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# Understanding the Human Machine

The concepts of "self-tracking" and "the quantified self" have recently begun to emerge in discussions of how best to optimize one's life. These concepts refer to the practice of gathering data about oneself on a regular basis and then recording and analyzing the data to produce statistics and other data (such as images) relating to one's bodily functions and everyday habits. Some self-trackers collect data on only one or two dimensions of their lives, and only for a short time. Others may do so for hundreds of phenomena and for long periods.

The tracking and analysis of aspects of one's self and one's body are not new practices. People have been recording their habits and health-related metrics for centuries as part of attempts at self-reflection and self-improvement. What is indisputably new is the term "the quantified self" and its associated movement, which includes a dedicated website with that title, and regular meetings and conferences, as well as the novel ways of self-tracking using digital technologies that have developed in recent years. A growing range of digital devices with associated apps are now available for self-tracking [1]. Many of these devices can be worn on or close to the body to measure elements of the user's everyday life and activities and produce data that can be recorded and monitored by the user. They include not only digital cameras, smartphones, tablet computers, watches, wireless weight scales, and blood pressure monitors, but also wearable bands or patches, clip-on devices and jewelry with embedded sensors able to measure bodily functions or movement and upload data wirelessly.

In many of these devices global positioning devices, gyroscopes, altimeters, and accelerometers provide spatial location and quantify movement. These technologies allow self-trackers to collect data on their moods, diet, dreams, social encounters, posture, sexual activity, blood chemistry, heart rate, body temperature, exercise patterns, brain function, alcohol, coffee and tobacco consumption, and many other variables.

## Emergence and Rise of the Quantified Self

The term "quantified self" was generated when the Quantified Self movement was first developed in 2007 by two *Wired Magazine* editors, Gary Wolf and Kevin Kelly. Wolf and Kelly set up a website devoted to the movement in 2008. Interest in the concept and the associated movement has developed rapidly from there. According to the Quantified Self website there are now

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over 130 quantified self groups in 34 countries around the world, many of which hold regular meetings involving "show-and-tell" discussions of how members have been engaging in self-tracking activities.

The term "quantified self" has now entered the cultural lexicon, and research suggests that its frequency of use has been increasing and gathering momentum annually. A study of the use of the term "quantified self" that I conducted using the Factiva global newspaper database between September 2008 (its first appearance) and July 2013 found that it was increasingly prevalent in news articles over this period, with a dramatic increase in 2012 and 2013. In 2009 only two news articles appeared mentioning the quantified self: one in the American *Life Science Weekly* that reported a study on the relevance to healthcare of self-tracking, and the other in the Canadian *Globe and Mail* that discussed the Quantified Self movement and people involved in it. However the number of articles rose to 21 in 2010 and 33 in 2011, and by 2012 148 articles had been published that used the term. The year 2013 has witnessed even greater interest: by the end of July 2013, 188 news articles discussing the quantified self had already been published. While these are not particularly high numbers relative to the thousands of topics that were reported in the news outlets included in Factiva, they do demonstrate evidence of growing and continuing interest in the quantified self concept and use of this specific term since 2010. The gathering momentum of the term is also evidenced by a Google Trends analysis I carried out, which demonstrated that "quantified self" was searched for more often during this same time period, beginning in early 2009 and reaching a peak in April 2013 [2].

Both news coverage of the quantified self and interest on the part of Google Search users therefore, have steadily grown since 2009. Terms such as "the quantified patient," "the quantified doctor," "the quantified body," "the quantified mind," "the quantified baby," and even "the quantified pet" are also beginning to appear in popular culture, demonstrating the taking up of the term "quantified self" and its application to more specific topics. It is also evident from news coverage that the tenor of news reporting on the quantified self has changed over time. The term "quantified self" is now frequently used not only in relation to members of the Quantified Self movement itself, but more generally to refer to the practices of self-tracking or lifelogging, terms used to denote collecting and recording data on one's everyday life practices.

