EUROPEAN JOURNAL OF Cultural Studies

Article

European Journal of Cultural Studies
2015, Vol. 18(4-5) 479–496

DOI: 10.1177/1367549415584857
ecs.sagepub.com
SAGE

Our metrics, ourselves: A hundred years of self-tracking from the weight scale to the wrist wearable device

Kate Crawford
Microsoft Research New York City, USA; MIT Center for Civic Media, USA

Jessa Lingel
Microsoft Research New England, USA

Tero Karppi
SUNY Buffalo, USA

Abstract

The recent proliferation of wearable self-tracking devices intended to regulate and measure the body has brought contingent questions of controlling, accessing and interpreting personal data. Given a socio-technical context in which individuals are no longer the most authoritative source on data about themselves, wearable self-tracking technologies reflect the simultaneous commodification and knowledge-making that occurs between data and bodies. In this article, we look specifically at wearable, self-tracking devices in order to set up an analytical comparison with a key historical predecessor, the weight scale. By taking two distinct cases of self-tracking – wearables and the weight scale – we can situate current discourses of big data within a historical framing of self-measurement and human subjectivity. While the advertising promises of both the weight scale and the wearable device emphasize self-knowledge and control through external measurement, the use of wearable data by multiple agents and institutions results in a lack of control over data by the user. In the production of self-knowledge, the wearable device is also making the user known to others, in a range of ways that can be both skewed and inaccurate.

Corresponding author:
Kate Crawford, Microsoft Research New York City, New York, NY 10011, USA.
Email: kate@katecrawford.net

We look at the tensions surrounding these devices for questions of agency, practices of the body, and the use of wearable data by courtrooms and data science to enforce particular kinds of social and individual discipline.

Keywords
Big data, self-knowledge, self-tracking, wearables, weight scale

> We live in an age of measurement … [yet] measurement is not something new. From the Domesday Book to modern statistics, history is filled with examples where records, numbers and measurement have been instrumental to understanding and intervening in the social world, and to defining what is normal and what is deviant, oftentimes with material consequences. (Ajana and Beer, 2014)

Wearable self-tracking devices have been described as triggering 'a new culture of personal data' and as representative of a revolution in how individuals understand their own bodies (Wolf, 2009). Wrist-band and clip-on trackers have grown rapidly in popularity since the release of the FitBit in 2008, offering various forms of data analysis, including physical activity, sleep quality, caloric burn and heart rate. The discourse around wearable devices gives the impression of a radically new technology offering precise and unambiguous physical assessment: devices that reflect back the 'real' state of the body. Beyond the purely physical, a fundamental claim of wearable devices is that data will bestow self-knowledge: the kind of self-knowledge that will create a fitter, happier, more productive person. This is a seductive promise, but not at all a new one.

This drive toward physical quantification and, specifically, a connection between external measurement and self-knowledge has a long history, evidenced by the fact that weight scales have offered this promise for over a century. Over time, the location and meaning of the weight scale has changed, shifting from the doctor's office to the street to the home, from a form of specialist medical knowledge, to public entertainment, to a private habit and an everyday domestic discipline. But this connection is curious: when did measurement devices become understood as capable of giving insight to the self? How was this association formed? By looking at the promises made through advertising about both the weight scale and wearables, we see that the connections between data, bodies and self-improvement made in the early 20th century are being repeated today, but with a twist: where the scale primarily gave the data to the user to reflect on her own patterns, the wearable device makes the user known to a range of other parties.

The wearable self-tracking device shares user data with a parent company, and in many cases with third party analytics companies who use it to reflect not just on the individual, but on users en masse. Here, at the aggregate level, the data take on a different value, both in terms of what meaning can be extracted from it, and in terms of its perceived capital value. Measuring human bodies was a profitable business for manufacturers of the domestic weight scale, but the information was uni-directional: It moved from the device to the consumer. With the wearable device, this relationship is far more

complex, with data flowing between devices, consumers, companies, institutions, social networks and back again.

As of late 2014, the wearable device found a new audience: the courtroom. The first recorded case using FitBit data is underway as we write, with a Canadian law firm using the data to support a personal injury claim. But how should wearables' data be treated as evidence? Is it to be understood as somehow more objective than the claim of the plaintiff or those made by human experts such as doctors? Here, we face more questions: how reliable is a wearable as a witness? What understanding of the 'normal' person is being used to compare against an individual's data? How are accuracy and truth being verified when wearable data are given evidentiary weight? There is a considerable tension between a person wearing a device for self-knowledge, and wearables being used against the individual in a court, by an employer or an insurer. The wearer and the wearable may have very different accounts.

By taking two distinct cases of self-tracking – wearables and the weight scale – we can situate current discourses of big data within a historical framing of self-measurement and human subjectivity. We are interested in how big data epistemologies are encountered in embodied contexts, including domestic devices and software applications but also in the ideological and political frameworks implemented in the use of these devices. This necessarily raises ethical issues about how the data produced by wearables can be used by a wide range of intermediaries. We argue that the production and use of big data of the body has simultaneous epistemological, legal and physiological implications.

