

Personal Tracking as Lived Informatics

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ABSTRACT

This paper characterises the use of activity trackers as “lived informatics”. This characterisation is contrasted with other discussions of personal informatics and the quantified self. The paper reports an interview study with activity tracker users. The study found: people do not logically organise, but interweave various activity trackers, sometimes with ostensibly the same functionality; that tracking is often social and collaborative rather than personal; that there are different styles of tracking, including goal driven tracking and documentary tracking; and that tracking information is often used and interpreted with reference to daily or short term goals and decision making. We suggest there will be difficulties in personal informatics if we ignore the way that personal tracking is enmeshed with everyday life and people’s outlook on their future.

Author Keywords

Activity Tracking; Data; Qualitative methods

ACM Classification Keywords

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

INTRODUCTION

Over the past few years there has been a proliferation of mobile apps and consumer devices for tracking personal information, particularly that related to health and wellbeing (for example diet, weight, sleep, walking and exercise). Many apps can be downloaded for free or at low cost. Some physical devices (such as pedometers) cost trivial amounts (see [19]). Yet there is also a market for premium devices (see [11] for a discussion of the FitBit). Mobile phone manufacturers including Apple and Motorola have also begun to make specific provisions for activity tracking by, for example, incorporating always-on

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CHI 2014, April 26 - May 01 2014, Toronto, ON, Canada
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accelerometers into their latest high-end mobile devices. The advent of smart watches, smart glasses and other forms of wearable computing in the consumer domain is also likely to bring further innovation and proliferation in this area. Personal tracking is, however, not new. People have long been able to track and manage activities using diaries and/or personal computers. Tracking can in fact be traced back to at least Roman times (where trackers were used not as personal devices but for measuring the mobility of soldiers). However, with the popularity of smartphones and digital devices with built in accelerometers and location services, the area of personal tracking appears to be one of great investment and growth.

Previous research in this area has predominantly focused on individual, researcher-supplied technologies. From a health research perspective, a tracker is either an instrument with which to measure activity, or an intervention to be applied across a cohort of people. Standard devices are used, and often treated as invisible lenses on activity (e.g. [19, 21]). In health research, consumer trackers are usually used, whereas evaluation in HCI is usually of a novel prototype (e.g. [13, 10]). In HCI the devices themselves are not treated invisibly but, as with health research, evaluation is predominantly of an individual technology and oriented to intervention. There is some research looking at integration of technologies, notably Bentley et al.’s [2] work on health mashups for behaviour change. Yet even here the researchers selected what the study participants should use. The *agency* of the people using such technologies is too often denied; Maitland et al.’s [12] study of weight loss and Mamykina et al.’s [14] study of diabetes management are rare exceptions. They point out that people chose, use, interweave and abandon various technologies in their own, lived efforts to improve their health. They found people were not changing their behaviour because of a technology, but were using technology because they wanted to change.

What people decide to track using consumer products, what trackers they decide to use, and how they use them over days, weeks, months and potentially lifetimes remains understudied. Studying individual, researcher supplied technology is somewhat at odds with the literature around personal informatics, which suggests that people can and should track various aspects of their lives. It is also somewhat at odds with what we already know about smartphone use. Barkhuus et al. [1] have pointed out that

the smartphone is not an information appliance but a “seamful” device that people artfully work with and around. We know for example that people do not just use one messaging service, social network site, or Web browser, but combine, work across and work between them. It seems unlikely then that people will choose one activity tracker and stick with it indefinitely. We also know that people find some surprising uses for technology. In this paper, therefore, we address what people are making of personal trackers for themselves. In the following section we discuss personal informatics. We then report findings from interviews with 22 people. In the final section we characterise personal tracking as “lived informatics”, a view that emphasises the practical, prospective and felt aspects of personal tracking for health and wellbeing.

PERSONAL INFORMATICS

The areas of personal informatics and the quantified self concern the collection and use of personal data, often from trackers and life-loggers. The rhetoric in these areas is to “live by numbers” (see e.g. [22]), to quantify and then optimize areas of one’s life. When, for example, does one sleep well, and what is it that affects sleep? Is one’s weight going up, and if so, is there data that can be used to tell why? It is clear from Quantified Self (quantifiedself.com) online forums, and the annual reports published by Nick Felton (feltron.com) that such ideas can be put into practice. But are such people early adopters, leading the way for the rest of us? Or is mainstream tracking something different?

Li et al.’s staged model of personal informatics systems [9] is often cited as a key representation for this area. This model was designed to offer “a comprehensive list of problems that users experience”. This model holds five stages: 1) at the *preparation* stage, people need to determine what information they will record and how to record it; 2) at the *collection* stage people do the data gathering; 3) at the *integration* stage people should prepare, combine and transform data; 4) at the *reflection* stage people can think about, explore and interact with the information; and finally 5) at the *action* stage people can “choose what they are going to do with their newfound understanding of themselves”.

