

Engaging Experience with Physical Activity Tracking Products

Armağan Kuru^{1(✉)} and Jodi Forlizzi²

¹ Department of Industrial Design, TOBB University of Economy and Technology, Ankara, Turkey
a.kuru@etu.edu.tr

² Human Computer Interaction Institute, Carnegie Mellon University, Pittsburgh, USA
forlizzi@cmu.edu

Abstract. Many people use physical activity tracking products to gather personal behavioral data, make better decisions, and make changes to their behavior. While the proliferation of new products on the market makes collecting personal data easier, how to help people engage with these products over a long period of time remains an open question. To uncover which features of physical activity tracking products lead to engaging experience, we conducted a study with people who use physical activity tracking products to support or track behavior change. We conducted baseline interviews and had participants interact with either a BodyMedia armband or a FitBit activity tracker. Participants rated their experience with the product daily for a period of four weeks and reflected on their engagement at the end of the study. Through synthesis and analysis of the study findings, we draw out four characteristics for engaging experience in physical activity tracking product use: *connectivity*, *curiosity*, *personalization*, and *motivation*.

Keywords: Design · Experience · User experience · Interaction design
engaging experience · Physical activity tracking

1 Introduction

Physical activity tracking products that can potentially help people improve the quality of their lives and their general well-being are on the rise. These products are special class of products that track data about their users, either automatically or through user input. A variety of physical activity tracking products exist in the form of commercial products. Currently, apps exist for counting steps, monitoring heart rate, and tracking sleep, among others. Others, such as Daily Burn [www.dailyburn.com], Endomondo [www.endomondo.com], and Runkeeper [www.runkeeper.com] are web sites with easy to access interfaces. Still others take the form of products along with mobile apps or web sites to offer more opportunities to engage with the data that is collected. In the past year, the market has proliferated with products from Body Media [www.bodymedia.com], Fit Bit [www.fitbit.com], Nike [www.nike.com], and Philips [<http://www.p4c.philips.com>] among others.

There is also a growing body of research that explores the design, uptake, use and effect of physical activity tracking products. In hopes of improving the interaction between technology and people, HCI researchers have explored the ways in which people interact with physical activity tracking products and how these provide feedback. Early research explored aesthetic and game-like visualizations of activity to motivate people to engage with the system [1–6]; others focused on the social and motivational aspects of sharing data [7, 8]. Physical activity tracking products may be helpful in setting tangible goals and relaying process towards that goal.

Yet, little design knowledge has been formalized about how to design physical activity tracking products to sustain use over time. Designers can take inspiration from legacy products such as jewelry, cars, and antiques to understand how relationships with products evolve over time [9]. The meanings attached to these products prolong their lifetime of use, but what about the more mundane technological products of daily life? The issue becomes even more important as apps, services and products continue to enter the market. More and more of these products are developed each month, competing for market share and the possibility of sustaining use over time.

As a community, we have yet to understand the trajectory of long-term experience with physical activity tracking products, to better support designing for *engaging experience*. To address this gap in design knowledge, we need to understand how interactive products can create engaging experience. This knowledge can help designers understand how to design physical activity tracking products that motivate people to use them over time, and positively affect their long term use [10].

In this paper, we explore the topic of engaging experience in physical activity tracking products, by first providing an overview of the literature. We then conducted a study comparing two products, the BodyMedia SenseWear device and the FitBit activity monitor. Through synthesis and analysis of the study findings, we draw out four characteristics for engaging experience in physical activity tracking product use: *connectivity*, *curiosity*, *personalization*, and *motivation*. We provide an initial framework to show the connection between these characteristics. Our goal is to help the design community design for engaging experience in future physical activity tracking products.

2 Engaging Experience with Physical Activity Tracking Products

Design researchers have been focused on how to design products that offer engaging experience for several decades. Early interaction design research asserted that products should engage people through their physicality, and be fun to use [11]. The goal of the designer in creating an engaging experience was to design a product that is fun to interact with. Subsequent research drew out specific dimensions of engagement to be considered in design, including challenge, positive effect, durability, aesthetic and sensory appeal, attention, feedback, variety/novelty, interactivity, and perceived user control [12]. When these product dimensions work together, the result is a product or product that attracts and sustains people through aesthetics, interaction, and use.