Our analysis begins with a brief historical account of the weight scale, looking at its changing role as it shifted locations from the doctor's office to the street to the home. Then we look at the recent emergence of wearable self-tracking devices, which are beginning to receive scholarly attention from health as well as sociology researchers. Next, in order to understand what these devices claim to offer users, we look at advertising campaigns of both weight scales and wearable devices. Finally, we consider the recent use of FitBit in courts, and the emerging role of the wearable as a legal witness. By addressing historical, semiotic and legal perspectives, we can consider the complex tension in self-tracking devices between a person's desire for self-knowledge and the way in which that person is known by a range of third parties, some with interests that may directly conflict with their own. By considering the longer history of bodily measurement and monitoring, and how that monitoring is conducted by different actors and institutions, we can better understand the evolving relationships between data, bodies and power.

Technologies of weight tracking: from the carnival to the bathroom

Since the late 19th century, the weight scale has become one of the most pervasive and familiar self-monitoring technologies. In many ways, the weight scale offers us a powerful example of how a monitoring device can move through different spaces: from the doctor's office to public squares and streets, and eventually into the home. Doctors only began monitoring and recording patients' weight toward the end of the 19th century, and the recording of weight did not become routinized until the start of the 20th century. In

1885, the public 'penny scale' was first invented in Germany, and shortly after began appearing in the United States in groceries and drug stores (Schwartz, 1986: 186). It was modeled after the grandfather clock, with a large dial, and once a customer stepped on the weighing plate and placed a penny in the slot, the spring would move the arrow to indicate the number of pounds. Some penny scales rang a bell when the weight was displayed, and others played popular songs like 'The Anvil Chorus' or 'Oh Promise Me' (Schwartz, 1986: 165).

Across the United States, people were fascinated with the ability to reflect on their weight as a precise number of pounds, a shift 'from a subjective to a numeric approach to evaluating weight' (Czerniawski, 2007: 273). By the 1930s and 1940s, the penny scale was widespread in US cities, found everywhere from subways to banks, movie theaters to office buildings. By 1937, a US Department of Commerce report noted that 'penny scales were the principle means of over 130,000,000 people keeping in touch with their weight and health'. But as Stearns (2002) observes,

> While a first doctor's scale was produced in 1865, regular use of scales may have actually lagged behind the introduction of public scales in the 1890s. In the long run, weight anxieties linked up with a modern fetish for precise, standardized measurements, applying these to intimate aspects of the body then exposed to medical scrutiny, but it took a while for this to happen. (p. 27)

Penny scales used a series of design mechanisms to lure people to check their weight in public spaces. The machines would dispense enticing offerings, including pictures of Hollywood movie stars, horoscopes, gum and candy, with the hope of luring passers-by to part with a penny and check their weight. Games began to be built into the scales: the Guess-Your-Weight scale would return your penny if you accurately placed the pointer at your weight before it moved there. But the extraction of money in exchange for data was the prime aim, so rather than returning pennies the objective for the scale owners was to collect as many as possible. 'It's like tapping a gold mine', claimed the Mills Novelty Company brochure in 1932 (Schwartz, 1986: 167).

Not long after the emergence of the penny scale came the domestic weight scale, a smaller, more affordable device designed for use in the home, allowing for self-measurement in private. As Stearns (2002) notes, the public recording of one's weight with the attendant noises and songs became embarrassing for many, so that when the domestic scale first appeared in 1913, it had strong consumer appeal (p. 28). This change in the location of weight scales also came with different moral imperatives:

> The shift from publicity to privacy, from the sociable to the personal, was a semantic shift from the third person to the second person and from the declarative to the conditional – from *what this person weighs* to *what you should weigh* and *what you could be*. (Schwartz, 1986: 165–166)

By the 1920s, several types of bathroom scales were on the US market, including the popular Health-O-Meter, which was 8 inches high, white and accurate within 1 lb. Instructions that came with bathroom scale recommended weighing in the nude, a new

intimacy with the body's metrics that was reinforced by advertisements that showed women in lingerie, sleepwear or girdles, posing provocatively on the scale.

This focus on the female body as the subject of the scale was quite recent – initially, the male body was the focus of weight-related marketing. For example, the best-selling diet guide in the United States at the turn of the century was William Banting's *A Letter on Corpulence*, which was aimed at men and 'featured foods associated with masculinity, wealth, and national and racial superiority such as red meat and alcohol' (Vester, 2010: 39). Early diet advice ignored women, as they were encouraged to be plump in order to be seen as healthy and beautiful, and in Vester's (2010) analysis of newspaper and magazines, women were not encouraged to diet until the 1920s (p. 39). The 'bathroom scale', located in the room of the house most associated with intimate bodily functions, had a shifting relationship to which bodies it was for, and how they should relate to the number brought up by the spring dial.

