Logging Phone Usage to Understand Health and Wellbeing

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Abstract

This paper discusses ideas and opportunities for the use of mobile phone app launch log data in the understanding and improvement of health and wellbeing. Rather than analysing a phone's sensor data or specific user actions within an individual app, the data set we discuss concerns when apps are launched on a mobile device and the duration of usage of each app. This data gives an abstract but broader picture of how a mobile device is used. Since many people use such devices regularly throughout the day, we suggest that such data can help build a useful picture of day-to-day activity. We also suggest it is helpful to look not only at health and wellbeing apps individually, but at how these are combined and used over the long term.

Author Keywords

Health and wellbeing; personal informatics; tracking

Introduction

There has been much interest over the past few years in mobile applications and devices for health and wellbeing, including applications that track activity (such as pedometers) and applications that enable the user to log activity (such as food loggers). In this paper we will suggest looking beyond sensors or individual health-related applications and to how the mobile

device as a whole can serve as an indicator and facilitator of health and wellbeing.

We will use the term *app tracking* to mean the recording of every time an app is launched on a mobile device, along with its duration of use. Our key premise is that app tracking can underlie new innovations in this area for health and wellbeing. The ideas we present in this position paper are speculative and forward-looking. They are grounded in our experiences in such logging (which include the release of a logger for iOS that has, to date, been downloaded over 25,000 times) alongside our experiences in developing applications for health and wellbeing. However, with this paper we seek to look beyond our current studies, and to envisage new directions for 'the quantified self'.

App Tracking

While there has been much discussion and innovation based on *in-app logging* in health and wellbeing (i.e. the developers of an application logging and storing data on how their particular app is being used – see e.g. [1]), the use of *app tracking* in this area is relatively unexplored. Whereas in-app logging concerns what is done in an individual app, app tracking concerns what is done more broadly on a device. Such logging is not the combination of two or more in-app logs, but rather presents a more abstract way of considering how apps are used. Primarily, an app tracking log can include when each app is opened, when an application launcher or device home screen is used, when the phone is locked or unlocked and when the phone sleeps. Other information that can be collected includes connectivity, battery state, charging state, and location. We describe our approach to app tracking elsewhere [2], including the ethical

considerations. Other studies that draw upon this type of logging include [3]. The example log in the margin of the following page shows a pseudo log to illustrate the kind of data we are describing. This is simple data giving minimal information about what is done on the device. Yet, as we will explain, it can potentially be used to supply insight into health and wellbeing.

App Use Logs as Proxy for Behaviour
Mobile devices are used frequently throughout people's waking hours. This means, as figure 1 shows, that for many users it is possible to obtain a reasonably good idea of when they are sleeping. We have found many people use their mobile phone last thing at night and first thing in the morning, often as an alarm clock. People will often also reach for their phones if awoken or having difficulty sleeping. Participants in our studies have been struck by how obvious their sleep patterns are when shown visualisations of their data, with some reporting that limited or interrupted nights of sleep were more readily visible from our data than that gathered from dedicated wrist-worn trackers.

The use of the phone is also patterned during the day. These patterns are far more complex than the blank periods we often observe at night, but we suggest there are opportunities to explore these. It may or may not be possible to differentiate a 'sick' day from a 'normal' day but it is reasonable to envisage connections being made between patterns of app use and patterns of activity.

