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Data's Intimacy: Machinic Sensibility and the Quantified Self

Sun-ha Hong, Massachusetts Institute of Technology, sunha@mit.edu

Today, machines observe, record, *sense the world* – not just for us, but sometimes instead of us (in our stead), and even indifferently to us humans. And yet, we remain human. Correlationism may not be up to a comprehensive ontology, but the ways in which we encounter, and struggle to make some kind of sense of, machinic sensibility matters. The nature of that encounter is not instrumentality, or even McLuhanian extension, but a full-blown 'relationship' where the terms by which machines 'experience' the world, and communicate with each other, parametrises the conditions for our own experience. This essay will play out one such relationship currently in the making: the boom in self-tracking technologies, and the attendant promise of data's *intimacy*.

This essay proceeds in three sections, all of which draw on a larger research project into self-tracking and contemporary data epistemologies. It thus leverages observations from close reading of self-tracking's publicisation in the mass media between 2007 and 2016; analysis of over fifty self-tracking products, some of it through self-experimentation; and interviews and ethnographic observation, primarily of the 'Quantified Self' connoisseur community. The first section examines the dominant public presentations of self-tracking in early twenty-first century discourse. This discourse embraces a vision of automated and intimate self-surveillance, which is then promised to deliver superior control and objective knowledge over the self. Next, I link these promises to the recent theoretical turns towards the agency of objects and the autonomous sensory capacities of new media to consider the implications of such theories – and the technological shifts they address – for the phenomenology of the new media subject. Finally, I return to self-tracking discourse to consider its own idealisation of such a subject – what I call 'data-sense'. I conclude by calling for a more explicit public and intellectual debate around the relationships we forge with new technologies, and the consequences they have for who – and what – is given which kinds of authority to speak the truth of the 'self'.


Keywords: data; self-tracking; quantified self; phenomenology; sense; measurement; technology; objectivity; epistemology, data, self-tracking, quantified self, phenomenology,

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You sleep. A thin rectangular strip, slipped unobtrusively under the bedsheet, senses your arrival; your movement; your resting heart rate; respiration cycle; and more besides. The smart sensors on the strip collect the data and transmit through WLAN to the cloud for analysis.¹ When you wake, your consciousness is greeted by a numerical sleep score on the smartphone app screen; a simple distillation of the many data points, and their estimated relationship to sleep quality, into a score out of a hundred. To be sure, the actual information collected by such machines remain fairly rudimentary – and, for many users, woefully ignorant of the wider context for meaning. Yet even as the devices remain imperfect, their deployment embeds a certain communicative network into the rhythm of everyday life. Here, the machine delves deep into the body, leveraging the latter's constant, preconscious discharge of material *traces*. In doing so, these devices promise to measure what the human cognition and intuition cannot. Only afterwards, bleary-eyed, does the conscious subject enter the picture.

At one corner of the Herbst Pavilion, on the San Francisco waterfront, two white, blonde women beckon nearby *flâneurs* to their booth.² On offer is a small, triangular device tied to a black strip, vaguely futuristic in its silver-white sheen. Just let it fire electrical pulses into your brain for a few minutes, they say; it can make you feel more active and productive, or if you prefer, calm and de-stressed. As I dial up the intensity on the 'Energy' module, the device fires rapid, stinging bursts into the head, producing a distinct 'heaty' sensation. One of the women explains that just as you might use caffeine as a pick-me-up, this is a more direct and effective method of controlling and optimising your body and mind. My own experience, as far as I can tell, are less clear – a mix of novelty's discomfort and a general feeling of tension. Yet if I doubted that this device was anything more than snake oil for the new century, this proved nothing either way; after all, the device exists precisely to regulate the subject beneath and before consciousness and its struggles. This intervening, nudging, conditioning relation seeks to establish the technology

¹ See Lasse Leppäkorpi, "Beddit Presentation," In *MoneyTalks* (Tampere, 2011).

² The site was the expo segment of the Quantified Self 2015 Conference, which was open to the public and designed to promote new self-tracking solutions to the wider population.

not as instrument, but as part of the subject's pre-reflective *equipment*³ for sensing their own bodies, and indeed, the 'feeling of their own feelings'⁴.

Today, machines observe, record, *sense* the world – not just for us, but sometimes instead of us (in our stead), and even indifferently to us humans.⁵ One contemporary frontier is self-tracking: machines which attach closely to our bodies and homes, monitor us automatically, and are persistently connected to other machines and databases. These machines are helping enact a human-machine communication network wherein self-measurement is not just a discrete activity, but an environmental or background process. These capacities are today being promoted through a technological fantasy I call *data's intimacy*: the idea that machines will know us better than we know ourselves, a kind of 'knowing' that embraces modernity's epistemic virtues of accuracy and objectivity. Yet as such networks reconfigure the production and circulation of 'personal' data, they also redistribute the actors and authority involved in the production of 'self'-knowledge. Who (and what) produces data about the individual? How is it consecrated as truth, as knowledge? Precisely because self-tracking machines stick so close to us, and promise 'insights' that upturn our own ideas about ourselves, they enact a situation where my epistemic relation to 'myself' becomes rerouted and externalised – betraying the old fiction of im-mediacy embedded in the word 'myself'.

By the early 2010s, self-tracking was part big business, part big dreams. Market estimates pegged the sale of 'wearables' – from fitness bands to smartwatches – at 15 billion USD in 2015⁶; the third quarter alone had seen over twenty million units shipped worldwide⁷. By then, a number of high-profile, relatively simple self-trackers had achieved millions of sales and a general public awareness. Fitbit, a wristband primarily based on its accelerometer sensor for movement detection, began to normalise a more data-

³ See Maurice Merleau-Ponty, *Phenomenology of Perception* (London: Routledge, 2012), 186.

⁴ Paraphrasing from Brian Massumi, *Parables for the Virtual - Movement, Affect, Sensation* (Durham: Duke University Press, 2002), 13.

⁵ This was, of course, presaged by earlier technical revolutions; see Friedrich A. Kittler, *Gramophone, Film, Typewriter* (Stanford: Stanford University Press, 1986).

⁶ "Wearables Market to Be Worth \$25 Billion by 2019," *CCS Insight* (September 1, 2015).

⁷ "Worldwide Wearables Market Soars in the Third Quarter as Chinese Vendors Challenge the Market Leaders, According to IDC," *International Data Corporation* (December 3, 2015); also see Deborah Lupton, "Quantifying the Body: Monitoring and Measuring Health in the Age of mHealth Technologies," *Critical Public Health*, vol. 23, no. 4 (2013), 393–403.

driven and persistently surveilled attitude towards exercise. In the mid-2010s, more complex offerings began to hit the market: Thync, the previously described brain energiser, used its own variant of cranial electrotherapy stimulation, joining other gadgets that transmuted the tools of neuroscience research towards popular injections of desirable mental states. The deployment of devices like the Apple Watch, a general purpose gadget equipped with a broad suite of sensors, have also begun to establish the hardware infrastructure necessary for mass uptake.

The emergence of self-tracking was afforded by two sociotechnical developments. The first involved sufficient improvements in sensor technology to allow affordable and miniaturised products – which could, by the late 2000s, rely on cloud computing and wireless networks to establish communicative infrastructures (at least in North America and Europe⁸). The second is the popularisation of what we call ‘big data’; at once a suite of methodologies, technical solutions and epistemic fantasies promising a new completeness in the old modern project of knowing the world (objectively). If the widely celebrated turn to big data involved projects of indiscriminate surveillance and totalising archives amongst government agencies, and of exhaustive consumer profiling, personalisation and predictive management amongst commercial platforms, then a similar set of technologies were beginning to spark a distributed landscape of connoisseurs, self-experimenters, start-ups, academic researchers and industry heavyweights converging on a certain ‘personal’ application. The boom in self-tracking was knitted into a grand narrative of the ‘Internet of Things’⁹ – itself a reprisal of ubiquitous computing, ambient intelligence, and other theories of smart machine networks dating back to the 1980s and 90s.¹⁰ In this essay, I call self-tracking

⁸ For the purposes of this essay, my research and analysis is limited to these regions, and especially focused on the United States.

⁹ The Internet of Things thus designates a broader set of connected objects; our analysis is limited to self-trackers, insofar as their pursuit of automaticity and intimacy drives their particular epistemic impact.

¹⁰ Both ubiquitous computing and the Internet of Things were coined by individuals at the intersection of commerce and R&D. For the former, it was Mark Weiser at the Xerox PARC laboratory, a major R&D centre with a history of landmark contributions to commercialised computing technologies; his thoughts on ‘invisible’ computing also influenced experiments with wearable computing in the 80s and 90s. See Susan Elizabeth Ryan, *Garments of Paradise: Wearable Discourse in the Digital Age* (Cambridge: MIT Press, 2014). For the latter, Kevin Ashton had been referred by his employer, the consumer goods giant Procter & Gamble, to the MIT Media Lab to work on RFIDs. Beyond the specific terms, visions of smart networks came hand in hand with work on what would become the world wide web during the 1980s – including the famous Coke machine in the Carnegie-Mellon computer science department building, which was coded to monitor its own stock in 1982 (See: “The ‘Only’ Coke Machine on the Internet,” *Carnegie Mellon University*.) and was followed up by the Internet-connected toaster in 1990. Fictional and

the hardware and software solutions that employ machinic *sensors* to monitor individual subjects' everyday lives, from physiological signals to social habits.

To be sure, self-tracking as a whole does not limit itself to a silent and rote 'collection'. As we have seen with the sleep tracker Beddit, and the headband Thync, they aspire to analyse, to recommend, to nudge. Self-tracking's pretension to an autonomous and proactive object life requires an understanding of how these technologies are transforming the *epistemic* relationship between 'big' data, 'smart' machines and human subjects – a relationship which, as I will show, comes in the form of a particular human-machine communication network. This essay asks of self-tracking: what kind of knowledge becomes privileged as objective?¹¹ Who, or what, is granted what kinds of veridical authority over the self? The object of analysis is not the success and failure of this or that technology, but the ongoing history of what Foucault in his last works called *alethurgy*. "Etymologically, *alethurgy* would be the production of truth, the act by which truth is manifested"; not 'what truth?', but which actors and forms accrue the status of producing truth.¹² Here, the question is how society organises the self's ability to speak its truth, to make itself intelligible. That is, the conditions under which individuals are encouraged to know themselves, and the technological design that configures their ability to datafy themselves, structure the ways in which we make ourselves intelligible to ourselves in the first place.¹³

This essay proceeds in three sections, all of which draw on a larger research project into self-tracking and contemporary data epistemologies. It

speculative visions of smart homes and experimental efforts at wearable machines themselves have a history reaching back deep into the 20th century.

¹¹ In other words, self-tracking follows a long modern tradition wherein the regulatory ideal of 'objectivity' endows new technological inventions with veridical authority – even as the latter actualise and reconfigure the kinds of virtues that the former represents. See: Lorraine J Daston LJ and Peter Galison, *Objectivity* (New York, Zone Books, 2007).

¹² Michel Foucault, *The Courage of Truth: Lectures at the Collège de France, 1983-1984* (Basingstoke: Palgrave Macmillan, 2011), 3.