Li et al.’s model is technology centric. The problems that users experience are technical problems to be resolved firstly by selecting the correct technology. Only once the technologies are in place, and the datasets transformed and integrated, can things like reflection and action take place. While we do not deny that it would be useful to have a rational and systematic set of tools for collecting data, we have known since Simon [20] that it is problematic to assume that people will postpone action until they have rationally determined “newfound understanding”. We find Li et al.’s vision reminiscent of the idea in health informatics and information systems that computerization can and should set the rational underpinning for (a consequently rationalized) human action. Pollock and

William’s [18] history of enterprise systems, and Berg’s [3] analysis of decision support in healthcare both show such rationalisation is rarely achieved.

Personal Informatics for Health and Wellbeing

In the research reported in this paper, our central concern has been for personal trackers associated with health and wellbeing. A number of approaches can be taken to tracking in this domain. Accelerometers are often used to measure movement and are typically incorporated into devices like pedometers and sleep trackers. Location based tracking is also heavily used, particularly for tracking exercise such as running and cycling, in which people cover geographic areas. Such sensor-based systems can collect information without the user needing to actively engage with them. Many pedometers are designed to be always on, with the users only having to remember to wear them. Other trackers require active engagement. Food and medication trackers, for example, require users to enter details manually. This can be cumbersome and many of the more successful trackers in this area seek to make logging easier through, for example, support for barcode scanning. Some trackers are beginning to shift from requiring active tracking to support for passive tracking. Smart scales, for example, wirelessly transmit information to a computer. Smart watches (e.g. Garmins) are able to monitor one’s pulse.

Personal informatics encompasses health and wellbeing, but goes far beyond it. For example, personal informatics covers personal finance, personal communications, life photography, travel information, diary keeping and so on. Sometimes wider personal informatics tools find application for health and wellbeing. But we must be clear: this paper focuses only on a fraction of the personal informatics domain (and related domains such as life-logging).

THE STUDY

Following Maitland et al. [12], and Barkhuus et al. [1], qualitative, exploratory methods have been used in this study. Posters were placed in coffee shops, a bookshop, and a university building in a city in Scotland. The posters advertised for 1) people that used a pedometer or activity tracker, 2) people that had used pedometers or activity trackers in the past, 3) people that would like to borrow and use a pedometer or activity tracker.

Method

The research process involved an initial unstructured interview, and then follow-up contact approximately one month later. Initial interviews were conducted with 23 people, and 22 agreed to follow-up contact. Nineteen follow-ups involved one or more further interviews, and often email contact as well. Three follow-ups were done solely by using email (two interviewees had left the UK, and the other was suffering from health problems). One interview was conducted using a video conferencing tool.

This paper reports on the 22 people we had extended contact with. That we were using unstructured methods does not mean that we just let participants talk. Questions of clarification were an essential part of the study. In particular we found that participants would often demonstrate features of apps that they did not use. The social features of apps almost became a running joke during the study. People would often say that the app connected to social networks such as Facebook, but when directly asked if they use that feature they invariably said “no”. The initial interviews lasted from 20 to 90 minutes, with most lasting about 45 minutes. The follow up interviews lasted 10 to 50 minutes. The length of the interview was contingent upon how much a person had to say and how many different activity trackers that person was using. Interviewees were either lent a tracker or were paid ten UK pounds.

The interviews were transcribed and thematically analysed. There is a long running debate in qualitative research as to whether themes should emerge purely from the transcribed data, or can emerge with reference to researchers’ experiences and reading beyond the study. Our work is in the latter camp; it has been undertaken while research and development has progressed on several activity-tracker projects, and was motivated and shaped by that fact (indeed it was inspired by our recognition that we knew little about how trackers other than our own were used).

A methodological dilemma we faced was that the study was designed on a false assumption. It was initially assumed that participants would either be people that used a tracker or would be people interested in trying out a tracker. As it transpired, people that used activity trackers were also interested in trying new ones out. In this situation, we conducted the first interview before lending a tracker. As we will discuss, we often found that people did not use our equipment to replace existing trackers, but to interweave with the trackers they already had. The data presented in this paper does not concern trackers lent to people, except in two cases where we discuss the use of a pedometer we lent to a nurse (P21), and to a cricket player (P20).

