This One Does Not Go Up To Eleven: The Quantified Self Movement as an Alternative Big Data Practice

Draft currently under review—please contact the authors if you would like to cite

Dawn Nafus

Intel Labs

Jamie Sherman

Intel Labs

Abstract:

In academic and public discourses, big data is primarily about powerful public and private sector institutions managing the actions of populations, and the ways this management becomes internalized in the lives of users. This ethnography of the Quantified Self movement, where participants collect and share extensive data about their own bodies, identifies practices that go beyond simply internalizing pre-determined frameworks. We argue that the movement is best understood as a kind of "soft resistance." Participants rapidly change which data they collect, and why. This practice fragments datasets, and thus creates technical, material resistance to traditional modes of data aggregation. More importantly, it enables participants to partially yet significantly escape the frames created by the biopolitics of the technology industry.

Introduction

In the summer of 2012, we attended a local Quantified Self (or QS) "meetup." Held in the offices of an internet startup company, the evening featured speakers sharing data visualizations and people talking about their "experiments" with data. One speaker, a young woman we call Angela, told the story of how she had been working in a job she thought she loved. Around the same time, she downloaded an "app" that "pinged" her several times a day, asking her to rate her mood. After a while, she discovered that her "mood score" when she was at work was not particularly good, and on the basis of this evidence, she realized that she was not as happy as she had thought, and eventually quit the job.

Another speaker, Charlie, had been using a device that tracked the cardinal direction he was facing at any given moment. He showed us a densely plotted block of pixels that looked like a fragmented hard drive. Colored pixels indicating the direction he had been facing every few seconds over the past three years. Red for south, blue for west, etc., were composed into a stream of dots that bore no resemblance to a standard time series plot. Having achieved this display, Charlie and the audience together gazed at it silently for a few moments until somebody asked what the long string of yellow pixels in the upper left was. Charlie looked back at the projected image for a moment and then, with a kind of elation, told us that must have been the time he drove up to see his parents, several hours North. A palpable "Ohhhh" spread over the audience as we stared with renewed interest in the image, searching for other treasures, strings of similar pixels representing, say, a trip to the shore, or a repetitive pattern revealing his daily commute. Later, Charlie told us that he felt this kind of tracking showed him what his perspective was at a given time his life.

It seems easy to dismiss, or outright scoff at an app that could reveal one wasn't as happy as one thought, or at the notion that cardinal directions might capture one's perspective in life in the most literal way. Yet people like Charlie and Angela are important voices in the current academic discussion of "big data" because they represent a profoundly different way of knowing what data is, why it is important, who gets to interpret it, and to what ends. The QS movement attracts both the most hungrily panoptical of the data aggregation businesses, and people who have developed their own notions of analytics that are separate from, and in relation to, dominant practices of firms and institutionalized scientific production. Their practices constitute an important modality of resistance to the dominant modes of living with data. The Quantified Self movement proliferates diversity, and as such offers the possibility of a much more nuanced understanding of what else large datasets are capable of, and how dominant forms of data practices might be confronted.

Situating Big Data

Academic and public discourses alike have been rife with discussions of the ways we are generating data in unprecedented amounts. Like the fictional guitarist Nigel in the 1980's film *Spinal Tap,* who made all of his amps go up to eleven in the belief that eleven made it louder, industry enthusiasm for big data privileges surface size over substance(Crawford and Boyd, 2011) or otherwise collapses the distinction between the two (Manovich, 2012). While Manovich sees the collapse of surface and substance as itself a significant turn, in other ways big data is no newer than eleven is louder. Since at least the 17th century, technologies of measurement have been shaped into tools to produce legitimacy and authority. Poovey tells us that in the context of the Enlightenment, it was a fledgling business class who first effectively mobilized the gravitas of scientific rationality to legitimize commerce by creating distance between the measured and the measurer (what she calls "modern facts") (Poovey, 1998). The history of statistics shows how merchants' early accounting techniques turned into vast and elaborate tools of state control. Tools such as the census were used to discern people who "count" from those who do not matter at all (Scott 1998). Dourish and Mainwaring (2012) have also noted this history, drawing the connection between current big data ideologies exemplified in Google's ambition to catalogue, systematize, quantify and "make useful" the world's knowledge, and nineteenth century colonial practices that similarly sought to centralize the collection and distribution of knowledge, goods,

and power. This situates big data as primarily about powerful public and private sector institutions managing the actions of populations, and fits it squarely into the longer term history of what statistics have been designed to do.