¹³ This is what Foucault calls a regime of truth, "that which constrains individuals to these truth acts, that which defines, determines the form of these acts and establishes their conditions of effectuation and specific effects" (Michel Foucault, *On the Government of the Living: Lectures at the Collège de France, 1979-1980* (2014), 93). It is about the power relations and definitions of 'truth' that subjects sign up onto in order to claim 'their' truth (Jesus R. Velasco, "Freeing Oneself from Power," *13/13: Michel Foucault's College de France Lectures* (February 9, 2016)); in other words, "every regime of truth requires the individuals who are implicated in it to engage in a specific *self-constitution*" (Daniele Lorenzini, "Daniele Lorenzini on On the Government of the Living," *13/13: Michel Foucault's College de France Lectures*, (February 7, 2016)).

leverages close reading of self-tracking's publicisation in the mass media¹⁴ between 2007 and 2016; analysis of over fifty self-tracking products; and interviews and ethnographic observation, primarily of the 'Quantified Self'¹⁵ connoisseur community. I observed, conversed, and sometimes formally interviewed Quantified Selfers at their annual conference and local 'meetup' settings across New York, Philadelphia and San Francisco. The focus is on the United States, where self-tracking has lately begun to expand beyond Silicon Valley and tech enthusiasts and into more general media outlets and consumer markets.

The first section examines the dominant public presentations of self-tracking in early twenty-first century discourse. This discourse embraces a vision of automated and intimate self-surveillance, which is then promised to deliver superior control and objective knowledge over the self. Next, I link these promises to the recent theoretical turns towards the agency of objects and the autonomous sensory capacities of new media to consider the implications of such theories – and the technological shifts they address – for the phenomenology of the new media subject. I then return to self-tracking discourse to consider its own idealisation of the tracking subject – what I call 'data-sense'. I conclude by calling for a more explicit public and intellectual debate around the relationships we forge with new technologies, and the consequences they have for who – and what – is given which kinds of authority to speak the truth of the 'self'.

Data's Intimacy

What kind of human-machine communication network is enacted through self-tracking's discursive and material deployment? To have intimacy is to have the other come into *intimus*, the inmost parts of the self. Self-tracking claims a new intimacy between the machine and the body, the machine and the body's truth – which relation seemingly authorises the truth-value of machine-extracted data. This intersection of the personal and the objective was typically expressed through in the following terms: (1) self-tracking would be a truly

¹⁴ 'Mass media outlets' here include a comprehensive analysis of self-tracking coverage in the following US publications: *The Atlantic*, *Fast Company*, *Harvard Business Review*, *Inc.*, *National Review*, *The New York Times*, *The New Yorker*, *The Washington Post*, *Wired*.

¹⁵ QS as a movement was founded by *Wired* editors Gary Wolf and Kevin Kelly in 2007, and since then has grown into a decentralised, international collection of local 'meetups', bi-annual conferences and online presence. QS tends to attract a higher proportion of, in Bourdieusian terms, connoisseurs: savvy, enthusiastic individuals who often experiment and hack their own tracking solutions. QS thus overlaps with, but is distinct from, the wider public dissemination of self-tracking practice. In this paper, I discuss trends that are more or less common across both, and where relevant, specify which kinds of groups I am describing.

personal form of self-knowledge, in part overcoming and in part supplementing the population as a unit of analysis. (2) This would occur through technology that is not isolated into discrete machines, but embedded unobtrusively across users' bodies, in their homes, under their skin; that is, a material and phenomenological *background* for subjects' everyday sensory life. Early twenty-first century self-tracking thus promoted a 'healthy' skepticism of human intuition and experience, and a corresponding faith in machinic senses. And therein lies the tension: between the promise of empowerment and control *for the subject* through self-knowledge on one hand, and the increased divestment of sensory and epistemic labour to the machine-body network on the other.

First, the advent of self-tracking was positioned as an individualising upgrade to the *population* as a unit of analysis and knowledge. The latter concept had developed in the 18th century in an effort to 'know' a human multitude that was threatening to grow beyond traditional means of approximation, especially lived intuition.¹⁶ The data it provided for the 'end user' allowed the individual to compare him/herself to their proper category, or even to approximate one's individual value when it could not be directly measured. In my fieldwork, many QSers [Quantified Selfers] framed their own motivation to self-track as arising from frustrations with this populational, averaging calculus.¹⁷ If people seem to respond to caffeine or cardio exercises in different ways, how can I figure out what 'works' for me? The idea was that self-tracking could answer, in ways that traditional, limited-sample populations could not (or could only roughly predict), how *I* personally would fare.¹⁸ QSers argued that whereas older lifehacking techniques like self-help books might insist on a one-size-fits all solution applied to a generalised cohort, QS would help you discover what protein shakes or fish oil is really

¹⁶ E.g. Michel Foucault, *Security, Territory, Population: Lectures at the Collège de France 1977-1978* (New York: Palgrave Macmillan, 2004); Evelyn Ruppert, "Population Objects: Interpassive Subjects," *Sociology* vol. 45, no. 2 (May 10, 2011), 218–33.

¹⁷ Such efforts echoed the backlash against statistical determinism as early as the 1840s – when, perceiving a similar 'love of numbers' across contemporary analyses, contemporaries complained that such knowledge could not answer the question of what will happen to *me* and what *I* must do now to better my chances (Ian Hacking, *The Taming of Chance* (Cambridge: Cambridge University Press, 1990), 145). That said, self-tracking does not sit opposite populational data, and often seeks to work together; the former, it is envisioned, could eventually build up to massive database of the 'Quantified Us' (e.g. Matthew Jordan and Nikki Pfarr, "Forget the Quantified Self. We Need to Build the Quantified Us," *Wired* (April 4, 2014)).

¹⁸ E.g. Laila Zemrani, "Using Self Tracking to Exercise More Efficiently," In *New York Quantified Self Meetup* (New York, 2015).

doing in your specific, individual case.¹⁹ The recurring insistence on a unique data point thus marks the promise of a particularly self-oriented (or, in the eyes of some commentators, ‘narcissistic’²⁰) knowledge. If Alphonse Quetelet had devised the average man [*l’homme moyen*] two centuries ago as an ideal fiction to understand each individual by, self-tracking practices endeavour to produce an individual without the spectre of that average – or, at least, produce an individual who is averaged within him/herself.

This vision of individualisation through machines was most pronounced in health and well-being tracking. Beddit, as I showed earlier, offered an ability to persistently track sleep patterns in the individual’s natural habitat – something that existing clinical devices like polysomnograms could not offer. It could also enact such tracking automatically and through algorithmic quantification, which again marked a departure from intuition or memory-based methods. Devices designed for individual, consumer-level use grew in tandem with so-called ‘mHealth’ or ‘e-Health’ devices that would allow everyday self-tracking to communicate personal data to hospitals and healthcare practitioners. Sano Intelligence’s skin patches monitor the subject’s bloodstream for glucose and potassium levels, and automatically alerts his/her doctor if dangerous levels are reached; skin tattoos (mc10), wearable bandages (BodyGuardian) and biodegradable, ingestible pills (Proteus) similarly began to extend the capacity for comprehensive, individualised data to the health and medicine industries. Here, self-tracking was seen to offer data “more ‘objective’ than the signs offered by the ‘real’, fleshly body and patients’ own accounts”²¹, in ways that recall the advent of microscopic vision and the ensuing challenge towards the credibility of the naked eye.²² The importance of such knowledge was asserted on the basis that you *need* to know to have a ‘good’ – fitter, healthier, more productive, more confident, self-aware, less stressed – life.²³

¹⁹ Melanie Swan, “The Quantified Self: Fundamental Disruption in Big Data Science and Biological Discovery,” *Big Data* vol. 1, no. 2 (June 2013), 92; Gary Wolf, “Tim Ferriss Wants to Hack Your Body,” *Wired* (November 29, 2010).

²⁰ E.g. Sarita Bhatt, “We’re All Narcissists Now, And That’s A Good Thing,” *Fast Company* (September 27, 2013); Monica Hesse, “Bytes of Life,” *The Washington Post* (September 9, 2008); Alicia Morga, “Do You Measure Up?” *Fast Company* (April 5, 2011).

²¹ Lupton, “Quantifying the Body,” 398.

²² E.g. see Adam Max Cohen, *Technology and the Early Modern Self* (New York: Palgrave Macmillan, 2009), 138.

²³ Also see Kate Crawford, Jessa Lingel, and Tero Karppe, “Our Metrics, Ourselves: A Hundred Years of Self-Tracking from the Weight Scale to the Wrist Wearable Device,” *European Journal of Cultural Studies* vol. 18, no. 4–5 (2015), 479–96; Deborah Lupton, “M-Health and Health Promotion: The Digital Cyborg and Surveillance Society,” *Social Theory & Health* vol. 10, no. 3 (2012), 229–44.

This intersection of new self-tracking technologies and the knowledge terrain of wellness / health is itself part of a longer modern history of projects for mapping and managing the human body. During much of the 20th century, Freud's popularity provided a conduit for the application of therapeutic and psychoanalytic knowledge regimes over areas like self-help, workplace management and marriage advice²⁴ – areas where, as in self-tracking today, the introduction of external systems for knowledge production and self-improvement hybridised relatively 'private' domains of human life with external and public systems of knowledge production. As we shall see, self-tracking's visions of transcending the biological limits of self-knowledge, and of aligning machinic sensibility with human cognition, extends older projects for knowing the human – from the Silk Road traffic of imported Eastern meditative practices since the 1960s²⁵ to the cybernetic imagination of the human as machine. These techniques are also united in the pathologies they take as their nemesis: a psychophysical malaise inherent in the modern subject, carrying various labels from stress to fatigue to information overload.²⁶

To return to self-tracking: the new proximity afforded by smart sensing machines attempts to *bypass* the unaware, error-prone, uncooperative, and otherwise recalcitrant subject, and get straight to the (allegedly) objective realm of bodily data.²⁷ This forms a stark contrast to techniques of confession, and of *avowal*, that had often (not always) characterised the search for individuals' truth in the West. Foucault provides the example of François Leuret, and his techniques for psychiatric treatment, from a 1840 treatise. A patient stands under a shower. Leuret insists: there is nothing true in your delusional claims about reality. The patient: I know what I saw and heard. Leuret: You will receive a shower "until you avow that everything you have said is pure madness."²⁸ The shower is ice-cold. The patient: I avow, but only out of compulsion. Another shower. I avow... all this, Foucault says, has little to do with *persuading* the patient, and everything to do with leveraging the

²⁴ Eva Illouz, *Cold Intimacies: The Making of Emotional Capitalism* (Malden: Polity Press, 2007); Eva Illouz, *Saving the Modern Soul: Therapy, Emotions, and the Culture of Self-Help* (Berkeley: University of California Press, 2008).

²⁵ Anne Harrington, *The Cure Within: A History of Mind-Body Medicine* (New York: W.W. Norton & Co., 2008).

²⁶ Academic writing has eagerly participated in at least this aspect of the puzzle. For instance, the arrival of 'new' media technologies and postmodern / late capitalist narratives has prompted a series of psychological labels stretched over a global humanity, from the 'fatigue society' to the sleepless inertia of a '24/7' world. See: Byung-Chul Han, *Müdigkeitsgesellschaft* (Berlin: Matthes & Seitz, 2010); Jonathan Crary, *24/7: Late Capitalism and the Ends of Sleep* (London: Verso, 2013).

