Tool, toy and tutor: Subjective experiences of digital self-tracking

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Abstract
Since the advent of the smartphone, users have become accustomed to alerts, notifications and reminders to interact with their internet-connected devices. But how do people make sense of prompts to exercise, eat or sleep? Digital self-tracking is a phenomenon that has grown substantially in recent years. However, despite some notable exceptions, there is still little sociological research into how users of wearable devices and apps subjectively experience self-tracking. This article draws on findings from a small qualitative study with 11 participants to reveal eminent themes in how users make sense of their self-tracking. Utilising and extending Lupton's theorising of self-tracking, we argue for triple roles of self-tracking devices; 'tool', 'toy' and 'tutor'. This trichotomy helps to characterise the use of self-tracking devices and apps, allowing us to reflect on the wider, ongoing implications of self-tracking.

The movements of daily life are experiential, lived and felt by human bodies. These movements are also biological, spatial and temporal. Calories burned, footsteps taken and hours slept can be recorded, measured and archived. Self-tracking, the process of

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quantifying and measuring one's activities, feelings and experiences, is not an entirely new phenomenon. Analogies have been drawn to measuring bodyweight with scales (Crawford et al., 2015: 480), or detailing personal experiences in diaries (Rettberg, 2014: 63). In the United States, 70% of adults track a health indicator like weight, blood pressure or sleep quality (Fox and Duggan, 2013). Wearable devices make this process easier by leveraging technologies (Li et al., 2010: 559): global positioning system (GPS) trackers, gyroscopes and wireless networking. The number of wearables being shipped reached 90 million in 2014 (Nafus, 2016: ix). According to Apple Watch promotional material, this self-tracking is 'all adding up to a better you' (Apple.com, 2016).

With digital self-tracking becoming more commonplace, how do users interact with and make sense of the data they produce? For whom is self-tracking data productive, and how? In this article, we draw on a small qualitative study conducted with self-tracking device users, in order to better understand the roles these intimate technologies play. Based on this data, we develop an argument for three roles of self-tracking devices: *tool*, *toy* and *tutor*. These three roles encompass key themes that emerged from semi-structured, in-depth interviews at the core of the study. These roles speak to the utility of the devices (tool), their novelty as playful gadgets (toy) and their more instructive capacity in guiding users into routine practices associated with 'healthy lifestyles' (tutor), as part of what Crawford et al. (2015: 480) describe as an 'everyday domestic discipline'.

Background

Since 2010, self-tracking devices have moved away from grandiose claims of 'lifelogging' or 'complete e-memories' (Bell and Gemmell, 2009: 6) built on stored audio, visual and biometric data. While those of the Quantified Self (QS) movement still strive to collect and reflect on detailed data for intrinsic reasons (Rettberg, 2014: 50–1), typical everyday self-trackers use consumer-grade wearable devices to track a few metrics: throughout the day, via sensors and algorithms, metrics like distance, calories and sleep are logged, and records of these are then stored and presented to users on smartphones and personal computers in the form of numerical and graphical displays. Given the intersection of the physical and digital within discourses of wellbeing, fitness and productivity, the literature on self-tracking cuts across a range of disciplines, including human–computer interaction (HCI), health, media studies and sociology. As such, most work draws upon this cross-disciplinary foundation. In the remainder of this section, we explore this background literature, to outline how people engage with the processes and data-flows of self-tracking. The intention here is to build towards a sociological understanding of the roles these self-tracking devices play in the everyday lives of users.

Everyday self-tracking is epitomised by interaction with data collection systems that can potentially create 'cycles of feedback and behaviour modification that are propagated as play' (Whitson, 2013: 167). This process of turning activity into 'play' is known as 'gamification' and sees the entwining of videogame elements like progress bars and collectibles with activity metrics. Activities like walking, sleeping and eating are recorded in these shared self-tracking 'games' and made visible and accountable to others through Web 2.0 technologies (Whitson, 2013: 171). Gamified systems do not exist in a vacuum however. Many features of biometric tracking can be traced to military

origins but, over time, these functions are normalised through gadgets and videogames that serve to continually highlight the 'fun' aspects of digital data traces (Ellerbrok, 2011: 541) and obfuscate the potentially problematic past and future applications of the technology (2011: 539).

Many scholars have noted that in creating data-driven games, analysts and designers perpetuate the cultural notion that 'data' stands for positivist scientific values of objectivity, reliability and trustworthiness (Crawford et al., 2015: 492; Pantzar and Ruckenstein, 2015: 93; Rettberg, 2014: 67; Ruckenstein, 2014: 77). Often, the data presented to users may not be assessed critically, with records being equated with physical phenomena (Drucker, 2011: 1). For example, a week of running, visualised as a graph of distances, times and maps, comes to stand in for the lived experience of bodily movement that constitutes running. When this valorisation of data occurs in relation to human bodies, it becomes easy to lose the subjective 'I feel' within a broader techno-scientific 'truth regime' (Foucault, 1984: 54). Metrics then, can alienate users from bodily experience as they do not always correlate with bodily sensation (Li et al., 2010: 558). Yet some form of record keeping is still necessary to track metrics over time. To overcome this tension, many self-tracking software platforms feature simplified 'at-a-glance' (McCosker and Wilken, 2014: 155) visualisations, such as a single pie chart representing 24 hours of activity. These visualisations are vital for sense-making, particularly for those with specific health issues such as chronic conditions (Greenfield, 2016: 136). The potential downside here is that individuals become framed as 'patients-in-waiting' based on pervasive medical monitoring (2016: 129). Thus, the interrelationships between these 'objective' data displays – vague measures like Fitbit's 'activity score' or Nike's 'fuel' measure (Rettberg, 2014: 65; Rooksby et al., 2014: 1169), subjective lived experiences and broader health discourses – are worthy of further exploration. Despite the suggestive nature of specific data semantics, much of the interaction with devices is still driven by social linkages; both those physically co-present during an activity and those present through 'Internet of Things' and Web 2.0 connectivity.

