

Understanding the Habitual Use of Wearable Activity Trackers

Annamina Rieder¹, Christiane Lehrer¹, Reinhard Jung¹

¹ University of St. Gallen (HSG), Institute of Information Management, St. Gallen, Switzerland
{annamina.rieder, christiane.lehrer, reinhard.jung}@unisg.ch

Abstract. Given the large discrepancy between rates at which wearable activity trackers (WATs) are initially adopted and their continued use, the question concerning how sustainable use emerges arises. While IS research has found habit an important driver of sustained use, the mechanisms of habit formation have been left unexplored. To address this research gap, we conducted narrative interviews to investigate the habit-formation mechanisms behind the use of WATs. We identified two drivers of habitual WAT use and constructed five narratives that provide insights into the habit-formation processes of WAT users and possible interrupting factors. Our results provide a valuable basis for both theory and practice in explaining how sustained WAT use develops.

Keywords: Wearable, Habit, Habit Formation, Sustained Use, Continuance.

1 Introduction

The growth in the wearable industry continues as increasing sales figures and numbers of adopters of wearable activity trackers (WATs) buoy the technology's success [11, 27]. However, abandonment rates for the devices are striking [11]. A study by Endeavour Partners reported that users' minimum attrition rate is as high as 30 percent within the first six months [18]. However, sustained use is a prerequisite for inducing long-term changes in health behavior, which is most WAT devices' key value proposition. Information systems (IS) research has identified habit as a key driver of continuous IS use [e.g., 20, 3], but most of its studies of habit and post-adoption phenomena are quantitative in nature and focus on the relationship between habit and factors like continuance, leaving the underlying mechanisms of habitual IS use unexplained. Research that has investigated WATs [e.g., 1, 12] has provided only a few insights into users' perspectives and experiences. Clarifying how habitual use patterns emerge in the context of WATs and post-adoption phenomena would help in designing WATs in a way that supports users' sustainable behaviors and habits. Against this background, our research question asks, *What are the underlying mechanisms of habitual WAT use?*

We used a narrative interview technique in qualitative interviews with ten habitual WAT users to gain a longitudinal insight into the users' experiences with the devices. Eyal's (2014) IS habit formation model, which is grounded in psychology and

neuroscience research, provided a valuable theoretical lens through which to investigate the cognitive and behavioral processes of habitual WATs users and the factors that can interrupt habitual use.

The paper proceeds as follows. First, we discuss the theoretical background on wearables, the role of habit in IS, and the mechanisms behind habit formation. Then we present our methodology and the results of our analysis. Finally, we conclude with a discussion of our results and limitations and a proposal for further research.

2 Theoretical Background

2.1 Wearable Activity Trackers

“Wearables” refers to any electronic computing device worn on the body and that uses sensor technology so users can track their personal activities and vital parameters [32, 29]. Even though a wide range of devices (e.g., wristbands, glasses, clothing) fall under the umbrella term of wearables, we focus on wearable devices that track physical activity: WATs. Wearable devices that are designed only to track other health-related parameters, such as fertility, blood pressure, or blood glucose levels, do not fall into the category that we investigate in this paper. WATs, which usually take the form of bracelets and watches, are the most popular category of the wearables market [11]. These devices allow users to self-optimize by providing them with insights into their physical performance through self-tracking of such parameters as steps, sleep, sports activities, and food consumption [29, 10]. Users can usually interact with WATs directly over the device’s screen or via mobile applications, which are typically accessible using a smartphone.

Because of the possible positive effects of WATs on personal health, the healthcare sector places considerable value on their potential. The intended behavioral outcomes of wearable use, such as increased activity levels and conscious nutrition, are key preventive measures that can improve public health and reduce strain on healthcare providers and insurers [10]. However, this promising outlook is dampened by the large discrepancy between adoption rates and sustained use. Findings from the US show that, despite adoption rates higher than 20 percent in 2014 and estimated adoption rates higher than 35 percent by 2020, attrition rates are as high as 30 percent within the first six months of use [18, 27]. Consequently, many WAT users do not reach the phase of sustained long-term use, which is a better indicator than mere adoption with which to assess the success of WATs [4]. Research has identified several issues that lead to discontinuance, including short battery life, inaccurate sensors, privacy concerns, insufficient data, and irrelevant information provided to users [6, 7, 27]. Some authors have also suggested that the design of WATs insufficiently incorporates findings from behavioral theory [21, 6, 7].