²⁷ Also see: David Lyon, "Surveillance, Power and Everyday Life," in *Oxford Handbook of Information and Communication Technologies*, ed. Chrisanthi Avgerou et al. (Oxford: Oxford University Press, 2007).

²⁸ Michel Foucault, *Wrong-Doing, Truth-Telling: The Function of Avowal in Justice* (Chicago: University of Chicago Press, 2014), 11-2.

subject's veridical authority towards the official proclamation of his/her madness. This is the game self-tracking seeks to transform. In its ideal form, there is no need for the subject to sign on the dotted line, at gunpoint or otherwise; the 'truth' is always already communicated from body to machine, before the subject has said a word.

Crucially, new technical capacities for persistent, automatic, proximity measurement also opened up kinds of data that were previously not easily extractible at populational levels, from subjective ratings of mood to the exact size of each person's social network.²⁹ Where tracking technologies colonised new aspects of the human self for datafication, its proponents consistently argued for the superiority of machinic accuracy and objectivity over the educated 'guessing' of human subjects. Thus a vision of individualisation and 'patient power' intersected with a certain prioritisation of machinic senses over the human.³⁰ This is not far from the *opus moderandi* of big data analysis in corporate and research spheres, and even the large-scale 'collect 'em all' approach of Snowden-era state surveillance. If the key process in state and corporate surveillance is to extract highly individualised information for each and every person, self-tracking also seeks unprecedented frequency, immediacy and accuracy through its 'personalised' observation. In Quetelet's time, statistical norms and populational data evolved quickly from a method of approximation to a production line for ideal norms and 'average men'.³¹ Today, self-surveillance contributes to a wider trend that has been called an 'unofficial resurgence' of logical positivism:³² a renewed confidence in the power of new, 'big data' technologies to deliver truth more objective than ever.

Second, self-tracking technologies increasingly turned towards an environmental and atmospheric form of everyday presence: a *background*. They were designed to become 'part of the furniture', rather than standing out as discrete and actively used tools, spatially bound archives, or specific and purposeful queries. By the early 2010s, devices were beginning to accompany users to the bed and the bathroom, in their walks up the stairs as well as runs in the park, in their phones and even, as we have seen, under their skin. Previously, measurement and its archival had typically been confined to specific and comparatively stable classes of objects and situations; the bathroom weight scale, the diary or journal, the doctor's office, the desktop computer. The shift towards ubiquitous sensors and prosthetic devices entails a qualitatively distinct kind of surveillance. Consider the ominously named

²⁹ E.g. Whitney Mallett, "Apps Are Getting All Emotional," *Fast Company* (December 10, 2014).

³⁰ E.g. Melanie Swan, "Sensor Mania! The Internet of Things, Wearable Computing, Objective Metrics, and the Quantified Self 2.0," *Journal of Sensor and Actuator Networks* vol. 1, no. 3 (2012), 217–53.

³¹ See Hacking, *The Taming of Chance*.

³² Jaron Lanier, *You Are Not A Gadget: A Manifesto* (New York: Alfred A. Knopf, 2010), 155.

home product 'Mother' – whose branding is, indeed, a conscious play on the trope of Big Brother. This product offers small, nondescript 'motion cookies' that can be attached to domestic objects like toothbrushes and pill-boxes. The cookies' motion, temperature and proximity sensors allow continuous monitoring of whether the keys have been picked up, or the front door has been opened. While each given implementation is rather nonspectacular, such tools point towards a domestic environment where tracking passes from a *specific action* to a general fact. As one industry insider put it, a 'planet with a nervous system'.³³ Self-tracking is thus implementing, in concrete terms, another small part of a fantasy that has existed since at least the 1980s: of computer technologies made 'invisible', melted fully into the human being-in-the-world.

The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it... Hundreds of computers in a room could seem intimidating at first, just as hundreds of volts coursing through wires in the walls did at one time. But like the wires in the walls, these hundreds of computers will come to be invisible to common awareness.³⁴

Such environments extend the well-documented, Internet-age tendency towards a phenomenology of distraction and abundance.³⁵ By building a complexity of automated observations and communications across various sensors, the human user is positioned not as a centralised controller over each process but a responsive actor that is alerted, interrupted and otherwise 'lead on' by this 'smart' environment. No doubt each user, and each use situation, then develops its own conventions; some users will frequently exercise their sovereign right to override the analysis and recommendations, others will be

³³ E.g. Daniela Hernandez, "Big Data Is Transforming Healthcare," *Wired* (October 16, 2012); also see Jill Walker Rettberg, *Seeing Ourselves Through Technology: How We Use Selfies, Blogs and Wearable Devices To See and Shape Ourselves* (Basingstoke: Palgrave Macmillan, 2014).

³⁴ So spoke Mark Weiser, of the famous Xerox PARC research centre, as early as 1991. Mark Weiser, "The Computer for the 21st Century," *Scientific American* vol.265 (September 1991). Also see Erich Hörl, "The Technological Condition," *Parrhesia* vol. 22 (2015), 8-9.

³⁵ See Nigel Thrift, "Lifeworld Inc—and What to Do about It," *Environment and Planning D: Society and Space* vol. 29, no. 1 (2011), 5–26; David M. Berry, *The Philosophy of Software: Code and Mediation in the Digital Age* (Basingstoke: Palgrave Macmillan, 2011); Judy Wajcman and Emily Rose. "Constant Connectivity: Rethinking Interruptions at Work," *Organization Studies* vol. 32, no. 7 (2011), 941–61.

habituated into their guidance, and yet others will simply ignore them. Yet in all cases, the design behind these implementations carries a set of epistemic affordances that seek to nudge users into the desired patterns of use. Ariel Garten, founder of interaXon (which produces Muse, a brain-tracking meditation monitor and aid), put it to me terms of a “practice of noticing”; a machinic habituation of human attention that would cultivate the desired (in this case, productively focused) consciousness to begin with.³⁶ In my fieldwork with QSers, many described their longer-term experience with tracking in similar terms; an experience where data, and its influence upon one’s habits, decisions and interpretations, becomes backgrounded and ‘forgotten’. Even as self-knowledge becomes more comprehensive and ubiquitous than ever, it also recedes into the background and out of subjects’ conscious engagement. To engage a machinic reading of ourselves is not so much to turn on and tune in, but to awake and become aware to an always already ongoing swarm of active objects – harvesting us and communicating with our bodies (and each other) in cables below our feet, radio wavelengths beyond our senses, frequencies beyond our temporal range.

Underlying all this is an essential tension. On one hand, there is the promise of a new level of empowerment and control for the tracking subject, extending the venerable modern connection between knowledge, power, and the rational subject. For self-tracking’s part, influential QS figures like Gary Wolf positioned early practitioners as analogous to the countercultural influence upon computing between the 1960s and 1990s.³⁷ Just as those ‘hippies’ had taken a military-industrial technology and helped produce a culture of personal computers and ‘digital utopianism’, self-trackers would act as vanguards for turning the tide of ‘big’ data towards empowerment and democratisation: personal computing ‘all the way in’ to the self.³⁸ In 2011, at the very first Quantified Self conference, Gary Wolf introduced the movement in these very terms:

We saw a parallel to the way computers, originally developed to serve military and corporate requirements, became a tool of

³⁶ Ariel Garten in discussion with author, June 2015.

³⁷ Fred Turner, *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism* (Chicago: University of Chicago Press, 2006).

³⁸ Sara M. Watson, “Living with Data: Personal Data Uses of the Quantified Self” (University of Oxford, 2013), 11.

communication. Could something similar happen with personal data? We hoped so.³⁹

In this vein, he argued that self-tracking could become a way to take ‘back’ our data that states and corporations have been using against us.

...why shouldn't you have access to the traces of your own behavior that you leave behind and that others collect? [...] ‘It’s more of a cultural shift,’ she says. ‘It’s about creating a culture where we own this data. This data is ours.’⁴⁰

Such sentiments were shared across a broad coalition of actors, from QSers to journalists and lay users. One entrepreneur, whose company provides microbiome analysis services for individuals, depicted a trajectory whereby the individual was formerly left at the ‘periphery’ of the traditional health process, crowded out by experts: now, “I test things on myself, I know what is happening, I am not the body that the scientific and medical establishment acts upon”.⁴¹ Laurie Frick, an engineer-turned-artist who promises “a glimpse into a future of data about you”⁴², vocalises a rather pragmatic attitude: “I think people are at a point where they are sick of worrying about who is or isn’t tracking their data [...] I say, run toward the data. Take your data back and turn it into something meaningful”⁴³ – in her case, personal data diagrammed into art. It’s *your* data, many self-trackers insisted, so surely you should get as much use out of it as the others do.⁴⁴

Yet there is a certain ironic bargain in play here. For one thing, the personalising rhetoric occludes the fact that self-tracking increasingly occurs through a suite of mass-produced devices, through which its producers can develop large-scale *populational* databases of personal metrics. (In that sense, self-tracking risks becoming not the plucky fightback of ‘small data’ versus the big, but the addition of small data to the big datasets.) Over the 2000s, the ‘Web 2.0’ era had produced a Faustian bargain whereby the individuals’ ability to socially connect to each other was the very means by which their

³⁹ Gary Wolf, “What Is the Quantified Self?” *Quantified Self* (March 3, 2011).

⁴⁰ Rob Walker, “Wasted Data,” *New York Times* (December 3, 2010).

⁴¹ Sam De Brouwer, Linda Avey, Jessica Richman, and Tan Le. “Frontiers of Tracking Health,” In *Quantified Self 2015 Conference* (San Francisco, 2015).

⁴² Laurie Frick, “The Future of Data about You,” *LaurieFrick.com*.

⁴³ Jacoba Urist, “From Paint to Pixels,” *The Atlantic* (May 14, 2015).

⁴⁴ In many ways, such discourse interpellates a particularly entrepreneurial, managerial, soul-oriented subject – in part by presuming a certain ‘middle-class’ degree of flexibility, resources, and literacy.

data became connectible and monetisable for these corporations.⁴⁵ In the same way, self-tracking's ability to 'know' the subject is producing its own grid of legibility for a broader set of actors – from employers interested in optimising the biopower of its human resources, to insurance companies which are already offering discounts in exchange for access to subscribers' Fitbit data.⁴⁶ The project of knowing more about and optimising the self enrolls many different commercial, business and government interests.

Even at the level of individual usage, the very promise of individual empowerment through self-knowledge valorises a machinic environment that surrounds, bypasses, and structures *a priori* the very conditions of the subject's experience of self-knowledge and self-improvement. This yields one common refrain in self-tracking discourse that *you cannot lie to yourself anymore*.

'For a certain type of person,' says Wolf, the Quantified Self founder, 'data is the most important thing you can trust. Certain people think a feeling of inner certainty is misleading.' [...] Computers don't lie. People lie.⁴⁷

We may knowingly tell fibs to ourselves about eating too much and running too little; we may not even notice that the eight-hour work day just included three hours of web-surfing. But the data will not filter out your momentary indiscretions, your corner-cutting, and it certainly will not parlay with your pitiful excuses. Human memory, consciousness, reason, so often is a cursed fog upon clear sight; data, unforgiving and unyielding, will scatter the confusion. Or at least, that's the idea.

