



# Long-Term Appropriation of Smartwatches Among a Group of Older People

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**Abstract.** In this paper, we analyze long-term appropriation of smartwatches among a group of older people. For the purpose of the study, we provided five older individuals (aged 71 to 80; three women, two men) with Android smartwatches. We interviewed participants after 2 and 12 months of smartwatch usage and observed its usage in an informal gathering 12 months after the end of the study. Drawing on Morville's model of user experience (2004), we focus on how the smartwatch was (not) useful, usable, valuable, and desirable for each participant in each stage of the process. Results show the relevance of usability and desirability in the (non-)appropriation of smartwatches for those participants. Specifically, participants used the smartwatches to express their sporty, techie and fashion identities.

**Keywords:** Older people · Wearable · Smartwatch  
Appropriation · UX

## 1 Introduction

Significant attention has been given to smartwatches in research into human-computer interaction in recent years. On the one hand, they offer access to basic smartphone information while leaving the hands free, supposedly allowing users to interact in a more natural way. On the other hand, they allow an intimate connection to be created with user's body, thus allowing certain body indicators to be obtained [1, 2]. Research into the topic is growing steadily. In part, this research is related to understanding smartwatch perceptions and usage, but it is also related to new possibilities for interaction. There is particular interest in how these watches could compensate for physical and cognitive decline often associated with older people [3, 4]. To further this understanding of how best to take advantage of this technology for older people, we present a case study analyzing long-term appropriation of smartwatches among a group of older individuals.

We provided five older individuals (aged 71 to 80; three women, two men) with Android smartwatches. The project was designed to follow their experiences over 12 months. Thus, we interviewed participants 2 and 12 months after the start of the study through informal interviews. In addition, 12 months after the end of the study, that is, 24 months after the study had started, when participants had no further commitments with the study, an informal gathering was held so that we could observe if participants

were using the smartwatches or not. We briefly chatted with each participant about their use. Our aim was to address the following research question: How do usefulness, usability, valuableness and desirability influence long-term appropriation of smartwatches among a group of older individuals?

In this paper, we present the evolution of participants' user experience (UX) to show how they did or did not become long-term users of the device. The results revealed different facets that influence smartwatch user experience. In general, smartwatches were useful and usable for most participants, but these were not the main reasons for (non-) appropriation. Otherwise, valuableness and desirability were key factors for (non-) appropriation of the smartwatches. Thus, engaged participants, those that kept using the smartwatch 24 months after the start of the study, found it valuable and used the device to express their sporty, techie and fashion identities or to obtain social recognition. The findings help to better understand the challenges facing the appropriation of smartwatches and other technological devices, especially among older people.

## 2 Related Work

In recent year, research has focused its attention on the perceptions of smartwatches and smartwatch usage. Both sides of the consumer process contribute to understanding the appropriation of a new technology [5]. Different studies have looked at smartwatches from the perspective of usefulness, usability, valuableness, and desirability, which will be further explained in Sect. 3. However, these aspects have been studied based on non-users or in short-term studies (less than 6 months) and with mostly young participants.

According to a survey of 226 potential users, where the average age was 21, "perceived usefulness and visibility (which is related to desirability) are important factors that drive adoption intention" [6] p. 276. According to another survey of 212 potential users (of whom 13.2% were 55+), relative advantages (usefulness), ease of use (**usability**), result demonstrability and enjoyment (valuableness) have a significant impact on users' attitude toward a smartwatch. In addition, attitude significantly influences smartwatch acceptance [7].

Some studies have explored how regularly people use smartwatches which is an indicator of their **usefulness**. Based on surveys with 90 Apple watch users, after 120 days of use (4 months), researchers identified that only 4.5% had stopped using the smartwatch [8]. A study based on data collected through activity trackers involving 50 students over 203 days (6 months approx.) concluded that the students wore the smartwatches an average of 10.9 h on weekdays and 8.4 during weekends [9]. Another study tracked the smartwatch activities of 307 anonymous users, with no demographics provided. According to the results, smartwatches are used more frequently throughout the day and for briefer periods of time than smartphones [10]. In addition, an analysis of the smartwatch logs of 27 participants from a university campus concluded that "smartwatch usage is more uniformly distributed compared to that of smartphones" [11].