Early news reports focused on the innovative aspects of quantifying the self, and debated whether such close attention to the details of one's life and bodily functions would extend beyond "uber geeks" or those "weirdly narcissistic" few who are interested in "extreme naval gazing," to the general population, as *Forbes* magazine (U.S.A) put it [36]. By 2012, news articles represented the quantified self as growing in popularity and becoming not only an important feature of health promotion but part of everyday life, as a way of maximizing productivity and happiness as well as health. As the British *Sunday Telegraph Magazine* [37] contended: "It began with a small group of digital obsessives recording their every heartbeat. Today the 'quantified self' movement is a gadget-filled fitness craze." By June 2013, *The Guardian* (U.K.) was asserting that "the "Quantified Self" movement (is) all the rage for people tracking their physical activity, food intake, vital signs and even their personal genome through digital services" [39].

While anecdotal accounts of how people are using self-tracking technologies are common on the Quantified Self website and in other blogs and news reports, little detailed academic research has yet been published on how people are engaging in this practice and how common it is. A recently published Pew Research Center study [3] found that the majority of Americans (69 per cent) engage in tracking practices of themselves or others for health reasons. However only one in five use digital technologies to do so. The others prefer to use older technologies such as pen-and-paper or simply to commit details to memory. Most of the academic papers to be published thus far discuss the quantified self in relation to promoting patient engagement and health promotion using self-tracking technologies. With the exception of one sociological analysis [4], these articles present the quantified self in laudatory terms as an integral aspect of new approaches in digital health [5]–[9]. One other article has taken a cultural studies approach to analyzing the use of gamification in relation to quantifying the self [10].

There is much still to be explored in terms of social and cultural analyses of the quantified self concept and its related movement. How do the discourses and practices of quantifying the self represent the self and the body? What assumptions, beliefs and values are drawn upon to portray both the Quantified Self movement's own descriptions and commentaries and in popular culture more generally?

## Body-Machine Metaphor

According to the Wikipedia definition, "The Quantified Self is a movement to incorporate technology into data acquisition on aspects of a person's daily life in terms of inputs (e.g., food consumed, quality of surrounding air), states (e.g., mood, arousal, blood oxygen levels), and performance (mental and physical)" [11]. This definition immediately begins to construct a view of the body/self as a machine-like entity, with "inputs" and "outputs" (glossed as "performance" in the definition) that can readily be measured and quantified. News reports and blogs similarly tend to use this kind of metaphor when discussing the quantified self. Self-tracking devices, for example, are described as providing

"A dashboard for your body" [38], and self-trackers are often described as "body hacking" or as "bio hackers." According to a *Financial Times* [U.K.] report [40], "Your body is the ultimate computer," while *The Guardian* [41] contends that "Your body isn't a temple, it's a data factory emitting digital exhaust."

Self-trackers are also positioned as scientists who are experimenting on their own bodies in their own best interests. References were made regularly in news article to quantified selfers as "body experimenters" or "their own lab rats" or "guinea pigs." Quantifying the self is "the science of the self," as *Metro Beijing*'s headline puts it [42], involving people "turning their bodies into medical labs" [43]. As the American *Newsweek International* [44] describes one self-tracker, he is attempting "to understand the human machine with a dose of science and a whole lot of data crunching."

The metaphor of the body as machine has a long history in western culture [12]. This metaphor changes as the technologies that dominate in historical eras change. At the time of the industrial revolution, for example, the human body was frequently portrayed as an engine, with pistons and pumps. With the advent of computer technologies, the body has often been represented as part of a digital information system, subject to communication errors causing illness and disease [12], [13]. Some writers on the quantified self have extended the metaphor of the body-machine by portraying self-tracking devices as producing knowledge about the self through technological "exosenses" that extend the body's sensory capabilities [9]. Using such technologies, humans are represented as becoming yet one more node in the Internet of Things, exchanging data not only with other humans but also with objects and material environments [8], [14]. The body in this discourse becomes positioned as a "smart machine" interlinked to other "smart machines." Bodily sensations become phenomena that are mediated and augmented through machines, transformed into data and then communicated back to the human user. This vision of the body as augmented via self-tracking devices present a digital cyborg, in which such devices not only become prosthetics of the body but extend the body into a network with other bodies and with objects [14], [15].