To be sure, this 'turn' towards machine-body communicative circuits is less an unprecedented step and more the continuation of a long story in the history of technology. One might argue that self-tracking is simply the latest carrier of an old torch – of externalisation, or in McLuhanian terms, extension of human intentions and capacities. Yet every such externalisation enacts a unique configuration of the rules of the game by which I am made knowable to myself and others. So the question: how should we situate this new human-

⁴⁵ E.g. José van Dijck, *The Culture of Connectivity: A Critical History of Social Media* (Cambridge: Oxford University Press, 2013); Michael Zimmer, "The Externalities of Search 2.0: The Emerging Privacy Threats when the Drive for the Perfect Search Engine meets Web 2.0," *First Monday* vol. 13, no. 3 (2008).

⁴⁶ See: Lucas Mearian, "Insurance company now offers discounts - if you let it track your Fitbit," *Computerworld*, April 17, 2015; Erika Pearson, "Smart objects, quantified selves, and a sideways flow of data," In *ICA 2016* (Fukuoka, Japan, 2016).

⁴⁷ Hesse, "Bytes of Life".

machine network, vis-à-vis the generational history of technology-human becomings? And how is this relationship acting as a site for new norms about the production and legitimation of self-knowledge?

Machinic Sensibility

Sleep Tracking App:	I see you're not violently throwing yourself around your bed, you must be in a deep sleep. Sweet dreams, buddy!
Me:	I'm actually still awake.
Sleep Tracking App:	But you're lying still...
Me:	Because I'm trying to get to sleep.
Sleep Tracking App:	You mean you ARE asleep.
Me:	I really don't.
Sleep Tracking App:	You're going to have to trust me, I do this professionally and I know sleep when I see it, and I'm pretty sure you're asleep right now.
Me:	I couldn't be more awake.
Sleep Tracking App:	This is all a dream... ⁴⁸

This satirical piece featured in the Quantified Self website's 'What We're Reading' section⁴⁹ – a wry nod to the disruptions in the epistemic production lines enacted through self-tracking. When machines cut directly to the body, the thinking subject is left in a somewhat *peripheral* position to his/her 'own' self-knowledge.

In this sense, self-tracking is founded on a certain privileging of *machinic sensibility*. My use of the term draws and deviates from Hansen's translation of Whiteheadian philosophy into the phenomenological transformations enacted by today's 'new' media. For his part, Hansen argues that 'twenty-first century media' [21CM] are defined by their ability to engineer the conditions of human experience. This much is banal: it is a quality constitutive of media in general, insofar as they are the 'elemental' structures we take for granted in order to communicate and in order to make

⁴⁸ "No Title," *Zen.Sen.Life* (August 31, 2015).

⁴⁹ Steven Jonas, "What We Are Reading," *Quantified Self* (October 26, 2015).

the world sensible.⁵⁰ What is allegedly unusual is that such engineering *entirely bypasses, occurs prior to, and in sensory regions inaccessible by*, the human subject.⁵¹ The argument goes that these technical objects observe, collect data on, indeed ‘sense’ the world at a level which human subjects have no access to. In self-tracking’s case, we find that some measurements, like galvanic skin response⁵², are absolutely beyond human access; others, like steps taken, are measured with a frequency and precision practically unavailable to human subjects. The result is formally analogous to the effect of ‘black-boxed’ algorithms in social media platforms and state surveillance systems.⁵³ The many micro-judgments that go into what counts as a step, what counts as ‘good’ sleep, what counts as ‘excitement’ are increasingly placed outside the subject’s reach. Machinic sensibility thus describes technical objects’ own ability to sense the material world, and derive information through this process, in ways that are always entangled with, but ultimately distinct from, human sensibility.⁵⁴ (Indeed, others have described this in terms of ‘inhuman’ extensions, or the ‘nonconscious cognition’ of technical objects.⁵⁵) It is this machinic sensibility that is the central cog in self-tracking as a human-machine communication network.

⁵⁰ John Durham Peters, *The Marvelous Clouds: Toward a Philosophy of Elemental Media* (Chicago: University of Chicago Press, 2015).

⁵¹ Mark B N. Hansen, *Feed-Forward: On the Future of Twenty-First-Century Media* (Chicago: University of Chicago Press, 2015), 37.

⁵² In most cases, human subjects are incapable of sensing, or consciously controlling in any direct fashion, their electrodermal activity.

⁵³ E.g. Louise Amoore, “Data Derivatives: On the Emergence of a Security Risk Calculus for Our Times,” *Theory, Culture & Society* vol. 28, no. 6 (2011), 24–43; Taina Bucher, “Want to Be on the Top? Algorithmic Power and the Threat of Invisibility on Facebook,” *New Media & Society* vol. 14, no. 7 (2012), 1164–1180; Tarleton Gillespie, Robert Seyfert, and Jonathan Roberge, “#Trendingtrending: When Algorithms Become Culture,” In *Algorithmic Cultures: Essays on Meaning, Performance and New Technologies*, 2016; Frank Pasquale, *The Black Box Society: The Secret Algorithms That Control Money and Information* (Cambridge: Harvard University Press, 2015).

⁵⁴ Thus Hansen argues that where technologies like writing could augment human memory by mimicking and supplementing the latter, 21CM provide a “wholly new, properly machinic faculty”. Where writing allowed us to experience things we *did not* in our own lives, 21CM focuses on retrieving data about ‘sensory micro-experiences’ that we *cannot* ever live out consciously. See Hansen, *Feed-Forward*, 53.

⁵⁵ Hence “technology is not human; in a specific sense, it is deeply inhuman. The best, fully functioning technology can be created only in opposition to the traditional image of what is human and living, seldom as [merely] extension or expansion.” Siegfried Zielinski, *Deep Time of the Media: Toward an Archaeology of Hearing and Seeing by Technical Means* (Cambridge: MIT Press, 2006), 6. For a view on ‘nonconscious cognition’, see: Katherine N. Hayles, “The Cognitive Nonconscious: Enlarging the Mind of the Humanities,” *Critical Inquiry*, vol. 42 (2016), 783–808.

Such a mediated relationship extends and qualitatively transforms the epistemic processes found in pre-digital forms of self-tracking. Let us consider a well-known example of a pre-computational technique. In 1726, the young Benjamin Franklin devised for himself a schema of thirteen virtues – ranging from temperance in food and drink, to industry in efficient labour. In his diaries, he constructed simple tables of the virtues and the days, where each night he would mark his observance (or lack thereof) of a given virtue. This, we note, is a discrete and ritualised process presided over by the reflexive subject. Franklin's own interpretive faculty was central to data curation. In such a process, it is the subject's conscious mind, and human memory, which grapples with the day's squabble with a neighbour, or the culinary temptations in the evening fare; and it is the subject who confronts the rigid and unyielding table with the devil in the details.

In contrast, let us turn to an example that is rather singular, and indeed still ahead of the curve of popular uptake, but therefore illustrative. Tahl Milburn is a Quantified Self enthusiast who has designed and installed what he calls a 'Life Automation System' [LIAM] in his own home.⁵⁶ There, USB sticks and other objects glow ambiently with colours – colours which correspond to a single 'LifeScore' derived from personally tailored and weighted variables. The score considers Milburn's net worth; the market performance of his investments; weight; activity; sleep; age; and more. Here, the subject's perception of sensing machines itself becomes atmospheric rather than discrete; meanwhile, the System ceaselessly communicates with Milburn's own body as well as a host of other machines. Here, the self becomes 'known' at a level that the subject cannot actively track of. Alternatively, consider RescueTime: a PC software (primarily, a browser extension) that lives in your computer. It silently fills a record of distraction, procrastination, leisure, and that elusive 'true productivity', in ways that few humans would be able to accurately recall on their own. Do you tend to slack off more often on Wednesdays? Do you typically spend 24% of your desk time on social media? While all kinds of holistic reasons would have entered into such behaviour, it is the beauty and terror of statistical, correlational epistemology that it will produce conclusions purely based on what it measures, and in doing so, suggest that all it does not measure cannot overrule the correlation it has discovered.⁵⁷ In this new breed of self-trackers, more and

⁵⁶ Tahl Milburn, "How My Life Automation System Quantifies My Life," In *Quantified Self 2015 Conference* (San Francisco, 2015).

⁵⁷ An analogous development can be found in the history of the intelligence quotient [IQ]. Steven Gould recounts how Alfred Binet, a student of Charcot, invented his scale for intelligence. Binet explicitly specified that his hodgepodge of tests could not be expected to fully and precisely represent 'intelligence', much less in the form of a single number. Instead, the sheer number of tests were designed to provide an internal consistency and comparability: surely a child who scores higher in 20, 30 tests than another has something going for him; this was seen as sufficient for

more of the knowledge production process (the surveillance process) occurs beyond the subject's experiential access – such that the machines, the categories, the databases, extract relevant data directly from the empirical self.

Yet the division between human and machinic sensibility cannot be an absolute one, and neither can the alleged rise of the machinic over the human be so complete. Historical precedents in techniques of self-knowledge and older forms of human-machine communication put paid any illusion of a pre-technical 'self'. We can, for instance, turn to numerous pre-21st century, pre-electronic technologies that similarly undercut and bypass human sensibility. Kittler's tale of the phonograph was precisely a story of how sound becomes recorded and manipulated as physical waves and noise, rather than any kind of articulation.⁵⁸ Photography may, in the typical senses, archive and circulate what is already visible to the human (e.g. the passport portrait), and sometimes modify it (e.g. Instagram filters), fundamentally remaining at the level of *approximating* human perception. However, as early as the 1870s, Eadweard Muybridge and Étienne-Jules Marey were producing chronophotographs: composite representations of worldly motion that were visualising aspects of movement that no human could, by definition, *perceive*. Indeed, Hansen himself draws on Marey as a key figure in the emergence of what he nevertheless calls twenty-first century media.⁵⁹ At a more conceptual level, technical objects' capacity for inhuman sensibility is already presaged in Heidegger's basic distinction of ready-to-hand [*Zuhandenheit*] and present-at-hand [*Vorhandenheit*]. Such a phenomenology accounts for both the appearance of things to us and their 'withdrawal'.⁶⁰ Machinic sensibility is not new, but each historical rendition of its promises reorganises the social distribution of epistemic authority across machines and humans, texts and bodies.

If self-tracking is hosting the 'swarming' of machinic sensibility into ever more autonomous, ever more environmentally diffused, ever more systematically interconnected forms, this is part of a broader narrative about the renewed importance of object agency, activity and sensibility. Here, we can identify a smorgasbord of approaches, from object-oriented ontology

Binet's original goal, which was to identify children in need of special education. Thus Binet wrote, "It matters very little what the tests are so long as they are numerous." Stephen Jay Gould, *The Mismeasure of Man: The Definitive Refutation to the Argument of The Bell Curve* (New York: W.W. Norton & Co., 1996), 179.

⁵⁸ Kittler, *Gramophone, Film, Typewriter*.

⁵⁹ Hansen, *Feed-Forward*, 53-55.

⁶⁰ The latter being extendable to an ontology of objects completely removed from any communication with humans, the quiet of absolute solitude. See: Graham Harman, *Tool-Being: Heidegger and the Metaphysics of Objects* (Peru, Illinois: Open Court, 2002).