According to previous studies, the main added value of smartwatches (or **valuableness**) is the possibility of reading notifications [12, 13]. In interviews with 10 smartwatch users, who had owned their smartwatches for at least three months confirmed that “Users see a large benefit in receiving notifications on their wrist” [14] p. 3557. One of the main reasons is “lack of impact of watch glances on conversation” [15] p. 3582, for example, among school teachers [16]. Personal interest and activities also shape smartwatch user experiences [17].

The influence of **desirability**, those aspects related with style and identity, on smartwatch appropriation has been discussed in different studies. Style is part of the smartwatch experience [13, 18]. “Individuals with a high level of vanity would consider using smartwatches to be more enjoyable (and) one’s need for uniqueness was found to be a critical predictor of how much one would perceive smartwatches to be enjoyable and useful for expressing oneself” [19] p. 9. Concretely, “display shape and standalone communication are more critical factors influencing respondents’ smartwatch choices than brand and price” [20].

### 3 Methods

The empirical evidence presented here comes from a case study originally designed to analyze the processes of smartwatch adoption and appropriation by older people. We provided a Moto G 360 smartwatch to participants, all of whom had to have a compatible Android smartphone. Participants had to be 65 or older. They already needed to be active users of smartphones, be strongly committed to following the study, and not have a smartwatch. They could choose between the Moto G 360 1st generation (1.6" screen) and the Moto G 360 Sports 2nd generation (1.37" screen), models available on the market at the beginning of the project. Participants received monetary compensation for time spent in interviews and were able to keep the smartwatch after 12 months of participating in the project. This particular study is part of a wider project, where we tracked their smartwatch activities with an app, conducting another three interviews to get bimonthly reports, but such information was not used for the purposes of this paper. Following approved ethical protocols, participants could stop their collaboration with the project at their convenience. They could do whatever they wanted with the smartwatch during and after the study period, just as long as they committed to giving the bimonthly interviews and using the tracking system for one year to participate in the project.

We use a mixed methods approach, combining reported speech with observations in real-life settings [21]. For the purpose of this paper, we conducted two semi-structured interviews, the first interview after two months and the second interview after twelve months of having the smartwatch. Twenty-four months after the start of the study, we met with the participants in an informal gathering, where we observed if they were using the smartwatches and briefly chatted with them to ascertain if they were using them regularly or not. Thus, we have combined detailed qualitative information on their experiences at months 2 and 12 with concrete qualitative data for month 24.

The study involved 5 participants: 3 women and 2 men, aged 71 to 80. In this paper we will refer to them as: W1, W2 W3, M1, M2. They are participants from an adult education center. We had met them previously because one of the paper's authors often volunteers as an ICT teacher and other research projects had been conducted at the center.

We used 4 of the 7 facets proposed by Morville [22] to understand different aspects of user experience; specifically, how useful, usable, desirable and valuable a product is for a user in any given moment. The 4 facets allowed a holistic understanding of each individual user experience, and were useful as a strategy to spark discussion with participants about their user experiences. We did not use the other 3 facets described in Morville's framework, namely that a product be findable, credible and accessible, as they were not closely related with the smartwatch experience analyzed in this study.

We will explain the four concepts we did use as described by Morville and how they relate to this project.

- Useful. The user should find some utility. In this project, we specifically considered if people used the smartwatch regularly as an indicator of usefulness, and what for?
- Usable. The product should be easy to use. Thus, we considered if they had problems, questions or issues they would like to clear up and have not yet learned about.
- Valuable. The product must provide an added value to the user, in comparison to other products. Specifically, we considered what participants found to be most valuable about the smartwatch in their opinion.
- Desirable. It refers to the power and value of image, identity and other elements of emotional design. In this study, this is how participants associate it with their personal identity.

