CRITICAL EXPERIENCES DURING THE IMPLEMENTATION OF A SELF-TRACKING TECHNOLOGY

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Abstract

Emerging technologies have brought several new ways to track, measure and evaluate own activity. Well-being, nutrition, physical training, mood, and sleep are a few of the various measures that can be self-tracked by different technological solutions. At the same time, people are becoming more interested in themselves and their own well-being, and constant tracking of own activities is getting more and more popular both on individual level as well as in general healthcare. This study examines critical experiences that occur during the implementation phase of the innovation-decision process and their influence to adopting or rejecting a self-tracking technology. The study is qualitative in nature and empirically based on thematic analysis of ten semi-structured interviews used together with the critical incident technique. The theoretical basis of the study comes from two well-established technology acceptance models: unified theory of acceptance and use of technology 2 (UTAUT2) and innovation-decision process. The results reveal the experiences and factors that are important for users in terms of deciding whether to adopt or reject a self-tracking technology during the initial phase of implementation. The results are also reflected to UTAUT2 and the innovation-decision process.

Keywords: self-tracking, human-computer interaction, implementation, adoption, well-being, UTAUT2, innovation-decision process

1 INTRODUCTION

Technology is revolutionizing the world with a variety of solutions including different products, applications, and services. It has accelerated a number of processes both in the work life and people's private lives. It has also enabled the tracking of various measures regarding person's own body and actions i.e., *self-tracking*. At the same time, people in general have become more interested in oneself and want to raise self-awareness of their own actions, choices, and the resulting consequences, particularly in relation to well-being. Exercise, nutrition, mood, and sleep are just a few of the many examples that are common to measure these days (cf., Quantified Self Guide to Self-Tracking Tools 2015). Technological development has increased our ability to track and measure our own actions with different wearable and wireless applications and we can collect various data from our everyday lives. In many cases, the technology automatically enables the collection and analysis of data, ranging from physical effort to emotional well-being (Whitson 2013). Instead of generalizations and averages, we can measure what we are actually doing. We can get information, for example, about what we have done, where, when, and what has been the impact. These kinds of actions for self-tracking can be put under the *quantified self* umbrella.

The term *Quantified Self* was coined in 2007 by Gary Wolf and Kevin Kelly, editors of the Wired magazine (e.g., Combs & Barham 2015; Strong 2014). The term has evolved from its original meaning of collaboration of users and tool makers who share an interest in self knowledge through self-tracking. According to Swan (2013), quantified self refers to one's actions of monitoring any biological, physical, behavioral, or environmental factors regarding one's life. An essential part of the quantified self phenomena is increasing self-awareness through technology and measured data (Lupton 2014) i.e., self-tracking. According to Wolf (2010), the technological development drives consumers to collect data about themselves. This kind of self-tracking has become a part of everyday life for many people (McFedries 2013) and can be a way of taking care of one's own health and well-being (Swan 2013). There are also varying reasons behind the use of different technologies offering some modes of self-tracking. The reasons can be both hedonic and utilitarian (Kari & Makkonen 2014; Makkonen et al. 2012). Self-tracking has been applied to various areas of life, for example, time management, social communications, and health context, "where the expanded definition of health is embraced as applications address both medical issues and general wellness objectives" (Swan 2009, 509). Self-tracking is indeed used more and more in general healthcare and in occupational healthcare (Paton et al 2013; Swan 2009), not just as a method to support treatment and therapy, but also to reduce the increasing healthcare costs (Swan 2013). There is also a growing trend in healthcare that the role of the patient is shifting from being a mere recipient to becoming a more active self-tracker (Swan 2009). Overall, different self-tracking technologies can be utilized by the individuals as well as by the health sector in disease prevention, treatment, and in promoting the general well-being.

As technology and self-tracking are ever more used to promote well-being both at individual level and in healthcare, these self-tracking technologies and the quantified self phenomenon become all the more relevant topics to study. Thus, it is also important to find out what kind of experiences either promote or hinder the adoption of these technologies. Examining the experiences of the users of these tools provide relevant information about the reasons behind adoption and non-adoption. This is especially important, as the use of self-tracking technologies is a voluntary choice for the majority, even if it is suggested by the healthcare professional. In the personal level of technology adoption, the first few weeks are crucial: does the new technology bring enough added value to the user's life or not? (Rogers 2003). Rogers (2003) defines this implementation phase of the innovation-decision process as the phase, where the individual implements the innovation into use and determines its usefulness. Thus, the implementation phase is perhaps the most essential phase in the adoption process, and highly important to study when examining the adoption of an innovation and the factors that influence the adoption and rejection. Therefore, this study focuses on the implementation phase.

Considering the rising popularity and importance of self-tracking technologies in both individual and societal level, and their growing significance in health care, it is important to conduct research on the subject. However, the number of studies on how people adopt and experience self-tracking technologies is still rather limited (Lupton 2013). This kind of investigation can have several important implications for the development and deployment of these technologies.

The purpose of this study is to find out the factors and experiences influencing the adoption and rejection of self-tracking technologies during the implementation phase, and also, to reflect the findings to two well-established technology acceptance models: UTAUT 2 and innovation-decision process. As such, the study can be seen to contain both exploratory and confirmatory elements. In this study we use the term *technology* as an overall term to cover different technological devices, products, applications, services, and other such solutions.

This paper aims to contribute to IS research by answering to the following two research questions:

1. What kind of experiences during the implementation phase influence the users' adoption and rejection of self-tracking technologies?

2. How do our findings reflect to UTAUT2 and innovation-decision process?

The focus of the study is on the subjective experiences of the users during the implementation phase of self-tracking technologies. The implementation phase is set to cover the first 2-4 weeks of use, as the study precisely focuses on the experiences and adoption decisions during the implementation phase, not on a long-term time scale. This phase can also be shorter, if the user rejects the technology earlier. The study is qualitative in nature and it is based on thematic analysis of ten semi-structured interviews used together with the critical incident technique.

