Studying the Role of Wearable Health-Tracking Devices in Raising Users’ Self-Awareness and Motivating Physical Activities

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Abstract

Health-tracking technologies have recently proliferated, offering great potential for promoting healthy behaviors. Despite this surge, we currently have little understanding of how users perceive these devices and possibly use them to move toward more healthful behaviors. The empirical research presented here raises our understanding about different affordances of these devices relative to greater awareness about daily practices of users and greater motivation for physical activities.

Introduction

According to a survey by the Pew Internet Project, 7 in 10 American adults, in one way or another, track their health-related activities. About one-fifth are using some form of technology (e.g., mobile devices or wearable devices), while half opt to track things only “in their heads” (Pew Internet 2013). Along the same lines, interest in consumer self-tracking technologies (e.g., Fitbit and Nike Fuelband) that measure movement to help consumers track and understand their daily activities has rapidly increased over the past few years. A number of recent surveys have focused on the pervasive impacts of these technologies, but most of these studies were commissioned by the vendors (e.g., Comstock 2013). In addition to this line of commercial research, a few empirical studies have been directed at the use of activity-tracking devices (e.g., Dannecker 2013). These studies, however, are mostly experiential, and they may not have fully captured the unfolding social reality and the complex ways in which behaviors are shaped over an extended period of time in natural settings. It is only through a context-aware approach that we can effectively explore motivation and actions in context. This study, by using a contextual approach, helps us examine the impact of a self-monitoring technology (Fitbit) on people’s perception and behavior in their efforts to promote a healthy lifestyle. This work, in particular, explores whether tracking and representing information, enabled by the use of Fitbit devices, makes any difference in the ways in which users interpret and make sense of their physical activities. In addition, we will examine the ways potential changes in users’ awareness may lead to meaningful changes in users’ motivation and physical behavior.

The Technological Focus: Fitbit

This work focuses on Fitbit as an activity-tracking device that uses a three-dimensional accelerometer to sense user movement. The device collects information about steps taken, and by combining that with user data, it calculates basic measures such as distance walked, calories burned, floors climbed, and duration and intensity of activity. Fitbit automatically syncs users’ data to desktop and mobile applications, providing a variety of numerical information representations.

Figure 1. Two types of Fitbit tracker used by the participants: Fitbit Flex (left) and Fitbit One (right)
Fitbit Flex (wrist wearable) and Fitbit One (clip-on)

Fitbit Flex is a wearable model and is worn like a watch on the wrist (Figure 1, left). It has a simple display of 5 LED lights that represent the number of steps taken in a day, and it vibrates to indicate that the personal goal has been reached. So, for example, if the activity level is low, only 1 or 2 LED lights will be lit. Fitbit One is clipped to one’s clothing or can be put in a pocket (Figure 1, right). This is different from Fitbit Flex, which offers a digital display that shows the number of steps and other types of information.

Methods

The empirical basis of this work included semi-structured interviews with 15 research participants who were selected based on the adoption of Fitbit devices and their willingness to share their experiences and thoughts about it. All of the participants were interviewed face-to-face, and interviews lasted between 45 and 60 minutes. The interview protocol included questions about: (1) their primary motivations for adopting Fitbit, (2) the general ways the participants used the device, (3) the type of information they obtained from the device and how they made sense of it, and (4) potential changes in their behavior or perception as a result of using the device. All of the interviews were audiotaped and transcribed verbatim.

Results and Discussions

Participants had a wide range of experiences with tracking physical activities before obtaining the Fitbit device, from tracking in their heads and manually recording to using other forms of tracking technologies such as pedometers and mobile applications (e.g., Run Keeper).

Table 1 summarizes the ways that participants obtained access to the information recorded by Fitbit. Most participants (10 of the 15) used the website to check more detailed information that was not provided by the device itself. All of the participants drew upon the information representation provided by the device to find out about their physical activities, which were considered convenient anytime and anywhere.

Table 1. Multiple ways of accessing information recorded by Fitbit devices

<table>
<thead>
<tr>
<th>Website</th>
<th>Mobile Application</th>
<th>Weekly Report</th>
<th>Fitbit Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>3</td>
<td>9</td>
<td>15</td>
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Two Types of Affordances: Informational and Motivational

Informational affordance embodies the ways the device registers and represents information. Fitbit devices automatically register several forms of physical activities and present this set of information via various methods (e.g., immediate feedback on the device or detailed analysis of activity on the website). These particular forms of information have consequences for how users encounter, use, and interpret the data. As such, quantifying their activity provided informational affordances that informed users about details of their activities. In addition to informational properties, Fitbit features conceptual properties and mechanisms that enable setting and reinforcing personal goals for physical activities. The device leverages information about activities and shows progress toward a goal, thereby facilitating goal achievement and providing motivational affordances.