In the first interview, we included several questions related to the participants' user experience, and we extracted topics related with all 7 facets described by Morville. As the most common topics found in this interview had to do with usefulness, usability, valuableness, and desirability, we ignored Morville's other three facets. In the second interview, we focused in questions related to these 4 facets. In the results for both interviews we extracted the comments related with the four facets. We assessed if their comments were positive ↑, ambivalent ↑↓ or negative ↓. Finally, we compared the experiences they reported during the first and second interviews with the observations made at the informal gathering after 24 months.

## 4 Results

At month 12 of the study, the five users reported that the smartwatch was **useful**. They were able to include it in their everyday life and use it for a variety of purposes, depending on their interests. However, two of them (W1 & W3) stopped using the smartwatch after month 12 of the study, once their commitment to the project was over. In the month-12 interviews, they stated that, although it was usable and useful, it was not valuable or desirable enough. Contrarily, by month 12, the other 3 participants found it valuable and desirable. At month 24 they were still consistently using the smartwatch, even though their commitment to the project had ended.

Except for a few problems at the beginning of the study, each participant learned to use the smartwatch. However, each one only became an expert in the features that interested them the most. Except for one participant (W2), the rest found the smartwatch **usable**. Despite the difficulties encountered, W2 was one of the participants still engaged at month 24. For all three engaged users, the smartwatch was **valuable**, although for different reasons. The activity tracker was the most valuable for M2 while the notifications were what W2 most appreciated. M1 found it valuable for the notifications, the maps and the music control. For all three, **desirability** played a role in smartwatch appropriation. The smartwatch helped to express their identity, whether it be sporty, techie or fashion-related, or to obtain social recognition. In the following sections, we provide details of the evolution of each participant’s user experience.

#### 4.1 W1, The Disenchanted

At month 12, she wears it every day, all day, at home and outside. The reports from the first and the second interviews are consistent; she finds it useful and usable. However, the smartwatch does not seem valuable and desirable to her (See Tables 1 and 2). She considers it just a cool thing, and more interesting for young people. When she started using the smartwatch, she had expectations about how it could change people’s lives. However, after 12 months of usage, these expectations have not been met, and she can find no reason to continue using the smartwatch. In fact, by the end of the project, she gave the smartwatch to her nephew.

**Table 1.** W1, Interview 1

↑	Useful	She uses it to check the time and notifications, which happens very often because she has a pretty active social life
↑	Usable	She finds it is easy to use, and, when asked, she gives this example: ... <i>during Christmas, he [her nephew] un-configured it [...] so I did the setup again [...] step by step</i>
↑↓	Valuable	She states <i>this is practical, because you wear it here (showing the wrist)</i> . However, she expects to get more out of it, to learn more things about it
↓	Desirable	She likes its practical features, but she doesn’t show any signal of emotional engagement with the device itself. She does not associate it with aspects of her identity, and she does not express any sign that the smartwatch clashes with her identity

**Table 2.** W1, Interview 2

↓	Useful	She wears it regularly and reports that she frequently uses it, only because she has a very intense social life: <i>I wear it. As I wear it, I use it. Look, not long ago I had a WhatsApp, now it comes another, that is, they are arriving.</i> However, she is clear about the fact that she won't keep using it: <i>I think that when we finish everything [the project], I'll give it away. Because I have a nephew who is twelve years old, nearly thirteen, and he loves it</i>
↑	Usable	She has no usability issues but has not explored the smartwatch that much during this time. She doesn't know anything new about the smartwatch, since previous interview
↑↓	Valuable	She finds it practical: <i>If they call me on my cellphone and I do not hear it, it vibrates here. And this is great for me. For example, I am in a class, and I stop, and suddenly pa-pa-pa, in class. If I'm interested... I take it. If I'm not interested.... The whatsapps too. Yes, for this, it is very practical.</i> However, she could take it or leave it: <i>If I wear the other one [classic watch], I have enough. If I have it [smartwatch], I look at it</i>
↓	Desirable	She doesn't identify with the smartwatch, she refers to it as a generational issue: <i>What do you want me to tell you? It's more like a hobby. And it's such a cool thing, for example, for kids. But for us, I do not know... not sure if it's worth it</i>

## 4.2 W2, Proud User

She uses it all day, at home and outside. Although she still has some usability issues and does not make extensive use of the smartwatch, she is a proud user and wants to show it off whenever there is an opportunity (see Tables 3 and 4).