The results can help the industry in developing more user-oriented technologies and in marketing them, and thus advance the adoption and diffusion of self-tracking technologies. In addition, our findings are of great value to the healthcare sector, in deploying self-tracking related means of care to the patients. The results also pose interesting findings on how self-tracking technologies can influence users' actions, even in unexpected ways, during the implementation phase.

This paper comprises the following sections. After this introduction, the theoretical background is described, followed by the methodology, results, and the conclusion sections. Finally, the limitations and future research are presented.

2 THEORETICAL BACKGROUND

This study is based on two well-established technology acceptance models. We have chosen the unified theory of acceptance and use of technology 2 (UTAUT2) as the underlying research model for our research. We consider this model the most suitable regarding the focus of our study, as UTAUT2 precisely focuses on the voluntary technology acceptance in the consumer context of use – not organizational (Venkatesh et al. 2012). In addition, our study builds from the innovation-decision process (Rogers 2003), which has also been widely used in technology adoption studies.

2.1 Unified Theory of Acceptance and Use of Technology 2

Venkatesh et al. (2003) first combined different determinants of technology acceptance and use in one unified model, the unified theory of acceptance and use of technology (UTAUT). UTAUT has four core determinants of intention and use that directly affect the adoption and use of technology: performance expectancy, effort expectancy, social influence, and facilitating conditions (only use behavior). UTAUT also presents four moderators of those key relationships: gender, age, experience, and voluntariness of use (Venkatesh et al. 2003). As the UTAUT model was mainly meant for organizational context, Venkatesh et al. (2012) extended the UTAUT model to cover the consumer

context in UTAUT2. The UTAUT2 incorporates three new determinants of intention and use into the original UTAUT: hedonic motivation, price value, and habit. In addition, in UTAUT2, facilitating conditions are seen to affect the behavioral intention also. Similar to UTAUT, gender, age, and experience are moderators of those key relationships, while voluntariness of use was dropped from the model because most consumer behaviors are completely voluntary (Venkatesh et al. 2012). Age and gender were not investigated in our study (other than that the participants had adequate know-how and interest to implement the technology), rather we centered our focus to the experience.

2.2 Innovation-decision Process

The innovation diffusion theory (IDT) (Rogers 2003), first introduced in 1962 by Rogers, has been widely used in studies examining technology adoption (Sahin, 2006). In IDT, Rogers (2003) describes the innovation-decision process. It reflects the decision-making process related to the adoption of an innovation and is defined as "the process through which an individual passes from first knowledge of an innovation to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation and use of the new idea, and to confirmation of this decision" (Rogers 2003, 475)

The innovation-decision process involves five stages: 1) knowledge, 2) persuasion, 3) decision, 4) implementation, and 5) confirmation. The process begins with the knowledge stage, when the individual becomes aware of the innovation. It is followed by the persuasion stage, where the individual seeks information regarding the innovation. This forms an attitude toward the innovation. The attitude and perceived characteristics of the innovation affect the individual's decision to either adopt or to reject the innovation. In the implementation phase, the individual implements the innovation into use and determines its usefulness. Following the primary adoption decision and implementation, the individual makes the final confirmation and decides whether to continue or discontinue using the innovation. If the individual's positive perceptions of using the innovation are strengthened, the use probably continues. If the individual faces conflicts with the prior decision to adopt, he or she may still reject the innovation. The less conflicts there are, the more likely the individual continues the use. Sometimes the primary decision to reject can be overruled and lead to later adoption, if the perceptions affecting the decision are positively strengthened. Overall, the process consists of a number of choices and functions, which can extend over a longer period of time (Rogers 2003). In addition to the different stages, Rogers (2003) defines prior conditions that affect the whole process. These are related to the decision maker (individual) and include previous practice, felt needs/problems, innovativeness, and norms of the social system.

Rogers also defines three characteristics of the individual that influence how the knowledge about the innovation can reach the individual. These are socioeconomic characteristics, personality variables, and communication behavior. For example, wealth and innovative attitude may contribute to the introduction of an innovation. Also, people who are more social may be more likely to hear about new innovations, because they have more social networks, through which they receive information. Communication behavior refers to different ways in which information moves from one person to another. These include, for example, mass media channels such as radio or TV, and face-to-face interaction with other people (Rogers 2003).

In the model, there are five perceived characteristics of the innovation that influence the individual's evaluation of the innovation: relative advantage, compatibility, complexity, trialability, and observability. Relative advantage is "the degree to which an innovation is perceived as better than the idea it supersedes". Compatibility is the "degree to which an innovation is perceived as being consistent with the existing values, past experiences, and need of potential adopters". Complexity is the "degree to which an innovation is perceived as difficult to understand and use". Trialability is the "degree to which an innovation may be experimented with on a limited basis". Observability is the "degree to which the results of an innovation are visible to others" (Rogers 2003, 15-16). Innovations that are perceived as greater regarding relative advantage, compatibility, trialability, and observability and having less complexity will more likely to be adopted.

3 METHODOLOGY

To collect and examine individuals' critical experiences in the implementation phase, we chose a qualitative approach. Qualitative research aims to understand people and their sayings and doings as well as the social and cultural context they live in. The goal is to understand real life and find new knowledge. One of the key benefits of qualitative research is that it enables the researcher to see and understand the underlying contexts in which actions happen and decision are made (Myers 2013).