There is a growing body of empirical work on self-tracking to draw upon, and while the findings of such studies are often amenable to sociological inquiry, their overall purpose often differs. Some aim to make recommendations for public health, while others aim to improve user interfaces or tracking experiences from a design perspective. However, a common thread in existing work is the intimate relationship between the visual displays and mnemonic connections to the social world.

In the HCI field, where self-tracking programs are designed and tested, Li et al. (2010), identified a five-stage model that covers the entire process of self-tracking: preparation, collection, integration, reflection and action. These stages described how users decided what to track (2010: 560–1), as well as how they collected and reflected on data (2010: 562), and progressed towards their goals (2010: 562). Barriers to effective self-tracking were also identified, relating to personal motivations, device physicality and data that contradicted subjective experience (2010: 560-–2). While it is still useful to identify such barriers, some have been overcome by the advance of self-tracking technology in subsequent years. This includes cross-platform applications that better synchronise data, and devices that distinguish specific activities like swimming or cycling. The main shortcoming of this stage-based model is its implied linearity. Manifold

complexities are condensed into the 'preparation' stage (2010: 560), such as motivations, choosing what information to track and how to do so. While some users altered their tracking methods over time (2010: 563), the fluid processes and motivations behind self-tracking are not fully examined. Later HCI studies, like that of Bentley et al. (2013), have extended their focus on motivation, noting that interfaces expressing 'natural language' aided user engagement (2013: 15): users then enjoyed 'seeing' connections between different data (2013: 9–10). In a system with many metrics, though, it was not always easy for users to identify relevant and useful information (2013: 19), and contradictions were still found (2013: 11). While these HCI studies are more focused on interface design than questions in the domain of the social sciences, they offer a useful foundation from which to approach more sociological questions.

Stepping back from specific studies, the formation of the entire self-tracking phenomenon can be theorised as a part of a steady evolution of practices and values that have normalised the technology, with heart-rate monitors moving from specific hospital equipment to generalised consumer wearables between the 1980s and 2000s (Pantzar and Ruckenstein, 2015: 100). With self-tracking devices now relatively normalised, Deborah Lupton (2016), a key sociologist working in this area, has examined their everyday use and proposed a range of self-tracking types. These tracking types extend from voluntary, 'private', self-surveillance (2016: 84) to 'communal' tracking, epitomised by QSers who pool and share ideas and data (2016: 131), to the externally influenced, 'imposed' and 'exploitative' types (2016: 117–18). These latter types of tracking include coerced self-tracking, such as the corporate 'wellness programs' of some workplaces (2016: 124), as well as instances where self-tracking data becomes 'biocapital for governance and marketing purposes' (2016: 117–18). Lupton also discusses the potential for subversive and emancipatory types of tracking (2016: 138). In subversive use, users recognise the constructed nature of data and its potential, and, through non-conformity and repurposing, attempt to resist dominant discourses which might include critiques of 'standard' daily steps or the apparent valorisation of certain 'healthy' bodies in marketing discourse.

This broader consideration of self-tracking is also seen in empirical work. In 2014 two small-scale but significant qualitative studies were conducted, one by Ruckenstein (2014) and another by Rooksby et al. (2014). While still having an interest in future device interface designs (as per HCI), these studies provide a more social account of how and why people self-track. Like Lupton (2016), Rooksby et al. (2014) identified potential types self-tracking, but with more emphasis on device use. The first type is 'directive' tracking, following goals formulated by individuals or devices (Rooksby et al., 2014: 1167), aimed at changes like weight loss (2014: 1167). The second type, 'documentary' tracking, is not used to make change, but to observe or satisfy curiosity (2014: 1167–8), such as measuring a jogging route once. Third, 'diagnostic' tracking is constituted by 'looking for a link between one thing and another' (2016: 1168), such as short-term monitoring of diet to find the cause of a stomach ailment. The fourth type is 'reward'-centred, where medals, leader-boards and other elements of gamification provide impetus (2016: 1168). Last is the loosely formulated 'fetishised' category, which collectivises technology enthusiasts following QS ethos, as well as those focused on the fashion and brand value of devices (2016: 1168).

Contrary to the delineation of categories, Ruckenstein (2014) argued that the motivations underpinning self-tracking and utilisation of recorded data are manifold. Participants were motivated by multifaceted internal goals to 'take control' (2014: 74), or to be a family role-model (2014: 73). Ruckenstein also highlighted the importance of data visualisation as a motivator, as it 'can "upgrade" everyday doings [and become an] artefact for co-constructing and negotiating meaning' (2014: 77). However, this study featured a deliberate mixture of self-selected participants and sponsorship from a specific device manufacturer (2014: 72). This meant that participants persisted with self-tracking despite reporting annoyance (2014: 75), and limits the applicability of the findings to self-tracking using other devices. In light of this, our study featured a recruitment strategy that targeted users whose relationship to their device was well established, and did not prescribe a specific brand or model of device.