To date, research on wearables has predominantly followed a quantitative approach to examine the effectiveness of using WATs in health behavior interventions [e.g., 12], and only a small fraction of articles has focused on the experiential side of WATs and the qualitative analysis of the user’s perspective [e.g., 2, 13, 24]. The majority of articles

has addressed only the adoption process, so we lack qualitative experience-centric research that explores sustained WAT use in the post-adoption phase.

2.2 Habit in Information Systems Research

Research on continued IS use in the post-adoption phase has consistently highlighted the importance of habit as a key predictor of continued IS use [20, 3, 14, 22, 19]. Habit can be defined as the automatic or unthinking performance of specific behavioral sequences, such as the use of an IS artifact, to obtain a certain goal in response to environmental cues [20, 3]. Automation occurs through the processes of repetition and learning.

Studies that have investigated the effect of habit on continued IS use have shown two primary influences: a direct positive influence on IS continuance, continuance intention and satisfaction [3], and an indirect suppressing effect that moderates the relationship between continuance intention and actual continuance [20]. Bhattacharjee and Lin's (2015) findings also supported this link, corroborating the notion that automatic behavior reduces the need for intention. Limayem et al. (2007) identified four antecedents of habits in IS use: frequency of the behavior, satisfactory outcome, a stable context, and the use of various features of the IS in question (comprehensiveness of use). Building on these findings, a handful of studies have investigated continued IS use and the role of habit in specific use contexts, including participation in online communities [14], online gambling [22], mobile location-based services [19], and quitting Facebook use [31].

Whereas the extant research on habit in IS use has involved variance theory, predicting the relationships between antecedents and outcomes, Kim (2009) offered a process view on IS continuance and the influence of habit. Drawing on a process model from cognitive psychology that outlines how memory is formed, Kim sheds light on the process that drives post-adoption behaviors. However, the model does not provide a detailed explanation of the process of habit formation itself.

In summary, the extant IS research assigns habit an important role in predicting IS continuance, but it has yet yielded only a few attempts to untangle the mechanisms and processes behind habit formation. Therefore, we turn to Eyal (2014), who developed a process model to explain habit formation with digital products and services.

2.3 Mechanisms of IS Habit Formation

Process of IS Habit Formation. Eyal's (2014) process model indicates that IS habit formation takes place in four-step cycles: trigger, action, variable reward, and investment (Figure 1). This view is in line with the definition of habit from social psychology, which understands habit as automated dispositions to respond to specific cues to obtain certain goals or end-states [25, 33]. Responses are learned sequences of acts, memorized through a process of repetition that have led to satisfactory outcomes in the past [25]. Habit formation takes place when a trigger—that is, an environmental cue—instructs users in a more or less explicit way about what action to take next [33, 25]. If users are sufficiently motivated and capable of performing the behavior, they

will execute the action [9]. The action always takes place in anticipation of a reward, which users expect to receive upon completion of the action [25]. After multiple repetitions, users start building associative links between the trigger and the action and between the action and the reward, which lead them to repeatedly and effortlessly perform the behavior when they are confronted with a similar context [28]. Users also typically “invest” in a specific technology by putting something of value into the system (e.g., effort, time, skill acquisitions) [8]. Along with the processes of associative learning, such investments increase the likelihood that users will repeatedly pass through the process [26]. Repeating this process with high frequency is critical to habit formation [17, 25].

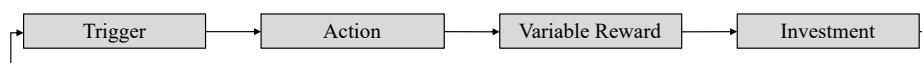


Figure 1. IS habit formation model (based on [8])

Trigger. A trigger can be understood as an “actuator of behavior” [8, p. 7], the first step in the habit cycle. Triggers are goal-related in so far as they cause individuals to desire a certain reward that they expect on execution of a specific behavior [33, 8]. The literature differentiates between external and internal triggers [9, 33] such that external triggers are stimuli sent out by the technology that tells the user what behavior to perform next (e.g., a push notification that reminds the user to take a specific number of steps every hour), while internal triggers do not require a sensory stimulus but are firmly installed in users’ minds and automatically activated as certain thoughts, emotions, or routines come up. Examples of internal triggers are feelings of boredom or hunger, certain weekdays, and preceding actions. Having laced up one’s running shoes could serve as an internal, routine-based trigger for users to activate their WATs’ sports monitoring function.