Participant Overview

We report on interviews with twenty two participants. Twelve participants were male and ten were female. Eleven were in their twenties, eight in their thirties and three in their forties. Ten were UK nationals, others came from North and South America, Europe, China and India. Eleven participants were full time students (six postgraduate and five undergraduate). Three worked in administrative roles, three worked in financial services, one was a nurse, and one person was unemployed. The three others worked in the software industry. All participants were able bodied. Seven participants were serious runners, two were training for marathons, and one for a cross-country race. One was a serious cyclist. Six others were regular sports players. Eight participants did not regularly exercise other than walk. Several participants were obese, and one had had weight-

loss surgery. Many participants, overweight or not, were concerned about weight. All but the two youngest female participants were dieting (one of whom told us in the second interview that she might begin dieting as her father had suggested she lose weight). One male, and the male partner of another participant wanted to gain weight.

Four people in the study were lent an activity tracker having never (or barely) used one before. The other 18 participants had used at least one tracker, and the majority were using several tracking and logging technologies. P12 was the most extreme, using or trying eight trackers at the time of the first interview. She had a long history of tracking, driven by a life-long desire to lose weight.

Reasons for participation in the study were mixed. Some participants were clearly gadget lovers, some very interested in borrowing a new device, and others wanted to talk about the devices they were using. Several participants were clearly struggling emotionally with their body image and seemed to value having someone to talk to. Two students were open about doing the study for the money. There was a self-selection issue in this study. Notably, a disproportionate number of interviewees (four) had run or were training for marathons. All participants were clearly socially mobile, relatively affluent, educated and were numerate. Several, in particular the financial traders and the software developers were clearly adept in statistics and data analysis. This is not a typical cohort to evaluate health technology with, and does not represent any general population. Rather we suggest the participants, in their unique ways, provide good cases for considering the idea of personal informatics.

FINDINGS

The interviewees were using diverse tracking technologies. The technologies in use by each interviewee at each interview are represented in Table 1. Most people used more than one tracker and many were accessing information from the same tracker in more than one way. The kinds of technology in use included:

- *Physical devices.* We found eleven participants were using a dedicated, physical device for the purpose of tracking. Popular devices included Garmins (used for running), and wrist worn trackers such as the Jawbone UP.
- *Apps.* Thirteen participants were using tracking apps on their smartphones. Some physical devices are integrated with a smartphone app. Other apps do a standalone data collection. A calorie tracker called My Fitness Pal was popular.
- *Exergames.* Two participants were using games consoles to log information. One had been using the Wii Fit for four years to log his and his partner’s weight. Another played exergames using an Xbox Kinect.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Nike Fuelband					X			X														
Nike+																						
Nike Sportsband																						
Garmin																						
FitBit Zip/One	X			X		X															X	X
Fitbit Flex																						
Jawbone UP			X																			
Fit Bug																						
Basic Pedometer																			X	X		
Striv																						
Moves																						
Endomondo																						
Map My Run																						
Run Keeper																						
Daily Mile																						
Sleep Cycle																						
Map My Ride																						
Strava																						
My Trax																						
Pedometer App																						
My Fitness Pal																						
Other Food App																						
Heart monitor																						
Gym Pact																						
Wii Fit / Xbox																						
Smart Scales																						
Period Tracker																						
Alcohol Tracker																						

Table 1: Trackers in use at the first (left column) and second interview (right column) for each of the 22 participants. An “X” denotes a tracker lent to a participant. Table does not include trackers used by participants in the past.

- *Web apps.* Several devices and apps enabled participants to examine data on the Web.

Other means of tracking were also discussed. One participant described using written charts to keep a record of her weightlifting. Others referred to having kept written records in the past, or to having used spreadsheets. One participant regularly blogged about her activity. We found people were tracking a range of activities.

- *Walking.* Many participants were using or had used a pedometer to track their walking. For some participants it would be occasional “big” walks or hikes. For others, an always-on pedometer was used to gain a sense of steps over a day.
- *Physical exercise.* Thirteen participants were tracking vigorous physical activity, including running, cycling and swimming. The most common of these by far was running. These activities were usually specifically scheduled and conducted as physical exercise, for example no one would track running for a bus or moving a sofa at home, but would track the runs they did or weights they lifted for exercise and training (although sometimes running or cycling would be a means of commuting to work).
- *Food and Drink.* Most participants tracked, or at some point had tracked their intake of food and drink. Some study participants said they had done this over the long term, but most seemed to have dipped in and out of tracking. Participants did this if they were interested in losing or maintaining weight. Two males also tracked their alcohol consumption.

- *Weight and Size.* Participants that were managing their weight would also regularly weigh and sometimes measure themselves. Three participants used ‘smart’ scales or a Wii Fit. Others entered their details into apps.
- *Sleep.* Six participants tracked their sleep, including how long they slept, and their patterns of deep and light sleep. One participant (P9) had bought a Jawbone UP specifically to deal with a sleep problem.
- *Nothing.* One participant (P18) was not tracking anything. Her Nike Fuelband was “a pretty watch”.