Most recently, in a social exploration of self-tracking, Lomborg and Frandsen (2016) asserted that self-tracking is a communicative endeavour. This communication occurred between users and devices (2016: 1020), between users and themselves, through feedback (2016: 1021–2), and also between multiple individuals engaged in shared physical activity (2016: 1023–4). Lomborg and Frandsen also noted the role of visualisations as providing a 'mirror' (2016: 1021) through which their participants examined their activity. However, participants in the Lomborg and Frandsen (2016) study did not unpack this visual element themselves, whereas in the study reported on in this article, we have incorporated this visual dimension of self-tracking into interviews. By using participants' visual data and subsequent reflections, our study finds similarities with the motivations, goals and actions suggested by Ruckenstein (2014), but, reflecting Lomborg and Fransden (2016), also attempts to find a way to characterise these as a set of potential roles that acts as a broader, more socially connected framework than the typology of Rooksby et al. (2014).

Literature, from both HCI and social perspectives adds to an understanding of self-tracking processes, and frames these processes within a world where data is increasingly valuable for institutions, corporations and individuals alike. Individuals are clearly motivated to engage in the production of enduring, digital traces of their movements and activities. The phenomenon is called *self*-tracking, and therefore subjective experiences of technology in everyday life need to be foregrounded to understand the place of self-tracking devices in users' lives. In exploring subjectivity, there is also a shared social element to self-tracking, and we hope to encapsulate this – as well as add to the above corpus of research – in our three-role trichotomy.

Methods

This article draws on findings from an exploratory study based on 11 in-depth interviews conducted in Australia. These interviews were transcribed – totalling over 60,000 words – for thematic analysis. Interviews were conducted face to face and via Skype, with participants recruited from known networks and through public advertisements. Nine participants were located in Tasmania, and two resided in Queensland. Of the 11 participants, four participants were interviewed as two married couples. These two couple interviews gave insight into how digital self-tracking translated into shared real-world interactions.

Participants were aged between 22 and 47 – an average of 33 – and came from a variety of educational and professional backgrounds. Participants' devices ranged from in-built smartphone applications to Wi-Fi-enabled scales, to marquee wearables like the Apple Watch. However, devices from the Fitbit range were the most popular (n = 8) during fieldwork in 2015.

Participants had their self-tracking devices on their person during interviews, and in conjunction with smartphone applications, these acted as prompts in the interview process. With the permission of participants, we include several screenshots of various smartphone application displays as well as interview extracts. Interviews about various types of self-tracking have been conducted previously (Elsden et al., 2015; Lomborg and Frandsen, 2016; Rooksby et al., 2014; Ruckenstein, 2014) and prompts are by no means novel; our method owes much to work in the HCI field (Beaudin et al., 2006; Eldsen et al., 2015). The use of user-generated visualisations, as well as the devices themselves, follows a lineage of novel forms of social research that incorporate digital technology, visual elements and ethnographic social science. In particular, the notion of 'ethno-mining' (Anderson et al., 2009) is useful in describing the intimate links that can be found and also created in a traditional research scenario with the addition of visualised digital records.

In prior work as in our study, visualisations are 'evocative' (Anderson et al., 2009: 126; Elsden et al., 2015: 541) and became a shared 'space' – additional to the verbal interview – for interpretation and rapport building (Anderson et al., 2009: 128, 130). Interviews were based on questions of 'How do you use your device?', and the reflex-like response from participants was to refer to visualisations. So this visual element was something that emerged during the research project, rather than being encouraged in advance as in previous research (see Elsden et al., 2015: 528). Our findings add to this literature by illuminating the way that visualisations act as an organic connective tissue between the self and other self-trackers. Our method therefore relies on elements of intent, explanation, interpretation and retrospection.

While the research was not impacted by sponsorship or enticements, it featured a sampling bias similar to other small-scale studies (see Rooksby et al., 2014; Ruckenstein, 2014): there was an over-representation of users who were passionate about health, fitness and/or technology, and their continued use of devices and apps necessitates satisfaction and positivity regarding self-tracking. Given the limitations of this study, there is a range of ongoing discussions that are beyond the scope of this article: self-tracking devices and the reproduction of certain body norms or health discourses; user privacy and corporate involvement, especially among health insurers; and wider questions around the role of 'big data'.

Tool, toy and tutor

In this section, we posit a *non-mutually exclusive trichotomy of roles* of self-tracking: 'tool', 'toy' and 'tutor'. We do this by drawing upon participant explanations of the how they self-track and how they make sense of their quantified digital traces, as well how this relates to existing literature. Together, participant experiences coalesce to demonstrate how self-tracking occupies a series of definable, but overlapping, roles in their daily lives.

A 'tool' is something used by people; helpful and perhaps necessary. A 'toy' is something used for fun, and implies a light-heartedness whereby devices and practices are not taken too seriously. A third role, that of 'tutor', helps explain the reciprocal aspects of self-tracking devices, like the formation of routines, by describing interactions between devices, data and users. These three roles are not mutually exclusive and can overlap. Depending on the individual, there may be tension, or perhaps awkward harmony, between these triple roles.

Central to the formulation of these roles is the clear finding in this study that individuals can craft narratives around their activity, based on and drawn out from numerical records of data. While other studies (Anderson et al., 2009; Lomborg and Frandsen, 2016; Ruckenstein, 2014) have utilised or noted the importance of visualisations of self-tracking data, this section takes inspiration from HCI literature (Anderson et al., 2009; Bentley et al, 2013; Elsden et al., 2015; Li et al., 2010), and presents user-generated 'screenshots' in tandem with qualitative findings and analyses, to provide sociological insight into the roles of self-tracking devices in the everyday lives of users.