User engagement is not a single phenomenon; it evolves with the experience of product use over time. It is a longitudinal process in which reactions towards the product can evolve over time. This process covers engagement, non-engagement-disengagement and reengagement [12]. When the novelty effect of using a product passes, people may disengage with the product. If, after a while, the user desires the experience and starts using the product again, reengagement occurs.

Other research defined engaging experience as a product's ability to inspire more frequent, active and intense interaction [13]. To do so, the product needs to attract the user's attention, keep her interest, and make her think about the product more frequently. Flow Theory [14, 15] is the state of high involvement in certain activities; these can involve product use. The skills of the individual and the challenges of the activity define the level of flow: If these two are at equally optimal levels, then the individual will be in flow. People feel anxiety if the level of challenge is high, but their skill level is not high enough to match these challenges. On the other hand, people feel bored while performing an activity if the challenges of the activity are low but their skill level is higher than the activity requires. It is evident that the level of flow increases when the user has the control of the activity.

Understanding how people experience products over time can provide insights. Chou and Conley [16] define engaging experience as an aspect of a product in addition to usability and aesthetics. We define *engaging experience* as the ability to inspire and motivate people, allowing repeated interaction with a thing over time. In product and interaction design, this has translated into the consideration of functional, aesthetic, social, and emotional needs of people during the design process [17, 18]. Products that feature regular feedback keep people engaged in using the product over time [7]. For example, a pedometer shows steps taken over the course of a day, and this information alone can motivate us to continue to use the product. Interactive products can command our attention, draw us in, and build curiosity [8]. Aesthetics must be considered, too, so the product fits with the notion of who we are and sustains use over time [19]. The quality of the data collected and how it is presented data is also an important factor for preventing the product abandonment [20]. For example, the Nike Fuelband [www.nike.com] features a dynamic visualization display and sleek form that invites sustained interaction.

As a community, we have yet to understand the trajectory of *engaging experience* with physical activity tracking products, to better support designing for sustained usage. To address this gap in design knowledge, we need to understand how these products can create engaging experience. This knowledge can help designers understand how to design new physical activity tracking products that motivate people to use them over time, and positively affect their long term use [10].

3 Methodology

To better understand engaging experience in physical activity tracking product use, we recruited participants by advertising the study on Craigslist and a campus recruiting web site. We sampled for people who had concrete goals related to becoming more active, or a desire to become more active. People who were interested in the study were

asked to complete a screening questionnaire in which we asked their age, type of phone, number of hours they are active per week, and whether they would be traveling or on vacation in the next five weeks. In total, 16 people (8 female; 8 male, ranging in age from 23–57, $M = 33.58$) participated in the study. Nine participants wanted to lose weight and six of them expected to increase their physical activity level.

3.1 Product Selection

To select the physical activity tracking products for the study, we reviewed 15 mobile and seven standalone products that were on the market at the time. We compared them through their abilities of mobility, interaction with data and perceptions of usefulness. Ultimately, two products were selected (Fig. 1): the BodyMedia wearable armband and the FitBit activity tracker. The BodyMedia and FitBit products were chosen because they both show activity in real time, which might be critical for long-term product use.



Fig. 1. BodyMedia and FitBit products

3.2 Data Collection

We conducted semi-structured initial interviews with participants, lasting 60–90 min. Here, we gathered details about their typical day, their daily activity level, and their general physical condition. During the initial interview, participants were asked to talk about their goals as participants of this study. Next, participants were given either the FitBit or the BodyMedia product, and were given a week to gain familiarity with the product. We asked participants to use the product for five weeks and after five weeks, we conducted semi-structured debriefing interviews with participants lasting between 45–60 min. All the interviews were voice recorded with the permission of the participants.

3.3 Analysis

We coded interview data thematically to provide qualitative information about the experience of using the product. We drew out characteristics from our data that described product qualities that contributed to long-term use, and therefore, engaging experience. To analyze the qualitative data, each voice record was transcribed into Excel sheets. Then, open coding was conducted where product characteristics, qualities and participants' interactions, needs and expectations were identified [21]. Each sentence of participants was combinations of several sentences; thus they were divided into meaningful utterances. In total 4 main product-quality codes were defined in with 37 sub-codes in total. After the content analysis, product and user related comments of the participants were separated from each other to emphasize the product-related dimensions of engaging experience.