Action. Action refers to the behavior performed in response to the trigger and in anticipation of the reward [33]. Performing the action requires the user to be sufficiently motivated and able to do so [9]. Pursuing the goals or end states that result from performing the action can include seeking to achieve a positive goal but also avoiding a negative one. Ability, that is, the ease with which a user can perform an action, also influences the likelihood that the action will occur. Ability involves the user’s personal capabilities and skillset, as well as contextual factors like time restrictions and the physical environment [25]. In the context of WATs, an action could include making the missing number of steps to fulfill the daily goal. Thereby, the user’s motivation to execute this action could, for example, be negatively influenced by the weather, while restrictions to the user’s ability could include not having sufficient time or being temporarily incapacitated due to an injury.

Variable Reward. The successful completion of the action is followed by a variable reward, a “positive reinforcer” of behavior [28, p. 89; 33]. With repeated encounters with a similar situational context, associative links between the context and response that have yielded a specific reward are established [33, 25]. Thus, what drives the user to comply with the trigger is not the reward itself but its anticipation, which causes the emission of neurotransmitters in the human brain [28]. The reward should be variable in so far as it provides the user with some degree of novelty [8]. Rewards can take a

variety of forms, including social rewards, rewards that fulfill the human desire to acquire resources and information, and rewards that have intrinsic benefits. Eyal (2014) highlighted the importance of the fit among the reasons an individual uses a product, his or her internal triggers and motivations, and the reward. Related to WATs, rewards could, for example, include receiving badges, seeing an upward tendency in performance, or improvements in wellbeing.

Investment. Users' investments in a product or service (e.g., time, data, effort, social capital) influence the value they assign to it [cf. 26]. In the case of technology and software, such investments can enhance the users' experience and, thus, increase the likelihood of re-engagement [8]. Stores of value with technology can take the form of data, followers, acquired skill, content, or reputation. In the context of WATs, investments could comprise a personal training history or a network of friends and followers.

3 Methodology

Since empirical evidence of the process through which habitual WAT use is formed is scarce, we employed an inductive, qualitative approach using narrative interviews, following established principles [16, 5], to capture individual users' experiences and a longitudinal picture of the individual's use history. In this interview technique, the interviewee recalls and gives an account of a past event [16]. Typically, the interview's organization and structure are left to the interviewee, and the interviewer does not intervene with the narrative until the interviewee has recognizably ended his or her recitation. Thus, this interview technique can help to overcome common biases like social desirability, as well as patterns of interaction in the interview, issues related to the wording and placement of questions, and topics and terminology brought in by the interviewer [16].

3.1 Data Collection

We interviewed ten WAT users who were based in Switzerland, which, with a 7.6 percent market penetration in wearable devices in 2017, is one of the most advanced markets for wearables in Europe [30]. In line with the narrative interview technique, we used no interview guideline [16]; instead, we used a pre-formulated initial stimulus to ignite the interviewees' narratives: *"I would like you to tell me the story of your activity tracker. This means from the moment you got it, until today."* We did not intervene until the interviewees had recognizably finished their narratives. Then we took up topics the interviewees had mentioned in their initial narratives to trigger additional accounts. All of the interviews were held in person, and interviewees were ensured anonymity and confidentiality in the statements they made during the interview. The narratives' duration (ranging from 24 to 68 minutes, with an average length of 42 minutes) and level of elaboration varied widely. We recorded and transcribed the interviews verbatim to ensure rigorous and transparent analysis of the resulting data. Interviews and transcriptions were done in the participants' native