Tool role

> It's not going to rule my life, I'm just using it as a useful *tool*. The technology's' come along to the stage where I can use this and go 'yeah that's wonderful for what I need at the moment'. (Michael, 46)

Using a device as a 'tool' means harnessing data to work towards lifestyle goals (Steph, 29; Jason, 35), to seek correlations between metrics or other people (Sue, 47; Michael, 46), or build a statistical record over many years (Greg, 42). As a tool, devices can be utilised for all-day tracking (n = 9), specific activity tracking (Greg, 42; Sandra, 26), or for more sporadic use based on fluctuating needs: for example, Chelsea (23), used her device to help her 'dial it down a bit' after overindulging while on holiday. Examples of a tool-like use of self-tracking devices can also be found in existing research, but, in contrast to these, the 'tool' role as considered here is a broader term that does not attempt to condense individual motivations (Rooksby et al., 2014) and processes (Li et al., 2010; Pantzar and Ruckenstein, 2015) into categories.

The use of a self-tracking tool often led to satisfying realisations, where data supported lived experiences. Lachie (26) identified his step patterns (Figure 1), over the course of a month, through a routine of work and study. The trend downward at the end of the month was explained as a study break, while graph spikes were associated with work and socialising.

That Lachie looked back on his steps and felt pride was interesting, and while emotional responses are seen in prior research (Elsden et al., 2015: 529), Lachie did not transform this to any specific motivation. On some level, he valorised being 'active', in a broad health sense, but only as a means to engage in social activities. He also saw the value of less active periods, as he could identify when he was engaged in study. For others, like Sue (47) and Sandra (26), anomalies in longitudinal records – in both cases, their sleep data (Figures 2 and 3) – were reminders of specific events.
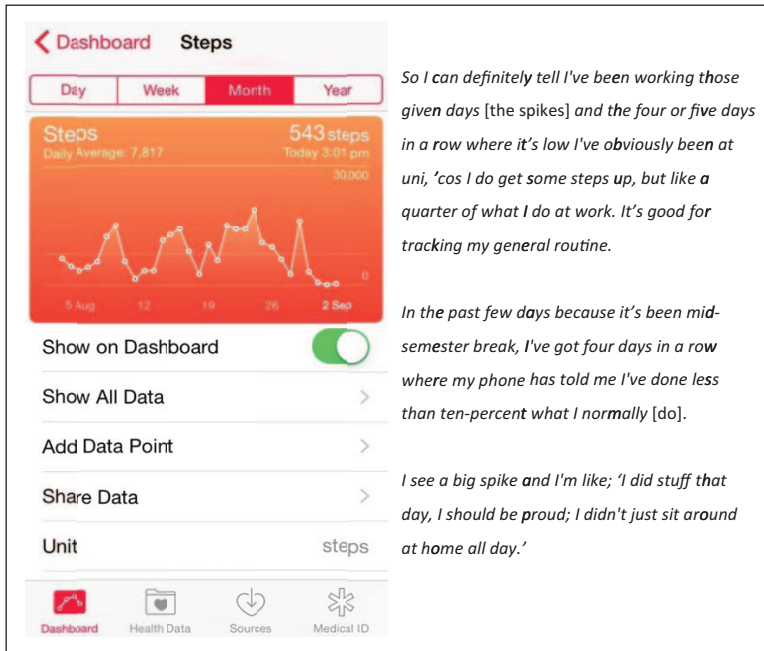
So I can definitely tell I've been working those given days [the spikes] and the four or five days in a row where it's low I've obviously been at uni, 'cos I do get some steps up, but like a quarter of what I do at work. It's good for tracking my general routine.

In the past few days because it's been mid-semester break, I've got four days in a row where my phone has told me I've done less than ten-percent what I normally [do].

I see a big spike and I'm like; 'I did stuff that day, I should be proud; I didn't just sit around at home all day.'

Figure 1. Lachie's steps.

Again, this is consistent with prior research, where images of meals in diet-tracking apps elicit specific memories (Elsden et al., 2015: 535), and data are made accountable to lived experience in order to form coherent narratives (2015: 538, 546). While mnemonic function is fascinating, it is important to note that the memory work participants engage in is not *entirely* organic. The design of data visualisations plays a significant role in later interpretation. The semantic construction of visualisations, including the participant screenshots included here, define boundaries of knowledge around sleep, activity, diet or any given app measurements. Yet simultaneously, these 'data pass themselves off as mere descriptions of a priori conditions' (Drucker, 2011: 1), and therefore labels and categories represent certain assumptions and conventions (2011: 5–6). On the one hand, this level of prescriptiveness can be positive for some users, since within the homogeneous interface of an app, their data, whether large or small, looks unanimously 'serious' and reflects expertise (Lomborg and Frandsen, 2016: 1022).