3.4 Results

From the results of our study, we derived four characteristics that we believe contribute to engaging product experience: *connectivity*, *curiosity*, *personalization*, and *motivation*. We suggest that when people feel curious about some kind of information coming from the product and have an interest in learning from the product, they start to engage with the product. When the product has the ability to allow people to make changes to how data is presented to better meet their needs, people will keep using the product. The experience then becomes continuous and engaging over time (Fig. 2). We think that curiosity and motivation are behaviors that are triggered by product interaction. Connectivity and personalization of data move from product back to user. In what follows, we define each characteristic with reference to the literature.

Connectivity. The first characteristic is connectivity, which we define as the “product’s ability to communicate with the user, who expects to connect to the product whenever they desire.” Data from our study revealed three important issues related to connectivity: (1) People want to see their data instantly, but usability problems related to connecting them to the product meant that they lost their interest in product use. Seeing data instantly increases engagement with the product. (2) Accessibility of data through multiple devices is critical in order to make the process of accessing data less complicated. (3) People expect that products prompt the user to connect by providing analyzed data along with meaningful suggestions and achievable goals.

Our data showed that staying connected to the product whenever people desire is vital to sustain engagement over time. When participants were able to connect to the product with the product’s interface, the web, or a mobile app, their engagement increased as they began to draw knowledge from their data. For example, one of the participant’s mobile apps used to access the system did not work well during the study, and he devised a way to get data from his device without connecting the device to a computer. He described this as a usability problem, and lost interest in using the product over time. This example shows how connectivity is an important aspect of engaging physical activity tracking products, as it enables sustained interaction with data and meaningful interpretations of the data over time.

Technology has made it easy to connect to an interactive product or service using any number of devices. Using a number of devices such as a smartphone, a wearable sensor, and a web site, products can determine where someone is, what they are doing, and how long they have engaged with a product or service [22]. These conditions also make it possible to access relevant data at all times. Interactive products can effectively sustain engagement by reacting according to the a person’s changing contexts of use [23]. Today, people use wireless connections, RFID tags and GPS applications in daily life, all of which can serve as points of connectivity. Many means for staying connected are readily available; well-designed products can take advantage of this to support engagement with products over time.

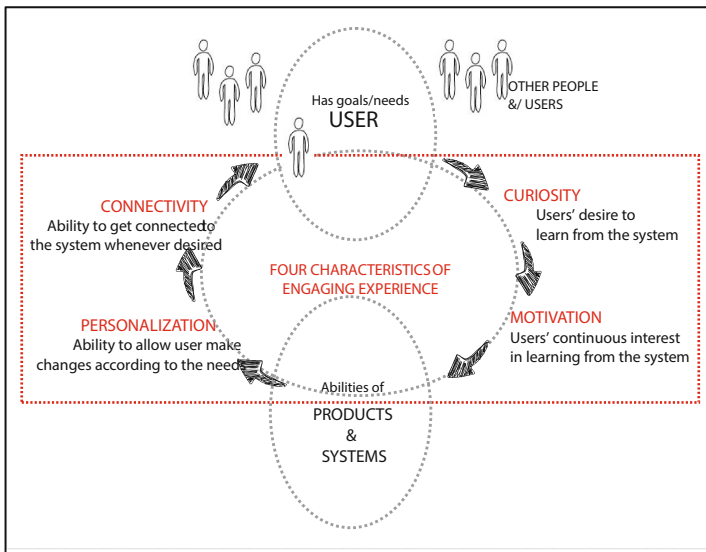


Fig. 2. Four characteristics of engaging experience.

In order to further explore connectivity as it affects engaging experience, physical activity tracking products should enable users to access and analyze data about themselves immediately. Products should support multiple points of data access and data interaction. There should be several simple and direct ways to access data, and data access should transfer seamlessly from one access point to another.

Personalization. The second characteristic is personalization, which we define as “the product’s ability to allow the user to make changes in the functionality, interface, information content or distinctiveness of a product” [24] to best support individuals’ needs.