Big data is not always about big institutions, but also about subjectivities. Foucault (1997) shows us how entangled the practices of measuring populations are with the practices of measuring and disciplining bodies. Indeed, the practices of big data are most visible and dynamic in online advertising and other forms of surveillance encountered at the individual level. Foucauldian critiques of big data are beginning to emerge. Cheney-Lippold, for example, shows how electronically generated data, designed for the management of populations, becomes internalized in the management of the self (Cheney-Lippold, 2011). Working outside the Foucaldian tradition, Mackenzie (forthcoming) shows how technologies of big data such as machine learning become entwined with notions of the self for the people who create them.

Gillespie (2010), Manovich (2012), Pariser (2011) and Crawford and Boyd (2011) all rightly complain that analyses of the way that the algorithms shape society are frustrated by the inability to access those algorithms. QSers[1] are also having conversations about how to scrutinize data in conditions where ordinary people so rarely have full access to it. They are developing ways of working around a system where data is largely designed to benefit advertisers first, and device users second. While big data may be big, these workarounds demonstrate it is also never total. The claim that data is always partial is, of course, a banal scholarly point. But to see how, in practice, limits are set on big data's rapacious ambition requires that we understand with some ethnographic specificity the alternatives and responses that are emerging. Below we offer a short ethnography of Quantified Self to show what some people do with data that goes beyond simply internalizing pre-determined frameworks. We conclude with some thoughts about what it might mean to step outside the big data discourse.

The Quantified Self Movement: A Brief History

The Quantified Self (QS) movement was founded in 2007 by Gary Wolf and Kevin Kelly of *Wired* Magazine. Wolf and Kelly felt that the explosion of personal tracking technologies, both software and hardware, opened up new questions about what these things meant for individuals. In a 2010 TED talk, Wolf describes the expansion of data production and suggests that while we generally think of this data as a "window" onto peoples' activities, the QS movement was founded to ask what it means to think of data "as a mirror" and what kinds of reflection, learning, and personal insights might emerge (Wolf 2010).

Since its inception, QS has spread internationally to include over a hundred groups in thirty countries with approximately 15,000 participants. Local groups are organized through meetup.com; anyone can start a group, with or without official ties to the central leadership. Over half the participants at gatherings are generally new to the movement, and local groups vary in frequency and size of meetings, from half a dozen or so to several hundred. Unsurprisingly, the largest and best established groups are

[1] Quantified Self participants call themselves "QSers" or self-trackers interchangeably.

centered in large cities with strong technology industries (San Francisco, New York, Toronto etc.). Despite the loose organizational structure, QS meetups are relatively coherent across sites. In part this may be the result of new groups being started by people who have already attended a meetup in another city or the 500-person international conferences, and in part through the extensive resources, discussions, and videos on the organization's website.

The Practice of Self-Tracking

Since 2011, we have been conducting ethnography within the movement. This includes keeping anthropological field journals of attendance at monthly Quantified Self meetings on the US West Coast and at two international conferences. We also joined in a smaller day-long workshop of QS leaders, and conducted individual semi-structured interviews with sixteen Quantified Self members in the US and Europe. In addition, we included online material from quantifiedself.com as part of our base of ethnographic observation. As anthropologists, a key component of ethnography is not merely observation, but participant observation. Actual participation contributes embodied, experiential data that offers a richer ground from which to query how participants make meaning. We explored for ourselves what it takes to find and use the right self-tracking tools, helped co-ordinate and attended "data hack nights," and took part in a firm's technical work to design algorithms for QS communities.

This mixing of technical, commercial, community and personal work indeed is par for the course within the Quantified Self movement. Our own mixed activities meant that we had something in common with other community members, and this facilitated our inclusion. Most members are simultaneous hobbyists and commercial actors. They might have a personal project to collect data in order to improve, say, sleep or mood ("experiments" in QS lingo), and also be a purveyor or builder of tools to do just that. They often have some kind of technical or medical educational background, or make Quantified Self tools in the context of academic computer science departments.