**Table 3.** W2, Interview 1

↑	Useful	She says she use it every, and all day, at home and outside. She mostly uses it to check the time
↓	Usable	She states that it has been easy to use. Although, at the same time, she only uses it to check the time, and she would like to do other things but has not figured out how to do them: <i>sometimes, I want to do something and it is difficult</i>
↓	Valuable	She does not report any use, beyond checking the time
↑	Desirable	The smartwatch gives her a positive image, and she tries to take advantage of this. She says that, when she meets up with somebody, she asks, <i>Did you notice, did you notice?</i> (pointing at the smartwatch). Then she has the opportunity to explain all the advantages of the smartwatch

**Table 4.** W2, Interview 2

↑↓	Useful	She wears it every day and all the time. Although she does not report frequent use, she adds: <i>this month I've been a little bit out of it... I haven't used the computer, either. Although the smartphone, yes!</i>
↓	Usable	She does not feel she has a good handle on using the smartwatch: <i>The steps themselves, mmm, this, if I were more confident, when I'm going to walk, yes, I would wear it, because it's comfortable [...] if I put it on right. She adds: When these things start to fail, mmmm, it is as if you have a Mercedes; has it failed me, or have I failed?</i>
↑	Valuable	She finds it valuable because: <i>I know when they call me. Mmm, if I do not hear the phone, the clock tells me that I have an email, that I have a message. If I'm waiting for those calls, then I go to the phone; otherwise, I don't bother</i>
↑	Desirable	She continues to be a proud user of her smartwatch: <i>I say, [...] come on, look what I've got! Look what I've got!</i>

### 4.3 W3, Communications

She uses it daily. It plays a role in her everyday communication, allowing her to keep an eye on the notifications on her smartwatch. However, it is not an essential device for her, and she is somewhat ashamed of it (see Tables 5 and 6).

**Table 5.** W3, Interview 1

↑	Useful	She uses it daily, although not at home or the gym, since she usually wears other watches. She finds it useful. She uses it to check the time, her steps and to manage notifications: <i>sometimes it turns on when I receive a message and, then, I see it. She also changes the screen design depending on what she is wearing</i>
↑	Usable	She does not have usability issues. She also does not have questions about other the smartwatch's other features
↓	Valuable	She does not find it valuable: <i>Well, if they give it to me, fine, but buy it, I think... I do not see it as useful</i>
↓↑	Desirable	She is not proud of it: <i>I usually have it covered. [...] But not because I don't like it and its spectacular, but because people our age say: "Well, what an ugly watch this woman is wearing", you know?</i> She does not like its design or the fact that it is a techie device: <i>No, it's not nice, not for me. Young people do say: "Oh!" They are more into these technologies... they want to have everything.</i> However, changing the smartwatch face every day to match her outfit makes her happy

**Table 6.** W3, Interview 2

↑↓	Useful	She uses it daily, basically to see notifications; she does not check how many steps she's taken any more. She does not change the watch face anymore
↑	Usable	She makes very basic use of it, mostly to check notifications. Although she has noticed that even with the same setup all the time she sometimes does not receive notifications (which was a common problem with the smartwatches they were using but was barely noticed by the other participants)
↓	Valuable	She reports that it is not valuable for her: <i>There is no big difference from wearing any other [watch]</i>
↓	Desirable	She said she is not proud of wearing the smartwatch

#### 4.4 M1, The Techie

Although he was fairly skeptical at the beginning of the study, as an explorer, he has explored all the possibilities of the smartwatch. He makes extensive use of it, particularly regarding things that matter to him, such as notifications, music and maps. Moreover, the smartwatch lets him express his techie identity (see Tables 7 and 8).