This is not an exhaustive list. One participant discussed tracking her menstrual cycle (the interviewer was male and it is possible other participants did not reveal this). One (P17) had written diary entries every day for three years, was an avid user of a reminder app and Evernote Food. He also used Foursquare as a means to record which cafés and bars he liked (Cramer et al. [4] discuss this kind of appropriation of Foursquare). P17 was attempting to track as many aspects of his life as possible, although it was clear to him that it was impossible to track everything:

“My girlfriend gets annoyed with me for all these things. ... You know if we’re in bed [my Jawbone UP] is comfortable for me, but it may not be comfortable for her. ... If we’re in a restaurant ... she’s like, you’re allowed thirty seconds and then put [the iPhone] away, cos its rude. She understands some of those things, but I think if I was in a restaurant like writing down all the things I had, that takes time and it would annoy me as well.” (P17)

That participant was alone in wanting to track as much as possible. Other people were modest and selective about tracking. For example, while at least ten people went to the gym, only two kept records of gym visits. When it came to individual activities (such as walking or running) some people wanted to track as much of that activity as possible. For many, walking was something to be tracked in its entirety. Every step counted for some participants, meaning for example that smartphone apps were insufficient as a tracker “*would be left in my bag a lot of the time.*” (P1) For others, some steps were more important than others. One person (P14) differentiated between “*normal*” and “*active burn*” walking, seeing the latter as most worthy of tracking. Two participants were interested in tracking only their long walks or hikes, and not their day-to-day movement. For one person, everyday walking was specifically something not to be tracked because “*It is not proper exercise*” (P7). Tracking is often, we see here, selective.

Temporalities of Tracking

One of the problems with establishing what trackers people use is that these technologies can be used in a number of ways. What counts as use? Certainly, some trackers were being used day in and day out, but others seemed to be used irregularly. For example P16 used a tracker only for some cycle rides. Food trackers also seemed to be used in bouts. While several participants tracked their eating and drinking, some were doing this for everything they ate, and others went through short periods of tracking. P4, a long-term user of My Fitness Pal, explained:

“You get in the habit ... if it doesn’t matter enough to you then you wouldn’t use it.” (p4)

This opinion is perhaps harsh, especially given that P4 was relatively slim and that the participant struggling most with obesity also struggled with food logging.

Very few people in the study had been using the trackers discussed in the first interview for more than a few months. Less than half of the participants had used an app or device for more than a year, although most had a long history of tracking. Table 1 represents two ‘snapshots’ of what trackers the participants were using. It is not a nuanced picture, but good enough to characterise that people can and do mix and change trackers. Our study participants did not select trackers along purely functional lines. For many, particularly the users of Nike products, branding was very important. Several participants were committed to this brand. Users of several of the physical devices reported their pleasure at having purchased it through an Apple Store. Physical trackers are also exchanged as gifts. P11 had received a tracker for her birthday, and P10 had bought a tracker on her birthday as a gift to herself. Two others (P3 and P4) said the new FitBit Flex was “on my birthday list”. A few systematically went through apps in online app stores trying out various products. Many went on the recommendations of friends and relatives, and many read

media articles and reviews. Participants did not stick with the same tracker indefinitely but were switching between them. Reasons for uptake and switching included the uptake of a new activity, or a new technology being released. We encountered several examples of switching being occasioned by switching phone (for example, when switching from an iPhone to a Windows phone; P1 was forced to move away from the Moves activity tracker). For P16, switching from one Android device to another provided an occasion to switch from MyTrax to Map My Ride. Loss and breakage also occurred.

The physicality of trackers was often important. Wrist worn trackers were being chosen partly because people were worried about losing or forgetting devices kept in pockets. Runners would sometimes prefer wrist worn trackers because they are less bulky, and although they are expensive they are less valuable than a phone (two reported damaging a phone when running). Some liked the conspicuousness of wrist worn trackers: “*I’ve chosen lime green!*” (P2). Whereas others preferred to be more discreet “*I clip it to my underpants, who’s gonna know?*” (P4). Physicality then, including the physicality of a smartphone, is an important consideration in tracking.

Five Styles of Personal Tracking

Trackers can be used in various ways. We have noticed several (overlapping) styles in which trackers can be used: 1) directive tracking, 2) documentary tracking, 3) diagnostic tracking, 4) collecting rewards, and 5) fetishised tracking.

Directive Tracking

Much tracking was goal driven. Many participants aimed to either lose or maintain weight, and would set a goal or limit (typically a calorie burn and intake) with reference to this. Many other participants were following a training program and therefore were striving to adhere to the goals set out by that program. Sometimes the goal would come directly via the tracker itself; most pedometers for example suggest appropriate goals. However, goals would often also come for external sources. A 10,000 steps a day goal was reported by several participants (and attributed to various sources, although the true origin seems to be in a Japanese marketing campaign [21]). The participants that were in training, particularly the marathon runners, were using trackers alongside a training programme. In one case this programme came from a book a friend had told the participant about, and in another case from the “My Asics” website. Even though many trackers did not necessitate a goal, some participants found themselves wanting to set one. For example P7 found he “*might as well*” start following a 10k training plan given he liked Map My Run.