Within QS, the perils of mixed motives are acknowledged and actively managed. Participants recognize their fellow QSers as a potential market, but also generally believe in the merits of both their personal experiments and products. This puts the QS movement in line with the broader phenomenon of mixing labor with notions of creative worth and pleasure within the technology industry (Neff 2012, Scholz 2012). QS manages this mixing in specific ways. QS meetups cohere around short talks about individual, personal experiments in self-quantification. Presenters are asked to talk about "what I did, how I did it, and what I learned." They cannot give straightforward product pitches about the general benefits of this or that tool, but may speak about their products as a personal reflection on their actual experiences with it. This forces not just hobbyists but also industry actors to take an entirely different perspective on data. In QS talks, data is not merely the thing that an amorphous crowd inadvertently gives to a company for free. In QS talks, the "crowd" from which data is commonly sourced is an actual person, in the flesh. For a brief moment, that very same person who might make money from other people's digital traces is asked to confront his or her own data, not as a resource to be abstracted by distant machines and turned into target marketing, but as a meaningful and useful reflection of himself. QS is one of the few places where the question of why data matters is asked in pressing ways that go beyond advertising, and beyond controlling the behaviors of others.

Just what does a personal relationship to QS data look like? Michael, a longtime QSer, cycles through things he tracks -- time use, moods, exercise, sleep patterns, work habits, food, weight, etc.-- with the aid of an expansive repertoire of technologies, both software and hardware. He is particularly concerned with his morning routine: "If I don't do it, I'm off for the rest of the day." It starts with weighing himself, then some pushups, followed by a meditation, and then a writing exercise using a program called "750 Words," in which he writes the first 750 words that come to mind. It acts as a meditative exercise that comes with an analytical bonus: algorithms scan the contents for mood, mindset and current preoccupations.

It would be easy to see Michael's ritual as a kind of rigidity, or a desperation for control, but his approach is much more subtle. He tracks when he needs to cultivate a particular habit, or when he is trying to understand what is happening with his body. He is able to have this extensive morning routine in part because he goes to bed much earlier than most people. This is a consequence of his sleep tracking. He used a Zeo, a sensor worn on the head which tells you in the morning about your sleep cycles, how often you woke up, etc.. Sleep was not a problem for Michael, but it also was not obvious whether it could or should be any different. This ability to see the unseen inspired his new intention of going to bed at 9 pm. That intention, however, needed to be supported in other ways. That might involve tracking when and how much exercise occurs to identify whether late night exercise keeps him up, or helps him go to sleep. On and on it goes.

Tellingly, the one thing he does not keep track of is what he is tracking. Giving up on tracking something is not a failure for him. Often it means the new pattern has now stuck, and he does not need data to see it anymore. The data has moved inside him in a way, transduced (Mackenzie 2002) into a sensation of having slept well, or into a temporal habit like waking up early. If it has not stuck, he might try again, or try a different kind of data. He looks at data in all its minutiae in order to focus the mind on the patterns that are happening. He describes his tracking practice as a way of living purposefully ("so I don't go on autopilot") and designs his physical environment accordingly. He uses a Buddhist framework of mindfulness and awareness to describe the role that data plays in his life. For him, data is a technology of noticing, not that different from the Buddhist meditation practices he draws on, which are not just about calming the mind but taking note of what is going on inside it and the body.

The 2012 Global Quantified Self Conference was full of these sorts of discourses of mindfulness and awareness as a description of what made self-tracking different from other technical practices. Other QSers we spoke with told us of the crucial importance of manually entering data, rather than focusing on technologies that can automatically collect it: "This glucose monitor will automatically upload my glucose levels, but I had to go back to doing it manually. When it's all automatic, you aren't really aware of what it is saying." The awareness of what is happening through and with data in the moment is as important a mirror as the post-hoc assessment. In-situ awareness surfaces threads of other associations—what was eaten, the environment, the associated social dynamics, etc.. This gives a fuller experience of what data changes might feel like, like rising glucose levels. One learns how to feel one's body through the data, which says "pay attention now." That can either lead to inspiration for tracking something that might be causing the phenomenon, or the decision to stop tracking it at all. Bosel (2012) recounts an incident from that same conference where a woman had been tracking closely her

ovulation, which had sensitized her to the physical signs of ovulation. This woman had difficulty getting clinics to acknowledge her practice, yet every time there was a disagreement between her and the clinic about whether she was ovulating, it was her self-knowledge, not the clinic's urine tests, that corresponded with the results of the more sensitive tests. In these ways, most self-trackers in no way cede authority to the supposed objectivity of devices, or the quantitative nature of sensor data. Instead, they traverse between what is inside and outside the body. They put things out in the world (software, reminders, routines, and sensors) in order to reflect on, and reorder, what is inside the body (the sensation of energy, mood, or productivity.)