language, either German or Swiss German dialect, and were processed by native German speakers. The quotations presented in this paper were translated into English. As we sought depth over breadth of information, a sample of ten participants was adequate to gain rich insights into personal use histories and to identify various habit formation processes. We followed a criterion-based sampling strategy [23], taking the respondents' gender, age, and duration of use into account. Although generalizability is not a primary objective in qualitative research, we tried to distribute interviewees evenly across both genders and to cover a broad age range. Our sample consists of four females and six males whose ages range from 18 to 58 years ($M=33.5$), and it includes both students and professionals (Table 1). The sample slightly over-represents younger people, but younger people tend to adopt WATs more frequently than older people do [30]. We also chose continuous WAT users (i.e., those who used their devices past the trial phase) who had used their WATs for at least six months, although a few had used them for several years. The use frequency varied across interviewees and largely depended on the motivation for use. Most interviewees used the device every day and even at night, while others only wore it only when they engaged in sports. Most of them used their WATs to track their daily activity, support their sports performance, and improve their health. Some reported using the devices to explore the novel technology out of curiosity. The four functionalities used frequently and long-term by more than three participants were step-counting (nine out of ten participants), sports-activity monitoring (6 participants), competition (5 participants), and heart-rate feedback (3 participants). Fewer than three participants used nutrition tracking and sleep tracking habitually, which others used mainly on a trial basis.

Table 1. Sample characteristics

<i>Alias</i>	<i>Age</i>	<i>Gender</i>	<i>Occupation</i>	<i>Total use duration</i>	<i># WATs used</i>
INT1	25	F	Student	> 24 months	2
INT2	24	F	Student	6 - 12 months	1
INT3	57	F	Project manager	12 - 24 months	2
INT4	58	M	Consultant	> 24 months	4
INT5	41	M	Entrepreneur	12 - 24 months	2
INT6	41	M	Entrepreneur	6 - 12 months	1
INT7	25	M	Student	6 - 12 months	1
INT8	20	F	Student	6 - 12 months	1
INT9	18	M	Student	12 - 24 months	2
INT10	26	M	Bartender	6 - 12 months	1

3.2 Data Analysis

The data analysis process broadly followed Chatman's (1978) recommendations. In the first step, we used narrative coding to decompose the narrative into its elements so we could extract the kernel sequence of events. According to Chatman (1978), the story of a narrative consists of *events* and *existents*. Events can be understood as changes of state that are driven by *actions* executed by significant agents (e.g., "*In the beginning, I measured my heart rate relatively consistently*" (INT4); "*This was when I actually stood up and started walking through the apartment*" (INT1)) and *happenings* that occur but are not directly influenced by the agents (e.g., "*This fitness tracker brought to my attention what I was eating and how often I was exercising*" (INT2); "*The problem was that it just wasn't working most of the time. Then there was something*

wrong with the software, then this, then that” (INT3)). Existents, on the other hand, are descriptive elements of the story that are constituted of *characters*, which are animate or inanimate agents that advance the plot (e.g., “I wasn’t really a sports enthusiast” (INT9); “My fitness tracker is a first-generation Apple Watch” (INT5); “The platform has more analytical functionalities, where my running coach could see my progress” (INT4)) and the *setting*, which is the space in which the characters exist and act (e.g., “I had two, three colleagues in school who had this too” (INT9); “During the semester break we took off the device when we had to study because we wouldn’t even make 1,000 steps per day” (INT1)).

We differentiated between kernel and satellite sequences of events. Kernel events are actions and happenings that advance the plot and are central to the participants’ narrative. For example, kernel events were identified if the participants gave an in-depth and lengthy recounting of their use history of a key WAT functionality. Satellite events are not central to the plot, so omitting them does not alter the story. For example, satellite events include when participants mention a WAT functionality only briefly or tell how they used it only on a trial basis.

In the second step, in which we focused on the kernel sequences of events, we identified the WAT functionalities that the participants used habitually: sports-activity monitoring, heart-rate feedback, step-counting, and competitions. Indicators of habitual use patterns were long duration of use, regular use, and signs of automaticity (e.g., when a user mentioned that he or she always and unthinkingly performed certain actions). For those functionalities, we identified the underlying drivers of habitual use. While our research process was exploratory, we were sensitized by the concepts of Eyal’s (2014) IS habit-formation model and used the model to identify how the steps of trigger, action, reward and investment were represented in the data along the narratives. The IS habit-formation model proved to be an appropriate theoretical lens, as the interviewees went through steps of the process when they used their devices’ various functionalities.

