Personal Informatics for Non-Geeks: Lessons Learned from Ordinary People

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Abstract
We have been studying how ordinary people use personal informatics technologies for several years. In this paper we briefly describe our early studies, which influenced our design decisions in a recent pilot study that included junior doctors in a UK hospital. We discuss a number of failures in compliance and data collection as well as lessons learned.

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H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous.

Introduction
Many studies of those using self-quantifying or **Personal Informatics** (PI) technologies have looked at people motivated by either a medical need, a desire to improve athletic performance or an interest in quantified self movement [1]- but what about the rest of us, the so-called "ordinary people"? For the last three years we have run various studies introducing various PI technologies to people with no obvious PI goals in order to examine factors that encourage or discourage adoption, as well as insights into personal behaviours. In this paper

we briefly describe our early studies, which influenced design decisions in our most recent pilot study and explore some of the reasons for the failures encountered in the pilot study.

Previous work

Our previous work involved two studies. **Study 1** used the original v1 FitBit in 2011 over a four-week period (three males and four females, age range 50-70) with individuals tracking their activity levels and sleep (as measured by the FitBit). Individuals received daily reports of their activity and sleep and found that the regular manual charge/sync requirement was too onerous. They also found that the sleep measurement, requiring a manual start and stop, was fiddly; and that sleep data was generally of low quality, often reporting very poor sleep even when the participant actually slept well.

Study 2 addressed the charge/sync issues revealed in **Study 1**, by using the FitBit Zip, which did not require daily charging and would sync automatically with any computer running a FitBit server. We addressed the poor sleep data problem by using a smartphone based sleep app (Sleep As Android and iOS Sleep Cycle). **Study 2** also ran over a four-week period with three groups who shared data within groups (**Group 1**: three females, age range 42-62; **Group 2**: five males, one female, age range 26-33; **Group 3**: three females, age range 26-29). **Study 2** found that the automated charge/sync of the Fitbit Zip resulted in more compliance and participants appreciated the more accurate sleep data. Overall sharing within the group generated more interest in the data than **Study 1** as people could compare with others and understand "how normal or abnormal" they were for that group norm.

Pilot study with junior doctors

In our current research, we are mainly interested in investigating the relationship between privacy preferences of people and group dynamics in a general sense. In our field studies, we are building technical infrastructures in order to collect PI data from "ordinary people" and share this data available with third parties (e.g., friends, family members, colleagues, etc.) in a naturalistic environment. Therefore, it is crucial for us to understand how "ordinary people" might interact with their life data and which factors affect their compliance and adoption of the technology.

We recently ran a pilot study involving junior doctors in a UK hospital. Junior doctors in the UK and Ireland are those who have begun their first year of work in a hospital after graduating from medical school (often called an "intern" in North America). We chose to extend the technology used successfully in **Study 2**, so again we used Fitbit Zips to record daily activity levels, and the *Sleep As Android* app to record sleep start, duration and quality. We implemented an app for bluetooth beacon logging in order to record with whom and where the junior doctors spent their time.We also monitored heart rate and heart rate variability (HRV) using a chest strap and the app we implemented to try to measure stress.

In addition to the collection and storage of this data, we aimed (in the main study) to make the data sharable through an app installed on the participants' phones. This will provide an opportunity to investigate the evolution of data-sharing patterns, (and hence privacy preferences), of junior doctors over the 12 month-period of the full study due to start shortly.

The first goal of our pilot study was to ensure proper functioning of the devices and software to collect and store junior doctors' data and to identify possible modifications that need to be made. The second aim was to identify social and technical challenges that may arise from the junior doctors' working environment.

Pilot study participants and data

During the pilot study, we recruited five junior doctors (three female, two male), all of whom were between 23 to 31 years old. Prior to the pilot study, none of the junior doctors had ever used any technology for life logging purposes. As far as we were made aware, none had specific health concerns.