## Enticements of Data

Huge volumes of data are now generated on individuals as part of their everyday routines, often in ways of which they are unaware as part of their routine transactions with digital technologies. The move towards collecting data on oneself in an "$n$=1" experiment (or collecting "small data") and valuing the insights these data may bring is part of a general valorization of data in wider society. Much is now made of the potential of big data to support corporate and state interests by collecting fine-grained details about individuals and populations [16], [17].

The discourse of the body as machine and as a scientific object for objective experimentation and measurement is also related to the statistical aspect of the practice of self-tracking. Individuals' ability to produce "numbers" measuring aspects of their lives is integral to the quantified self approach. It is assumed that the production of such hard/objective data is the best way of assessing and representing the value of one's life and that better "self-knowledge" will result, as demonstrated in the Quantified Self website's tagline "self knowledge through numbers."

The advent of digital technologies able to assist in the collection, measurement, computation, and display of these numbers has also been important in promoting the cause of the self-tracking movement. While people have been able to monitor and measure aspects of their bodies and selves using non-digital technologies for centuries, mobile digital devices connected to the internet have facilitated the ever more detailed measurement and monitoring of the body and everyday life in real time, and the analysis, presentation and sharing of these data [4], [9]. When digital technologies are employed, the practice of self-tracking appears even more scientific, because computer devices, platforms, and algorithms are viewed, like the numbers they generate, as neutral, apolitical, unbiased, and more accurate than human perceptions and judgments [16], [17]. For example the Quantified Self movement co-founder Gary Wolf was quoted in a *Washington Post* article [45], as commenting that: "For a certain type of person, data is the most important thing you can trust. Certain people think a feeling of inner certainty is misleading." A self-tracker also interviewed for this article agreed with this sentiment: "I want to understand the changes that are actually happening [in my life], not just my perceptions of them." The author of this news story goes on to assert that: "Computers don't lie. People lie" [45].

From the beginning of discussions of the quantified self concept, therefore, the discourse of trusting data over embodied knowledge, the machine over the human, was evident. Data appeared to offer certainty, while the body's perceptions were represented as untrustworthy, inexact, inaccurately mediated through human experience rather than being objective. In these representations, technology and the data it produces becomes portrayed as offering unique insights into the workings of the human body that individuals' unmediated haptic (physical sensations) cannot [4], [15]. Like other biometric technologies, self-tracking devices are viewed as able to peer inside the body, releasing its secrets (and possibly uncovering its lies).

## Neoliberalism and Self-Responsibility

The often intensely individualistic focus of quantifying the self is worthy of note. When notions of health, wellbeing, and productivity are produced via data

drawn from self-monitoring, the social determinants of these attributes are hidden. Illness, emotional distress, lack of happiness, or lack of "productivity" in the workplace become represented primarily as failures of individual self-control or efficiency, and therefore as requiring greater or more effective efforts, including perhaps increased intensity of self-tracking regimens, to produce a "better self."

The quantified self approach may therefore be viewed as one of many heterogeneous strategies and discourses that position the neoliberal self as a responsible citizen, willing and able to take care of her or his self-interest and welfare. Foucault's writings on the practices and technologies of the self in neoliberalism are pertinent to understanding the quantified self as a particular mode of governing the self [18], [19]. As scholars drawing upon Foucault's work on neoliberalism have contended, this political approach promotes the concept of the citizen who needs no coercion to behave productively and in the interests of the state. Rather, the citizen voluntarily takes up modes of practice that both achieves self-interest and conforms to state objectives. Governmental power is exercised through the regulation, monitoring, and surveillance of citizens' bodies and encouraging citizens to engage in these practices on their own behalf [20], [21].