4 Results

Our analysis revealed two drivers of habitual WAT use identifiable across narratives. On the one hand, habitual WAT use was driven by users’ offline habits performed independently of WAT use, as it was the case for the functionalities sports activity monitoring and heart rate feedback. On the other hand, the technology itself fostered habitual WAT use by sending out triggers, as with step counting and competitions. Each of the following subchapters covers one of the two motors. The first subchapter illustrates habitual WAT use driven by offline habits by presenting the composed narratives for the functionalities sport-activity monitoring and heart-rate feedback. The narratives in the second subchapter on the motor habitual WAT use driven by the device, are related to the functionalities step reminders, activity statistics, and competitions. The narratives presented below follow the logic of the IS habit formation model, comprising the three impelling elements *trigger*, *action*, *reward*, as well as potential *interrupting factors* to habitual use found in the data. We purposely left out

the *investment* element of the model, as we did not find any explicit mentions in relation to specific WAT functionalities.

4.1 Habitual WAT Use Driven by Offline Habits

Habitual Use of Sport Activity Monitoring

Sport activity monitoring allows users to track their exercise (mainly running) using performance indicators like distance, pace, and blood oxygen consumption. A characteristic of this functionality is the need to switch it on and off to monitor the activity while it is being performed. The interviewees who habitually used sport activity monitoring typically had already established a sports habit—usually running—or wanted to develop one before they adopted a WAT. Most had a clear focus on sports and intended to support their sporting goals using a WAT or were interested in monitoring and the data as such.

It's a Christmas gift that I asked for because I went running regularly. I basically used the tracker for running. I also wore it during leisure time and at work, but I mainly used the functionalities for running, like to measure the distance I had run. It also monitored the heart rate, which was useful sometimes, and especially the time per kilometer, which was very important to me. I wanted to see the progress I made. (INT10)

Sport activity monitoring was in all cases cued by a pre-existing (offline) sports habit, which can be classified as an internal trigger. Intending to or preparing to engage in sports would automatically trigger the participants' subsequent action of switching on the sports tracking mode. In addition, several interviewees engaged in information retrieval after the sports training sessions and even processed the information further by, for example, sharing it with their social networks or feeding it into other data analytics platforms.

When I bought the Suunto, I started trying out the apps. I found that very exciting. There are lots of interfaces through which you can export data. My main platform is Strava, which allows me to see my activities. For example, I went skiing, and you can see where I took photos. I'm sure there are some people who would call this profile neurosis, but I think it's fun. (INT4)

Using sport activity monitoring brought the interviewees multiple kinds of rewards that were all based on the technology. The interviewees often mentioned that the statistics and history motivated them and allowed them to monitor their progress and path toward reaching their goals, which had a confirming effect. Moreover, quantification and visualization of the sports training sessions were considered rewarding in themselves because they led to insights into novel parameters. Monitoring the training sessions also gave the interviewees a sense of achievement because parameters like calories burned, time trained, and distance covered were made transparent. Sports activity monitoring also rewarded them with social recognition when they shared their achievements through social network sites and received positive responses. In addition, spending time with the monitoring data was perceived as entertaining, as they could, for example, keep track of their routes on Google Earth and add the photos they had taken during the training.

Of course, it is great at the beginning, when you're proud or when you do your ten kilometers for the first time and pass your limits for the first time, or when you do your first trail run. Of course, you do want to share this and document all of it. (INT5)

The most common cause for interruptions of the habitual use of sport activity monitoring was loss of the reward. Besides not being able to look at the statistics because of technical problems or a general lack of interest in seeing one's progress, interviewees described how the documentation lost its novelty and excitement after a time. Other such interrupting factors were changes in underlying offline habits that resulted in loss of the trigger and broken devices.

For me, it was the case that it didn't particularly motivate me anymore. It was more like you've been outside for an hour in fresh air and had a good time, so documentation wasn't that important to me anymore because I realized I felt good. You end up doing it regularly – when you move from compulsion to enjoyment. That makes the difference. (INT5)

Habitual Use of Heart-Rate Feedback

Heart-rate feedback, which provides users with close to real-time information about their heart rate, is constantly running in the background. This functionality was mainly used habitually by interviewees who also reported strong, established sports habits or wanted to develop them before adopting a WAT. Using heart-rate feedback served specific goals: improvements in distance and pace or high calorie burn.