Logs as Proxy for Mental Wellbeing
Links have been shown between the social connectedness of people and their physical or mental wellbeing (e.g. [4][5]). Reduced social engagement is
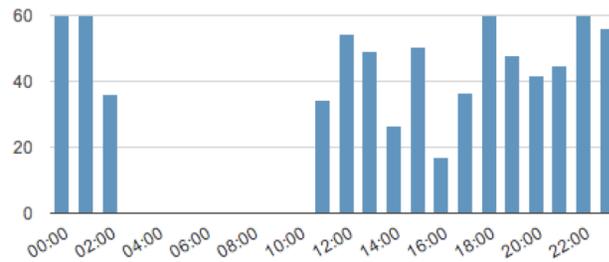
Figure 2: A Plot showing minutes of device use for every hour of one day. What is most apparent is a blank period, strongly indicating when this person slept.

sometimes an indicator of deterioration of mental wellbeing. Madan et al [4] inferred participant health status using a combination of Wi-Fi scanning to detect movement, Bluetooth proximity to detect face-to-face encounters and call and SMS logs. It would be interesting to study similar issues solely through the study of social apps or services. App tracker logs do not enable the collection of data about face-to-face meetings, or specific social connectivity (e.g. who is called on the phone), but do allow for analysis across apps, to look for fluctuations in the use of communication or social networking apps in general.

Alternatively, it can be considered that people often feel their phone is addictive or something that moves them away from social life. People may wish to use a personal informatics app in order to gain more control over their device use. The use of app tracking logs simply to feed back information about when and how often the phone is used may be a useful step in gaining a sense of control, and help become more mindful.

Tracking Across Apps

App tracking logs may appear to offer less insight into health or activity than the data gathered from an individual app. But we should consider that health and wellbeing apps are not always used individually, but in sets or as 'configurations'. In our experience, many people do not just use one health app, but several. For example we see a lot of people using diet apps such as MyFitnessPal as well as pedometer apps. People also sometimes use several exercise apps, for example separate apps for gym exercise, for running, for cycling, for swimming. We should be mindful therefore that if we are to look at app use outside of controlled studies we need to look across apps.

Secondly, we should consider that health and wellbeing apps are often not used indefinitely. Applications often seem to be designed with the idea that users would consider that the more data is gathered, the more valuable it becomes. Yet through our studies we have found that many people will often use several different applications over a period of time, perhaps switching from one pedometer to another. Moreover, we have noticed that users are often keen to get a good sense of their routine, but once they know how many steps they typically take walking to work or the distance of their favourite regular cycle, that collecting data becomes less useful. App tracking at a large scale with many thousands of users allows us to look across such long term use of apps, in particular allowing us to look at when apps are switched between, the patterns of trying out and sticking with apps, and whether one app tends to be replaced by another, or users stop using a particular class of app altogether.

Design Opportunities

We have alluded to several design opportunities:

- Sleep tracking
- Analysing patterns of behaviour
- Analysing social connectedness
- Managing excessive app use
- Understanding the use of multiple apps
- Understanding long term patterns of use

Firstly, we should address why anyone would consider using app tracking data as a proxy for behaviour when high quality trackers are already available. The answer is that doing so uses ready-existing information. It does not require an extra device or app to be running which could have a high battery cost.

Secondly, we should address that app use data may well compliment rather than replace other health and wellbeing data. For example, it is interesting when data from an activity tracker is viewed alongside these logs. This information often reveals the phone is used when sedentary, and that game-playing is associated with long periods of physical inactivity. Contemporary health research is pointing to the importance of reducing sedentary time [6], yet sedentary behaviour is hard to track because it is difficult to sense light movement, and sensing across the day can have a cost on battery. We think turning to the kind of data we describe could help in looking beyond tracking active behaviour to the challenge of understanding sedentary behaviour.

Finally, we believe it is important to move beyond thinking about individual apps for wellbeing and behaviour change. We do not believe behaviour change needs to be, and foresee that it rarely will be, achieved using an individual app over the long term. We think a challenge for this area is in understanding how people work across and between different apps over the long term. App tracking can help in understanding this.

Conclusion

This position paper has discussed opportunities and ideas regarding 'app tracking' and health and wellbeing. The paper is speculative, arguing that the future of 'the quantified self' may lie across and between apps. This is not to say the future is in the rational integration of data, but to say it is in understanding and making use of the messy and patchy ways in which mobile devices are used in the real world.

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