Documentary Tracking

Another common style of use of trackers can be characterized as documentary tracking. In this case, the

participants were interested in documenting their activities rather than changing them. Sometimes this was out of interest, for example P21 carried a pedometer with her during her working day and would discuss step count and calorie burn with the other nurses at break time.

“So they’d be like, how many steps did we walk? We were kind of using it like a collective. We all discussed it and we’d be like, oh that’s shit, heh heh. It’s only that many calories for all we’ve been doing ... But we lost interest ... it was the same day in, day out.” (P21)

Some seemed to be using trackers in this way because they were aggrieved by the amount of activity they were doing and somehow wanted to underline their effort. For example P6 had previously worked in a shop and used a pedometer app one day in order to show how far he was walking *“quite a considerable distance ... without leaving a building!”* P20 on the other hand seemed convinced he ran around more than other fielders in his cricket team and the pedometer was used to underscore his effort (if not make a comparison). In these instances both participants were using pedometers to tell stories about themselves.

Several others were doing documentary tracking to work out information about their routine activities. For example once some people had a sense of how many steps it was to work, or what speeds they were doing on a regular cycle ride, then it was no longer necessary to record them. An example given by someone who only occasionally used a tracker was:

“I was visiting my parents and used MyTracks. And even though I’m really familiar with that area because I grew up there, I didn’t really know the mileages between different places. And over time I got to know if I did a certain circuit it would be a certain number of km. ..., it would be 60 or 70 km and that’s all I needed to know. And also it would give me an idea of how long that was going to take me, so that I could plan my day.” (P16)

There were also examples of people using food and drink trackers to document pleasurable experiences, and couples using trackers on special walks. Documentary tracking was not usually a long-term endeavour. Little tracking was being done for the sake of building up a stock of data about life. Sleep tracking was perhaps the only area where logs were being accrued in isolation from specific goals. Participants P15 and P16 had been using a sleep tracker seemingly just to keep an eye on things, and P1 also seemed to like the confirmation that she was sleeping.

“my sleep pattern is averaging 7 hours a night deep sleep ..., I know I sleep well ... I suppose I really value sleep. It’s so so important.” (P1)

To some extent all participants would do some sort of documentary tracking. For some, this could then be transformed into goal driven tracking, but for others

documentary tracking is a data collection necessary only on occasion.

Diagnostic Tracking

A form of tracking mentioned by two interviewees can be characterized as diagnostic tracking. This form of tracking is looking for a link between one thing and another. P3 spent some time logging medication and diet in an attempt to find out why he was having stomach problems. P9 had purchased a Jawbone UP specifically because he wanted to know why he was tired in the mornings even after getting what he saw as an adequate length of sleep. Diagnostic tracking was done over a period of time but did not need to carry on indefinitely, just until the person was satisfied that they have an answer. P3 felt he was able to use trackers to show that his stomach problem resulted from combining medication with particular foods. For P9, it seemed just the very fact that he was tracking had come to help him get better sleep. The ability to diagnose and perhaps avoid a serious illness by analysing data is one of the grand ideas in the Quantified Self discourse (e.g. [22]) but we found this was an interest for only a couple of participants and that the realities of diagnostics were rather mundane.

Collecting Rewards

A form of tracking discussed by four people was tracking in order to score points or register achievements. This had some overlap with documentary tracking, for example P16 paid particular attention to a downhill section of his cycle route on which he would attempt to reach as high a speed as possible. This section seemed to be the key reason why he had used a tracker more than just once on this regular route. Two other runners who were following a training plan also liked to “race” other users of the app.

Three participants were tracking in order to claim rewards. One was tracking as a part of his health insurance scheme (this scheme rewarded people for gaining at least 40,000 steps a week), and two were using the app Gym Pact as a way of generating some income (users of the app that fail to reach targets make small payments to users that do). The irony of this for all three was that this points scoring was being done in addition to their own tracking. Similarly, P13 who bought a FitBit pedometer, continued to also use the Striiv pedometer as she was part way into a competition:

“I ended up getting one of the FitBit things [but am] still using Striiv. Yeah, they had some sort of contest, like you walk 7500 steps per day, for the next two months, then you can win a 500 pound Amazon gift voucher.” (P13)

Some participants were interested in gaining achievements for achievements’ sake:

“Sometimes I want to cheat, I just take it off and do the shaking so the fuel goes up. ... There’s a record of how many days you have been consecutively been reaching your goals. You don’t want that number to jump back to zero” (P15)

Fetishised Tracking

Some participants were tracking because of a purer interest in gadgets and technology. P17 was collecting a lot of data seemingly for data's sake. Regarding an online diary he kept, he said: *"when it gets to a few hundred days you can't miss it you know"*. Several others, particularly the users of wrist worn trackers, liked the conspicuousness of these devices. Users of the Nike Fuelband in particular saw this as being a *"cool"* (P15) or *"pretty"* (P18) technology.