The potential problem here is that self-tracking data displays may dictate meaning and, by extension, define the human actions they record. This concern about 'truth regimes' (Foucault, 1984: 54) is a valid one; however, the subjective experiences that participants shared suggests that the concern may be overzealous. Despite outwardly appearing to be rigid quantitative visualisations, these charts and graphs were reference points that readily allowed self-trackers to interweave their personal narratives with numbers in very much an agential manner. This occurred with all participants, across a variety of metrics, devices and apps.
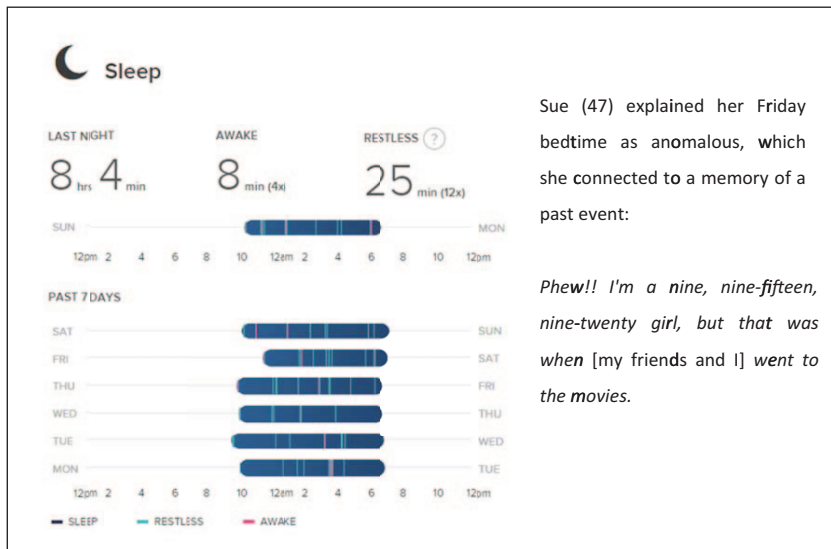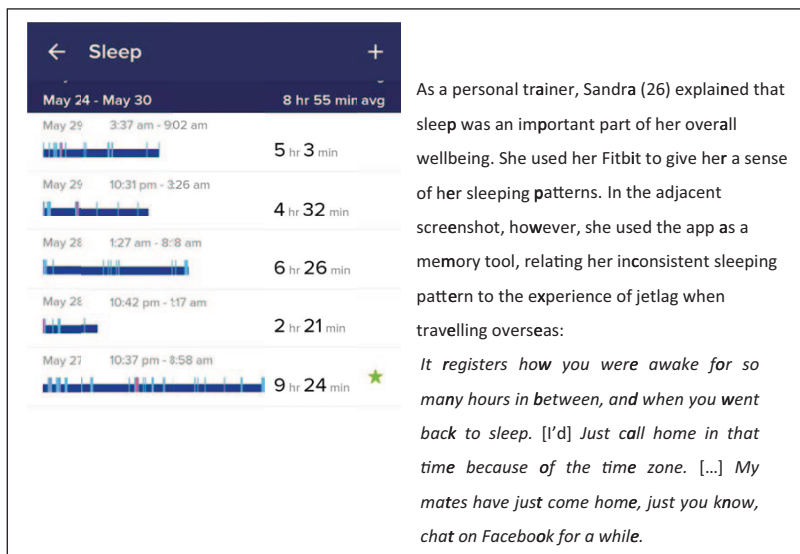
Figure 2. Sue's sleep.

Sue (47) explained her Friday bedtime as anomalous, which she connected to a memory of a past event:

Phew!! I'm a nine, nine-fifteen, nine-twenty girl, but that was when [my friends and I] went to the movies.

Figure 3. Sandra's sleep.

As a personal trainer, Sandra (26) explained that sleep was an important part of her overall wellbeing. She used her Fitbit to give her a sense of her sleeping patterns. In the adjacent screenshot, however, she used the app as a memory tool, relating her inconsistent sleeping pattern to the experience of jetlag when travelling overseas:

It registers how you were awake for so many hours in between, and when you went back to sleep. [I'd] Just call home in that time because of the time zone. […] My mates have just come home, just you know, chat on Facebook for a while.

Consistent with this individual agency, engaging with the 'tool' role does not mean that *every* function of a given device needs to be used. For instance, Miranda (43) explained that she ignored sleep-tracking functionality in her Apple Watch: 'I don't need

a device to tell me the quality of my sleep.' This sentiment was echoed by Sarah (22): 'I don't really need to see it. Looking at it didn't really help me sleep better at all.' Beyond this context, stern beliefs about the value of self-assessment and subsequent rejection of some self-tracking functions, raises *disuse* of devices as an area for future research. For our participants though, the 'tool' role highlights the importance of choice. They self-track for a reason (to stay active; get more sleep), and the 'tool' is a means to that end. The temporality of tracking may vary, be it a constant routine or an infrequent check-in, but the inherent flexibility of self-tracking 'tools' is what ultimately makes them informative measurement and memory aids.

Toy role

> Expensive *tool* to have, expensive *toy* to have, but it's fun to play with for me. (Miranda, 26)

The 'toy' role relies on gamified rewards (Rettberg, 2014; Whitson, 2013) and users' exploration of visual data. Visualisations appealed to some participants; 'I'm quite visual – so I like to be able to see that graph' (Sandra, 26). We can see from Figure 3 that Sandra was awarded a 'star' for sleeping over nine hours. Other participants described their engagement with gamified reward systems; 'there was a Serengeti Badge or something and it gave you a fact […] to do with the distance' (Sarah, 22). Encouraged by gamification, friendly competition across a shared platform like Fitbit or Pacer (Jason 35; Sarah, 22; Zac, 27) is also part of the 'toy' role. Interaction with others, either within an app or through broader platforms like Facebook, allows for deliberate displays of self-tracking data, which can not only share activity or location but also express emotions. Playful 'toy' engagement also mediates face-to-face interactions, for example, in work environments where a workplace 'team is competing with a whole bunch [of] corporate entities' (Jason, 35).