The story of how I came across the fitness tracker was that I started to go running on a regular basis, like two to three times a week, and I had to measure my heart rate because it was not supposed to exceed 160. I think my personal trainer was afraid I would have a heart attack. (INT5)

A pre-existing (offline) sports habit serves as an internal trigger, so engaging in a habitual activity like running or doing cardio exercise automatically set the cycle in motion.

I also used the heart-rate monitor during sports. I always checked it; for example, when I went running, I would eventually have to make a cardio peak and then I always checked whether it was over 160. (INT2)

The interviewees report two subsequent actions in the case of heart-rate monitoring: constant interaction with the device during the activity to check the heart rate and immediate adjustment (e.g., breathing, pace) when the heart rate deviated from the target.

I tried to keep a lower pulse on longer distances and not go at full intensity. I also tried to slow down a bit when my pulse was at 160 or so. The tracker was really useful for when you want to improve your running performance. Sometimes, even when you don't have the impression you're going so fast, you take a look at your pulse and the pace and you say, "Oh, 170 is maybe a bit too high for a flat route—should probably slow down." (INT10)

The rewards interviewees got from using heart-rate monitoring were not usually delivered by the technology but were internal. Interviewees reported rewards that were personal in nature, such as feeling good, improving, being able to run longer in a healthier way, and getting to know their bodies.

However, through repetition and learning, interviewees felt they had acquired a subjective feeling for their bodies and heart rates, which obviated the need to use the digital heart-rate feedback provided by WATs. Changes in underlying habits that resulted in loss of the trigger, and broken devices are other factors that interrupted the habitual use of the heart-rate feedback.

Once you've reached a certain level—this was the case with me after some three months, and after half a year it got really easy—where you can run for an hour plus, you've learned to deal with it and you also feel for

yourself which pulse is good for you, then you don't need the technical support anymore to guide you. As you get to know your body better, the device becomes less informative. (INT5)

4.2 Habitual WAT Use Driven by the Device

Habitual Use of Step Reminders

The step-counter of a WAT is always running in the background, recording each movement that is sensed as a step. Most WATs come with pre-set hourly and daily step goals or let users specify goals themselves. External triggers in the form of push notifications on the WAT screen or the user's smart phone drove the habitual use of the step-counting functionality for our interviewees. The devices reminded users to move if they were to achieve their hourly activity goals or informed them of how many steps were left to reach their daily step goals. Such push notifications triggered the interviewees to interact with their WATs and to engage in offline actions—that is, to take the number of steps that were necessary to reach a certain goal.

I always got something five or ten minutes before the hour saying, "Hey, 300 steps left for the hourly goal" or so. It was vibrating, and then you realized, "Oh, I've been sitting around for an hour looking at the computer. I'll get up and go to the toilet or somewhere else just to walk a few meters." You're always reminded when an hour passes and another hour passes, and you haven't moved at all. (INT7)

Interviewees reported various rewards upon executing the triggered behavior. Complying with the cue usually left them with the feeling of being energized and more fit during their daily activities. Moreover, as making hourly step goals also added to the overall step count, they felt that compliance contributed to overall goal achievement. With WATs that were using a different technique like a punishment logic with a red bar that appeared on screen after a certain amount of sedentary time, executing the action was perceived as a relief.

The more bars you had, the longer it took to get rid of them, so if you had one bar, you could cross your apartment two or three times before it eventually disappeared. But when you had five bars, this meant you would have to move for five or ten minutes to get rid of all of them. Yes, the red bar really annoyed me. (INT8)

The most common interruption to the habitual use of step reminders the interviewees mentioned was the loss of the trigger if users stopped wearing the WAT regularly. Even though the interviewees intended to maintain their activity levels, they reported being unaware of their hourly number of steps and so were not cued to move.

I only stand up when I really have to. If I am not made aware of it, I don't think, "Oh, I haven't gotten up for three-quarters of an hour straight." (INT9)

Habitual Use of Activity Statistics

WATs provided the interviewees with a wide variety of statistics and historical data about their physical activity, graphically represented in dashboards that were accessible via smartphone app. Unlike using step reminders, using these functionalities requires the user to access and retrieve information actively.