Of course, a number without context can only mean so much. For the weight scale to function as a normalizing technology, it had to operate in tandem with another technology: the height and weight table. While it was the Belgian mathematician Quetelet who first devised the height and weight chart in 1836, it was seen as impractical as it only listed one average height and weight for each year of age he represented (Czerniawski, 2007: 274). It was not until the Association of Life Insurance Medical Directors of America established a committee to develop an 'industry standard' height and weight table in 1895 that the real mission began to gather data and standardize it across the medical and insurance domains. By 1908, the statistician Louis Dublin compiled the Standard Table of Height and Weight for Men and Women, and this became the default standard for doctors to assess 'ideal' weight (Czerniawski, 2007: 280). Now the number on the weight scale could be compared to a table, and that would locate the patient's age and what they 'should' weigh. Penny scales began to prominently feature a height and weight chart to be read while being weighed. Together, the scale and the height and weight chart became a powerful dual technology for defining normalcy. Meanwhile it was the move to the innermost parts of the domestic sphere – the bathroom – that allowed the scale to be an everyday tracking tool, one that promised the ability to 'control' one's weight and reach the ideal numerical range.

Keeping track of one's weight via the bathroom scale was not, however, only about weight management. It was also seen as representing a powerful form of self-knowledge, an association made as early as the 1890s. This connection between knowing one's weight data and self-knowledge at a deeper level continued as the weight scale moved from public space to the domestic sphere, and continues today, where value and self-worth can be attached to the number of pounds weighed. As one participant in an eating disorders group confessed, after being asked how she feels if she does not weigh herself: 'I don't feel any way until I know the number on the scale. The numbers tell me how to feel' (Austin, 1999: 264).

With the emergence of wearable self-tracking devices, remarkably similar claims appear: self-tracking will lead to self-knowledge. There are already accounts of fitness trackers being used by people who suffer from eating disorders, a grim example of self-tracking and internalized surveillance taken to an extreme (Mahdawi, 2014.) The history of the weight scale reminds us that tracking devices are agents in shifting the process of

knowing and controlling bodies, individually and collectively, as they normalize (and sometimes antagonize) human bodies.

The birth of the wearable self-tracking device

Wearable devices are designed to quantify everyday exercise and rest, mood and diet, and then provide feedback to users such that they can better understand and possibly modify their activities and behavior. Fitbit launched its FitBit Classic in 2008, a small, clip-like device designed to track the number of steps taken, calories burned, activity intensity and sleep, followed in 2013 by the Fitbit Flex, a wristband device. Other companies began to follow suit, with Jawbone's UP device launched in 2011, the Nike+ FuelBandSE[1] in 2013 along with Withing's Pulse, and Microsoft's Band in 2014. The value generated by these products applies both to users, through the process of reflecting on the data about their daily patterns, and to the parent companies and third party data companies that develop and market these products as data gatherers and analyzers.

There is a small but growing body of scholarship interested in how the themes of domesticating technology and quantification are brought together in self-tracking devices. To date, much of the focus has been on the Quantified Self (QS) movement. Swan (2013) defines a QS participant as

> Any individual engaged in the self-tracking of any kind of biological, physical, behavioral, or environmental information. There is a proactive stance toward obtaining information and acting on it. A variety of areas may be tracked and analyzed, for example, weight, energy level, mood, time usage, sleep quality, health, cognitive performance, athletics, and learning strategies. (p. 85; see also Boesel, 2013; Butterfield, 2012)

We would add that the QS movement has a significant social component: that users self-identify with QS and develop relationships (online or off) with other users of the same technologies. Beyond this group, there is a much larger, less well-defined group of users who use self-tracking devices yet are unlikely to attend self-tracking meet-ups or participate in QS online communities, and may not even be aware of their existence. It is this larger category that we are concerned with here.

Self-tracking devices are typically attached to the wrist of the nondominant hand, which moves less, and infers the user's overall movement as well as heart rate. For example, the Fitbit (2014) uses

> … a 3-axis accelerometer to understand your motions. An accelerometer is a device that turns movement (acceleration) of a body into digital measurements (data) when attached to the body. By analyzing acceleration data, our trackers provide detailed information about frequency, duration, intensity, and patterns of movement to determine your steps taken, distance traveled, calories burned, and sleep quality.

Fitbit (2014) describes their accelerometer feeding into a 'finely tuned algorithm' that looks for 'motion patterns'. In addition to measuring activity, the accelerometer also monitors inactivity. During sleep, the accelerometer tracks any unconscious movement in order to correlate the amount of time spent in 'light' and 'deep' sleep states, with the deep state being correlated with very little movement. Similarly, the Jawbone UP describes its sleep

tracking functionality as 'monitoring your micro movements to determine whether you are awake or asleep' (Jawbone, 2014) and the Pulse marketing states that its sensor 'precisely assesses your movements, so that the Pulse can run a sleep cycle analysis' (Withings, 2014). Nike Fuelband is far less direct about its data gathering process, offering only that it 'can track your movement as you sleep' (NikePlus, 2014). In addition to monitoring time and type of sleep, some of these devices – such as the Jawbone UP – offer mechanisms of intervention, for example, creating a morning alarm that wakes the user at the 'ideal' time, meaning that the device issues a 'gentle vibration' during the lightest part of a sleep cycle, within a 10- to 30-minute window. By continuously recording a range of variables, these devices become an intimate part of everyday life, silently recording data 24/7, detecting patterns and inferring habits of users' daily (and nightly) lives.

