

# Measurement, self-tracking and the history of science: An introduction

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## Abstract

This article introduces the papers contained in this special issue and explores a new field of interest in the history of science: that of measurement and self-making. In this special issue, we aim to show that a focus on self-tracking and individualized measurement provides insight into the ways technologies of quantification, when applied to individual bodies and selves, have introduced new notions of autonomy, responsibility, citizenship, and the possibility of self-improvement and life-course decisions. This introduction is an exploratory history of measurement and self-making, and it provides a discussion of self-tracking in the past as part of the genealogy of present-day digital self-tracking technologies. It concludes that a focus on measurement and self-making highlights the relationship between measurement and morality, the making of the ideal of an autonomous self, capable of improvement, and the relationship between autonomy and surveillance.

## Keywords

Self-tracking, measurement, self, history of the body, history of medicine

## Introduction

Today people increasingly use digital technologies to collect data about their body functions and everyday habits.<sup>1</sup> They measure aspects such as sleep patterns, physical performance, and calorie intake, as well as mood and productivity, in pursuit

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1. The idea of this special issue developed at a workshop, held in Utrecht in June 2017, sponsored by the Netherlands Organisation for Scientific Research and the Descartes Centre for the History and Philosophy of the Sciences and the Humanities.

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of self-knowledge and self-improvement. This rapidly growing popular interest in “self-quantification” has been hailed by journalists and sociologists as a revolutionary development. Historians know better: there are all sorts of measuring tools and ideals for self-improvement that go back as early as the nineteenth century, if not further.<sup>2</sup> This special issue highlights this genealogy and provides background to our increasingly metric life today.

The articles in this special issue all discuss aspects of self-tracking and personal quantification during the last two centuries. They look at how individuals in the western world became interested in their own measurements, and at how scientific professionals and the state suggested that they should. We explore what kinds of new selves were stimulated by these measurements, and how ideas about self-tracking were bound up with new notions of autonomy, responsibility, citizenship, the possibility of self-improvement, and life-course decisions. We follow, for example, the early-nineteenth-century Genevan pastor François-Marc-Louis Naville, who tracked his daily score on virtues such as self-control and early rising, and we read about the case of Robert Flenchley, an American teenager in the 1950s with a long record of below average grades at school and a negative attitude, who, once he knew about the very good results of his intelligence test, was reported to have found renewed purpose in life and a new self-confidence.

We use a wide definition of self-tracking to include all sorts of ways in which people have turned their bodies, minds, and habits into data. This includes quantified data as well as lists that were systematically filled in using checkmarks or other symbols. We look at measurements that were taken daily, or even more frequently, for instance in diabetes management, and also at measurements such as intelligence tests that were taken once a lifetime or once in many years. The articles in this special issue are all about measurements of body, mind, and behavior. Of course, there are other kinds of measurements that also shape identities: measurements of the weather in at-home science, for example, that people used to fashion themselves as scientifically minded personae, or increasingly exact measurements in the kitchen that generated new ideas about good household management or motherhood. These are beyond our range of discussion.<sup>3</sup>

Our histories of self-tracking address several questions: How did new practices of measurement change the way people thought about their lives, their bodies, and their relationship to authorities? What kind of personhood did these techniques propagate? How did numbers become an incentive to self-improvement? This introduction will frame these questions in discussions about the shaping of the self between

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2. Kate Crawford, Jessa Lingel, and Tero Karppi, “Our Metrics, Ourselves: A Hundred Years of Self-Tracking from the Weight Scale to the Wrist Wearable,” *European Journal of Cultural Studies* 18 (2015): 479–96 and Deborah Levine, “Measure, Record, Share: Weight Loss, Biometrics, and Self-Tracking in the U.S.,” *American Journal of Preventive Medicine* 55, 5 (2018): e147–51.

3. Jan Golinski, “The Care of the Self and the Masculine Birth of Science,” *History of Science* 40, 2 (2002): 125–45 and Caroline Lieffers, “‘The Present Time is Eminently Scientific’: The Science of Cookery in Nineteenth-Century Britain,” *Journal of Social History* 45, 4 (2012): 936–59.

individual desires and the larger societal forces and will trace some of the longer histories of self-tracking. On the basis of the different articles in this special issue, suggestions will be made about what new insights a focus on self-measurement or self-tracking can bring.

## Historiography

Present-day digital self-tracking technologies have been paid critical attention by sociologists, who recognize their role in the empowerment of the individual but also emphasize the increasing (self-) surveillance that our society requires and that this technology has pushed.<sup>4</sup> They also weigh up the new self-knowledge that the user experiences against the reductionism of numbers and the hidden goals of the algorithm.<sup>5</sup> The kind of personhood that surfaces in this research is the self-governing neoliberal subject who is responsible for her or his own health and wellbeing and who outsources this self-regulation to technology.<sup>6</sup> Anthropologist Natasha Schüll, for instance, sees an “ideal of technologically assisted self-regulation” in self-tracking devices and argues that, “[b]y offering consumers a way to simultaneously embrace and outsource the task of lifestyle management [. . .] such products at once exemplify and short-circuit cultural ideals for individual responsibility and self-regulation.”<sup>7</sup>

