and other health information, which, in combination with their activity data, can be used to gain a complete picture of their health. Fitbit's smartphone app welcomes new users with the following message: "Track your Fitness, all day and night. Get active. Eat better. Manage weight. Sleep better" (Fitbit, 2016b).

Since 2007 Fitbit's market share has grown exponentially. By the summer of 2015, the company was valued at $4.1 billion, selling 4.8 million devices in the third quarter of that year (Goode, 2015; The New York Times, 2016). Their main competitors are Nike's FuelBand and Jawbone's Up, which are similar devices that can be worn like a bracelet (New, 2013). Smartwatch producing companies such as Apple, Microsoft, Samsung and Garmin are also starting to compete with Fitbit's products, as they are incorporating increasingly more activity tracking and other health-related software in their watches (Goode, 2015).

What all Fitbit's products have in common is that they capture physical activity data and store this in a database, which can be accessed through an online interface that

shows the user his or her performance and progress. Fitbit sells nine different products. Eight of these are more or less advanced wearable bracelets, each with slightly different features. The ninth product is the Fitbit Aria, a 'Wi-Fi Smart Scale' that measures weight, BMI, lean mass and body fat percentage, and which automatically syncs with the Fitbit smartphone app (Fitbit, 2016d). The Fitbit Zip is the most basic wearable, starting at €59,95, and only measures steps, calories, distance and number of active minutes (Fitbit, 2016c). All other wearables also have sleep tracking and a silent wake alarm. The most advanced is the Fitbit Surge, which also measures heart rate, has GPS tracking and functions as a smartwatch by enabling Caller ID, Text Notifications and Music Control (Ibid.).

Appendix B: Statements

Meanings

Healthcare

1. Gebruik Fitbit helpt om lichamelijke problemen eerder te signaleren
2. Fitbit kan ingezet worden als preventief hulpmiddel om gezond te blijven
3. Het menselijk lichaam is te complex voor digitale thuismetingen
4. Door lichamelijke functies te meten geeft Fitbit een goede weergave van mijn gezondheid
5. Door Fitbit gebruik zullen mijn ziektekosten verminderen

Healthier lifestyle

6. Sinds ik Fitbit gebruik heb ik mijn gewicht beter onder controle
7. Fitbit geeft een goede weergave van mijn bewegingspatroon
8. Fitbit helpt mij om gezonder te eten
9. Sinds ik Fitbit gebruik let ik meer op mijn gezondheid
10. Fitbit helpt mij om meer te bewegen
11. Sinds ik Fitbit gebruik heb ik een beter slaapritme

Motivation

12. Competitie met anderen helpt mij om meer te bewegen
13. Groepsdruk helpt mij om meer te bewegen
14. Zonder beloning beweeg ik minder
15. Fitbit helpt mij om op het gebied van sport tot het uiterste te gaan
16. Competitie met anderen is stressvol
17. Ik sport vaker sinds ik Fitbit gebruik

Fun

18. Fitbit is vooral een speeltje
19. Fitbit gebruik is leuk
20. Ik heb Fitbit vooral gekocht uit nieuwsgierigheid
21. Ik vind het leuker om te sporten als ik Fitbit gebruik

Overall wellbeing

22. Ik vind het fijn dat Fitbit aangeeft hoe gezond ik ben
23. Als ik fysiek gezond ben, ben ik gelukkig
24. Ik kan gestrest raken door het gebruiken van Fitbit
25. Fitbit data kan mij overweldigen
26. Ik vind het vervelend als ik mijn Fitbit-doelen niet haal

Sharing of data

27. Mijn Fitbit data moet goed beveiligd worden
28. Vrienden mogen al mijn Fitbit data inzien
29. Collega's mogen al mijn Fitbit data inzien
30. Werkgevers mogen al mijn Fitbit data inzien
31. Het is geen probleem dat onbekenden mijn bewegings- en slaappatroon inzien
32. Bedrijven mogen Fitbit data gebruiken voor commerciële doeleinden
33. Verzekeringen mogen aangepast worden op basis van Fitbit data

Materials

Product characteristics

34. Fitbit metingen geven een juiste weergave van de werkelijkheid
35. Fitbit voldoet aan mijn verwachtingen
36. Het design van de Fitbit is goed

Utilizing Fitbit

37. Ik gebruik Fitbit vooral voor het monitoren van slaapritme
38. Ik gebruik Fitbit vooral voor het meten van beweging
39. Ik gebruik Fitbit vooral voor het meten van hartritme
40. Ik gebruik Fitbit vooral als verlengstuk van mijn smartphone (als smartwatch)
41. Ik gebruik Fitbit elke dag
42. Ik gebruik Fitbit alleen tijdens het sporten
43. Als ik sport, gebruik ik de Fitbit
44. Ik draag mijn Fitbit armband dag en nacht
45. Ik gebruik Fitbit net zo veel als toen ik hem net kreeg

Competences

Required competences

46. Fitbit is gemakkelijk in gebruik
47. Fitbit is gemakkelijk te installeren
48. Ik heb genoeg voorkennis om Fitbit te gebruiken
49. Het is gemakkelijk om een overzicht te krijgen van de voor mij relevante Fitbit data
50. Ik begrijp goed hoe ik alle functies van Fitbit moet gebruiken

Appendix C: Interview script

Introductie, toestemming vragen voor geluidsopname en uitleg onderzoek en onderzoeksdoelstellingen. Tevens uitleg van sociale groepen en hun interpretaties die zijn geïdentificeerd in dit onderzoek.

1. Kunt u iets vertellen over uzelf en uw organisatie?
2. Wat is uw rol in de organisatie?
3. Wat voor rol spelen wearables in uw werk?
4. Hoe kijkt u in algemene zin aan tegen wearables?
5. Wat voor positie denkt u dat wearables gaan innemen in de maatschappij, wat zijn hier de mogelijkheden voor?
6. Vindt u dat deze technologische ontwikkeling gestimuleerd moet worden?
    - Waarom wel/niet?
    - Zo ja, hoe moet dit gebeuren?
7. Wat ziet u als de grootste obstakels voor de diffusie van wearables?
8. Kunnen deze issues opgelost worden?
9. Wie is hier verantwoordelijk voor?
10. Wat betekent het dat er drie groepen zijn met een verschillende interpretatie, hoe moet je hiermee omgaan?
11. Wat zijn de consequenties voor de sociale inbedding van wearables?
12. Hoe kunnen we ervoor zorgen dat de wensen van al deze groepen gehonoreerd worden?

Afsluiting.