We installed the software to sync Fitbit data on one of the PCs in doctors' mess (common room), where junior doctors can rest in while they are on call or due to be. Every time a junior doctor entered the doctors' mess, their activity level data locally stored on their Zip was transferred to Fitbit servers.

We used the *Sleep As Android* app to monitor their sleep patterns. This app stores sleep data (e.g., time to go to sleep, time to wake up, sleep duration, deep sleep period, etc.) locally on the phone which is regularly synced to our server. Since this app is only available for Android platforms, we had to loan Android phones to two of the junior doctors.

Polar H7 chest-straps were given to each doctor to monitor heart rate and heart rate variability (HRV, a proxy for stress). We created a custom Android app to log this data as well as all of the Bluetooth beacons visible. The app requires Android 4.2 platform and Bluetooth 4.0 and only one of the junior doctors' smartphone complied with these technical specifications. Therefore remaining junior doctors were loaned extra phones to run this app, in addition to their personal phones.

In order to uncover social groups among junior doctors (i.e., who is with whom at what time and where), we attached Bluetooth 2.0 dongles to stationary PCs in places they frequented during their shifts at the hospital. Our app was capable of monitoring the MAC address, signal strength and timestamp of a device whenever a junior doctor was within the proximity of any of the dongles. All of this data were stored locally on smartphones and regularly synced with our server.

Figure 1: Fitbit Zip (top left), chest strap for heart rate and HRV monitoring (top right), Sleep as Android app with sleep movement graph, and sleep sound recording (bottom).

What went wrong?

During the pilot study, data collection did not turn out as expected, hence we ended the study after 4 weeks and conducted a debriefing session. During the session, we asked the junior doctors about the problems experienced while using the devices and apps. In the following subsections we explain these problems.

Uncomfortable chest strap
Among all data types, we were able to collect minimum amounts of heart rate and HRV data (on average three days per junior doctor). During interviews, two of the participants told that they found the Polar H7 chest strap quite uncomfortable for constant wear. One of these two junior doctors wore the chest strap only once, while the other wore it for six days. Two of the junior doctors also told us that they had rashes due to the chest strap continuously.

Immature software
One of the reasons why we could collect far less heart rate and HRV data than we expected was due to the immature software. The app we implemented was tested on a couple of Android phones including the ones that were given to four of the junior doctors. We were unable to test the app on the model of handset owned by the single participant who used an Android phone; they reported frequent crashes and eventually stopped using the program entirely.

Necessity to carry an extra phone
As mentioned previously, four of the junior doctors had to carry the Android phones we gave them as well as their own phones and they found carrying an extra handset quite impractical.

Concerns about the sleep app
More sleep data was collected compared to Bluetooth, heart rate and HRV data (18.8 days per junior doctor on average), since junior doctors did not have to carry the extra phone in order to record their sleep patterns. However, one of the junior doctors used the sleep app only once. When we interviewed him, he said that using the sleep app made him "feel weird". Two of the junior doctors said that using the sleep app on a regular basis proved to be labour intensive

Lessons Learned

Alternative heart rate and HRV monitoring
As an alternative to chest strap in our actual study, we are considering to use a heart rate monitoring watch clipped to clothing that would prompt users to measure their heart rate during their daily routine. We would then be able to take heart rate measurements at certain intervals.

Mature software
Adequate software testing will be done before the software is used in the actual field study. A revised version of the app will need less human intervention. We will replace the third party software used to upload data from the phones to our servers.

One-phone solution
During the debriefing session, junior doctors agreed that using their own phone would be the ideal solution rather than carrying an extra phone. Therefore, we will implement a multi-platform version of the app.

Passive sleep monitoring
Since junior doctors found using a sleep monitoring app invasive and labour intensive, we have decided to use a sleep sensor that is placed beneath the sheet to record their sleep data automatically.

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References

[1] Wolf, G. Know thyself: Tracking every facet of life from sleep to mood to pain, 24/7/365. *Wired* (17.08.2009).