[OOO] to new materialism⁶¹, speculative realism, and more generally of posthumanist subjects or ‘distributed’⁶² subjects; approaches which have fundamental differences, to be sure, but more or less converge on a *tendency* to ‘demote’ the human from a privileged position in the analysis⁶³, to assert a ‘flatter’ ontology between humans and things of all kinds.⁶⁴ Such theories are at once explanations of, and responses to, their own historical context; they are contemporaries of increasingly autonomous technological systems. In many ways, this lockstep development of theoretical explanations and practical phenomena mirrors a previous age of technical innovations. After all, it was the rapid emergence of unprecedentedly complex, interconnected machines in mid- and late-19th century – emblematised by the sociotechnical system of the railroad – that precipitated the modern meaning of the word ‘technology’.⁶⁵ (Still later, the continuing proliferation of technical systems across Western societies would precipitate discourses of technology ‘out of control’.⁶⁶) The lived experience of seismic changes in the human-machine relation thus accompanies shifts in the theoretical landscape. If scientific reason of the 19th century sought to uncover an ‘aperspectival’ objectivity⁶⁷, today we witness moves to look beyond Kantian correlationism, and to make claims about what objects are and what they do beyond the sensory and meaning-making relationality provided by the (human) subject.⁶⁸ In all this, the key is not the arrival of machinic sensibility as an absolutely autonomous and objective system, but the ways in which technical capacities for machines’ sensing modify the conditions of human sensibility. On top of that, it is also a question of how the social *imagination* of machinic sensibility – its intimacy, its accuracy – reframes and reevaluates human cognition, feeling and experience.

⁶¹ E.g. William Connolly, “The ‘New Materialism’ and the Fragility of Things,” *Millennium - Journal of International Studies* vol. 41, no. 3 (2013), 399–412.

⁶² For a general sketch of such theories vis-à-vis new technologies, see Lea Schick and Lone Malmberg, “Bodies, Embodiment and Ubiquitous Computing,” *Digital Creativity* vol. 21, no. 1 (2010), 63–69.

⁶³ E.g. Bruno Latour, *Reassembling the Social: An Introduction to Actor-Network Theory* (Oxford: Oxford University Press, 2005).

⁶⁴ E.g. Jussi Parikka, “Operative Media Archaeology: Wolfgang Ernst’s Materialist Media Diagrammatics,” *Theory, Culture & Society* vol. 28, no. 5 (2011), 52–74.

⁶⁵ See Leo Marx, “The Idea of ‘Technology’ and Postmodern Pessimism,” in *Does Technology Drive History? The Dilemma of Technological Determinism*, ed. Merritt Roe Smith and Leo Marx (Cambridge: MIT Press, 1994); Ron Kline, “Technological Determinism,” in *International Encyclopedia of the Social and Behavioral Sciences* (New York: Elsevier, 2001).

⁶⁶ Langdon Winner, *Autonomous Technology: Technics-out-of-Control as a Theme in Political Thought* (Cambridge: MIT Press, 1977).

⁶⁷ Lorraine Daston, “Objectivity and the Escape from Perspective,” *Social Studies of Science*, vol. 22 (1992).

⁶⁸ Such a ‘post-Kantian’ project is explicitly laid out by Quentin Meillassoux, in the form of a certain revival of the Cartesian thesis. Quentin Meillassoux, *After Finitude: An Essay on the Necessity of Contingency* (London: Continuum, 2008).

And so, here we return to the tensions at the heart of data's intimacy: if self-tracking technologies are emerging through an increasingly complex and autonomous network of machinic sensibility and machine-body (and machine-machine) communication, it still remains a practice of *self*-tracking; a reflexive activity whereby the thinking, experiencing subject, the seat of phenomenology, communicates with its worldly environment and derives a sense of meaning. This is not necessarily in opposition to the interest in 'humbling' our philosophical anthropocentrism. Even if a system like LIAM operates independently of human subjects, *we* remain human and perspectival. Correlationism may not be up to a comprehensive ontology, Meillassoux says⁶⁹, but the ways in which we encounter, and struggle to make some kind of sense of, machinic sensibility matters.

Data-Sense

Insofar as machinic sensibility is posited as the *solution* to a human problem, the human subject is identified as a problematic object requiring augmentation. The promotion of autonomous machines and objective self-knowledge thus comes hand in hand with what I call data-sense: a futurist project for cultivating 'good' subjects that can learn to communicate with machines (and through them, their own bodies). During the 2010s, both the QS movement and self-tracking industry began to reach a wider public audience, and sought to provide a vision of self-surveilling, self-optimising, self-knowing subjects that could hop on for the ride without being engineers, health professionals or Silicon Valley techies. This involved an exhortation for human subjects to develop new kinds of skills, literacy, tacit knowledge, attitudes. This is what I call *data-sense*, playing on practitioners' frequent discussions of 'new sensors and new senses'.⁷⁰ Data-sense names the new ways of seeing that human users are being encouraged to adopt in order to become digital natives in a self-tracking, data-driven society.⁷¹ Here, our use of 'sense' recalls both Merleau-Ponty's *sens* (meaning, sense, direction) and *le sentir* ('to sense' and 'to feel'), and indeed, the double meaning of 'sense' still latent in everyday English: a sense for feeling, and a sense for making meaningful.⁷² Data-sense describes

⁶⁹ Meillassoux, *After Finitude*.

⁷⁰ Matteo Lai and Erica Forzani, "New Sensors, New Senses," in *Quantified Self 2015 Conference* (San Francisco, 2015).

⁷¹ I am aware that Deborah Lupton, largely contemporaneously with myself, has been developing a similar usage of the term. While her full analysis (in monograph form) remains unpublished at time of writing, Lupton too appears to speak of 'sense' both in terms of the biological senses and sense-making as meaning-making. See Deborah Lupton, "Self-Tracking Practices as Knowledge Technologies," *This Sociological Life* (April 2, 2016).

⁷² Here I am using Donald Landes' translation in Merleau-Ponty, *Phenomenology of Perception*.

the ways in which human subjects' sensory access to their own bodies, and their equipment for making sense of the data at hand, are both reconfigured – rendering them suitable parts for the machinic production of personal data.

How was this data-sense described and justified in self-tracking discourse? The problems it was meant to address were articulated by reviving familiar tropes that had percolated throughout the Internet age: data as flood, and as nonsense. Some commentators had characterised self-tracking as 'small data', a uniquely individual alternative to the broader emergence of 'big data'.⁷³ However, the new availability of persistent *streams* of data points soon meant that just like populational data, self-tracking would be beset by the problem of data overload.⁷⁴ In self-tracking as much as other sites of 'big' data-driven knowledge, the sheer *comprehensiveness* of this data supplied hopes for genuinely 'representative' datasets as well as anxieties about humans becoming overwhelmed by it. Self-tracking discourse thus spoke of 'drowning in data'⁷⁵, having 'too much' data⁷⁶, in ways that reprised the narratives of the 'information flood' in the 1990s that had themselves been a response to the public distribution of the World Wide Web. As John Durham Peters notes, sea and seafaring metaphors have always been a staple for cyberspace discourse; they, consistent with the far older history of seas, oceans and ships as metaphors and as media, illustrate the plenitude of data as a rich source of knowledge and control, and yet itself a vastness that defies full capture.⁷⁷

This narrative intersected with another problem: data as *nonsense*. How to take a knowledge technique whose central value is in going beyond the human senses, and *translate* it into a human-friendly grid of intelligibility? In the mid-2010s, self-tracking was typically judged as emitting large streams of data into the world, but still lacking a robust 'action layer'⁷⁸ that would allow it all to become meaningful to technological laymen.⁷⁹ More sceptical actors contended that for all the obsessive and indulgent counting of such

⁷³ Swan, "The Quantified Self"; Matthew Cornell, "The Big Bucket Personal Informatics Data Model," *Quantified Self* (February 18, 2011).

⁷⁴ Also see Tom Fawcett, "Mining the Quantified Self: Personal Knowledge Discovery as a Challenge for Data Science," *Big Data* vol. 3, no. 4 (2016), 249–66.

⁷⁵ Alex Peysakhovich and Seth Stephens-Davidowitz, "How Not to Drown in Numbers," *New York Times* (May 2, 2015).

⁷⁶ Sean Brennan, "Awareables: The Technology of Superhumans," *Wired* (March 2015).

⁷⁷ Peters, *The Marvelous Clouds*, 54, 107.

⁷⁸ Melanie Swan, "Sensor Mania! The Internet of Things, Wearable Computing, Objective Metrics, and the Quantified Self 2.0," *Journal of Sensor and Actuator Networks* vol. 1, no. 3 (2012), 235.

⁷⁹ Thomas Goetz, "Harnessing the Power of Feedback Loops," *Wired* (June 19, 2011).

‘datasexuals’⁸⁰, making sense of the data still remains a major obstacle.⁸¹ This concern was situated in a broader set of anxieties about what I have called trace-bodies⁸²; that is, the institutionalised production of identities or profiles on the basis of personal data. Self-tracking came into public awareness even as corporate data-mining was increasingly being criticised as a commercial exploitation of personal traces, an economy which deprived users of knowledge about the contents and production of their own data. At the same time that the Web 2.0 economy provoked concerns that “we are [becoming] strangers to our normatively aggregated selves”,⁸³ self-tracking was seeking the translational tools it would need to deliver on its promise of empowerment through data and personalised control.

The rhetoric of data-sense aligned these problems not as flaws in new technological means, but flaws inherent in the (mythical figure of the) pre-technical human that could and should be overcome on the fleshly end. In turn, data-sense embraced a futurist, posthumanist vision of the ways in which human subjects would evolve to swim in their data. At the most basic level, we find the idea of data-sense as a certain kind of literacy. In 2012, *Wired* – ever the evangelist for new practices in computing, and the institution whose employees had co-founded QS – a conference subtitled ‘living by numbers’. On the podium was Kevin Kelly – not only QS’ co-founder, but a veteran discourse-crafter who had helped disseminate utopian visions of the World Wide Web and virtual communities over the preceding four decades:

We’re horribly, I mean, we’re just not evolved to deal with numbers. Our brains aren’t really good with dealing with numbers, we don’t do statistics very well, we’re not really a number animal.⁸⁴

⁸⁰ See: Evgeny Morozov, *To Save Everything, Click Here: The Folly of Technological Solutionism* (New York: Public Affairs, 2013), Chapter 7; Chris Matyszczyk, “How to Work out If You Are a Datasexual,” *Cnet* (April 18, 2012); Dorien Zandbergen, “Data Confessions of the Quantified Self,” *Leiden Anthropology Blog* (July 1, 2013).

⁸¹ Emily Singer, “Quantifying Myself: Self-Tracking Failures,” *MIT Technology Review* (June 22, 2011); Keith Wagstaff, “Data Overload: Is the ‘Quantified Self’ Really the Future?” *NBC News* (August 30, 2014); Katy Waldman, “The Year We Quantified Everything and Learned ... Anything?” *Slate* (December 27, 2013).

⁸² Sun-ha Hong, “Presence: The Sense of Being-There and Being-with in the New Media Society,” *First Monday*, vol. 20, no. 10 (2015).

⁸³ Tanya Nyong’o, “Plenary 4,” in *Affect Theory Conference | Worldings | Tensions | Futures* (Lancaster, PA, 2015).

⁸⁴ Kevin Kelly in Gary Wolf and Kevin Kelly, “Wired’s Gary Wolf & Kevin Kelly Talk the Quantified Self,” in *WIRED Health Conference: Living by Numbers* (New York, 2012). Also see Pete Mortensen, “The Future Of Technology Isn’t Mobile, It’s Contextual,” *Fast Company* (May 24, 2013).