The data extraction may be constant, but it is not always accurate. Each brand of wearable device has its own peculiarities in how it works: some will count arm movements as walking, others cannot register cycling as activity, and the sleep tracking functions deploy relatively crude methods when distinguishing between light and deep sleep. Simply put, these devices do not offer consistent or reliable accounts of human activity, as evidenced in product reviews that document the divergences between devices claiming to measure the same actions and behaviors (see Patel, 2013). There are also important questions to ask about the kinds of assumptions regarding normal health, mobility and progress embedded in these systems. As Watson (2014) notes in her account of using her Fitbit in the weeks following a serious hip injury, wearables assume bodies that are regularly and consistently in motion, and a linear relationship of increasing fitness, generically defined. Aging and differently abled bodies bring into relief the underlying presumptions of physical and subjective normality at work in wearable self-trackers.

As an example of the complexities of measurement, data and individual agency, consider the technical instructions required for sleep tracking with the Jawbone UP: the device does not in fact detect when a user falls asleep; instead, the user signals to the device[2] that she is going to sleep by tapping on the wristband. In the morning, she must similarly tap the device to alert it that she is awake. The user must decide when she is about to sleep and define the first moment of wakefulness, in contrast with everyday experiences of sleep as something far more slippery and less conscious. The data is necessarily blurry at the edges: did she tap the device then fall asleep immediately, or did it take longer? Did she remember to alert the device first thing in the morning or perhaps forgot until after breakfast? To date, the UP band cannot detect sleep itself and requires this ongoing nightly and morning ritual engagement with the user. In order to situate the politics of wearable self-trackers within a larger history of metrics and objectivity, we turn to a critical comparison of advertising as a source of rhetorical framings of the weight scale and the wearable self-tracker.

Product promises: an analysis of self-tracking advertising

Having addressed the weight scale and wearable as technologies that emerged in the context of simultaneously measuring and knowing bodies, of giving users information while also demanding their data (and money), we now turn to the advertising and marketing used to sell these technologies. What promises are made to consumers of these devices? What uses are promoted and under what assumptions? A surprising similarity

Figure 1. Public scales from the late 1880s in contemporary Paris.

emerges between the slogans used for the weight scale and the wearable: the device offers self-knowledge, and through that a new sense of control over the body, which leads to a better life.

I measure, therefore I am: self-tracking and self-knowledge

The connection between externalizing one's data – knowing your metrics – as a precursor to self-knowledge and the good life can be traced from the first public weight scales onward. Early European public scales came with inscriptions, such as the one shown in Figure 1 from the late 1880s in Paris, which offers the homily: 'He who often weighs himself knows himself well. He who knows himself well lives well'.

This understanding of weight tracking offers a kind of moral epistemology: not only *should* one know one's weight, but it is necessary to know it in order to lead a good life. But there is another imperative at work here: penny scales were a significant money-making enterprise, generating a strong profit motive in the emphasis on weighing oneself 'often'. The relationship between the exchange of data for money was clear: spend a penny, receive a datum. But while the rhetoric of self-knowledge through data remains in the representations of self-tracking devices, the data relationship is less clear. The user will be able to reflect on their own data by wearing a device all day and night, and that data will always be shared with the device maker and a range of unknown others. What they do with that data is much less clear, and ultimately at the company's (rather than the customer's) discretion. The layers of obfuscation regarding how data are mined are accentuated when comparing the user experience of getting data from wearables versus a weight scale. On

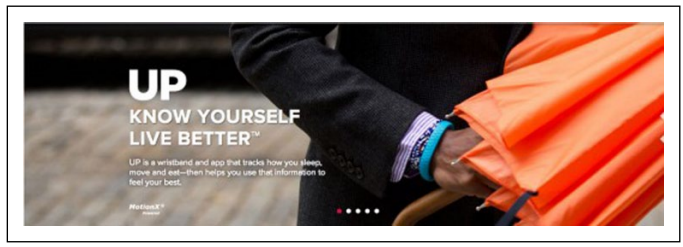

Figure 2. Jawbone UP: 'Know Yourself, Live Better'.

a traditional weight scale, one simply steps on and a number appears. There is a private data relation between the scale and the person, and it goes no further unless the data are consciously shared with others. The user gets to make a choice about whether they share the data from the domestic scale, and with whom. For self-tracking devices, data are mediated by a smartphone app or online interface, and are held firstly by the wearables company, along with other personal data such as name, age and gender. The user never sees how their data are aggregated, analyzed, sold or repurposed, nor do they get to make active decisions about how the data are used.

In the case of Jawbone's UP device, the slogan most commonly used in their advertising has been 'Know Yourself. Live Better' (Figure 2), a phrase that echoes the marketing of the penny scale. The tagline that follows promises that the UP will 'track how you sleep, move and rest – and help you to use that information to feel your best'. The language here shifts from being phrased as an imperative – 'know thyself' – to being couched more like therapeutic support, helping you 'feel your best'. The image in Figure 2 gives us a partial view of a well-dressed, dark-skinned man in a suit, his cuff resting next to his bright blue UP band, and a bright orange umbrella. The image invokes suggestions of a savvy businessman in urban space, with an emphasis on fashion and style. More than a technology, the UP is part of a lifestyle, converging fitness, fashion and financial success.