The way some tracking apps create a 'feed' (Bentley et al., 2013: 7, 9), akin to online social media, also gives users control over the depth of their data exploration and online social interaction. This means they can freely drop in and out of tracking practices, and maintain an optimal level of enjoyment. Therefore, tracking can be undertaken on a whim to satisfy 'curiosity' (Zac, 27) or alleviate 'bored[om]' (Sarah, 22), because a 'toy' is something valued for its own sake, and only for as long as desired. The 'toy' role also requires a level of accessibility. So, while simplified metrics like 'deep sleep' may not be scientific, they are understandable in a 'natural language' (Bentley et al., 2013) sense. 'Toy' also encompasses novelty functions, such recording and wirelessly transmitting heartbeats to fellow Apple Watch users (Miranda, 43) or playing videogames: '[mimicking a colleague] I can play Minecraft on mine! [laughter]' (Sue, 47).

Central to the toy role is the notion of 'play', which tended to manifest in a very social way for participants. Sarah (22), for instance, explained self-tracking as mediator of banter with a friend, and Zac (27) spoke about his friendly competition with his father:

> I guess, 'cos I don't see my best friend very often and we're both in competitions together frequently, it's like a fun way to interact. 'You're shit, you're not walking' [laughs]. (Sarah, 22)

> I like to use Pacer as well 'cos my Dad has Pacer. And we can have competitions to see who can get the most steps and he always beats me [laughs]. (Zac, 27)

As demonstrated by the friendly connections above, the continuation of a viable 'toy' role relies on similarly-inclined others. So while participants were aware of deeper self-tracking, for those with a 'technological point of view' (Sue, 47), this was couched as detrimental to sociality: 'One of our friends who had one, he got super into it and super obsessed. He was doing like 25,000 steps a day' (Jason, 35). For Jason, there was a clear 'hierarchy of use' operating here, where a high level of use becomes excessive (derided) or exceptional (lauded) in comparison with one's own use. This means the 'toy' role is one that can only be sustained when users not only play by the 'rules' of each self-tracking 'game' but also adhere to the contextually established social norms of their group: norms that are themselves grounded in the physical abilities and technological nous of self-tracking companions.

Tutor role

> I think it's a good *guide* to have. (Sandra, 26, own emphasis)

The 'tutor' role of self-tracking involves users learning and being motivated by their longitudinal data in a reflective feedback loop (Pantzar and Shove, 2005; Whitson, 2013: 167). This role is also driven by flexibility and a willingness to iterate, exemplified by participants who adjusted their activity based on recommended goals, or tried additional features such as training programs, even if these were deemed unsuitable. 'Tutor' also features a reciprocal relationship between devices and users: through advice-giving, devices are endowed with an agential quality (Lupton, 2016: 39), an endowment that helps sustain device use.

The title 'teacher' was considered here, but participants were reticent to engage with overtly pedagogical training programmes:

> It's an extra feature ['Fitbit Premium'; a paid service with added functionality]. I don't need to spend $14 a month to get it from online, I don't know the qualifications of the person setting it for me anyway, or even if it's just a computer, doing it from the information I've given them. (Steph, 29)

> Nike had like a training plan […] it was just unreal, I had to run like six times a week. (Greg, 42)

While users were aware of, and willing to consider, broader health discourses like 'sitting too long is killing yourself, or something like that' (Miranda, 43), and 'your 30 minutes a day, that's all you've got to do' (Sue, 47), they were also ambivalent towards these discourses becoming *too* prescriptive:

> That's a little bit like the food pyramid […] I don't eat that much at night-time to have that many vegetables […] I don't really believe that's exactly how it should be. And I suppose it's the same thing for steps. […] I don't particularly believe that that the 10,000 is exactly for everyone. (Michael, 46)

As well as the antagonistic nature of training programs, the choice to stop tracking a metric like sleep – made by both Miranda (43) and Sarah (22) – shows a dislike of data

oversaturation and of normative conceptions. These two participants relied on embodied characterisations of their sleep as acceptable, rather than external assessments. Existing work has identified that users are wary of paying too much attention to what health metrics are 'normal' (Beaudin et al., 2006), suggesting that elements of 'subversive' (Lupton, 2016) device use are not uncommon. While users understand the potential for self-tracking data to be harnessed towards exploitative ends, like health insurance policies (Lupton, 2016: 117), the personal value of data was an acceptable trade-off (Ruckenstein, 2014: 77). Users like Zac (27) recognised multiple values of the tutoring process, stating; 'They are trying to make money off you. But at the same time it benefits you.'

In tension with our characterisation of the 'tutor' role as reciprocal, existing literature finds that users value data because of its perceived objectivity (Bentley et al., 2013: 5; Rettberg, 2014: 67). Findings from our study demonstrate that participants prefer a balance between objective device and subjective user, with devices offering suggestions, not prescriptions. This supports existing HCI assessments of natural language feedback (Bentley et al., 2013: 7) and linguistic turns from 'monitoring' to 'coaching' (Pantzar and Ruckenstein, 2015: 94). Thus, 'tutor' supports the popularity (n = 11) of casual metrics like 'steps' among our participants. Lachie (26) summed up why steps-counts were an intuitive and appealing metric:

> The steps is the main thing I'm interested in, just because it's immediate and it's immediately *relatable*, like, 'those were my steps'.

As well as intuitive expressions of daily activity, participants also demonstrated an ability to engage in deeper self-evaluation, beyond their apps. By comparing both data and observations, they came to conclusions about the nature of their lifestyles as 'healthy': 'I'm lucky I've got a job where I can move about' (Sue, 47), 'From what my friends do as well I sort of know that […] I'm a bit more active than them' (Zac, 27). For the couples interviewed, these local aggregations of data mixed with intuitive comparisons were key to their self-tracking. Within the context of their relationships, their 'tutored' tracking became a locus of dialogues about activity, routine and diet. Monitoring metrics together as a couple, with 'tutor' devices as an intermediary, is fundamental to the self-tracking of Sue (47) and Michael (46), and also Steph (29) and Jason (35). Metrics like 'peak' and 'cardio' heart-rates were jointly interpreted, for instance.