In Greenhalgh's (2012) account of American constructs of fatness, scales are cruel technologies of scolding and shaming people. They are used as weapons to deem people "unhealthy" regardless of personal physiology or highly contested medical knowledge on the topic. She shows how, in a deeply medicalized culture, the shift from fatness as an aesthetic problem to fatness as a health problem *deepens* feeling of unworthiness. To our surprise, most QSers do not grip too tightly to normative understandings of what is and isn't "healthy." Many digital technologies for health do, however. They use normative tropes like points when people act in "healthy" ways. Michael largely avoids these, or repurposes them when they are designed in this way. He prefers tracking tools where he can set his own direction, which of course is never his own alone. He takes ideas and frameworks from extensive reading of psychology, technology theorists, political thinkers and life coaches. He draws a very clear distinction between what might be "good for you" as a general principle, and what works for him. There may or may not be a deep attachment to a particular framework for some time. In the words of another QSer, "sometimes people grab on to the frame so hard they break it," meaning that a strong attachment also elicits a discovery of where the frame falls short in practice. If scales are sometimes used in QS to internalize feelings of unworthiness, they are not used this way for very long. QS community talk facilitates and supports people in moving on to the next thing after the frame breaks.

In QS we find *both* extensive discussion of received wisdom, *and* deeply idiosyncratic practices that reflect highly particular notions of well-being. At QS meetings, unusual behavior or appearance is accepted and flourishes. We have seen people standing on one leg while listening to talks, wearing adult pajamas, and adhering to diets not found in any book. Invariably, when one plucks up the courage to ask why, the explanation ends up appearing as if these things are the most sensible thing in the world to do. We take this to be not just sign of QS's alterity, but also the result of a particular, shared practice of interacting with data. QS not only approaches discourses of healthiness with skepticism, but relies on practices of listening to the body, reading data carefully, and devising responses to both signs from the body and signs from the data. If this ends in standing on one leg while listening to a talk, so be it.

Soft Resistance, Lateral Moves

Is one man's collection of data across a dizzying, yet nonetheless finite number of devices and parameters really "big data"? Certainly some trackers individually approach "bigness" as their data exceeds the capacity of tools such as Excel. For most, though, the individual data is well below that threshold. Nonetheless, QS data is "big" in a number of ways. First, in the aggregate, QSers generate data that makes large institutional data collectors salivate. At the 2012 conference, many participants

were in fact dreaming of what could be done with "all this data" if only it could be harvested. Such visions stoked fantasies of the disciplined consumer of health management products, who could also be mined for scientific discoveries and marketing opportunities via crowdsourcing. To harbor these visions requires one to at least temporarily reassume the role of businessperson or medical researcher. With most adopting hybrid roles, this mode of talk was not neatly separated from that of dedicated hobbyists. Second, while the amount of data collected by individual users is limited, an "n=1," the kinds of data collected reflect the same explosion of measurement that is at the root of big data. The Quantified Self movement was sparked by, enabled by, and is explicitly a response to the proliferating modes of data collection and the expansion of sensors beyond laboratories into relatively affordable, easily obtained consumer devices. In this sense, QS practices are entirely inseparable from big data.

QS welcomes big data actors, but its insistence on the centrality of the "n=1" rather than the aggregate or normative means it also puts space between the movement and those actors. Algorithms that generate Michael's sleep report may have the wrong construct of "good" sleep for him, but data that the sensor records might nevertheless be useful to him. There may not be a market for Angela's individual data, or the general category of "mood as an indicator of job satisfaction" as Angela constructs it. There is clearly no such market for Charlie's "perspective" as a function of cardinal directions. Any attempt to aggregate it into something "larger" effectively makes it something else. In these ways, QS is less a "crowd" to be sourced, and more a multitude of analysts, each with an analytics of n=1.