To gather the data, we chose interviews as the data collection method. "The qualitative interview is the most common and one of the most important data gathering tools in qualitative research" (Myers & Newman 2007, 3). The type of qualitative interview we chose was a semi-structured interview, as we wanted to collect meaningful experiences related to the theme of the research. It is also the most used type in qualitative research in information systems. In a semi-structured interview there is an incomplete script, but usually some pre-formed structure that the interviewer follows (Myers & Newman 2007). This was also the case in this research. To gain maximal benefit from using semi-structured interview as a tool and avoid the potential problems and pitfalls, in planning and conducting the interviews we followed relevant guidelines for semi-structured interviews presented in previous literature (e.g., Guest et al. 2006; Myers 2013; Myers & Newman 2007).

Our study included two interviews for each interviewee, one before and one after the implementation. Therefore, we developed two distinct interview scripts: one for the interviews before the implementation (Script 1) and one for the interviews after the implementation (Script 2). Following Myers and Newman (2007), the scripts included the opening, the introduction, key questions related to certain themes, and the closing. The themes of both interviews are presented in the appendices. The themes of Script 1 were developed based on the research questions, previous literature, and the theoretical background (UTAUT2 and innovation-decision process). Script 2 included the same aspects added with the critical experiences of the implementation phase. To collect the descriptions of those critical experiences, we used the critical incident technique (CIT) originally presented by Flanagan (1954). The interviewees were asked to describe the critical incidents that occurred during the implementation phase in as much detail as possible. Critical incident is an experience that the person "perceives or remembers as unusually positive or negative" (Edvardsson & Roos 2001, 253).

CIT has been widely applied as a research method in various different research disciplines (Butterfield et al. 2005). CIT is a well-established method which allows the researcher to "to collect, content analyze, and classify observations of human behavior" (Gremler 2004, 66). Flanagan (1954) points out that the CIT "does not consist of a single rigid set of rules governing such data collection. Rather it should be thought of as "a flexible set of principles which must be modified and adapted to meet the specific situation at hand" (Flanagan 1954, 336). In planning the research, we followed Flanagan (1954) and used such words as: appreciation, efficiency, development, production, and service to be prominent in statements of general aims. Overall, CIT has been proven to be a sound research method and is well suited for gaining insights on a previously undiscovered phenomenon (Gremler 2004; Meuter et al. 2000). Thus, CIT fits the purpose of collecting critical experiences well.

Following McCracken (1988), in selecting the interviewees we aimed for fairly homogenous sample that share critical similarities concerning the research question. Thus, we aimed to maximize the depth and richness of the data. In addition, certain criteria were used: 1) the person was interested in self-tracking technologies, 2) the person had the possibility to use and was about to implement one or more of these technologies, 3) the person was motivated to take part in the research. To recruit the interviewees, we used a snowball sampling approach (Patton, 2002). We first sought persons that met the set criterion and then suggested them with the possibility to participate in the study. Selected participants provided information on further possible participants and these again spread the word. Since we were looking for authentic implementation situations, we did not require all the interviewees to implement the same technology, but allowed them to choose a technology toward which they had a genuine interest themselves. All interviewees reported that they would have probably implemented the

technology in the near future even without the suggestion of the researchers. The implementation and use of different technologies was not in contradiction with the focus of the research, as the aim was not to examine experiences related to one specific technology, but rather to find out critical experiences that arise from the implementation of self-tracking technologies on a general level.

The study was conducted with ten interviewees. Out of the ten interviewees, six implemented an activity tracker and four implemented a mobile application for self-tracking. In addition, four of the interviewees were simultaneously implementing another mobile application, in which case they were also interviewed about these. Leading to a total of eight interviews about the mobile application experiences. Thus, in total we obtained 14 implementation experiences (6 activity trackers and 4 + 4 mobile application). All of the implemented technologies also supported some kind of social features such as sharing or web-based community.

In total, we conducted ten interviews before the implementation and ten interviews after the implementation. The second interview was held four weeks after the first one. The interviews (10 + 10) were conducted during late 2014 by one of the authors. The interviews were held face-to-face with the interviewee. On average, the interviews lasted 30 minutes. The interviews were recorded and transcribed (in the interviewees' native language). Based on the transcriptions and notes made during the interviews, the analysis began.

The method of analysis we used was thematic analysis, which is the most widely used method of analysis in qualitative research (Guest et al. 2012). Thematic analysis is a method for "identifying, analyzing and reporting patterns (themes) within data" (Braun & Clarke 2006, 79). It organizes and describes the data set in rich detail, and normally goes even further by interpreting various aspects of the research topic (Braun & Clarke 2006). In addition to identifying, analyzing, and reporting the patterns in our data, we also aimed to interpret various specific aspects and exceptions related to the topic of our research. In doing our analysis, we applied the guidelines by Braun and Clarke (2006) and Patton (2002). As suggested (Braun & Clarke 2006; Patton 2002) we applied these guidelines flexibly to fit the research question and data, and the analysis process was not linear phase-to-phase process, but a recursive one, as we moved back and forth between the different phases of the analysis.

4 RESULTS

The sample consisted of ten Finnish interviewees between 21 to 27 years of age. Two were male and eight female. The interviewees were people interested in self-tracking technologies and had little or some previous experience of these technologies.

The results regarding the adoption and rejection of technologies are presented in Table 1. Table 1 depicts how many interviewees either adopted or rejected the technology during the implementation phase i.e., how many continued and how many discontinued using the technology. As four of the ten interviewees also implemented another technology, there are total of 14 implementation experiences.

	Mobile application	Activity tracker
User 1 (male, 27, employee)	1	1
User 2 (female, 24, employee)		1
User 3 (female, 24, unemployed)	1	
User 4 (female, 21, student)		1
User 5 (female, 24, student)	2	
User 6 (female, 24, employee)		1
User 7 (female, 24, employee)	1	1
User 8 (male, 25, student)	1	1
User 9 (female, 24, student)	1	
User 10 (female, 24, employee)	1	
Implemented	8	6

Adopted	3	3
Rejected	5	3

Table 1. Adoption and rejection of technology.