In our study, we discovered three findings related to personalization: (1) People wanted the product to “talk to” them specifically, rather than just collecting data and analyzing it according to pre-defined parameters. (2) People wished for the product to make suggestions for behavior change based on analyzing their data. (3) People expected the product to adapt to users in relation to their changing needs and goals.

In general, our study participants expected that the product would offer better adaptation and personalization to their individual needs. For example, one of the participants was initially motivated to use the product. However, she became bored over time, exclaiming that the product was just like a parrot, showing her the data exactly as it was recorded. Instead, she expected the product to be more adaptive and interpretive, to intervene by presenting additional information to the recorded data. Our participants described how personalization is important for interactive products, because personalized interaction strengthens the feeling of ownership of the product and inspires extended use.

Personalized data takes the form of tailored offerings from a service provider to its customers. Products and services are customized relative to the knowledge provided by customers to best fit their needs [25, 26]. Personalized technology can in this way have a persuasive effect on customer, for example by offering personalized messages to improve their well-being [27].

Future physical activity tracking products could go beyond the simple display of information to include personalized prompts for individual users or case-specific solutions. They could represent a person's ideal self in terms of who they want to be, satisfy them emotionally, and prevent them from becoming bored with using the product. They could offer features that people can customize to their personal needs and taste. By understanding the specific user, the product needs to adopt itself to user expectations. For example, tracking whether a purchase was shipped to the customer herself or to someone else might better be tailored Amazon's recommendations. In this way, a product can analyze personal data and make suggestions accordingly.

Personalization cannot be entirely product-driven; it should be a combination of user input and approximations made by the product. For example, a personalized product could be a transition to being a personal coach or helper, where the product coordinates with the user to improve their quality of life.

Curiosity. The third characteristic is curiosity, which we define as “the desire to learn about and keep interest in product data.” Our data revealed several important issues related to curiosity: (1) At first, learning about something that people don't know about makes them curious. For example, seeing sleep data at the beginning of the study was novel and people described their curiosity to make sense of this data. (2) A person's curiosity can be satisfied by having instant access to their data. (3) As people understand their data, the process of accessing it becomes more repetitive. They need suggestions about how to break the monotony, which results in decreased curiosity about their data.

In our study, we saw that some of our participants' curiosity decreased over time. We reasoned that this was partly due to the static information displayed by the product. For instance, one of the participants stated that she was curious to interact with her new product at the beginning of the study, but after a while she felt less motivated to interact with the product when the data became more repetitive. She hoped that future versions of the product would be more interactive and offer ways to sustain curiosity. She expected the product to describe “what the data means” and “what it represents”. We interpreted this to mean that a product's functionality is highly related a user's curiosity and that adaptability of a product can greatly enhance curiosity and engagement.

We also learned that product breakdowns can negatively affect curiosity and therefore engagement. For example, one participant was curious about her data when doing yoga, yet another was curious about his data when he was walking from home to campus. In both cases, the product was expected to be always readily accessible to address any desire to fulfill one's curiosity. These examples show that curiosity is important in the early stages of product use; when curiosity is satisfied during the early stages of product use, sustained engagement with the product is more likely to occur. Curiosity might also be sustained over time, for example through prompts and suggestions about the user experience of the product and the change in the user results.

Keeping people curious depends highly on the dynamism of their actions. As a very basic example, people feel curious when they start reading a very fascinating novel. The trigger of curiosity is the answer to the question of "what comes next?" [28]. Thus, curiosity is not simply a one-time phenomenon, but instead unfolds over time. In the literature, curiosity is defined as the "*provocative and intentional behaviors*" that people elicit in response to any activity with inherently novel and uncertain properties [29]. Other literature has described curiosity as having "*an appetite for information*" [30]. Curiosity is a very strong feeling that makes people feel enthusiastic about learning something that is unknown. As we now live in a world where a proliferation of products can collect and make a variety of dynamic information about an individual available at any time, it is possible to create curiosity over time and therefore support engagement over time.

To sustain curiosity, products should offer dynamic views of data and allow the data to be easily accessed on demand. Designers of interactive products should facilitate constant and easy updates for the data over time. In addition, the product should provide incentives and content to sustain curiosity.

Motivation. The final characteristic is motivation, which we define as "the product's ability to stimulate people's interest in order to make them continually interested in using the product for reaching a specific a goal."