A similar example is found in the campaign surrounding the Microsoft Band. In one image, a woman is standing on a bus, staring into the middle distance, while the tagline reads: 'This device can know me better than I know myself, and can help me be a better human' (Figure 3). The woman is acceding self-knowledge to the wearable – through constant data collection and the perspective that it brings over time, it can know her better than she knows herself. In an ironic shift, this transfer of self-knowledge to the tracking device then makes her a better human. The interplay of the text and the highly airbrushed image of the woman creates a strange sense of a human–device hybrid – a cyborg form that is both human and not, with the wearable acting as a supplement to create a superior being.

The means by which one obtains self-knowledge in these campaigns is through data, and specifically through highly accurate data, where accuracy is a privileged, if not defining, lure of its functionality. In 1925, as the bathroom scale was increasing in popularity, one of the selling points was that it was more accurate than the public scale. An image of a young woman standing on a scale in her underclothes appears in one

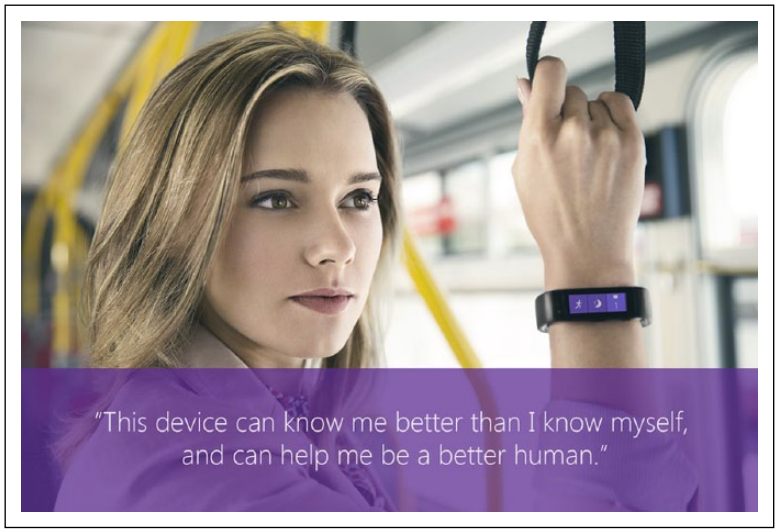

Figure 3. The Microsoft Band.

advertisement, with the catchphrase: 'She doesn't GUESS – She KNOWS' (Figure 4). The Health-O-Meter Automatic Bathroom Scale offered customers to 'reduce your weight this new scientific way', because 'casually weighing yourself on unreliable public scales isn't enough – *you must know your weight*' (italics in original).

This advertisement shows both the rhetorical turn toward accuracy, privacy and repetition (the scale allows you to 'weigh yourself every day, without clothing' and gives you 'accurate, reliable, positive knowledge about your weight'). Weighing oneself is described as 'simple and pleasant', and simply using the scale will result in losing '20, 30, 40 pounds or more' without the use of diets, drugs or 'tiring exercises'. Control of the body is achieved through regular use of the device, and weight control becomes easy.

While it was the public scale that was described as the 'unreliable' competitor to makers of bathroom scales, in the specific case of the wearable, there is no prior, mainstream domestic technology to unseat. Thus, we see that companies like Withings market sleep tracking as an improvement against subjective 'impressions', in a similar way that the penny scales were marketed as the first technology to assert metrics and accuracy over general perception. Despite the functional murkiness of how, precisely, the device disambiguates light and deep sleep, or even the extent to which knowing about time spent in each phase will actually improve one's own sense of well-being, the Withings Pulse lets the promise of measurement stand for itself (Figure 5).

Making similar appeals to accuracy, the 'Counselor' bathroom scale, from 1953, promised to tell the truth – about 'your figure smartness' and 'your family's health' (Figure 6). As a woman perches on the scale in her nightgown, we are told that the scale is '*unequalled for accuracy*'. While this advertisement suggests the scale will tell the 'truth' of the consumer's weight, the greater suggestion is that this numerical truth will set her free – it will make her more able to maintain her weight and to be her best self.

Figure 4. Advertisement for the Health-O-Meter weight scale, 1925.

This relationship between numerical accuracy, truth and self-knowledge is similarly operationalized by wearable devices, despite the quality of the metrics about activity and sleep being nascent and uncertain, and the data often in consistent. Nonetheless, the claims of accuracy remain, as a powerful articulation of the belief that the better the data, the better the quality of self-knowledge, and so a 'better human' is created.