As can be seen from Table 1, from the 14 implementations, six lead to adoption and eight ended in rejection. From the eight mobile application implementations, three lead to adoption and five to rejection. From the six activity tracker implementations, three lead to adoption and three to rejection.

4.1 Critical Experiences and Reasons Behind the Adoption and Rejection During the Implementation Phase

Figure 1 summarizes the foundation (theoretical background) and the results of the study, divided into expectations before the implementation and experiences after the implementation.

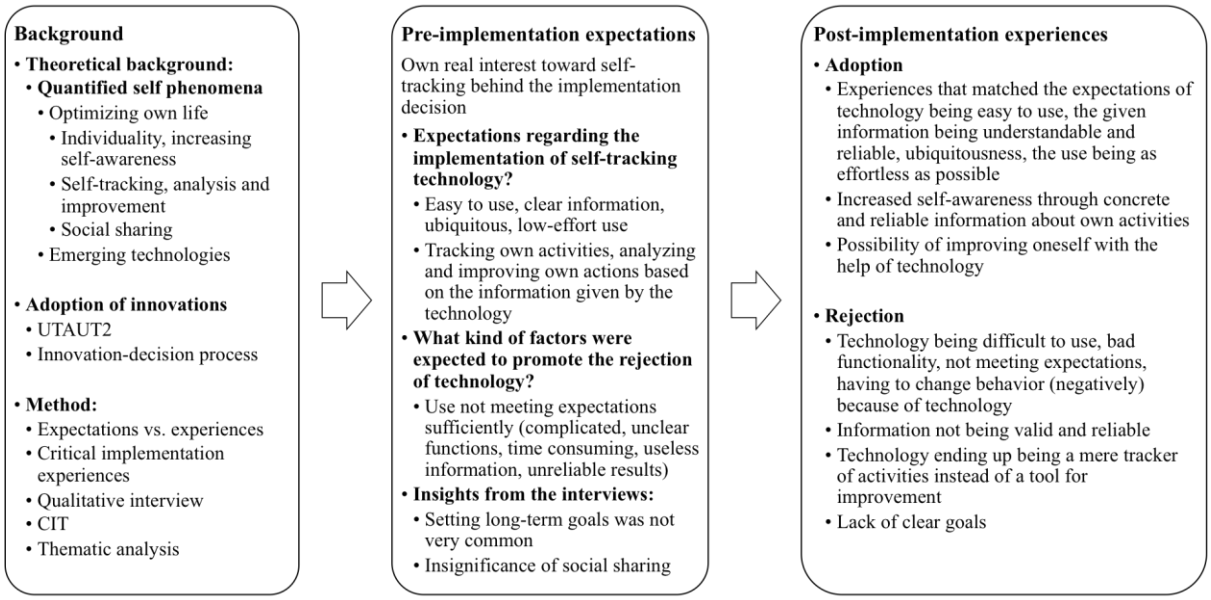

Figure 1. The foundation of the study and summary of results.

The adoption of technology was influenced by several different types of implementation experiences. In line with both previous research (Rogers 2003; Venkatesh et al. 2012) and pre-implementation expectations, these experiences were related to the expectations regarding ease of use, clarity of information, and effortless adoption. The ubiquitousness of the technology was emphasized in our results. The interviewees expected that the technology should be effortless to wear and carry, and at the same time measure their activities with as little needed effort as possible. In other words, the effort expectancy was quite extreme. In practice, if the user perceived the technology to be sufficiently ubiquitous and useful part of everyday life, it positively influenced the experience of using the technology. Also, the clarity and usability of provided information had an important role in adopting the technology. It was required to be easy to understand.

Based on previous research (Rogers 2003; Venkatesh et al. 2012) and pre-implementation expectations, it was expected that the continued adoption of technology is influenced by the possibility of improving oneself with the help of technology. Our results highlighted the importance of this already from the outset. A mere tracking of one's own activities is not enough to sustain interest toward continuous use of the technology if the user is unable to utilize the gained information. The user expects and needs experiences that concretely show that he or she has improved in the measured area. Our results also emphasized the validity and reliability of the information. It was important for

the users that the technology gave relevant information that was also perceived reliable. If the data produced by the technology did not provide needed, usable, and trustworthy information from one's own activities, it was likely to lead to rejection of the technology. Also, if the user did not have a clear felt need or a problem before implementing the technology, the perceived benefit could restrict to a "nice to know, but so what"-level, which was likely to lead to discontinuance (rejection) already in the implementation phase. However, this indicates that users do test new technologies even without a clear felt need or a problem that they would look to find a solution to.

One very interesting finding from our results was that the functionality of the technology can drive users to change their behavior intentionally. This was apparent with the experiences related to activity trackers (that are most often worn on one's wrist). A number of interviewees reported that they wanted to achieve better (tracked) results (e.g., more tracked activity by the tracker) and intentionally changed their behavior for that, for example, by walking instead of cycling, or by carrying goods in the other hand than where they had the tracker, so that the device would track all their activity and not show them as passive time in the absence of hand movement. With mobile applications, users reported that the increased battery consumption forced them to plan more about when and how to charge the battery. These intentional changes in behavior did not improve users' performances, but instead made their daily activities more difficult. This was an important new finding.

4.2 Results Reflected to UTAUT2 and Innovation-decision Process

As the theoretical background of this study is based on UTAUT2 and innovation-decision process, the results from the interviews are compared to these models. The pre-implementation interviews focused on the expectations and other determinants behind the behavioral intention presented in these models. Post-implementation interviews investigated how the pre-implementation expectations actualized and focused on the implementation experiences and their influence on adoption and rejection.