Interweaving Personal Trackers

We found that many participants to have used several trackers (a situation that may be related to the self selection issue noted earlier). Often trackers were being used to track different aspects of life. Sometimes these had clear separation. For example P7 could use his Wii Fit to monitor his weight and Map My Run to monitor running with no problem. Some participants had trackers that had crossover functionality and yet were able to keep these separate. As an example, food logging is supported by several apps, and yet participants had little trouble choosing one with which to do this. Several people liked to use both a pedometer and a running app. For some these could be separated by carrying a pedometer when they were walking and switching to a Garmin or other running technology while they were running. P4 would use the pedometer for her jogs to work, and a Garmin when she was specifically training. Others would just have both a pedometer and running app on at the same time. To have two measures of the same activity would not necessarily be cause for confusion. However, problems crept in where people were integrating data. Integration was usually done using the My Fitness Pal app as a hub. Integration was popular as a means of comparing calories consumed and expended. However this could be problematic:

"I just always have to remember to just synch one of them to My Fitness Pal, or if it gets confused." (P13)

"The Jawbone Up synchronisation back to My Fitness Pal has been broken for about three weeks. There's a time zone issue, which means that the number of calories that you burn doesn't work, there's a black hole between midnight and 6am. So unfortunately at the time of day when you synch you calories with the Jawbone UP back to My Fitness Pal it cuts off a quarter of the daily activity" (P14)

Several participants reported using several trackers with ostensibly the same functionality. The example of P13 using both a FitBit and a Striiv pedometer (because she was part way into a competition) was given earlier. P14 was also using two pedometers. He was extremely particular about calculating calorie expenditure and although he generally preferred to use his Jawbone UP he told us:

"So I've kind of stopped using Endomondo but I'm kind of still using it for what I call my active burn calories." (P14)

P14 was also using a third pedometer, the FitBug. This was offered to him through his health insurer and could be used to collect points and claim free gifts.

Activity trackers are also increasingly interweaved with an infrastructure. Data from some devices such as the Jawbone and Nike+ sensor cannot be viewed on the device itself but require a computer or phone. Physical devices required charging and often needed to be synched with a smartphone or computer. Smartphone choice affected use and choice of apps. Some infrastructure was shared. P7 said that when he moved in with his partner, he began using his partner's Wii and therefore lost his accrued Wii Fit data.

Interweaving trackers is not a case of rationally organizing them, but working with, through and around them. The situation is reminiscent of what Nardi and O'Day refer to as *"information ecologies"* [16].

Uses of Tracking Data

Many trackers present not just a single measurement but several. For example, pedometers typically show calories burned, distance travelled, and steps. Nike apps also show a proprietary measure *"fuel"*. People had different preferences:

"I just switch off the calories and steps. Because I don't think they're as necessary for me. ... What I need is the Nike Fuel, the number, to motivate me ... it's not very accurate but it makes sense" (P15)

For others, the relevant measure and goals would come from a programme or training plan.

"The target that Rosemary Conley tells you to do is 10,000 steps a day. Which is about 40 minutes walking. And, if you do ten, at 10,000 steps your metabolism is burning fat." (P1)

"I really want to know the time and distance I've run. Its good that [my Nike Sportsband] has got the pace because on [the My Asics training plan] it gives you a pace you should be running at." (P10)

Accuracy was something some participants were more concerned with than others. Some participants had clearly gone to lengths to configure devices with correct measurements (such as their stride size) whereas others were happy to guess. Most interviewees realized or accepted that accuracy just was not guaranteed, and found ways to work around this:

"I did 4 hours 29, but the app was slightly different from what my time was in the Marathon ... I did 27 point 6 miles on the app but the marathon is 26 point 4, but I think the app is using GPS." (P8)

"So accuracy is not that good, but it wouldn't bother me ... it's got to be a ballpark of am I moving enough" (P1)

Some were happy to shake their trackers in order to meet goals or unlock badges. Others wanted their steps to be steps: *“I’m slightly concerned ... I do a lot of knitting”* (P2).

Temporality of Tracker Data

The main use of tracker data appeared to be short term, usually on the day that the data was generated. Running data was being used during a run in order to do things like keep to a set pace, and decide what was an appropriate place to turn around so that a run ends at home. Pedometer users were working on daily targets and would refer to that number at points during the day in order to decide whether they needed to do more to meet target.