The concept of the quantified self takes up and interprets a view of the body/self that positions it as amenable to improvement, an object of personal enterprise and work. One aspect of this ideal of the responsible, entrepreneurial self involves the imperative of active risk avoidance and attempts to monitor and manage one's health as part of promoting one's life chances [20], [22], [23]. When self-tracking tools incorporate gamification strategies, such self-management is rendered not only into a responsible activity but also as fun and competitive [10].

Achieving self-knowledge is an important dimension of responsible self-management. The data that are collected as part of self-tracking and the patterns and associations that can be identified in and between these data are vital to this project. Thus for Quantified Self member Alexandra Carmichael, self-tracking her moods and feelings of wellness or illness is "a way of taking an honest look at myself, seeing what needs to be improved, and understanding my patterns" [46]. Understanding patterns in one's life is the starting point for making changes based on these observations, and new digital technologies support this endeavor. Indeed recent forms of neoliberalism are intimately intertwined with digital technologies, particularly in writings on digital health, education, and workplace productivity. These technologies afford the expansion of the networks and spaces in which self-monitoring and self-management can be exercised, as well as offering new ways of gathering detailed data about individuals in realtime. As a news article on the quantified self put it, practices like self-tracking put people "in charge of their health" [47]. This notion of control, of taking charge of one's body, is an important attraction for many of those who self-track. The data derived from self-tracking appear to offer at least some degree of certainty that one's own perceptions cannot and a greater degree of control over the messiness and unpredictability of the fleshly body.

In neoliberal states, the discourses that valorize self-tracking as part of self-management and control over bodily disorder are moving into broader public arenas and becoming part of government policy and corporate endeavours to maximize worker productivity and (in the U.S. context) to reduce expenditure on health insurance coverage. The potential of promoting self-tracking has become even more integral in a political environment in which states are confronting fiscal crises and are seeking to withdraw from expenditure on welfare provision systems [24], [25]. For example, self-tracking strategies as one approach to reducing healthcare expenditure is beginning to receive a high degree of attention in government policy and practice as part of the ideal of the "digitally engaged patient" [26]. Quantifying the self as part of top-down government and corporate enterprises moves away from the focus on "self-knowledge" undertaken for personal reasons (voluntary self-surveillance) that is central to the Quantified Self movement, to a broader use of the concept that raises issues around the involuntary or even coercive monitoring and surveillance of citizens for external purposes [14].

## Community and Prosumption

While some quantified selfers keep their data to themselves and are not interested in engaging in community-based activities, others, particularly those who are members of the Quantified Self movement, may also value engaging in communities. An important dimension of the quantified self approach for many participants is the opportunity to share their data with others or to aggregate their own data with others' data for the same behavior. The regular meetups, conferences, and discussion groups on the Quantified Self website all attest to the desire of quantified selfers to engage in a community of like-minded others, a kind of club for self-trackers. When quantified selfers meet or engage online with each other, the quantified self becomes the quantified community, a place where others share not only one's values and goals but possibly also their data. The rhetoric of the Quantified Self website, for example, often refers to the importance of "getting more meaning from our personal data" [27] by sharing insights and aggregating data with other members.

This drive towards "sharing your numbers" fits into the wider discourse of content creation and sharing that underpins many activities on Web 2.0 social media

platforms. The term "prosumption" has been used to describe the mix of consumption and production that characterizes digital media interactions [28]. Like blog entries, comments on websites and social media platforms, micro-blogs, and status updates, collecting and sharing data on oneself is a form of prosumption. Self-trackers are both the consumers of the devices they use (whether these are wearable computers, websites, or simply pen-and-paper records) and the producers of the data that are collected via these devices. When they blog about their data and what these reveal or participate in quantified self meetings or conferences to share their findings, they are engaging in the kind of participatory democracy that is viewed as central to the Web 2.0 age, in which sharing of data and other forms of content is valorized [29], [30].