Our data revealed some important findings about motivation: (1) Participants expected the product to prompt the user to motivate them to do more physical activity. However, when it did, they were disappointed to see only information displayed, rather than a motivational message. Simply looking at the data was not motivating. (2) In order to stay motivated, participants wanted to see more than a record of their activity. (3) If data is inaccessible, or the product is offline, it affects motivation negatively. (4) Positive feedback about one's behavior seems to sustain motivation and product use.

Some of our participants said that the products used in the study did not motivate them at all. They related this lack of motivation to the way that they interacted with the product. They wanted to be prompted with new behavioral suggestions and goals; instead, the products simply presented information about their activities and sleep patterns. Therefore, they lost motivation. Some participants desired for the product to give them suggestions for new physical activities based on an analysis of their daily activities, calories burned and calories eaten. For others, receiving notifications about progress and rewards for the good progress were found to be motivating. If data were inaccessible, or there were problems in interacting with the product, it negatively affected motivation. Collectively, these findings indicate that motivation is an important

aspect of engaging experience with interactive products, because it affects how people use the product and can ultimately affect whether and how people change their behavior.

Motivation influences the way people behave [31]. This behavior indicates "...how hard people are willing to try and how much effort they are planning to exert in order to perform the behavior [32]". Motivation also plays a vital role in changing both attitude and behavior [33]. It can be an individual process, but often it is evaluated in terms of external outcomes. Social Cognitive Theory [31] describes the process by which people affect their behavior by evaluating outcomes. The theory defines a motivational process in which people affect their behaviors by self-evaluation of outcome behaviors. The Theory of Reasoned action [34] also defines motivation as a prominent factor in one's behavior. When people are motivated and appreciate the outcome of the behavior, the behaviors are more likely to change. Setting an intention, articulating a goal, making progress towards that goal, and achieving the goal are all interrelated and connected to motivation [34]. If a goal is perceived to be valuable for one's self, people will more readily change their behavior by doing something new and continuing to do it [35, 36]. Thus, without the desire and intention to change one's behavior actually carrying through a plan will be difficult.

Technology can be designed to persuade people to increase their motivation and to trigger a certain behavior [37]. When human abilities are enhanced with aspects of technology, human behavior is more likely to change [37]. By looking at how technology can positively increase motivation, new challenges are revealed for product developers. Researchers are striving to understand how products might be adapted as user interactions are streamlined, people change their behavior, and learn things about themselves.

One potential drawback of products that motivate people is that they run the risk of misleading users by asking them to work towards goals that they can't achieve. This can lead people to stop using the product when the goals are unattainable. By giving motivating, but not unrealistic messages, an interactive product has the potential to provide an engaging experience. Otherwise, interest in the product will wear off, and users will likely abandon it.

4 Conclusion

Developments in technology contribute to the success or failure of interactive products and products. Yet many of these products and products are abandoned after a short time, and fail to help people realize their goals in using the product. In this paper, we explored how to offer engaging experience in interactive product use by helping to create products that inspire curiosity, motivate people, and adapt to their individual needs and changes in goals over time. With this research agenda, we hope to explore how to better design products to offer engaging experience and to improve people's lives.

In the study, we found two product-related (connectivity and personalization) and two behavioral qualities (curiosity and motivation) that led to extended use of the product and contributed to engaging experience. Some of the participants described merely having the device as a motivating factor. Others expected the product motivate

them to do more physical activity through prompts and other motivational messages. They were disappointed in the pure information display. People liked the ability to see data instantly; they found it to be motivating and the availability of data in turn affected their curiosity. When product and data could be connected to a desktop computer, it positively affected people's motivation and curiosity. It provided a means of comparing one's data over time and to other users. This also prompted suggestions about tailoring to personal needs.

We believe that the dimensions will be stronger when we are able to observe product use over time. For this reason, interaction with other information resources such as GPS, personal health records, knowledge on types of exercise and benefits, cause-effect relationships etc. is required so as to allow the user to personalize all the aspects of the system. Other concerns are also critical, such as integrating information coming from other resources, or integrating information and data related to health-related concerns. These will ensure prolonged usage, as people will believe that the system is "really" useful to them.

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