In this case, the narrative remains at a utilitarian and instrumental level: self-tracking is described as requiring new skills, akin to the problem of learning the right grammar or typesetting. Kelly does not stop here, however. He goes on to argue that machinic sensibility can and should be appropriated into subjects' own sensory experience:

But what I think the long term direction of this is, is, we want to use these sensors we're talking about to give us new senses. To equip us with new ways to hear our body [...] right now we have to see the data, the charts, the curves, but in the long term where we want to go is, we want to be able to feel, or see, or hear them.⁸⁵

These 'new senses' are thus described as an internalisation of machinic temporalities, rhythms, patterns of communication, into user-subjects' phenomenological equipment.⁸⁶ The disjuncture between the rhetoric and its concrete instantiations is striking. For his part, Kelly provided the example of a simple experiment, of unknown provenance: a customised belt that would regularly vibrate in the direction pointing North. Soon enough, he claimed, the wearer had developed an 'unconscious sense' of cardinal directions. Of course, even the humans of the Internet age have not forgotten to read North and South by simply observing the sun. This is not to suggest that the poverty of the one example floats or sinks the validity of the ambition. Rather, we locate in this disjuncture the orienting optimism of data-sense: a discursive strategy for mobilising public, media and industry enthusiasm towards a specific kind of technological near future.

Others beyond Kevin Kelly joined in juxtaposing the relatively modest commercial products and design experiments to lofty ideals of transformation – whether to advance their corporate appeal, out of genuine enthusiasm, or both. Haptics was a key frontier; if the visual and aural alerts common in personal computers and smartphones were designed to explicitly interrupt the user and enact 'hard' jolts on their attention,⁸⁷ haptic feedback was beginning to experiment with more persistent, backgrounded kinds of responsivity. A squishy button that 'pops' when tasks are completed sought to train subjects

⁸⁵ Wolf and Kelly, "Wired's Gary Wolf & Kevin Kelly Talk the Quantified Self".

⁸⁶ Tamar Sharon and Dorien Zandbergen, "From Data Fetishism to Quantifying Selves: Self-Tracking Practices and the Other Values of Data," *New Media & Society*, OnlineFirst (2016).

⁸⁷ See Wajcman and Rose, "Constant Connectivity".

into a haptic stimuli for productivity⁸⁸, while gently buzzing wristwatches could again provide ‘low-friction’ feedback that human subjects could learn to accommodate in the same way they, say, seamlessly receive information about temperature through their skin⁸⁹. Yet again, artistic projects act here as the vanguard of more mass market developments. In 2013, a London designer showcased a self-tracking device that would use discomforting or even punishing feedback, including a flare of intense heat, to train the subject’s senses.⁹⁰ The turn to haptics thus reprises the role played by skeuomorphic design elements throughout the history of personal computing. Technologies are here designed to mimic the sensory responsivity between humans and their existing environment in order to cultivate new lines of human-machine communication – a process that has been called ‘biopedagogy’.⁹¹ Thus self-tracking presents new ways not only to capture the objective truth of the body, but also to arrange the open wavelengths or frequencies that the human subject could be tuned into so that they might participate in their own ‘self’-knowledge.

This imagined reconfiguration of the subjects’ sensory equipment, and the emergence of a pervasive communicative circuit between selves and their sensors, reached its rhetorical peak in claims of a broader, posthuman shift. Kevin Kelly elsewhere christens it *exoself*: an ‘extended connected self’ that constantly discharges data while receiving all kinds of machinic communications, both consciously and non-consciously.⁹² Such language extended the long narrative of technological transcendence that had characterised utopian (and some dystopian) rhetoric about personal computing and the Internet in previous decades – and, indeed, the broad and powerful influence of cybernetics throughout the 20th century that defined the body and the selves as information systems.⁹³ One particularly relevant branch of that

⁸⁸ Joseph Flaherty, “Work 2.0: A Web-Connected Sticky Note That Bosses You Around,” *Wired* (April 24, 2014).

⁸⁹ Mark W. Smith, “A Fitbit Fanatic’s Cry for Help: I’m Addicted to Steps,” *The Washington Post* (May 11, 2015).

⁹⁰ Adele Peters, “This Scary Gadget Zaps You When You Get Lazy,” *Fast Company* (December 16, 2013).

⁹¹ Aristeia Fotopoulou and Kate O’Riordan. “Biosensory Experiences and Media Materiality Fitbit and Biosensors: Imaginaries and Material Instantiations,” in *IR16*. (Phoenix, Arizona, 2015). For an analysis of how such relationships are brokered with a focus on social spaces, also see Lucy Suchman, *Human-Machine Reconfigurations: Plans and Situated Actions* (Cambridge: Cambridge University Press, 2007).

⁹² Swan, “The Quantified Self,” 95.

⁹³ Katherine N. Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago: University of Chicago Press, 1999); Deborah Lupton, “Self-Tracking Cultures: Towards a Sociology of Personal Informatics,” in *OzCHI ’14: Proceedings of the 26th Australian Computer-Human Interaction Conference: Designing Futures, the Future of Design* (Sydney, 2014).

cybernetic imaginary had been the countercultural influence on personal computing and the Internet as a route to a technologically expanded consciousness – a vision that Kevin Kelly himself had actively brokered in the 1980s and 90s.⁹⁴ This posthumanist vision proposed not to transform users into hyper-rational machines, but to leverage machinic sensibility towards a more ‘authentic’ relationship to one’s own humanity. Industry and media actors claimed that, for example, “technology will offer a level of self-awareness that could make us more human than ever”.⁹⁵

All in all, the rhetoric of data-sense presents a broad array of skills, sensory interfaces, moral virtues, and forms of communal organisation – all of which seek to newly demarcate the role and identity of the ideal self-tracking subject. To be sure, the concrete practices on hand, from heat-shock haptics to sleep scores, hardly add up to a grand posthumanist development of ‘new senses for new sensors’. The rhetoric of data-sense is about overstepping the reality of existing achievements and attempting to orient public imagination towards the technological future that is apparently just around the corner. This is not to say that self-tracking of the early and mid-2010s did nothing for human mechanisms of self-knowledge. Rather, it is to emphasise the ways in which self-tracking devices in this period were increasingly cultivating fresh channels for communicating machinic data to human subjects. These channels were being designed not to provoke discrete queries and deliberations, but a habituated and tacit receptivity to the continuous flow of machinic communications.

This level of machinic intervention is a clearly phenomenological one. Vision, Merleau-Ponty said, is “the means given me for being absent from myself.”⁹⁶ Notwithstanding his complicity in the Western tendency to privilege vision over the other senses (something which he acknowledged later in his career), we can apply this thinking to self-tracking’s efforts to augment the senses as a whole. To sense one’s own body is already for consciousness to direct itself towards something else, an object; self-knowledge, in other words, is to know the ‘me’ as an object distinct from the conscious ‘I’.⁹⁷ Data-sense is designed to intercede in exactly this process, retraining humans’ sensory equipment to coordinate with smart machines and to be guided by them at increasingly ‘pre-reflective’ levels. It might be described as a

⁹⁴ Turner, *From Counterculture to Cyberculture*.

⁹⁵ Brennan, “Awareables”.

⁹⁶ Maurice Merleau-Ponty, “Eye and Mind,” in *The Merleau-Ponty Aesthetics Reader*, ed. Galen A Johnson (Evanston: Northwestern University Press, 1996), 146.

⁹⁷ Merleau-Ponty, *Phenomenology of Perception*.

technological habitus: the social tempering of the body that allows individuals to internalise the virtues, senses and knowhow necessary to function in that technological society.⁹⁸ Subjects are informed that this new habitus is how they might achieve the kind of efficacy or competency that ‘counts’ in the new knowledge regimes – whether it be the savvy social media user that extracts reputational and monetary rewards through the network, or the self-tracking connoisseur who is able to ‘stay on top’ of the sensory ecosystem. In this way, the human subject is trained to adapt its own sensibility, aligning itself with a machinic sensibility that remains inhumanly other but can now begin to organise subjects’ sensing of their ‘own’ selves.

This retraining, however, has dimensions and consequences that go beyond the simple utopianism of ‘new senses for new sensors’. First, that very slogan could be reinterpreted, mindful of historical precedents in systems of classification and quantification, as ‘new numbers and metrics to which we must now adapt our living’. In linking, say, galvanic skin response or heart rate variability to stress, and then resolving the scientific discussions behind such correlations to singular, automatically produced scores, mass-produced tracking devices enact new relations of truth production whereby the subject’s truth may be declared and authorised. Such classification systems tend to be invisibilised over time⁹⁹ – and the seductively objective appearance of quantified measures¹⁰⁰ plays a key role in this process. (Consider, for example, how the Apple iPhone’s pedometer still uses 10,000 steps per day as the golden rule for sufficient exercise – a figure which was popularised by the Japanese product *manpo-kei* (meaning, literally, ten thousand steps) in the 1960s.)

Second, despite the imperfections of the devices themselves, their mediated public presentation through the rhetoric of data-sense continues to mobilise subjects to consume, experiment, and produce ever more data about themselves. In other words, it is no coincidence that self-tracking’s vision of empowerment through data production dovetails seamlessly with the industry’s hopes of tracking individuals as data producers, whose output can then be harvested and commercialised. Neither is it accidental that issues of data privacy, so central to the debates around state surveillance, have tended to remain on the periphery of self-tracking discourse. This is not to suggest a conspiratorial explanation, where QS founders or self-tracking entrepreneurs harbour secret plans to steal users’ data. The correlational epistemology underlying big data’s favoured techniques – like machine learning and Bayesian inferences – are designed to benefit from as much data as possible.

⁹⁸ Peter E.S. Freund, “Civilised Bodies Redux: Seams in the Cyborg,” *Social Theory & Health* vol. 2, no. 3 (2004), 273–89.

⁹⁹ Geoffrey Bowker & Susan Leigh Star, *Sorting Things Out: Classification and its consequences* (Cambridge: MIT Press, 1999).

¹⁰⁰ Theodore M. Porter, *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life* (Princeton: Princeton University Press, 1995).

Driven by a data hunger that characterises other contexts of ‘big’ data and surveillance, many (not all) pioneers of self-tracking technologies find it simply rational to advocate that sharing is often ‘worth’ the cost in privacy.

To be able to measure myself is to render myself newly eligible for measurement by others; to lend veridical authority to these measurements, and measuring machines, is to give them a certain kind of capital as our spokespersons. Data-sense thus describes the rhetorical, methodological and economic modes of orientation towards a new set of numbers by which subjects are asked to make themselves legible, efficient, truthful.

A Relationship

If data’s intimacy describes the new authorisation of machinic sensibility to cut close to our bodies, our spatial and temporal rhythms, our sensory equipment, and to thereby speak ‘our’ truth, then data-sense sketches out the ways in which such a human-machine communication network also trains the human subject in a new set of virtues and skills. This twin process we might describe simply as a *relationship*. Gilbert Simondon understood that to speak of technology in purely instrumental terms is to minorise it; that is, utterly reduce its many relational consequences upon the subject and its environment.¹⁰¹ Mark Hansen, too, suggests that the rise of machinic sensibility means 21CM is even less capable of being reduced to a dead and inert tool, and instead “challenges us to construct a relationship with them”.¹⁰² But what does it mean to speak of relationships? Whether in the vernacular sense of an interpersonal relationship (such as the romantic type), or in the language of networks, we know that a relationship transforms each and every involved party by the virtue of the relating, connecting, communicated. We also know that the configurations of power and knowledge in each relationship is open to negotiation, and never determined by its constituent parties. Such negotiation involves retraining not just one, but both sides of the relationship – guided not solely by the affordances of the technology, but the moral values that we would wish to espouse.