I was curious to see how many steps I take and how this changes over the course of the week—how this changes based on whether you're doing sports or are just at university. Even if I did not reach my step goal each day, I just concentrated on the weekly average and made sure that I got a daily average of 10,000 steps per day, and if I succeeded in that, I didn't care too much when I had a day on which I had fewer steps and another one with more. Then it was kind of balanced. (INT1)

For some functionalities, the triggers are external, but they take a passive form, as they remind users of the goals they have set and to interact with the technology when it catches their attention. For example, merely seeing the wristband on one's wrist or seeing the WAT app on the screen of a smartphone app can serve as a trigger.

Triggered actions can be comprised of only interaction with software components or can also include execution of an offline behavior. Interviewees regularly checked their numbers of steps, consulted their statistics and histories, and looked into the progress they had made toward reaching their goals. However, most interviewees used their WATs' functionalities not only by interacting with them but also by adapting their offline behavior based on their progress toward their goals. Most participants engaged in extra activity if they had not reached their step goal yet.

When you're looking at your device and you see that you have half the steps that you normally do, it's a bit shocking and you think you'll have to do something about it. (INT7)

Interviewees received a variety of rewards from the technology for executing the actions it triggered, including a sense of achievement, confirmation from an upward trend over the use history, and avoidance of "punishment" when the interviewee's goal was to prevent a downward movement in data. Engaging in offline behavior in response to the activity history also added to interviewees' well-being and their perceptions of their fitness, as it kept them active and moving.

When you went running, you quickly got 15,000, 16,000 steps, and that was great. I had days on which I had 25,000 steps—that made me proud. And then it also told you the calories, and then you saw you really burned a lot. (INT3)

For some users, learning effects decreased the interviewees' perceptions of rewards and their excitement from using the activity history functionality for a period of time.

It eventually loses its novelty value or you eventually know and get a feeling for how many steps you've walked. (INT6)

The interviewees' ability to perform the offline behavior was restrained in some cases when they faced changing schedules or lost awareness of the number of steps they had taken after discontinuing use of their WATs.

I know that I don't do a lot during the exam period, and I think that I can't because I have tons of other stuff to do. But when you have it in black and white that you have 1,000 steps over the whole day, you just don't wear the WAT at all to silence your conscience. (INT1)

Habitual Use of Competitions

WATs offer users the opportunity to compete against other users through a social network. The functionality, which is based on step-counting, lets users initiate or accept competitions and provides them with reports in the form of rankings or reminders entailing the status of the competition. Competing against other WAT users was rarely the interviewees' initial motivation to use a WAT; instead, they learned about the function when they adopted their devices and tried it out with their friends. The strength of the habit of using competitions was affected by one's social network's motivation and involvement.

In the beginning, it was fun to see how many steps I take, but then two or three colleagues at school had the device too and there was the possibility to engage in challenges against each other. I eventually started walking home from school just to win the challenge. (INT9)

Engagement in competitions was triggered external to the device when the interviewees were invited to compete against other users or initiated the competition themselves. To participate in a competition, interviewees had to take the first action of initiating or accepting an invitation. Further actions included checking the competition status and the rankings in the social network. The interviewees also often engaged in an offline behavior like taking more steps to win a competition.

It motivated me. I purposely took the stairs or, when I had to take the subway for one stop, I walked instead because I desperately wanted to beat my boyfriend. (INT2)

Rewards for participating in a competition were usually delivered by the technology. Interviewees drew social recognition from competitions, as others got to see how active and fit they were and offered admiration. Interviewees also received confirmation through winning a competition that confirmed that they were better or more active and sporty than their competitors, which served as a form of reward. Besides being entertaining, competitions also supported interviewees' fitness by prompting them to take even more steps.

I believe this is what motivates people most—comparing themselves to others. You look up on Freeletics or LinkedIn what all the other people are doing and you think, “Ah, shit, I totally don't have my life under control,” and then you do something about it. (INT2)

The reason for ending the habit was usually that interviewees lost interest in the rewards. Similar to step-counting, some interviewees lost interest in the function after the excitement and novelty value had vanished and rewards had become predictable.