“And if I get home at night and I’ve done 7000 I’ll go out and do another 2000. So it’s keeping me on that sort of 10,000 track.” (P1)

There was some evidence of short-term comparative analysis of data. For example some pedometer users were interested in reaching their targets on several days in a row. Runners would also compare their runs to their previous ‘equivalent’ run.

“Yeah so once I’ve finished running that’s the screen it shows you, and it shows you the routes and everything. I’ll then go into the workout screen ... and I’ll look at what I’ve just done, and how long it was as a run, and how long the comparative run was before.” (P7)

The study found very few examples of long-term data sets being valued. Several people clearly had accrued a number of years of data, and several took pride in that fact. However, there was little interest in using tracker data from years, or even weeks ago.

“Every marathon I’ve done since I got this, I’ve got all the training runs in a folder. I don’t look at them. But at the time, when you’re training for something, [the data is] really important.” (P4)

Most participants did not have a regime for saving data. Many did not seem concerned about transferring data from a device to a computer. Often data transfer would happen only if syncing was automated (for example wirelessly or via a charger cable). Many did not seem concerned about losing old data when moving to new services and devices, and one person said he purposefully deleted data because *“I like to keep things rather tidy”* (P16).

The Sociality of Personal Tracking

As Maitland et al. [12] pointed out, personal tracking is often social. This is not necessarily to say that the nominally social features of trackers are put to use, for example no one in the study published data to Facebook or Twitter; most would only write on Facebook about a major or newsworthy achievement such as the completion of a marathon (Newman et al [17] discuss people’s reluctance to discuss wellbeing information on general social network sites). One person did occasionally write about her activity

in a healthy eating group set up by her and two friends, although she used this to announce achievements, for example posting a screenshot when she beat her personal best in Moves. In fact, several participants were scathing of others that do post to Facebook:

“You always get some people like that who are like ‘oh yeah, I had a great run today: five miles.’ Ooh! Well done! Nobody ever does that! Five whole miles!” (P6 - sarcastically)

“I don’t know, I find it kind of egotistical ... it’s almost one of those things where you set yourself up for failure” (P10)

Some apps allow you to ‘friend’ others within the app itself and to view others’ data that way. Most people appeared to be connected to one or two others. P8 reported that she would sometimes play a tag game with one of her in-app friends, but otherwise few people made use of or saw benefit in such social functions. One thing several participants liked however was to compete with other users of an app (usually strangers). Some apps offered routes where runners or cyclists could race each other and post records. The Nike+ website also allowed people to see their performance against the averages for their gender and age group.

Moreover, tracking was often a co-present activity. Tracking was often done among families, friends and co-workers. Walks can be special when undertaken together by couples, and for P7 Map My Walk had been used to document such “special” activities. P3 on the other hand, wanted to have the same pedometer as his wife. They would take them together on walks, and compare information about their commutes. Couples and families could also share scales, P7 described how he would persuade his partner onto the Wii Fit once in a while as he was concerned he was underweight. Not all family relations are convivial. P1 recounted a story in which her son took her FitBit on a long walk in order to smash her own record.

“I said it’s not about walking further than me. It’s about your own fitness and everything!”

Kinship, as Harper [5] has discussed, is played out through technology in complex ways. Others reported using activity trackers among friends and colleagues. The use of a pedometer by nurses on their ward rounds was discussed earlier. P16 described how when he went running, he and his running partner would share the data from the partner’s Garmin.

“She’s a bit fastidious about things like this, so she would have a spread sheet, and because I was with her, running all the time, regularly at weekends, we were running both at the same speed, same distance, we’d keep an eye on this thing together.” (p16)

There were also examples given by participants where the device was totemic of wellbeing. Colleagues would recommend devices to each other (or sometimes talk behind

people's backs about who ought to get one). Colleagues, it seems, would only sometimes show their data to each other. But the very fact of device ownership could signify a shared outlook, and serve as a bond and talking point.

DISCUSSION: LIVED INFORMATICS

The participants were invited to interview by a poster asking "Do you use an activity tracker?" and the interviews began with a vague request along the lines of: "*I'm interested to hear what trackers you use, what you like and dislike, and so on.*" This request was not met with a naming of what apps and devices that person had, or what kinds of thing they wanted to measure, but something more akin to a life story. Often this story concerned weight management, or ever-developing interests in sports and training. Often this story involved family and friends. Often the story extended over years, and followed people who would move countries, form and leave relationships, and start or change careers. Tracking was explained in terms of people's lives, worries, hopes, interests, careers and so on. Something that we were perhaps a little underprepared for was the emotionality of activity tracking. For most people, tracking was directly tied to self-esteem. For some it tied into pride at completing marathons, achieving fantastic speeds on a bicycle, and/or raising thousands of pounds for charity. For others the tracker tied into body image problems, to aging, and/or to broken relationships. Often tracking seemed to tie into people's mental health. The situation is reminiscent of McCarthy and Wright's discussion of "technology as experience" [13] and we find ourselves drawn to their call for design to engage with *the felt life*.