**Table 7.** M1, Interview 1

↓	Useful	He wears it every day. Although, he says he does not know if the smartwatch is useful. He doesn't want it to consume him like the smartphone: <i>When you receive a WhatsApp, there are people that feel the need to check who sent it. I don't</i>
↓	Usable	Apparently, discovering its features has not been easy, because at this point he still states: <i>I do not know which features it has</i>
↓	Valuable	At this point he is not clear if the smartwatch is in fact valuable, but he still has high expectations not yet met by it: <i>I would like it to behave like a smartphone, except that I can't talk. [...] I think, this has just arrived, I don't know how far it can go, but, in the news they say we'll be able to pay with the smartwatch</i>
↑	Desirable	The smartwatch is in line with his techie identity. He identifies himself as a person who is willing to use technologies, and that is where his interest in the smartwatch lies: <i>We should take into account that there are people, the same age as me, and older, [...] let's say, that don't want to know about the Internet and computers at all.</i> Specifically, he says the smartwatch is a <i>technology that may be a bridge that will lead to more... more interesting milestones, [...] otherwise we would still be stuck in the Stone Age</i>



**Table 8.** M1, Interview 2

↑	Useful	He finds it useful, not only because he uses it every day, but also for its many features: <i>I use it every day. Every day. I mean, I use the clock every day because I've gotten used to it.</i> In addition, he would buy it: <i>Now that I have used it, and they are less expensive, probably not this one, but another, yes, for sure, I would buy [another]</i>
↑	Usable	He does not report any usability issues. On the contrary, he has explored many of the smartwatch's features, which he learned how to use on his own
↑	Valuable	<i>I use mainly the features that are related with my interest, for notifications, for the maps and the music; those are the three more relevant uses</i>
↑	Desirable	The smartwatch enhances his techie identity. He volunteers as a smartphone teacher for older people, and having a smartwatch gives him extra authority on the subject. According to him, <i>I have to be up-to-date</i>

#### 4.5 M2, The Sportsman

He uses it every day, all day, and even during the night. He is highly proficient in using the activity tracker. He has great interest in showing his walking achievements on the smartwatch and places great value on using it for walking. The smartwatch contributes to his sporty identity, as you can see in the following tables (Tables 9 and 10).

**Table 9.** M2, Interview 1

↑	Useful	He wears it every day and, according to him: <i>what I do most is [check] the heart rate and walking ... [check] the steps [...] and also, it notifies you when there is a call</i>
↑↓	Usable	He shows great proficiency in managing the pedometer. However, he is not receiving WhatsApp or email notifications, and he does not know why
↑	Valuable	It is valuable for him, as he walks every day, and he enjoys having a record of his activity, and he also checks how fast he goes while walking
↑	Desirable	He uses it to express his sporty identity, by sharing his sports milestones with others. For example, he reported that while he was buying sneakers, and another client asked him if they were durable, and he answered, showing the smartwatch: <i>Look at how many steps I've taken</i>

**Table 10.** M2, Interview 2

↑	Useful	He uses it every day; he says that he will keep using it in the same way. He uses it to manage notifications and to keep track of his sports activities
↑	Usable	He does not have problems using the smartwatch. He emphasises that he has no problems with the features he uses the most, and he is interested in more but has not explored the watch further
↑	Valuable	He likes watches and states that: <i>if it gives me more data... better</i>
↑	Desirable	The smartwatch reinforces his techie and sporty identity. He keeps sharing his sports achievements with his acquaintances through the smartwatch

## 5 Discussion

According to previous studies, usefulness, usability, valuableness and desirability all influence to a greater or less extent smartwatch appropriation [6, 7].

One study had shown that, after 4 months of usage, a minority of smartwatch owners (4.5%) cease to use them [8]. Although the two studies are not comparable, the abandonment of the smartwatch was not so minor in our study. Two participants out of five stopped using the smartwatch, once their commitment to the project was over. The fact that the study was long-term and that participants were highly committed to it both had an influence on this. On the one hand, participants were under no obligation to use the smartwatch during the first 12 months; they just had to commit to giving the interviews and handing over the logs on their smartwatch activities. However, they most likely felt that they should use it, thus affecting usage. On the other hand, during the month-12 interviews, it was clear that the actions and reports of the two participants who eventually abandoned the smartwatch were not consistent. It was clear that they were not engaged completely with the device, thus we expected them to stop using the watches. Moreover, the fact that one of the researchers had engaged previously with the community, lending to a more ethnographic approach [23], allowed us to meet participants informally at events beyond the project itself. While, the project was designed to last 12 months, we decided to take advantage of this relationship to understand appropriation beyond the project, which is something very uncommon in research, despite its relevance [24, 25].