As we have seen, technologies of self-measurement rely on rhetorics of agency, where the act of purchasing a device promises a kind of empowerment and control. For example, a 1950s Borg ad for a weight scale promises, 'Give Someone a Lovely

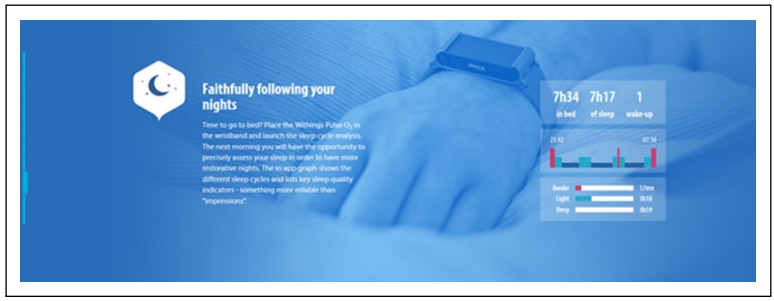

Figure 5. Image from the features description on the Withings Pulse webpage.

Figure for Christmas', and features a slim, well-dressed woman with a carefree smile and her left hand gesturing toward the scales that, presumably, she has to thank for her figure (Figure 7). The determinist implication of the ad is that the mere purchase of a scale produces a desirable figure. Constant consultation with one's own data generates the desired outcome of a thinner body. Measurement becomes the substitute for diet and exercise, transforming the body through a daily interaction with data about the body.

In his initial explanation of 'Quantified Self' as a technological project of self-improvement, Gary Wolf (2009) declared that the unofficial slogan of the movement would be 'self-knowledge through numbers'. In these advertising strategies for weight scales, we see that the historical lineage of self-knowledge through data goes much further back. Wolf and other self-tracking enthusiasts celebrate the precision of numbers as a means of self-knowledge over the fuzziness and abstraction of self-impressions and feelings. Yet, the transition from feelings to numbers is not as smooth a transition from abstraction to the concrete, despite the claims of the advertisements above. As we have seen, the claims to accuracy and reliability of these devices are mythic: it gives *some* accurate data, *some* of the time. And that data are being aggregated, interpreted and potentially onsold in a range of contexts well beyond the control of the user, and sometimes in direct contravention of her interests. With more disturbing implications in the context of monitoring, surveillance and power, particularly when such data are used by employers or health insurers, there is a problematic lack of control that individual users have over the flows of that data.

Quantified self-incrimination

In late 2014, the first reports emerged of a court case using Fitbit data. A Canadian law firm drew on a client's Fitbit history in a personal injury claim to show that her activity levels were lower than the baseline for someone of her age and profession. But they did not use the raw Fitbit data directly: they relied on a third party analytics platform, Vivametrica, which compares individual data to the general population. Vivametrica makes the claim on their web site that they 'define standards for how data is managed, bringing order to the chaos of the wearable'. But what is the standard for health data from

Figure 6. A 1953 ad for the Counselor bathroom scale.

Figure 7. A holiday ad from Borg, marketing its weight scale.

wearables? Much depends on what data they use and how they define the 'normal' healthy individual, yet research on exercise, sleep, diet and health changes constantly, and this contextual 'norm-setting' data used by an analytics platform is rarely transparent.

What will it mean when wearable device data are used in court by prosecutors looking for self-incriminating evidence, or to deny injury and disability claims? Will it change the relationship that people have to their wearable device when it can betray them in a courtroom? By wearing a self-tracker, people are

> … creating a split narrative in the way their lives are measured. There is their experience, and there is the data about them: these may converge or diverge for reasons to do with the fallibility of human memory, or the fallibility of data tracking systems. (Crawford, 2014)

But in this divided account, the data are perceived as more objective and reliable than a subjective human account. Given the unreliability of the data collection done by

wearable devices, and the opaque proprietary platforms used by third parties to compare that data to a manufactured norm, there are real risks in according this data the weight of strong legal evidence. By giving these systems the power to represent 'truth' in a court case, we are accepting the irregularities of their hardware and software, while also establishing a set of unaccountable algorithmic intermediaries. The wearable, and the systems that subtend it, become unreliable witnesses masquerading as fact.

As we have seen from the advertising strategies of both the weight scale and wearable self-trackers, these devices make similar promises while offering different relationships to data in the context of bodily control. Researchers have pointed out that in the age of networked connectivity, systems that are supposedly built *for* you are, in fact, systems *about* you and the data you provide (e.g. Bossewitch and Sinnreich, 2013; Van Dijck, 2009: 43, 2013). With the notion of 'implicit participation', Schäfer (2011) has described how social media users contribute data unconsciously by merely using different social media sites and interfaces:

> Implicit participation is channeled by design, by means of easy-to-use interfaces, and the automation of user activity processes … it is a design solution that takes advantage of certain habits users have … The user activities performed on these web platforms contribute to the system-wide information management and can be exploited for different purposes, such as improving information retrieval, or gathering user information for market research. (p. 51)

From the data collected, the wearables company can aggregate and analyze massive data sets of users in different neighborhoods, cities and countries. They can conduct detailed analysis on the different patterns according to the demographics that the user is asked to offer up: gender, age, eating patterns, moods, level of daily exercise. Yet, the user only receives an individual report of their data, day after day. From this perspective, when people start using these devices they enter into a relation that is an inherently uneven exchange – they are providing more data than they receive, and have little input as to the life of that data – where it is stored, whether it can be deleted and with whom it is shared.