There was a range of different people in the study. Not only were their circumstances different, but there were clear differences of interest and personality. Some people identified as being (in the words of P3) "*a stats person*" and liking to see data, charts and other information. Some people were very organized and tidy. Others said they were (in the words of P1) "*not a data person at all*", but made the effort to track and even found they could take pleasure in it. Some reported that they were (in the words of P4) "*into fitness*" whereas others were (in the words of P2) "*not a gym person*". One person was P13 "*into games*" but another P14 "*not a games person*". Each person, in his/her own way, made the activity of tracking his/her own. Although participants regularly referred to personality, it seems unlikely that cognitive models can explain their tracking. Personality was only part of a larger story of body image, family, personal circumstances and so on.

Nobody was just a *user* in this study. Behaviour change, where this was even an issue, was not being done with a tracker, but across multiple technologies over time. Nobody had downloaded an app or bought a device and then decided to lose weight or start running because of it, but rather they were using apps often over short-term periods to support longer-term interests and issues. Sometimes apps and devices would inspire people to walk more, or perhaps

follow a training plan. Only one participant was interested in the retrospective use of long-term data. Tracking data is overwhelmingly for use in the short term. In fact, personal tracking might best be understood as prospective rather than retrospective. Tracking is often about where you are heading in life. It is often about trying to lose weight, about training for a marathon and similar goals. People here do not aspire to do dispassionate data analysis about their bodies, but on the contrary, are doing something deeply emotional and often passionately focused on a future. We are reminded of Ingold's notion of "*dwelling*" [7]. When people track their activities (when they *dwell* in data) they are not building a description of their lives, but are *wayfaring* in information. To know ourselves is not to look at the past or even to the present, but to the future. Ingold uses the term 'wayfaring' specifically to suggest that one is not following a set path to one's imagined future but is navigating using a variety of information, cues and intuitions as best one can. Knowing oneself may involve collecting and reflecting on information about oneself but is for the purposes of a life being lived. In Harper's [6] terms, tracking is part of "*a praxis of living*".

Our observations about 'documentary' and 'diagnostic' tracking are a little closer to the vision of personal informatics than our observations of other forms of tracking. Here people seem to want to create a reasonably accurate account of something, but for the sake of understanding routine, keeping a record or finding something out. These forms of tracking are not long term, and can sometimes playfully involve the creation of false data. Building a long term, accurate record was a minority pursuit. Long-term collection may become popular and may prove very valuable, but we emphasise that to track over the short term is not necessarily to give up or fail.

To characterize the situation we have observed we introduce the term 'lived informatics'. With this term we are underscoring our observations, trying to characterize a state of affairs rather than laying out a vision. The term is meant to mean just that people are using information and finding its meaning in their day-to-day lives. Li et al. [8] have previously pointed out that people collect personal data for reasons other than personal informatics, such as reminiscing about the past, aiding memory, and personal information management. But our point is more radical. We are not saying that things are done in addition to personal informatics, but that personal informatics must be done over a range of lived activities. We do not suggest that our work undermines the grand vision of personal informatics. All we do is show it is unrealistic to assume that people can or want to do rational data collection, and act only when data has been validated and thoroughly analysed. From a lived informatics perspective, we suggest:

- Do not expect people to act as rational data scientists. Understand that people will pick and choose trackers, switch over time, and will have times when they track a

lot and times when they track just a little. Consider collecting metadata on app use alongside activity data.

- (Re)consider personal tracking as social tracking. Look beyond support for publishing data to social networks, for example to co-present tracking, kinship, friendship, support, competition and play.
- Design for interweaving, not just integration. It is not reasonable to expect that people will have a rational set of trackers each with a clearly defined function. When evaluating a new technology, consider how it might be used alongside others in an information ecology.
- Consider that behaviour change is not just a possible outcome of using an individual technology, but is something that is achieved by people, potentially across various technologies that they interweave.
- Recognise that data can be meaningful in the context it is produced, but may lose meaning when it is removed from that context.
- Evaluation should address more than measuring 'improvements' in activity. Consider, for example, the emotionality, the hope and the fun people may have.
- Attend to the physicality of tracking. This includes the physicality of phones when designing smartphone apps.

We have critiqued personal informatics but must emphasise this is from a perspective that does not address or envisage what might be most effective in terms of public health. We have explored the perspectives of current users of personal trackers, and we seek to open discussion of what people want, do, and experience when using personal trackers.

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