4.2.1 Expectations Reflected to the Technology Acceptance Models

The expectations, recognized determinants, and the new associations that influenced the initial adoption decision are presented in Figure 2 for UTAUT2 and in Figure 3 for the innovation-decision process. The associations related to actual use of the technology are dimmed, as they are examined in relation to the actual experiences.

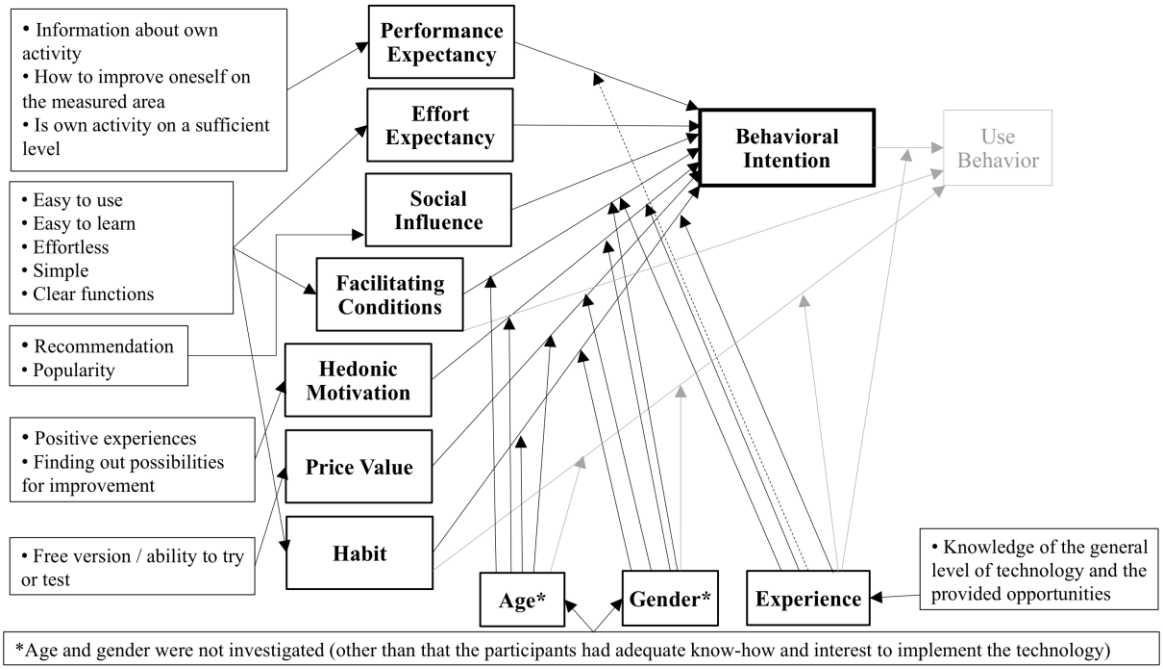

Figure 2. Expectations regarding self-tracking technology in the UTAUT2-model (modified from Venkatesh et al. 2012, 160).

Regarding UTAUT2 (Figure 2), the performance expectancy was based on expectations that using the technology would bring sufficient added value and advance the achievement of a possible goal. Receiving clear information that helps in assessing the level of own activity and how to improve it were considered especially important performance expectations. In addition, we also found that previous experience on self-tracking technologies influenced the performance expectancy toward new technologies. Previous experience had created a vision about the technologies and their benefits on a general level and this influenced the performance expectations. Thus, according to our results, there is an association between experience and performance expectancy preceding the behavioral intention. This association is not found in UTAUT2 and is presented in Figure 2 with a dashed line.

Effort expectancy, facilitating conditions, and habit were all based on same expectations: easy to use, easy to learn, effortless, simple, and clear functions. These were seen as essential, so that the use is easy enough (effort expectancy) and the functions support the use (facilitating conditions), and should these expectations realize, they advance the formation of habit. Hedonic motivation was based on expectations of receiving positive experiences and finding out possibilities for self-improvement, as these were expected to increase perceived pleasure, fun, and well-being. Social influence was based on the popularity of the technology and recommendations, which influenced the intention to start using the technology. Concerning price value, being able to try or test the technology or the technology being free lowered the barrier to start using it. In addition to UTAUT2, the expectations are also reflected to the innovation-decision process in Figure 3.