The insistence on the idiosyncrasy of individual bodies and psyches, and in-situ reflection rather than post-hoc definition, constitutes an important alternative notion of "analytics." In industry parlance, analytics is the job that algorithms do. They parse large datasets, identify patterns, and infer meaning. Choices about what is worth measuring are embedded in algorithms. Algorithm designers define the range and content of categories, such as gender, activity level, and the like, which can then be used to classify people on the basis of online behavior, and deliver advertising or content accordingly. To the extent algorithms learn, they change what patterns constitute "manliness" or whether the person measured is classed as a "man," but they do not change the fact that they are looking to distinguish men from women. Algorithms' malleability make for what Cheney-Lippold (2011) has called "soft biopolitics," one responsive to changes in how one might construct and perform such things as manhood. Still, they are no less pervasive, constraining and manipulative in the way they shape the domain of possibilities available to that person by limiting what content or advertisements they see.

Building on Cheney-Lippold's soft biopolitics, we argue that the Quantified Self movement is best understood as a kind of soft resistance. Both QS practices and algorithms share Cheney-Lippold's sense of softness-- a readiness to evolve what constitutes meaning as it unfolds. However, the algorithms that QSers face often have a much harder edge than the constructs of gender at stake in search engines. The mobile health industry is much less democratic about what constitutes "healthiness," and more focused on how to cajole people into conforming to those standards. Big data enthusiasts come to the Quantified Self world in search of access to data that could indicate "healthiness" as indexed by relatively stable measurements, controlled and vetted by medical practice. But QS practices simply do not cohere in this way. Healthy practice for Charlie is completely different from Michael and Angela, not

just in terms of what they think or believe, but at a data level. The difference cannot be thought of as a standard deviation from a norm; rather, they are not on the same curve. Their differences are embodied in diverging practices that cannot be meaningfully assembled together using the categories in current circulation. In fact, attempts to elicit participation in coordinated studies within QS have rarely succeeded because people have such wildly different ideas about what constitutes an interesting measurement.

By making themselves into people who do not fit the category, QSers appropriate big data's attention to granular patterns, but resist the categories that are built into devices and into the market for data. Participants might use this or that construct of health as a starting point, but the category mutates more quickly for people than for the algorithm—for example, from the presence of full REM cycles into a bedtime routine, into a meditation practice. Those categories might never be directly modeled by the algorithms that have informed them. QS participants use the constant unfolding of meaning to critically question what constitutes relevant information, whether individual datapoints or entire categories of knowledge. In these ways, QS resists *through* its softness.

The value placed on evolving one's tracking practices frustrates would-be big data collectors. Creating an aggregate coherence from fragments of three week tracking stints is far more difficult to do than from steadily collected longitudinal baselines. Indeed, employees of established medical institutions often complain that QS is "not scientific enough" for this reason. We argue instead that the analytics Michael performs is not an absence of rigor but an appropriation of, and resistance to, the emergent norms of the big data business. On one hand, there is a separation between self and data in Michael's practice that resembles the processes that feed algorithmic analyses. In the inner workings of algorithms and in Michael's self tracking, measuring creates distance through which data gains an aura of objectivity: it becomes "fact." As with the soft biopolitics of algorithms, these facts are used to determine output and outcomes. On the other hand, people like Michael collapse measurer and measured in an analytical hermeneutics not captured in Foucauldian understandings of the disciplined body, where internalized normative standards are determined top down. Here, the self is made subject in the double sense of the word (as both subject of-, and as subject to-), through self-objectification, but this self-objectification lays claim to more far reaching sovereignty than Foucault's model allows. Indeed, Charlie mentioned to us after his talk that "of course, all I'm really doing here is collapsing subject and object" as if that were the most ordinary thing in the world to do. This multivalent approach to data, at once agentive and committed to "modern facts," means that tropes of scientific inquiry are in play enough to continue to intrigue healthcare institutions, but few participants actually care about creating wider legitimacy for their claims about the body. They are making a disciplined body, but one that is idiosyncratically so. When people like Michael pick up and puts down different tracking procedures, they have more agency as sense-maker than the algorithm or the would-be big data collectors. Self-trackers are making a lateral move, working beyond but also alongside received categories.

This mode of dealing with data also fuels a more direct political resistance. As a gathering of influential lead users, QS is a context in which companies must respond to vocal complaints about the ways that closed algorithms produces closed categories. Some in QS argue that companies should give open

access to the data collected by device sensors but not their algorithms per se, to allow alternative interpretations to flourish. QS is also an occasion for users to hold device manufacturers to account by empirically testing their claims. For example, self-trackers ran public experiments showing the "steps taken" as recorded on different devices for the same run.