They are also becoming part of an aggregated data set that is compared against other forms of data: medical and otherwise. Just as the Association of Life Insurance Medical Directors of America devised standardized height and weight charts in the late 1800s, now companies like Vivametrica are vying to become the standard-setters for wearable device data. There is considerable power in becoming the standard-setter of what makes a 'normal' user. But the weight scale also showed how the concept of 'ideal weight' also brings into being forms of social and individual discipline. Unknowingly, the data from wearable users are contributing to new definitions of normalcy around activity and rest, and this can have both individual and collective consequences.

For example, one large US health insurer, Cigna, launched a pilot program in 2014 where it distributed wearable devices to all the employers of one of its corporate customers. When the data indicated that a number of employees were on the verge of diabetes, they started reducing risk behaviors. A Cigna spokesman said, 'We can literally bend the cost curve' (Olsen, 2014). But this can also come at the cost of pressuring some workers to conform to health ideals. Already, some companies use punitive measures like increased insurance costs for smokers (Fitzhugh, 2013). While self-knowledge may be the rhetoric of wearable device advertising, it is just as much a technology of *being*

known by others. With more detailed information, far more individualized and precise interventions can be conducted, with the potential for political and cultural impact well beyond that of the weight scale.

Conclusion

Both the wearable and the weight scale offer the promise of agency through mediated self-knowledge, within rhetorics of normative control and becoming one's best self. The idea of agency becomes deeply complicated in both technologies, mirroring the complex entanglements of information, consent and privacy. On the one hand, the act of purchasing and using a device reflects an intention and choice, and the ability to 'know more through data' can be experienced as pleasurable and powerful. When shared with others, such as in the QS community or wearable-centered fitness groups, it can also afford a sense of community. At the same time, there are complex questions of agency, privacy and consent. The body is tracked, documented and rendered meaningful through a device that records a wealth of data for the parent company, third parties and possibly insurers and employers, and only a small fraction of the potential and value of this data is returned to the user. Beyond the clear economic disparity, companies like Jawbone and Fitbit get to see aggregated data: the patterns of activity (and inactivity) across geography, class and gender among many other possible categories. This god's eye view offers a significant and politically charged perspective – yet the user only gets to see their individual behavior compared to a norm, a speck in the larger sea of data.

In pursuing this line of inquiry around questions of socio-technical agency and data science, we make two critical claims. First, making meaning out of self-tracking data requires collective rather than individual participation, in that self-tracking devices that rely on statistical comparisons are necessarily contingent on a set of data points (a body amidst other tracked bodies). Users get a personalized report, yet, the system around them is designed for mass collection and analysis. It functions as a 'biopolitical public domain', to use Cohen's (n.d.) term, designed to 'assimilate individual data profiles within larger patterns and nudge individual choices and preferences in directions that align with those patterns' (p. 7). And while there is a strong rhetoric of participation and inclusion, there is a 'near-complete lack of transparency regarding algorithms, outputs and uses of personal information' (Cohen, n.d.: 7).

The normalizing role of data is also evident in the history of the weight scale; yet, there is a critical difference between the two devices. The 20th-century weight scale assessed then gave its data directly and in the clear, without aggregating it or reporting it back to its maker, and height and weight charts were publicly accessible. In contrast, users of wearables are told very little about the cultural and scientific assumptions that undergird notions of the normal user, and they are simply placed in percentiles that lack any transparency in their construction or use. Who gets to see the user's data and how is it being used? In this way, the relationship between users, devices and companies is fluctuating, and the full use of the data is always out of sight to the user. Finally, the economic value of the data, be it for the wearables company to increase its perceived value as a big data collector or as a set to be traded and sold, is never shared with the users who make up that data set. Neither may users extract or 'delete' their data if they stop using the wearable device.

Crary (2013) argues that 'there are now very few significant interludes of human existence (with the colossal exception of sleep) that have not been penetrated and taken over as work time, consumption time, or marketing time' (p. 15). By looking at the last hundred years of self-tracking via the weight scale, we can more clearly recognize the ways in which metrics have encroached into many more states and experiences of the human body. With the advent of the wearable, even sleep is fair game. The increasing emphasis on the measured self has brought with it a range of capital-driven imperatives and standard-making exercises that seek to normalize and extract value from our understanding of ourselves, while making us ever more knowable to an emerging set of data-driven interests.

Funding

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Notes

1. The Nike+ FuelBand did not have sleep tracking functionality until its FuelBand SE was released in early 2013. By March 2013, Nike had closed down its data department for the FuelBand and it is unclear that it will develop further.
2. The devices require users to alert the device upon going to bed and on rising – to activate and deactivate 'sleep mode'. In this way, they require habitual interaction, almost like a pet, echoing other technological relationships such as Tamagotchis, a popular children's toy in the 1990s that required ongoing engagement from the user in order to keep it alive.