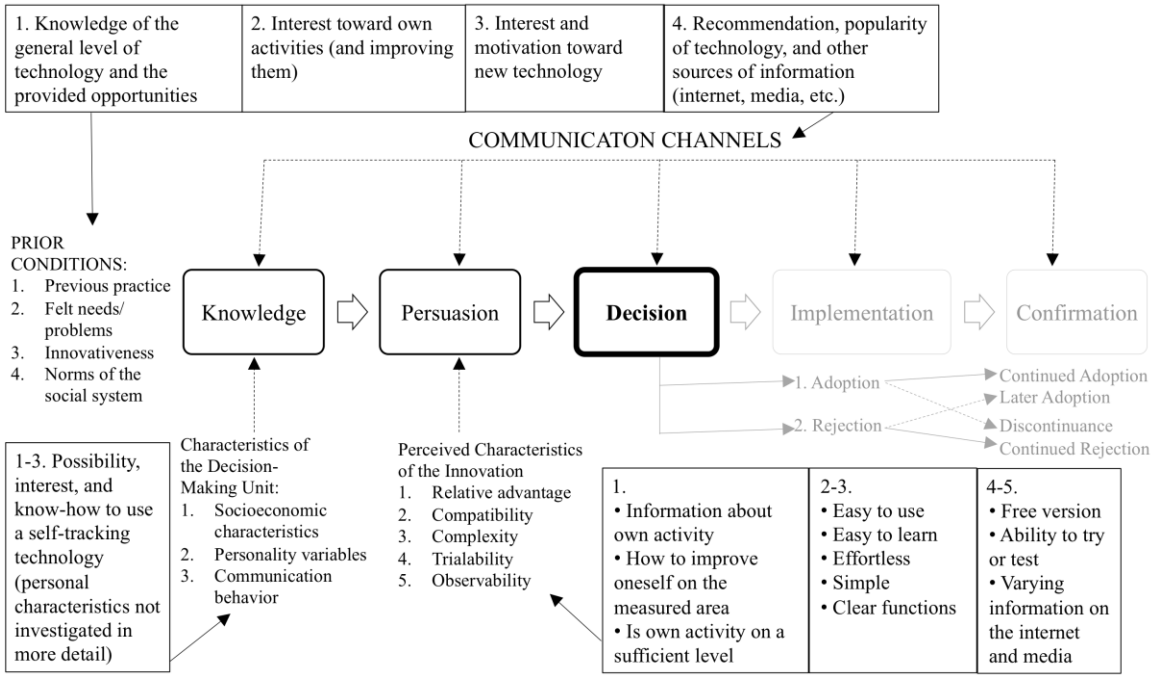

Figure 3. Expectations regarding self-tracking technology in the innovation-decision process (modified from Rogers 2003, 170).

The knowledge stage is based on prior conditions, which in our results were related to previous experience, interest toward own activities and improving them, interest toward new technology, and the popularity and recommendations together with other sources of information. Knowledge is followed by the persuasion stage, where the perceived characteristics of the innovation also play an important role. In our results these were highlighted through the expectations of technology offering information for self-improvement, being easy to use and learn, effortless, simple, clear, and available for testing and evaluation through external information. Our results support that these factors regarding the persuasion stage affect the individual's initial decision to either adopt or reject a self-tracking technology.

As can be seen from Figures 2 and 3, when reflecting and comparing these results between both models, same aspects arise. The main difference between the models is the bigger role of personal characteristics and communication channels in the innovation-decision process. As mentioned earlier, personal characteristics were not investigated in greater detail (other than that the participants had adequate know-how and interest to implement the technology), but regarding communication channels, we found that other sources of information such as Internet and media were influential, as users used these to seek positive and negative information about the technologies themselves.

4.2.2 Experiences Reflected to the Technology Acceptance Models

The experiences and determinants influencing the actual use of self-tracking technology are presented in Figure 4 for UTAUT2. As the focus here is specifically on the use of the technology and on the implementation experiences, the determinants preceding the behavioral intention are omitted. Similarly, Figure 5 presents the implementation experiences reflected to the innovation-decision process, with focus on the last stages of the process concerning the use of technology.

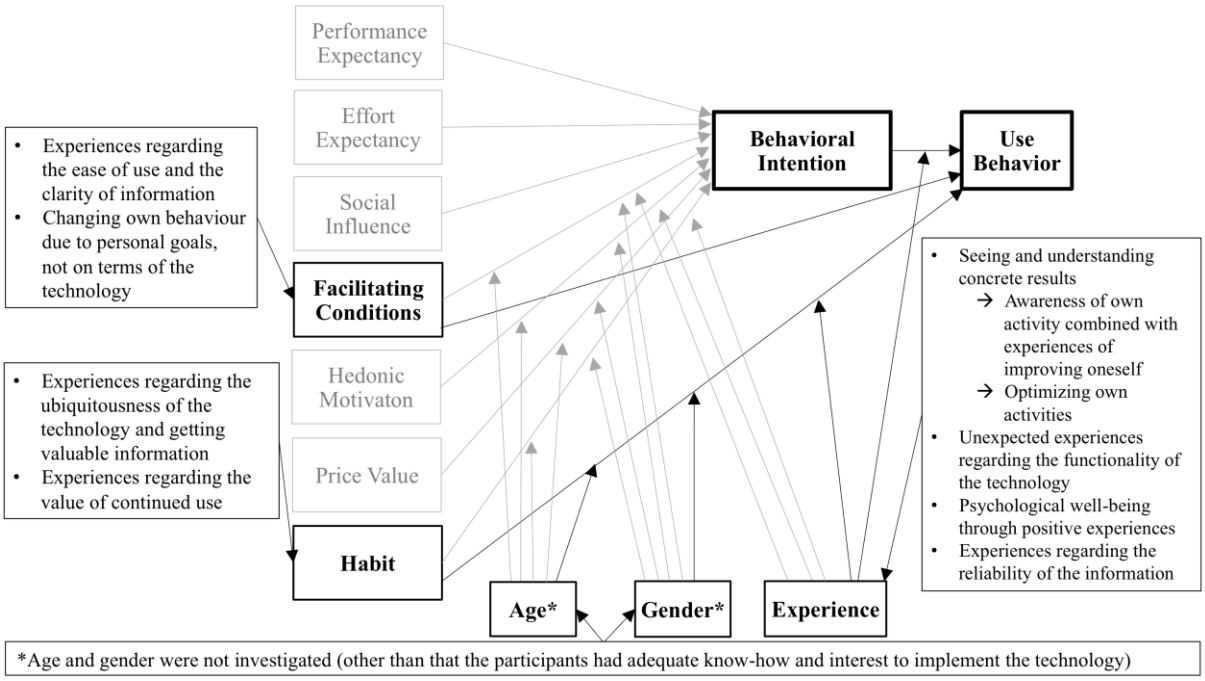

Figure 4. Implementation experiences regarding self-tracking technology in the UTAUT2-model (modified from Venkatesh et al. 2012, 160).