At some point, after all these competitions were nothing special anymore, it just wasn't an advantage to me anymore. (INT2)

Other problems had to do with restricted social networks and frequently losing competitions, both of which negatively affected the rewards connected with the behavior.

With the one colleague I used it with, I didn't have any chance. Even when I thought I had done lots of steps, like 40,000 or so a day, he ended up getting 60,000. Then I thought I'd have to stop this, as it started annoying me. (INT1)

5 Discussion

This study investigates the mechanisms behind habitual WAT use. Based on narrative interviews, we identified two distinctive drivers of habitual WAT use and constructed five narratives that provide insights into WAT users' habit-formation processes and possible interrupting factors. The two drivers of habitual WAT use are pre-existing offline habits and the device itself. When offline habits drive WAT use, WAT use is embedded into existing behavioral sequences that have become habitual prior to WAT adoption. When use habits are driven by the device, users are incited to learn and perform new behaviors.

Our research contributes to the literature on habit and wearables and has implications for theory and practice. First, we contribute to the IS literature on habit [e.g., 20, 3] by unveiling the process by which use habits are formed in the context of WATs. Two drivers of habitual WAT use are pre-existing offline habits and the technology itself,

but only one of the two drivers tends to be in effect with a particular user—that is, users either habitually used their WATs in response to an offline habit (INT3, 4, 5, 10) or were driven by the technology (INT1, 6, 7, 8, 9), rather than being motivated by both drivers (INT2). Moreover, taking into consideration Limayem et al.'s (2007) research, which provided insights into antecedent conditions of IS habit, our findings indicate that comprehensiveness of use is not a substantial driver of habit in the WAT context or for our sample. On the contrary, we observed a tendency toward long-term use and stronger use habits the more users were focused on only a few functionalities of the WAT. Wide adoption of WAT features was often associated with trial usage or weak habits.

Second, we contribute to research on wearables by offering insights into the experiential side of WATs, particularly by providing information about habit-formation processes and habitual use of WATs. Unlike to several other kinds of IS, WAT use cannot be conceptualized simply as interaction with the device's software components, as WATs aim to induce offline behavior, and the performance of such behavior constitutes a qualified form of WAT use. Our findings suggest that a much of what leads to interruption of sustained WAT use resides with the user, although the perspective of current WAT research predominantly allocates interrupting factors to the technological sphere.

Our research has several implications for theory and practice. First, our research suggests that it is reasonable to conceptualize habitual WAT use along its functionalities because users develop use habits for some functionalities, but not for others. Second, Eyal's (2014) IS habit-formation model is useful in explaining IS habits on a fine-grained level, as we found evidence for the stages of the model in our data. Therefore, IS researchers could apply the model to examine similar IS habit-formation processes. Third, our research offers producers clarity about the habit-formation processes that are related to WAT use and about potential interrupting factors. Building on such information, WATs designers can design them in a way that supports particular stages of the habit-formation process and that anticipates and counteracts the interrupting factors that are obstacles to long-term WAT use. Fourth, as habitual WAT use is driven in part by pre-existing offline habits, producers must shift their focus away from technology-driven behaviors to consider users' existing behavioral patterns and habits.

6 Limitations and Further Research

The present research is subject to some limitations. Because this research is qualitative, we limited the number of interviewees we used for analysis, so we may not have heard all variations of use cases in the WAT context or have covered all functionalities equally. Future research may consider interviewing users with other use cases and contexts. Although the narrative interview technique is especially valuable when it comes to exploring longitudinal, process-like issues with highly individual character, some themes could be under-represented in the data, which could be why we found no evidence of the investment element in our data. While interviewees mentioned

investment-related aspects of WAT use on a general level, such as appreciating the historic data or having gained specific use skills, we were unable to relate them to specific functionalities. Future research could verify this finding and investigate the role of investment in the habit-formation process with WATs. Moreover, habits always underlie automated cognitive processes that users do not necessarily consciously perceive. Therefore, when we relied on the interviewees' memories, we had to use interpretive proxies to identify such processes. However, also other forms of qualitative studies, as well as quantitative studies, address this particular limitation, so future research could use other research methods (e.g., mining WAT use data) to triangulate and establish reliability. Finally, future research could go a step farther to look into behavior changes that result from sustained WAT use and assess how WATs are keeping up with their goal of inducing behavior changes in their users.

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