QS politics is not defiant, but in dialogue with, and reliant on, dominant forms of big data. People like Michael sit in the same room with people hoping that QS data could just go up to eleven (as it were), as if all data could all equally fuse together in a gigantic pot. Sometimes the two modalities are practiced by the same person. QS also does not escape the wider biopolitics of late capitalism that relies on a radical individualism to drive consumption as a mode of expression, and to elide structural inequalities by framing all actions in terms of personal "choice." QSers are enrolled in the constructs of healthiness embodied in the devices that they use, inasmuch as those are the dominant constructs with which participants must wrestle. But wrestle they do. Unlike Gillespie's YouTube users, who are unwittingly shuttled around to this or that content, and are largely prevented from seeing the choices being made for them, QSers do see outside the frame that devices set for them. What the ethnographic material reveals is that people interact with these algorithms not as blind, mindless dupes, but rather as active participants in a dialogue that moves between data as an externalization of self and internal, subjective, qualitative understandings of what the data means.

This short ethnography suggests the need for a much broader theorization of what resistance looks like in the context of big data. In this instance, what was a problem for big data companies—the difficulty of making meaning out of "all this data"—became a solution for those looking to resist being defined and governed exclusively by frameworks set by large or commercial institutions. This solution was a soft one, one that made use of those same dominant forms while making data aggregation across devices and time periods more difficult to conduct. The Quantified Self is but one response to the logics and cultures of big data, but it is one that tells us that data's contingencies, uncertainties and proliferations can be turned into asset where companies and the medical profession do not have the last word. The industry can be made to encounter the limits of its own capacities, even if it ultimately chooses to continue to talk as if its data goes all the way to eleven.

References

Bosel, W. (2012). The Woman Versus the Stick: Mindfulness at Quantified Self 2012. Retrieved from http://thesocietypages.org/cyborgology/2012/09/20/the-woman-vs-the-stick-mindfulness-at-quantified-self-2012/.

Boyd, D., & Crawford, K. (2011). Six provocations for big data. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1926431.

Cheney-Lippold, J. (2011). A new algorithmic Identity : Soft biopolitics and the modulation of control. *Theory, Culture & Society*, 28, 164-181.

Dourish, P. & Mainwaring, S. (2012). "Ubicomp's Colonial Impulse." *Proceedings of UbiComp' 12*, 133-142.

Foucault, M. (1997). The Birth of biopolitics In P. Rabinow (Ed). *Michel Foucault, Ethics: Subjectivity and Truth.* New York: The New Press (pp.73-79).

Gillespie, T. (2010). The politics of 'platforms'. *New Media & Society*, *12*(3), 347-364.

Gillespie, T. (forthcoming). The Relevance of algorithms. In T. Gillespie, P. Boczkowski, and K. Foot (Eds.) *Media Technologies*. Cambridge, MA: MIT Press.

Greenhalgh, S. (2012). Weighty subjects: The biopolitics of the U.S. war on fat. *American Ethnologist*, 39(3), 471-487.

Mackenzie, A. (2002). *Transductions: Bodies and machines at Speed.* London: Continuum.

Mackenzie, A. (Forthcoming). "'Wonderful people': programmers in the regime of anticipation." *Subjectivities*.

Manovich, L. (2011). 'Trending: The Promises and the Challenges of Big Social Data.'. *Debates in the Digital Humanities*. Retrieved from http://www.manovich.net/DOCS/Manovich_trending_paper.pdf.

Neff, G.(2012). *Venture labor: Work and the burden of risk in innovative industries.* Cambridge, MA: MIT Press.

Pariser, E. (2011). *The filter bubble: What the Internet is hiding from you*. New York: Penguin Press.

Poovey, M. (1998) A History of the Modern Fact: Problems of Knowledge in the Sciences of Wealth and Society. Chicago: University of Chicago Press.

Scholz, T. (Ed.). (2012). *Digital Labor: The Internet as Playground and Factory*. New York: Routledge.

Scott, J. 1998 *Seeing like a state: How certain schemes to improve the human condition have failed.* New Haven: Yale University Press.

Wolf, G. (2010). The quantified self. Retrieved from http://www.ted.com/talks/gary_wolf_the_quantified_self.html.