Together with behavioral intention, the determinants that directly affect the use behavior are facilitating conditions and habit, while experience, age, and gender have a moderating role. Facilitating conditions were positively influenced by experiences regarding the ease of use straight from the outset and technical features that provided clear and understandable information. They were negatively influenced by experiences of complicated usability, vague information, and ending up changing own behavior in a negative way on terms of technology. Habit formation was advanced by experiences regarding the ubiquitousness of the technology and receiving valuable information. Also, the perceived value of continued use was important. If the use did not provide sufficient value, it hindered the habit formation, together with experiences regarding unsuitability of use in everyday life.

In addition to these determinants, the use behavior was influenced by experience. Especially those experiences that increased the users' awareness of own activities and helped in optimizing them were essential. An important aspect behind this was the experience of information being valid and reliable. Also, positively surprising experiences were perceived influential as they amazed the user and motivated to continue the use. These kinds of critical experiences positively influenced the adoption decision. Respectively, similar but negative experiences negatively influenced the adoption decision and were likely to lead to rejection. In addition to UTAUT2, the implementation experiences are also reflected to the innovation-decision process in Figure 5.

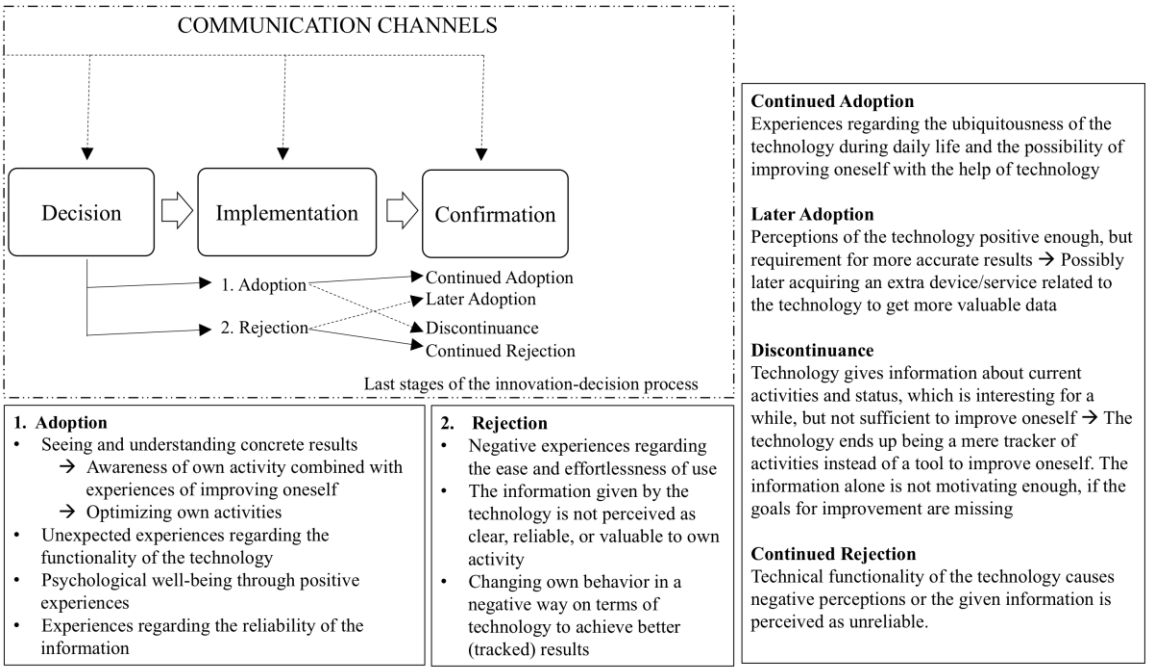

Figure 5. Implementation experiences regarding self-tracking technology in the innovation-decision process (modified from Rogers 2003, 170).

If the user has made the initial decision to adopt a self-tracking technology, the technology is implemented into use to determine its usefulness. Compared to UTAUT2, the aspects behind the adoption and rejection are similar in the innovation-decision process. However, the innovation-decision process also covers the continuance of adoption. Based on the implementation experiences, the user makes confirmation on whether to continue the adoption of the technology or not. Continued adoption is fostered by positive experiences regarding the technology's usefulness in self-improvement and ubiquitousness in everyday life. The initial decision to adopt can also end in discontinuance, especially if the technology ends up being a mere tracker of activities and the user finds it useless for self-improvement. Also, the lack of goals regarding the use can lead to discontinuance.

As with the decision to adopt, the initial decision to reject can either continue or change. Continued rejection is fostered by negative perceptions regarding the functionality of the technology or the information it provides. With self-tracking technologies, these perceptions were so influential, that the interviewees rather adopted another self-tracking technology instead and it was seen unlikely that the initial decision to reject would change into later adoption. Rejection could possibly change into later adoption, if the perceptions regarding the technology were positive enough, but the technology was required to offer substantially more benefit than it currently did. This could perhaps be achieved through acquiring some extra accessory that would provide new measures and improve the value of the overall data. But as mentioned, this later adoption was seen improbable.

5 CONCLUSION

This study examined the factors and experiences influencing the adoption of self-tracking technologies during the implementation phase. The focus was on the critical experiences that either promote or hinder the adoption or lead to rejection during the implementation phase. Theoretically the study was based on two well-established technology acceptance models: UTAUT2 and innovation-decision process. The main research questions of the study were 1) What kind of experiences during the

implementation phase influence the users' adoption and rejection of self-tracking technologies? and 2) How do our findings reflect to UTAUT2 and innovation-decision process?

The main theoretical contribution of the study comes from answering these questions and reflecting the results to two well-established technology acceptance models: UTAUT2 and innovation-decision process. We found that adoption and rejection of self-tracking technology is influenced by several different types of implementation experiences.