Given the ease by which the data collected by self-tracking can be shared with others via social and other digital media, the quantified self as it is configured via digital devices also incorporates performative elements. Sharing data has implications not only for how users view and understand their own bodies but for how other members of the quantified self community view and respond to them. Many blog posts and comments on the Quantified Self website refer to the ways in which quantified selfers seek to display their data, often employing innovative visual displays in their "show-and-tell" presentations. Quantifying the self, in this context, is not merely about monitoring and measuring oneself. It is also centrally about communicating dimensions of the self using visual or other material based on one's data, seeking to help others see and understand the patterns in the data and perhaps make connections to their own data in productive ways.

## Reflexivity and the "Qualified Self"

Not only do self-trackers make choices about what data about themselves are important to collect, they make sense of and use data in highly specific and acculturated ways. They seek to make connections between diverse sets of data: how diet, meditation, or caffeine affect one's concentration, for example, or how one's mood is influenced by exercise, sleep patterns, or geographical location, or the specific interactions of all of these variables. As part of these processes, self-trackers interpret "the numbers" they produce on themselves in certain ways based on how they want the numbers to represent them or underlying assumptions about what they mean. Self-tracking is a practice that presents a version of the self and the body that one most wants to achieve. This is the qualitative or interpretive aspect of self-quantification: the ways in which the numbers are interpreted and given meaning. Here "the quantified self" in effect is "the qualified self" [30].

So too, many participants in the Quantified Self movement engage in reflexive practices concerning why they are collecting their data, what they plan to do with it, how they can improve their methods, how it feels to collect and use data and what the wider implications are for their concepts of selfhood and embodiment [32]. As Wolf puts it in a comment on one of the Quantified Self website's forums: "Our role is not to 'sell' this technology to ourselves, but to use it thoughtfully and share our knowledge, so that we add reflective capacity – that is, some thoughtfulness – to the systems we and others are making" [33].

As noted earlier, in recent news coverage the quantified self has expanded to become a key term to encompass the collection of data about individuals, whether deliberately, involuntarily, reflexively, or automatically. In this sense, we are all quantified selves, or "data doubles" [34]. It has been contended, therefore, that those who identify with and are part of the Quantified Self movement are different from those who are not actively engaging in collecting data on themselves. Quantified self adherents practice self-tracking reflexively and deliberately: those who are monitored by external surveillant technologies are part of a different phenomenon [32].

Members of the Quantified Self movement seek to control their "data selves" in the face of the vast amounts of data that is collected on them, as this is part of the ethos of the movement as it evolves. One of the co-founders of the Quantified Self movement, Kevin Kelly, makes reference to this in a blog post, in which he argues that everyone will begin to self-track because: "Almost everything we do today generates data" and as a result, "today capturing data about ourselves is often trivially easy… Because tracking our data is so easy, more and more folks are doing it." Kelly asserts that because so large a volume of data is created on individuals, learning how to interpret and use these data has become an important life skill and will become "the new normal" [35]. As Kelly's words suggest, one dimension of the quantified self movement is the notion that it can provide a means of establishing control over the vast amounts of data that are produced about oneself. The discourse of control in quantified self discussions, therefore, is not only about controlling one's body and one's self using data, but exerting control over data themselves.

## Dimensions of the Quantified Self Phenomenon

It is evident that the quantified self phenomenon is merely one dimension and expression of broader currents in contemporary societies, including conceptualizing the body as a machine, the primacy of neoliberalism, and self-responsibilization, prosumption practices via digital media, the desire for community, the imperative to control both the unpredictable nature of one's body and the data that are generated about oneself, and the valorizing of digital data. The Quantified Self movement and the quantified self concept are themselves evolving as new forms of data and

devices to measure these data are generated and different ways of thinking about exactly what self-trackers should seek to achieve and how the movement should define itself emerge. These changes require investigation and further analysis, particularly as the concept of quantifying the self is entering larger discussions, policies, and practices; for example, in relation to healthcare, health insurance, and health promotion. The quantified self/Quantified Self phenomenon is no longer only about individuals focusing upon themselves, nor about the small data they collect, but has become part of major commercial enterprises, the digital data economy, and government. In a context in which digital data are becoming increasingly valued for commercial purposes, the political and ethical aspects of how personal data are generated, stored, and interpreted should be identified and critiqued.

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