References

Ajana B and Beer D (2014) The biopolitics of biometrics: An interview with Btihaj Ajana. *Theory, Culture & Society* Available at: http://theoryculturesociety.org/the-biopolitics-of-biometrics-an-interview-with-btihaj-ajana/ (accessed 31 May 2014).

Austin SB (1999) Fat, loathing and public health: The complicity of science in a culture of disordered eating' culture. *Medicine and Psychiatry* 23(2): 245–268.

Boesel W (2013) What is the quantified self now? *The Society Pages: Cyborgology*. Available at: http://thesocietypages.org/cyborgology/2013/05/22/what-is-the-quantified-self-now/ (accessed 4 June 2014).

Bossewitch J and Sinnreich A (2013) The end of forgetting: Strategic agency beyond the panopticon. *New Media & Society* 15(2): 224–242.

Butterfield AD (2012) *Ethnographic assessment of quantified self meetup groups*. Doctoral Dissertation, San José State University, San Jose, CA.

Cohen JE (2015) The surveillance-innovation complex. In: Barney D, Coleman G, Ross C, et al. (eds) *The Participatory Condition*. Minneapolis, MN: University of Minnesota Press.

Crary J (2013) *24/7: Late Capitalism and the Ends of Sleep*. New York: Verso.

Crawford K (2014) When fitbit is the expert witness. *The Atlantic*, 19 November. Available at: http://www.theatlantic.com/technology/archive/2014/11/when-fitbit-is-the-expert-witness/382936/

Czerniawski AM (2007) From average to ideal: The evolution of the height and weight table in the United States, 1836–1943. *Social Science History* 31(2): 273–296.

Fitbit (2014) Features. Available at: https://www.fitbit.com/flex (accessed 3 June 2014).

Fitzhugh M (2013) Employers push workers toward healthier choices. *The Burrill Report*. Available at: http://www.burrillreport.com/article-employers_push_workers_toward_healthier_choices.html (accessed 1 December 2014).

Jawbone (2014) FAQ. Available at: http://jawbone.com/store/buy/up24#faq (accessed 31 May 2014).

Mahdawi A (2014) The unhealthy side of wearable devices. *The Guardian*. Available at: http://www.theguardian.com/commentisfree/2014/jan/03/unhealthy-wearable-fitness-devices-calories-eating-disorders-nike-fuelband (accessed 27 November 2014).

NikePlus (2014) NikePlus support. Available at: http://support-en-us.nikeplus.com/app/answers/detail/a_id/48057/p/3169,3180 (accessed 31 May 2014).

Olsen P (2014) Wearable tech is plugging into health insurance. *Forbes*, June 6. Available at: http://www.forbes.com/sites/parmyolson/2014/06/19/wearable-tech-health-insurance/ (accessed 1 December 2014).

Patel S (2013) A comparative review – 28 days with the fitbit one, jawbone UP, Nike+ FuelBand, and BodyMedia LINK. *Get Grok*. Available at: http://www.getgrok.com/2013/01/a-comparative-review-28-days-with-the-fitbit-one-jawbone-up-nike-fuelband-and-bodymedia-link/ (accessed 26 November 2014).

Schäfer MT (2011) *Bastard Culture! How User Participation Transforms Cultural Production*. Amsterdam: Amsterdam University Press.

Schwartz H (1986) *Never Satisfied: A Cultural History of Diets, Fantasies and Fat*. New York: The Free Press.

Stearns PN (2002) *Fat History: Bodies and Beauty in the Modern West*. New York: NYU Press.

Swan M (2013) The quantified self: Fundamental disruption in big data science and biological discovery. *Big Data* 1(2): 85–99.

Van Dijck J (2009) Users like you? Theorizing agency in user-generated content. *Media, Culture, and Society* 31(1): 41.

Van Dijck J (2013) *The Culture of Connectivity: A Critical History of Social Media*. Oxford: Oxford University Press.

Vester K (2010) Regime change: Gender, class, and the invention of dieting in post-bellum America. *Journal of Social History* 44(1): 39–70.

Watson SM (2014) Stepping down: Rethinking the fitness tracker. *The Atlantic*. Available at: http://www.theatlantic.com/technology/archive/2014/09/hacking-the-fitness-tracker-to-move-less-not-more/380742/ (accessed 25 September 2014).

Wolf G (2009) Know thyself: Tracking every facet of life, from sleep to mood to pain, 24/7/365. *Wired*. Available at: http://archive.wired.com/medtech/health/magazine/17-07/lbnp_knowthyself (accessed 3 December 2014).

Biographical notes

Kate Crawford is a Principal Researcher at Microsoft Research, a Visiting Professor at MIT's Center for Civic Media, and a Senior Fellow at NYU's Information Law Institute. Her work focuses on the social, cultural and historical contexts of data platforms.

Jessa Lingel is a post doctoral researcher at Microsoft Research, working with the Social Media Collective. She received her PhD in Communication and Information from Rutgers University.

Tero Karppi is Assistant Professor of Media Theory at the Department of Media Study, State University of New York at Buffalo. Karppi's work focuses on the theme of disconnections in social media and network culture, and his work has been published in journals such as Culture Machine, Fibreculture and Simulation and Gaming.