In 2014, Dan Saffer, a design consultant, wrote for *Wired* on the ethical challenges of algorithm-driven societies – of which self-tracking forms just one part. It is an odd (and probably unintended) jaunt into Deleuzian territory, or perhaps Haraway’s thesis on companion species. We need to ‘tame’ our algorithms, Saffer argues, like humans once tamed animals. As we domesticated wolves into dogs, we also evolved to render ourselves compatible with them; the same must now happen, Saffer suggests, with a nonhuman ‘species’ that we have let loose into our lived environments.

¹⁰¹ See Hörl, “The technological condition”.

¹⁰² Hansen, *Feed-Forward*, 37.

But here's the thing about the domestication and evolution of dogs: we also evolved to live with them. They changed us, as well. They became part of the human ecosystem. There's evidence that dogs and humans co-evolved brain processes and chemicals such as serotonin. Given enough time, algorithms might have such an impact on us as well, changing how we think. And while (unlike dogs) algorithms might not change us at a genetic level, they are changing our behaviour.¹⁰³

Notably, this line of argument focuses on a degree of *choice* technological societies possess when considering what kinds of human-machine communication networks, what distributions of veridical or epistemic authority, they want to foster as they accommodate new technological innovations. The question raised by data's intimacy and data-sense is how we might begin to more explicitly discuss the moral and experiential, as well as technical and epistemic, stakes in our relationships with new technologies. Thus Saffer argues:

One way of speeding up this evolution [of humans and algorithms] is providing a means of telling [algorithms] what we need and value. We need to insert an awareness of human feelings and human limitations into the code.¹⁰⁴

To think of relationships is to temper the promises of intimacy, knowledge, and posthumanist transcendence that are carrying self-tracking technologies into the popular fray. Scholars have already warned that the fantasy of big data makes pretensions to absolute objectivity and neutrality – leading to Chris Anderson's (in)famous claim of the 'end of theory'.¹⁰⁵ Yet what is at stake in self-tracking's fantasies of 'better knowledge' is precisely this opportunity to cultivate a relationship with technology that is not reducible to the old modernist projects of progress and objectivity. Even as technology appears ever more autonomous, engineering cognition and affect before the subject can even be aware, it is necessary to conceptualise it as an open and contingent relationship, where its effects on truth-telling and self-

¹⁰³ Dan Saffer, "Why We Need to Tame Our Algorithms like Dogs," *Wired* (June 20, 2014).

¹⁰⁴ Ibid.

¹⁰⁵ danah boyd and Kate Crawford, "Critical Questions for Big Data," *Information, Communication & Society* vol. 15, no. 5 (2012), 666.

knowledge are not ‘determined’ in advance. In Andrew Feenberg’s words, ‘another technology’ must be made possible.¹⁰⁶

¹⁰⁶ Andrew Feenberg, *Critical Theory of Technology* (Oxford: Oxford University Press, 1991).

Bibliography

- Amoore, Louise. "Data Derivatives: On the Emergence of a Security Risk Calculus for Our Times." *Theory, Culture & Society* 28, no. 6 (2011): 24–43.
- Berry, David M. *The Philosophy of Software: Code and Mediation in the Digital Age*. Basingstoke: Palgrave Macmillan, 2011.
- Bhatt, Sarita. "We're All Narcissists Now, And That's A Good Thing." *Fast Company*, September 27, 2013. <http://www.fastcoexist.com/3018382/were-all-narcissists-now-and-thats-a-good-thing>.
- Bowker, Geoffrey, and Susan Leigh Star. *Sorting Things Out: Classification and its consequences*. Cambridge: MIT Press, 1999.
- boyd, danah, and Kate Crawford. "Critical Questions for Big Data." *Information, Communication & Society* 15, no. 5 (2012): 662–79.
- Brennan, Sean. "Awareables: The Technology of Superhumans." *Wired*, March 2015. <http://www.wired.com/insights/2015/03/awareables-technology-superhumanism/>.
- Bucher, Taina. "Want to Be on the Top? Algorithmic Power and the Threat of Invisibility on Facebook." *New Media & Society* 14, no. 7 (2012): 1164–80.
- Cohen, Adam Max. *Technology and the Early Modern Self*. New York: Palgrave Macmillan, 2009.
- Connolly, William. "The 'New Materialism' and the Fragility of Things." *Millennium - Journal of International Studies* 41, no. 3 (2013): 399–412.
- Cornell, Matthew. "The Big Bucket Personal Informatics Data Model." *Quantified Self*, February 18, 2011. <http://quantifiedself.com/2011/02/the-big-bucket-personal-informatics-data-model/>.
- Crary, Jonathan. *24/7: Late Capitalism and the Ends of Sleep*. London: Verso, 2013.
- Crawford, Kate, Jessa Lingel, and Tero Karppi. "Our Metrics, Ourselves: A Hundred Years of Self-Tracking from the Weight Scale to the Wrist Wearable Device." *European Journal of Cultural Studies* 18, no. 4–5 (2015): 479–96.
- Daston, Lorraine J. "Objectivity and the Escape from Perspective," *Social Studies of Science* 22 (1992): 597–618.
- Daston, Lorraine J., and Peter Galison. *Objectivity*. New York: Zone Books, 2007.
- De Brouwer, Sam, Linda Avey, Jessica Richman, and Tan Le. "Frontiers of Tracking Health." In *Quantified Self 2015 Conference*. San Francisco, 2015.
- Fawcett, Tom. "Mining the Quantified Self: Personal Knowledge Discovery as a Challenge for Data Science." *Big Data* 3, no. 4 (2016): 249–66.

- Feenberg, Andrew. *Critical Theory of Technology*. Oxford: Oxford University Press, 1991.
- Flaherty, Joseph. "Work 2.0: A Web-Connected Sticky Note That Bosses You Around." *Wired*, April 24, 2014. <http://www.wired.com/2014/04/work-2-0-a-web-connected-sticky-note-that-bosses-you-around/>.
- Fotopoulou, Aristeia, and Kate O'Riordan. "Biosensory Experiences and Media Materiality Fitbit and Biosensors: Imaginaries and Material Instantiations." In *IR16*. Phoenix, Arizona, 2015.
- Foucault, Michel. *On The Government of the Living: Lectures at the Collège de France, 1979-1980*. Basingstoke: Palgrave Macmillan, 2014.
- . *Security, Territory, Population: Lectures at the Collège de France 1977-1978*. Edited by Michel Senellart. Translated by Graham Burchell. New York: Palgrave Macmillan, 2004.
- . *The Courage of Truth: Lectures at the Collège de France, 1983-1984*. Edited by Frédéric Gros. Translated by Graham Burchell. Basingstoke: Palgrave Macmillan, 2011.
- . *Wrong-Doing, Truth-Telling: The Function of Avowal in Justice*. Edited by Fabienne Brion and Bernard E Harcourt. Chicago: University of Chicago Press, 2014.
- Freund, Peter E S. "Civilised Bodies Redux: Seams in the Cyborg." *Social Theory & Health* 2, no. 3 (2004): 273–89.
- Frick, Laurie. "The Future of Data about You." *LaurieFrick.com*. Accessed March 29, 2016. <http://www.lauriefrick.com/>.
- Gillespie, Tarleton, Robert Seyfert, and Jonathan Roberge. "#Trendingistrending: When Algorithms Become Culture." In *Algorithmic Cultures: Essays on Meaning, Performance and New Technologies*, 2016.
- Goetz, Thomas. "Harnessing the Power of Feedback Loops." *Wired*, June 19, 2011. http://www.wired.com/2011/06/ff_feedbackloop/2/.
- Gould, Stephen Jay. *The Mismeasure of Man: The Definitive Refutation to the Argument of The Bell Curve*. New York: W.W. Norton & Co., 1996.
- Hacking, Ian. *The Taming of Chance*. Cambridge: Cambridge University Press, 1990.
- Han, Byung-Chul. *Müdigkeitsgesellschaft*. Berlin: Matthes & Seitz, 2010.
- Hansen, Mark B N. *Feed-Forward: On the Future of Twenty-First-Century Media*. Chicago: University of Chicago Press, 2015.
- Harman, Graham. *Tool-Being: Heidegger and the Metaphysics of Objects*. Peru, Illinois: Open Court, 2002.

- Harrington, Anne. *The Cure Within: A History of Mind-Body Medicine*. New York: W.W. Norton & Co., 2008.
- Hayles, Katherine N. *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics*. Chicago: University of Chicago Press, 1999.
- Hayles, Katherine N. "The Cognitive Nonconscious: Enlarging the Mind of the Humanities." *Critical Inquiry* 42 (2016): 783–808.
- Hernandez, Daniela. "Big Data Is Transforming Healthcare." *Wired*, October 16, 2012. <http://www.wired.com/2012/10/big-data-is-transforming-healthcare/>.
- Hesse, Monica. "Bytes of Life." *The Washington Post*, September 9, 2008. http://www.wired.com/2010/11/mf_qa_ferriss/.
- Hong, Sun-ha. "Presence: The Sense of Being-There and Being-with in the New Media Society." *First Monday* 20, no. 10 (2015).
- Hörl, Erich. "The Technological Condition." *Parrhesia* 22 (2015): 1–15.
- Illouz, Eva. *Cold Intimacies: The Making of Emotional Capitalism*. Malden: Polity Press, 2007.
- Illouz, Eva. *Saving the Modern Soul: Therapy, Emotions, and the Culture of Self-Help*. Berkeley: University of California Press, 2008.
- Jonas, Steven. "What We Are Reading." *Quantified Self*, October 26, 2015. <http://quantifiedself.com/2015/10/reading-73/>.
- Jordan, Matthew, and Nikki Pfarr. "Forget the Quantified Self. We Need to Build the Quantified Us." *Wired*, April 4, 2014. <http://www.wired.com/2014/04/forget-the-quantified-self-we-need-to-build-the-quantified-us/>.
- Kittler, Friedrich A. *Gramophone, Film, Typewriter*. Translated by Geoffrey Winthrop-Young and Michael Wutz. Stanford: Stanford University Press, 1986.
- Kline, Ron. "Technological Determinism." In *International Encyclopedia of the Social and Behavioral Sciences*, 15495–98. New York: Elsevier, 2001.
- Lai, Matteo, and Erica Forzani. "New Sensors, New Senses." In *Quantified Self 2015 Conference*. San Francisco, 2015.
- Lanier, Jaron. *You Are Not A Gadget: A Manifesto*. New York: Alfred A. Knopf, 2010.
- Latour, Bruno. *Reassembling the Social: An Introduction to Actor-Network Theory*. Oxford: Oxford University Press, 2005.
- Leppakorpi, Lasse. "Beddit Presentation." In *MoneyTalks*. Tampere, 2011. <http://www.slideshare.net/TechnopolisOnline/beddit-presentation>.