Sue (47) and Michael (46) had sometimes 'copied and pasted [graphs] into a Word document', allowing them to compare their Fitbit heart-rate graphs (Figure 4) and co-interpret data:

Sue:	I would interpret that as Michael not working – 'cos it's based on heart-rate – he's not working to his capacity. Because if he was his heart-rate would have been up there! Like, some of my heart-rates were like 183 and 179. Michael's, you know, chilling out at you know, 150 …
Michael:	And what we've worked out that is because, oh more say me, because I've only just started running again after 30 odd years – that could have been due to soreness, like, actually just plodding along …
Sue:	So going as hard …
Michael:	… hard as I can but having sore calves or something like that.

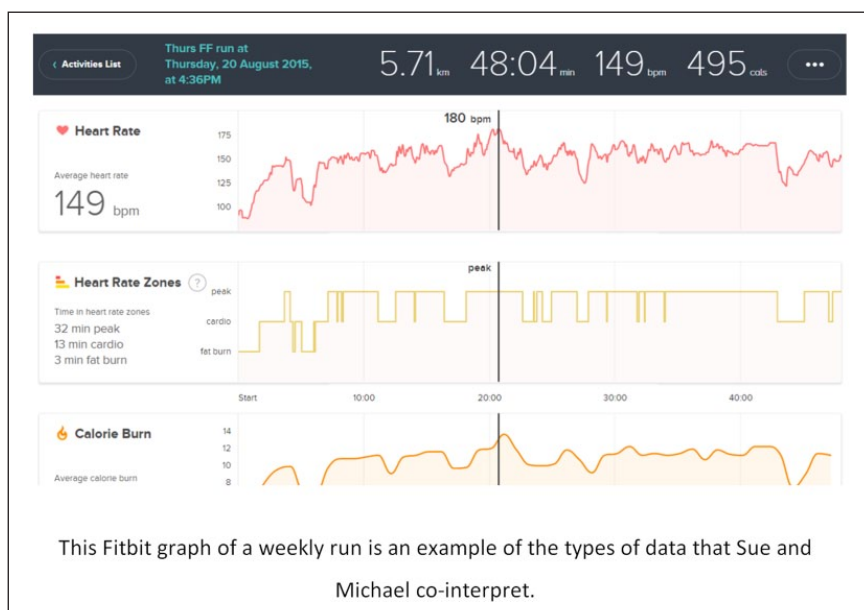This Fitbit graph of a weekly run is an example of the types of data that Sue and Michael co-interpret.

Figure 4. Sue's Thursday run.

For couple Steph (29) and Jason (35), Fitbit devices were part of a broader lifestyle change, and again, they both saw each other's encouragement and shared goals as essential:

Jason: I think the reason it worked for me is because it was a focus for a whole bunch of other change that I was like, trying to implement at the same time. […] It just sort of ended up being the focus that all of that led towards. If I just bought it off the shelf, just on a whim, I may have used it for a couple of weeks, and probably left it behind.

Steph: It would have been just another gadget I needed to have because it was new and cool. But because we got it at the time we did, it was serving a purpose, not just another cool gadget.

These insights go beyond demonstrating data-sharing with specific others (Elsden, 2015: 537) and show much more of the communicative co-present nature of self-tracking (Lomborg and Fransden, 2016). Sue (47) and Michael's (46) mixture of lived experience of sore muscles, recorded data and joint interpretation are a prime example of what Lomborg and Fransden describe as an oscillation between sensing and seeing (2016: 1022). Being an effective 'tutor' is not just related to the machinations of devices in everyday practice (Li et al., 2010; Pantzar and Ruckenstein, 2015: 96; Pantzar and Shove, 2005: 2): we argue that theories of practice, feedback loops and stage-based models do not entirely capture the complex ways that people engage in self-tracking in the reflexive 'tutor' manner. Rather, there is a nuanced and flexible social aspect, which is the true driver of self-tracking and change in the long term.

Conclusion: triple roles

Either by their own admission or evident in the way they dabbled in different self-track-ing apps, participants in this study acknowledged that self-tracking became integral to their daily lives. This occurred across a spectrum of areas; fitness, productivity and lei-sure. However, as Michael (46) noted earlier, *integral* is not the same as *essential*: he does not want his device to 'rule' him. The implication he draws is that if a device acts concurrently as 'tool', 'toy' *and* 'tutor', it may lead to a relationship of dependence. For participants in this study, balance seemed essential. Self-tracking remained relevant because it was open to the addition and subtraction of overlapping aspects of need, fun and learning. Therefore, continued, increased or decreased self-tracking depends on a complex relationship between 'tool', 'toy' and 'tutor' device roles. The key to all this is interpretation, something that each individual did in their own way, by reflecting on their data visualisations, and in many cases, through comparison with others.

This study reveals participant behaviour similar to some prior research. The studies of both Rooksby et al. (2014) and Lomborg and Frandsen (2016) featured participants who utilised two devices; either for two different types of exercise (Rooksby et al., 2014: 1169) or for deeper measurement (Lomborg and Frandsen, 2016: 1021). Zac's (27) use of multiple apps, and Sue (46) and Michael's (47) interpretative approach demonstrate a similar level of technical and discerning self-tracking. But, as this article argues, these examples highlight the subjective nature of self-tracking, rather than a definite category of behaviour. Ultimately, users make self-tracking useful in their own contexts, and their devices play a mixture of roles in their daily lives.