Informational Affordances of Fitbit

We found that by quantifying their movements and generating personal information, Fitbit devices increased the participants’ awareness about their own physical activity. Several of the participants used to keep journals about their activities before adopting Fitbit; however, they commonly found journaling to be cumbersome and were inconsistent in noting their activities. With Fitbit, they only have to carry the device around, and it collects valuable information without interfering with daily life activities. The user can therefore have their activities recorded without the need to remember and manually journal them. The participants mentioned that they were more conscious and more aware of their activity after using the
device because the visible information provided them with knowledge of their activity level. Participant 8 highlighted this affordance: “I also thought that the piece of it that was intriguing was that you get to see how much exercise you were getting just in your normal day, you know, whether I was at home cleaning the house or doing laundry, or whether I was here at school walking up and down the stairs.”

However, a subset of participants made it clear that they also derived motivational affordance from the device. Figure 2 explains how different groups of participants perceived the device and how the differing perceptions led to desperate affordances. Every participant in the study benefits from the tool, as it generated information affordance. That is, all the participants leveraged the information generated by the device, and increased their awareness. The next question is: how may a heightened awareness about one’s physical activity motivate a subset of the participants to become more physically active?

![Figure 2. Two types of affordances generated by using the Fitbit](image)

**Motivational Affordances of Fitbit**

The interview findings highlighted two groups: 1) One group considered Fitbit to be a motivational tool that encouraged behavior change, and 2) the other group thought that the device provided awareness but did not change their behaviors or motivate them to engage in more physical activities.

Participant 9 (from the first group) stated that the resulting awareness encouraged behavior change: “I know that this week then would have been a week of inactivity because now I’m tracking with the Fitbit and paying attention to that. So I put active time in my schedule this week. So I’ve already got maybe three hours of active time in because I want to again increase my activity during these really tough times. [If] that where in the past I would just sit at my desk.”

Also, Participant 15 stated that the information she got led her to change her behavior: “It changed the type of exercise I did, so that was a change in behavior. It increased my motivation because if I came close to a goal I would do a little more so I would achieve it. It chastised me a little bit. If I totally bombed so like maybe there would be some days where I would only do 3,000 steps or something not desirable it would inform me of that information and make me a little more motivated to correct next day.”

In contrast, Participant 8 (from the second group) who was not motivated by the device argued: “It was good because it clarified your perception or assumption about your activity but it didn’t get to the behavior change.” Some of the participants in this group mentioned that they gave up using Fitbit after knowing their daily patterns through the device, while their lives didn’t change significantly.

The discrepancy between the two groups led us to explore why uses of the same device resulted in different outcomes. Although the features of the device were almost the same across all of the users, the affordances brought about in use were not. Further examination of the interview data underscored two primary factors that mediated the way the use of the device generated motivation. Figure 3 explains that the health-tracking device was not the only factor that motivated users toward more activity: there were other salient factors
that mediated the effect of the health-tracking device on the user’s motivation. In fact, personal characteristics, including health status, individual knowledge and attitudes toward physical activity, and the psychological and behavior attributes may have affected the way the user engaged with the device. In what follows, we explain two of the mediating factors.

**Figure 3.** Factors mediating the motivational affordances of the device

**Health Background**

We found that personal health history such as surgery or obesity could have led to users’ behavior change when they drew upon the device. Participant 4, who had a medical precondition prior to the use of the device, changed her behavior as she began to use Fitbit: “I had a medical condition (arthritic hip), and so over time I moved less and less, and I would plan meal preparation so that I would move the least steps possible. What happened was I had the hip operations, and then I could walk. And I got the Fitbit, and then I realized that I had to undo and relearn and be inefficient in my movements, so that I’m moving around the house a lot more than I used to. I had to learn to be inefficient to just move.” In a similar fashion, Participant 12 who had a weight problem used Fitbit to keep herself active: “I did find out I paid a lot more attention to what I did. I actually decided to move where I park to a different location so I could get more steps in every day.”

**Personal Differences**

In addition to health contexts, personal motivations that varied across individuals influenced the way they perceived the functionality of the device and used it. For example, on the one hand, a few participants were primarily concerned with more daily activities. These self-motivated individuals usually used goal-related feature of the device to improve their activity level. Participant 1 noted: “The group [aspect of the device] really didn’t drive me to be more active. I am a much more self-motivated person. I want to compare with myself. I would rather know I’m doing better than 6 months ago.”

On the other hand, some participants were socially motivated since they were driven by competition with others. Participant 3 mentioned that when he saw others’ activity levels on the website, he felt a sense of competition and consequently greater motivation: “I said yeah he’s stepping up, I may need to step up my pace. If you have a certain competitive streak in you and you notice that he is consistently doing more than you are; you’re like I need to do more.”

**Conclusion**

The empirical work presented here focuses on the use of activity-tracking devices and the way they are adopted by users in practice. Our findings demonstrated two distinct forms of affordances generated by the use of the devices. For all the participants, the devices served as valuable informational tools by quantifying and making their daily physical activities visible. What’s more, for a few participants, the device provided motivational affordances, encouraging more physical activities. To delineate the reasons behind these differing affordances, our study further highlights consequential individual differences in terms of perception (personal context) and motivation (self-motivated vs. social motivation) that affect how individuals use the device to motivate themselves.
References