- Lorenzini, Daniele. "Daniele Lorenzini on On the Government of the Living." *13/13: Michel Foucault's College de France Lectures*, February 7, 2016. <http://blogs.law.columbia.edu/foucault1313/2016/02/07/daniele-lorenzini-on-on-the-government-of-the-living/>.
- Lupton, Deborah. "M-Health and Health Promotion: The Digital Cyborg and Surveillance Society." *Social Theory & Health* 10, no. 3 (2012): 229–44. doi:10.1057/sth.2012.6.
- . "Quantifying the Body: Monitoring and Measuring Health in the Age of mHealth Technologies." *Critical Public Health* 23, no. 4 (2013): 393–403.
- . "Self-Tracking Cultures: Towards a Sociology of Personal Informatics." In *OzCHI '14: Proceedings of the 26th Australian Computer-Human Interaction Conference: Designing Futures, the Future of Design*. Sydney, 2014.
- . "Self-Tracking Practices as Knowledge Technologies." *This Sociological Life*, April 2, 2016. <https://simplysociology.wordpress.com/tag/self-tracking/>.
- Lyon, David. "Surveillance, Power and Everyday Life." In *Oxford Handbook of Information and Communication Technologies*, edited by Chrisanthi Avgerou et al., 449–472. Oxford: Oxford University Press, 2007.
- Mallett, Whitney. "Apps Are Getting All Emotional." *Fast Company*, December 10, 2014. <http://www.fastcompany.com/3039624/apps-are-getting-all-emotional>.
- Marx, Leo. "The Idea of 'Technology' and Postmodern Pessimism." In *Does Technology Drive History? The Dilemma of Technological Determinism*, edited by Merritt Roe Smith and Leo Marx, 237–58. Cambridge: MIT Press, 1994.
- Massumi, Brian. *Parables for the Virtual - Movement, Affect, Sensation*. Durham: Duke University Press, 2002.
- Matyszczyk, Chris. "How to Work out If You Are a Datasexual." *Cnet*, April 18, 2012. <http://www.cnet.com/news/how-to-work-out-if-you-are-a-datasexual/>.
- Mearian, L. "Insurance company now offers discounts - if you let it track your Fitbit." *Computerworld*, April 17, 2015. <http://www.computerworld.com/article/2911594/insurance-company-now-offers-discounts-if-you-let-it-track-your-fitbit.html>.
- Meillassoux, Quentin. *After Finitude: An Essay on the Necessity of Contingency*. London: Continuum, 2008.
- Merleau-Ponty, Maurice. "Eye and Mind." In *The Merleau-Ponty Aesthetics Reader*, edited by Galen A Johnson, translated by Michael B Smith, 121–49. Evanston: Northwestern University Press, 1996.

- . *Phenomenology of Perception*. Translated by Donald A Landes. London: Routledge, 2012.
- Milburn, Tahl. “How My Life Automation System Quantifies My Life.” In *Quantified Self 2015 Conference*. San Francisco, 2015.
- Morga, Alicia. “Do You Measure Up?” *Fast Company*, April 5, 2011. <http://www.fastcompany.com/1744571/do-you-measure>.
- Morozov, Evgeny. *To Save Everything, Click Here: The Folly of Technological Solutionism*. New York: Public Affairs, 2013.
- Mortensen, Pete. “The Future Of Technology Isn’t Mobile, It’s Contextual.” *Fast Company*, May 24, 2013. <http://www.fastcodesign.com/1672531/the-future-of-technology-isnt-mobile-its-contextual>.
- “No Title.” *Zen.Sen.Life*, August 31, 2015. <http://zensenlife.tumblr.com/post/128009987024/sleep-tracking-app-i-see-youre-not-violently>.
- Nyong’o, Tanya. “Plenary 4.” In *Affect Theory Conference | Worldings | Tensions | Futures*. Lancaster, PA, 2015.
- Parikka, Jussi. “Operative Media Archaeology: Wolfgang Ernst’s Materialist Media Diagrammatics.” *Theory, Culture & Society* 28, no. 5 (2011): 52–74.
- Pasquale, Frank. *The Black Box Society: The Secret Algorithms That Control Money and Information*. Cambridge: Harvard University Press, 2015.
- Pearson, E. “Smart objects, quantified selves, and a sideways flow of data.” In *ICA 2016*. Fukuoka, Japan, 2016.
- Peters, Adele. “This Scary Gadget Zaps You When You Get Lazy.” *Fast Company*, December 16, 2013. <http://www.fastcoexist.com/3023294/this-scary-gadget-zaps-you-when-you-get-lazy?partner=newsletter#6>.
- Peters, John Durham. *The Marvelous Clouds: Toward a Philosophy of Elemental Media*. Chicago: University of Chicago Press, 2015.
- Peysakhovich, Alex, and Seth Stephens-Davidowitz. “How Not to Drown in Numbers.” *New York Times*, May 2, 2015. http://www.nytimes.com/2015/05/03/opinion/sunday/how-not-to-drown-in-numbers.html?_r=2.
- Porter, Theodore M. *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*. Princeton: Princeton University Press, 1995.
- Rettberg, Jill Walker. *Seeing Ourselves Through Technology: How We Use Selfies, Blogs and Wearable Devices To See and Shape Ourselves*. Basingstoke: Palgrave Macmillan, 2014.
- Ruppert, Evelyn. “Population Objects: Interpassive Subjects.” *Sociology* 45, no. 2 (May 10, 2011): 218–33.

- Ryan, Susan Elizabeth. *Garments of Paradise: Wearable Discourse in the Digital Age*. Cambridge: MIT Press, 2014.
- Saffer, Dan. "Why We Need to Tame Our Algorithms like Dogs." *Wired*, June 20, 2014. <http://www.wired.com/2014/06/algorithms-humans-bffs/>.
- Schick, Lea, and Lone Malmborg. "Bodies, Embodiment and Ubiquitous Computing." *Digital Creativity* 21, no. 1 (2010): 63–69.
- Sharon, Tamar, and Dorien Zandbergen. "From Data Fetishism to Quantifying Selves: Self-Tracking Practices and the Other Values of Data." *New Media & Society*, 2016.
- Singer, Emily. "Quantifying Myself: Self-Tracking Failures." *MIT Technology Review*, June 22, 2011. <https://www.technologyreview.com/s/424441/quantifying-myself-self-tracking-failures/>.
- Smith, Mark W. "A Fitbit Fanatic's Cry for Help: I'm Addicted to Steps." *The Washington Post*, May 11, 2015. <https://www.washingtonpost.com/news/to-your-health/wp/2015/05/11/a-fitbit-fanatics-cry-for-help/>.
- Suchman, Lucy. *Human-Machine Reconfigurations: Plans and Situated Actions*. 2nd Editio. Cambridge: Cambridge University Press, 2007.
- Swan, Melanie. "Sensor Mania! The Internet of Things, Wearable Computing, Objective Metrics, and the Quantified Self 2.0." *Journal of Sensor and Actuator Networks* 1, no. 3 (2012): 217–53.
- . "The Quantified Self: Fundamental Disruption in Big Data Science and Biological Discovery." *Big Data* 1, no. 2 (June 2013): 85–99.
- "The 'Only' Coke Machine on the Internet." *Carnegie Mellon University*. Accessed March 28, 2016. https://www.cs.cmu.edu/~coke/history_long.txt.
- Thrift, Nigel. "Lifeworld Inc—and What to Do about It." *Environment and Planning D: Society and Space* 29, no. 1 (2011): 5–26.
- Turner, Fred. *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism*. Chicago: University of Chicago Press, 2006.
- Urist, Jacoba. "From Paint to Pixels." *The Atlantic*, May 14, 2015. <http://www.theatlantic.com/entertainment/archive/2015/05/the-rise-of-the-data-artist/392399/>.
- van Dijck, José. *The Culture of Connectivity: A Critical History of Social Media*. Cambridge: Oxford University Press, 2013.
- Velasco, Jesus R. "Freeing Oneself from Power." *13/13: Michel Foucault's College de France Lectures*, February 9, 2016. <http://blogs.law.columbia.edu/foucault1313/2016/02/09/freeing-oneself-from-power-on-the-government-of-the-living/>.

- Wagstaff, Keith. "Data Overload: Is the 'Quantified Self' Really the Future?" *NBC News*, August 30, 2014.
<http://www.nbcnews.com/tech/innovation/data-overload-quantified-self-really-future-n189596>.
- Wajcman, Judy, and Emily Rose. "Constant Connectivity: Rethinking Interruptions at Work." *Organization Studies* 32, no. 7 (2011): 941–61.
- Waldman, Katy. "The Year We Quantified Everything and Learned ... Anything?" *Slate*, December 27, 2013.
http://www.slate.com/blogs/xx_factor/2013/12/27/quantified_self_critique_personal_data_apps_for_calories_exercise_sleep.html.
- Walker, Rob. "Wasted Data." *New York Times*, December 3, 2010.
<http://www.nytimes.com/2010/12/05/magazine/05FOB-Consumed-t.html?mtrref=undefined&gwh=224196DF50B6FEC7F871890CABC54F5A&gwt=pay>.
- Watson, Sara M. "Living with Data: Personal Data Uses of the Quantified Self." Master's Thesis. University of Oxford, 2013.
- "Wearables Market to Be Worth \$25 Billion by 2019." *CCS Insight*, September 1, 2015. <http://www.ccsinsight.com/press/company-news/2332-wearables-market-to-be-worth-25-billion-by-2019-reveals-ccs-insight>.
- Weiser, Mark. "The Computer for the 21st Century." *Scientific American*, September 1991.
- Winner, Langdon. *Autonomous Technology: Technics-out-of-Control as a Theme in Political Thought*. Cambridge: MIT Press, 1977.
- Wolf, Gary. "Tim Ferriss Wants to Hack Your Body." *Wired*, November 29, 2010. http://www.wired.com/2010/11/mf_qa_ferriss/.
- . "What Is the Quantified Self?" *Quantified Self*, March 3, 2011.
<http://quantifiedself.com/2011/03/what-is-the-quantified-self/>.
- Wolf, Gary, and Kevin Kelly. "Wired's Gary Wolf & Kevin Kelly Talk the Quantified Self." In *WIRED Health Conference: Living by Numbers*. New York, 2012.
http://library.fora.tv/2012/10/15/Wireds_Gary_Wolf__Kevin_Kelly_Talk_the_Quantified_Self.
- "Worldwide Wearables Market Soars in the Third Quarter as Chinese Vendors Challenge the Market Leaders, According to IDC." *International Data Corporation*, December 3, 2015.
<http://www.idc.com/getdoc.jsp?containerId=prUS40674715>.
- Zandbergen, Dorien. "Data Confessions of the Quantified Self." *Leiden Anthropology Blog*, July 1, 2013.
<http://www.leidenanthropologyblog.nl/articles/data-confessions-of-the-quantified-self>.

Zemrani, Laila. "Using Self Tracking to Exercise More Efficiently." In *New York Quantified Self Meetup*. New York, 2015.

Zielinski, Siegfried. *Deep Time of the Media: Toward an Archaeology of Hearing and Seeing by Technical Means*. Cambridge: MIT Press, 2006.

Zimmer, Michael. "The Externalities of Search 2.0: The Emerging Privacy Threats when the Drive for the Perfect Search Engine meets Web 2.0." *First Monday* 13, no. 3 (2008).