Interestingly, the two to stop use were two of the three women in the group, while the two men were still engaged with their smartwatches after 24 months of use. In other studies analyzed, most participants were men [8, 9]. Which is something that would require further analysis.

The other three participants were still using the smartwatches at month 24. Many smartwatch routines follow the habits acquired in regular wristwatch routines [26], and this should have helped participants to appropriate the smartwatch. In fact, the three engaged users were all fans of watches and were used to wearing watches. However, the two participants who stopped using the smartwatches also were used to wearing watches every day. The effort-benefit ratio of smartwatches differs from that of standard watches, and thus it was not only a matter of inherited routines for the two who decided not to continue use.

In previous studies, users have questioned the limited features of smartwatches [27], particularly compared to smartphones [13], and users' interest in replacing their smartphone with a smartwatch has been analyzed [28]. This was also an issue in the first interviews in our study, but after 12 months of smartwatch use it ceased to be one. With usage, they came to understand how the device was meaningful or not in their everyday lives based on its own features or significance.

Lundell (2016) classified smartwatch users among communicators and techies. Communicators use the smartwatch mainly to manage notifications, and techies feel they can identify with the techie values communicated through the use of the smartwatch. However, for the participants in this study, having the watch merely as a tool for managing notifications was not reason enough to continue using it. The two participants who ceased

use were very active users of the notifications, as both of them have very active social lives, but they did not find it valuable enough and were not able to identify themselves with the smartwatch. Thus, similar to activity trackers, both image (desirable) and hedonic motivation (valuable) play an important role in intention to use [29].

According to previous studies, the most used/valuable/reported feature is checking notifications [12, 13]. This was indeed the single usage that was common to all participants in the study. However, it was not the most valuable feature for all of them, nor was it the reason for using the smartwatch daily. The sporty guy in this study used the notifications like everyone else, but his main reason for using the smartwatch was to keep track of his sports achievements and share them easily from his wrist, thus reinforcing his sporty identity.

The analysis shows the relevance of a smartwatch's **desirability** in its appropriation (or not) for all participants. Style-based choices constitute a relevant part of the smartwatch experience [13, 18]. However, this not only refers to size, shape or color, but to the features provided and the cultural meaning of the smartwatches. The values socially attributed to the object should be in consonance with user identity, so the object is used to express personal identity. Since artifacts are ascribed with cultural meaning, both in their production and consumption [30], participants used the smartwatch to express their sporty, techie or fashion identities. Sportsmen mainly use the smartwatch to follow their sports activities and socially share their sporting achievements. Similar to what Lundell and Bates describe [8], techies explore all the possibilities that smartwatches have to offer, know how to use many of those features – not only the ones they use most often – and advertise them. Fashion lovers use smartwatches to obtain social recognition, following the techno-optimistic idea that early adopters are respected by peers [31] thus using it as a desirable product.

## 6 Conclusion and Limitations

We studied smartwatch appropriation among a group of 5 older individuals aged 71 to 80 over the course of 24 months. Specifically, we analyzed how usefulness, usability, valuableness and desirability influenced smartwatch appropriation. For most of the participants, the smartwatch was useful and usable, but these were not the main reasons for adoption. It was valuableness and desirability that played a key role in smartwatch appropriation. Thus, smartwatches, and probably other technological devices, play a key role in expressing user identity. In this study, we observed how participants used the smartwatches to express their sporty, techie and fashion identities. Thus, identities or the cultural meaning of the devices should be taken into account when designing technologies that are meant to play a significant role in the lives of older people. Although, the sample of the study is very short, we choose such approach in order to get a deep understanding of the user experience, in a longitudinal perspective. We know that the reports from participants should be influenced by their interest to participate in a research project, and receive a smartwatch for doing so. We compensate such bias, by collecting the experiences of participants once their commitment with the project was over.

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