The adoption was promoted by experiences that matched the expectations of technology being easy to use, the given information being understandable and reliable, and the use being as effortless as possible. In practice, if the technology was sufficiently ubiquitous and useful part of everyday life, it promoted the adoption. The continued adoption of technology was also influenced by the possibility of improving oneself with the help of technology. The interviewees highlighted use experiences that concretely showed improvement in the measured area or the expected fulfillment of personal goals.

The rejection was promoted by experiences of the technology being difficult to use, bad functionality, the given information not being valid and reliable, technology usage not matching expectations regarding use and improving oneself, and the technology ending up being a mere tracker of activities instead of a tool to improve oneself. Also, if the user did not have a clear goal in mind about what to achieve by using the technology, it likely lead to discontinuance (rejection). In addition, we found that the functionality of the technology can drive the user to change behavior intentionally in a way that does not improve performances, but instead makes daily activities more difficult. Such experiences also promoted rejection. This was an important new finding and indicates that with self-tracking technologies, it is particularly important to consider how the technical functionality of the technology can influence the user and the use, and take this into account in the design process. It is also something to consider when providing use instructions or creating manuals.

To promote the diffusion of self-tracking technologies, new users will need insights and guidance on how to make the use of these technologies more goal-oriented, not just something to wear. This could be achieved by setting clearer and more concrete target goals for usage. As our results show, the users want clear, relevant, and easy-to-understand information, so providing this could also advance the goal-oriented use of self-tracking technologies. Also, when deploying these technologies for patients, the professionals should provide them with clear guidance and goals for use.

Overall, our findings were mostly in line with UTAUT2 and innovation-decision process, which supports their selection as the theoretical foundation. In addition to these confirmatory findings, we did find that previous experience on self-tracking technologies influence the performance expectancy toward new technologies. This association between experience and performance expectancy preceding the behavioral intention is not found in UTAUT2.

The other new findings of the study concerned the goal-oriented use (and lack of it) of self-tracking technologies and the role of information. A mere interest and motivation to use the technology are not sufficient for continued adoption, if the use does not meet the personal needs and goals, and the use is more driven by the technology than the user. Thus, it could be said that there is a shift in users' demands from *quantified self* to *qualified self*. Also, the concreteness and reliability of the information was ever more emphasized in improving own activities and subsequently influenced the continued adoption. In addition, our study shows that acting or living on the terms of a self-tracking technology can have a negative influence on the daily activities and life of the user.

In conclusion, we believe that the various actors operating in the self-tracking technologies industry can use our findings and implications to develop even better self-tracking technologies that gain popularity among people. Also, we hope that the findings and implications can help the healthcare sector in deploying self-tracking related means of care to the patients and in improving general health and well-being.

6 LIMITATIONS AND FUTURE RESEARCH

There are three main limitations in the study. First, as the focus was on the implementation phase, the target group was rather small, as it had to consist of people just about to implement a self-tracking technology. Therefore, to recruit the interviewees, we had to seek persons interested in the subject and then suggest the possibility to participate in the study. However, all interviewees could choose the implemented technology themselves and reported that they would have implemented the technology at some point in the near future even without the suggestion of the researchers. Thus, the implementation was a natural situation and based on own interest. We also followed previous guidelines (McCracken 1988) in selecting the interviewees. Second, although providing a great amount of information, the number of interviewees could have been higher and the composition of sample more balanced. However, we believe that an adequate number of interviews were conducted, as we continued to conduct interviews till we had recognized that their marginal benefit was significantly reduced. Third limitation concerns the general limitations of qualitative interview. However, to gain maximal benefit from using a semi-structured interview as a tool and to avoid the potential problems and pitfalls, in planning and conducting the interviews we followed relevant guidelines for semi-structured interviews and CIT (Braun & Clarke 2006; Flanagan 1954; Guest et al. 2006; Myers 2013; Myers & Newman 2007). It is also to be noted that the identified themes in the thematic analysis are always based on the interpretations of the researchers (Guest et al. 2012). Thus, we also applied relevant guidelines in doing the analysis. As most often with qualitative research, it's difficult to make generalizations from the sample to a larger population (Myers 2013) and one needs to be cautious if doing so.

The findings of the study also provide potential paths for future research. First, this study examined the implementation and adoption of different self-tracking technologies, but it would also be interesting to investigate one specific technology. By investigating a specific technology, it would be possible to identify technology-specific characteristics in more detail. Second, the target group could be limited to a certain kind of users who have similar goals, for example, weight loss, better sleep, or other specific area. Third would be to investigate why some technologies are more successful than others, for example, by comparing the most popular self-tracking technologies to less popular ones.

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APPENDIX A THEMES OF PRE-IMPLEMENTATION INTERVIEWS

1. Background	*1.1 Demographics*	*1.2 Socioeconomic characteristic*
2. Prior conditions	*2.1 Previous practice*	*2.2 Felt needs/problems*
3. Innovativeness, personality	4. Social aspects	5. Performance expectancy
6. Effort expectancy	7. Facilitating conditions	8. Hedonic motivation
9. Price value	10. Habit	

More detailed descriptions of the themes and key questions are available from the authors by request.

APPENDIX B THEMES OF POST-IMPLEMENTATION INTERVIEWS

1. Critical experiences	2. Appreciation	3. Efficiency
4. Development	5. Production	6. Service
7. Context of implementation	8. Performance expectancy	9. Effort expectancy
10. Facilitating conditions	11. Hedonic motivation	12. Price value
13. Habit	14. Social aspects	15. Relative advantage
16. Compatibility	17. Complexity	18. Trialability
19. Observability	20. Communication behavior	

More detailed descriptions of the themes and key questions are available from the authors by request.