Across the three roles, it is clear that the involvement of *others* does aid in sustaining *self*-tracking, and this is supported by existing findings in which self-tracking was a 'communicative' and 'co-present' activity with others (Lomborg and Frandsen, 2016: 1023; Rooksby et al., 2014: 1170) and where narratives of self-tracking featured familial and emotional motivations (Rooksby et al., 2014: 1171). The findings presented here exemplify some dimensions of Lupton's (2016) types of self-tracking, like the encour-agement by others to continue self-tracking and the 'communal' nature of data interpre-tation. As such, the triple roles of tool, toy and tutor aim to offer a flexible characterisation of the fluid process of self-tracking, and may go some way to explaining what maintains self-tracking processes over time. But this is not to suggest that these three roles are strict categories.

Greg's (42) narrative below exemplifies the fluid intersection of the three roles. His intrinsic interest in 'cool' data (Figure 5) suggests he views self-tracking as a 'toy', despite the simple 'tool'-like accumulation he prioritises. Additionally, his interest in accumulation has, over time, morphed into a relationship of 'tutoring' – because he found himself being encouraged to exercise by his app.

Beyond Greg's narrative in Figure 5, the 'hierarchy of use' identified by Jason (35) earlier also shows the intersection of the three roles. Despite Jason using his Fitbit as a 'tool' for lifestyle change, he saw leader-boards as light-hearted 'toy' functions. Even a casual tracking of routines (Figure 1) saw Lachie (26) mildly valorising activities that aided the accumulation of steps. As Zac (27) stated, self-tracking occurs in all its nuances because 'you make the app work for yourself. You get what you want out of it.'
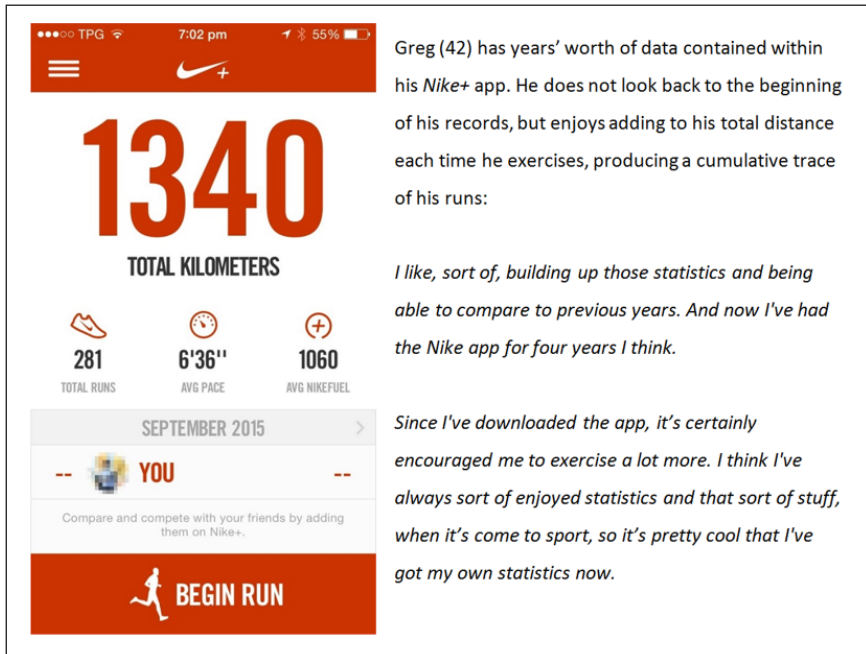
Greg (42) has years' worth of data contained within his *Nike+* app. He does not look back to the beginning of his records, but enjoys adding to his total distance each time he exercises, producing a cumulative trace of his runs:

I like, sort of, building up those statistics and being able to compare to previous years. And now I've had the Nike app for four years I think.

Since I've downloaded the app, it's certainly encouraged me to exercise a lot more. I think I've always sort of enjoyed statistics and that sort of stuff, when it's come to sport, so it's pretty cool that I've got my own statistics now.

Figure 5. Greg's runs.

The triple roles of tool, toy and tutor reflect the interwoven values of extrinsic need, fun and reciprocal learning for participants in this study. This role trichotomy serves a similar function to already identified types of self-tracking (Li et al., 2010; Lupton, 2016; Rooksby et al., 2014). However, by using HCI methods and presentation, we have situated these roles within a visually and socially mediated context. A key design feature of self-tracking, natural language communication, is valuable across the role trichotomy; between device and user, and *other* users. Our postulation of three self-tracking roles recognises this communication as vital, and therefore the roles are a way of identifying the hidden social aspects that assist with self-tracking, and help to link data to lived experiences.

Looking ahead, the intimate place of self-tracking in daily life makes it a topic of continued relevance. This study was limited in scope, and there is much more to be learned by further incorporating and analysing visual self-tracking artefacts. As suggested earlier, a range of other concerns related to self-tracking also require further attention: the power and pervasiveness of big data for individuals, the neoliberal underpinnings of self-tracking, and questions about personal privacy in digital spaces. The challenge for researchers will be to account for the action of both individuals and institutions, and to keep pace with evolving technological affordances. Devices continue to quietly measure, but to be useful, they still require much interpretation in design, use, and application phases. Whether self-tracking, and the associated interpretive work required for use is sustainable in the long term, or begins to constitute technological encroachment, is a

serious issue. Future empirical research would benefit from examining self-tracking through a lens of technological intimacy – in a similar context to other devices such as mobile phones – to further explore how lives are being shaped around, and by, advancing technologies.

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