Of course, modern examples of self-tracking and self-quantification differ greatly from the historical measurements that are central to this special issue. Furthermore, present-day “quantified self” technology is an extreme example, based as it is on specific software and hardware, algorithms, databases, and user communication, whereas self-tracking technologies such as the weighing scale have changed less over the years. Nevertheless, the recent concerns raised about the influence of technology on our lives

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4. See for example Deborah Lupton, *The Quantified Self: A Sociology of Self-Tracking* (Cambridge, UK: Polity Press, 2016), Dawn Nafus (ed.), *Quantified: Biosensing Technologies in Everyday Life* (Cambridge, MA: MIT Press, 2016), Gina Neff and Dawn Nafus, *Self-tracking* (Cambridge, MA: MIT Press, 2016), Btihaj Ajana (ed.), *Self-Tracking: Empirical and Philosophical Investigations* (Cham, Switzerland: Palgrave Macmillan, 2018), Fabien Granjon, Véra Nikolski, and Anne-Sylvie Pharabod, “Métriques de soi et self-tracking. Une nouvelle culture de soi à l’ère du numérique et de la modernité réflexive?” *Recherches en communication* 36 (2011): 13–26, and Rachel Sanders, “Self-tracking in the Digital Era: Biopower, Patriarchy, and the New Biometric Body Projects,” *Body and Society* 23, 1 (2017): 36–63.
  5. Tamar Sharon, “Self-Tracking for Health and the Quantified Self: Re-Articulating Autonomy, Solidarity, and Authenticity in an Age of Personalized Healthcare,” *Philosophy & Technology* 30, 1 (2017): 93–121. Sharon also mentions the discussion about digital self-tracking as a result of the disintegration of collective responsibility for health.
  6. Andrea Righi, “The Corpulence of Self-tracking: The Quantified Self, Derrida, and Writing in the Age of Digital Accountability,” *Theory & Event* 20, 3 (2017): 679–98. See also Chris Till, “Exercise as Labour: Quantified Self and the Transformation of Exercise into Labour,” *Societies* 4, 3 (2014): 446–62.
  7. Natasha Dow Schüll, “Data for Life: Wearable Technology and the Design of Self-care,” *BioSocieties* 11, 3 (2016): 317–33, 317.

do point to the ways in which old and new technologies of measurement co-produce aspects of our inner selves and ideals of how to live.

Several strands of the historiography of science are important to any sketch of a genealogy of our metric lives. In the case of quantification, historians of science have paid particular attention to measuring on the macro level: historians of science have shown how the use of numbers became more widespread in science and society, especially by the late nineteenth century. Ted Porter showed how quantification was successful because it was able to smooth communications between people of different classes, professions, or nationalities, often at great distance. And as he and scholars such as Alain Desrosières and Ian Hacking described, social scientists co-operated with politicians to decide what was important to quantify in society. By measuring topics from mortality to unemployment, they have made these phenomena more concrete and relevant to the developing nation-states that have used them as a means of social control.<sup>8</sup>

Historians of science have also detailed how quantification in the human sciences produced new ideas about bodies. As mathematicians defined statistical averages and medical scholars normal blood pressure or normal blood sugar levels, other disciplines such as anthropology or psychiatry also started to define what bodies and behaviors were normal, average, or typical and what or who was a deviation.<sup>9</sup> As others have added, non-state actors, such as the insurance industry or clothing manufacturers, also played a role in deciding what measurements were considered possible, what was worth measuring, and what were the ideal body dimensions.<sup>10</sup>

Accounts of the emergence of what historians have called the “modern self,” the idea of an individualized inner self that can be understood and shaped, have emphasized how notions of the self emerged in an interplay between the larger forces of science and the state, on the one hand, and the micromanagement of the self and identity, on the other. Following Michel Foucault’s work on governmentality and the practices of which it was made up, historians of the self have emphasized how important science and the state

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8. Ted Porter, *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life* (Princeton: Princeton University Press, 1995), Ian Hacking, *The Taming of Chance* (Cambridge: Cambridge University Press, 1990), Alain Desrosières, *The Politics of Large Numbers: A History of Statistical Reasoning* (Cambridge, MA: Harvard University Press, 1998), and Ian Hacking, “Kinds of People: Moving Targets,” *Proceedings of the British Academy* 151 (2007): 285–318. For a more technology-oriented book see Geoffrey C. Bowker and Susan Leigh Star, *Sorting Things Out: Classification and its Consequences* (Cambridge, MA: MIT Press, 1999).

9. See among many others Volker Hess (ed.), *Normierung der Gesundheit. Messende Verfahren der Medizin als kulturelle Praktik um 1900* (Husum: Matthiesen Verlag, 1997) and Peter Cryle and Elizabeth Stephens, *Normality: A Critical Genealogy* (Chicago: University of Chicago Press, 2017).

10. Amanda M. Czerniawski, “From Average to Ideal: The Evolution of the Height and Weight Table in the United States, 1836–1943,” *Social Science History* 31, 2 (2007): 273–96, Daniela Döring, *Zeugende Zahlen. Mittelmaß und Durchschnittstypen in Proportion, Statistik und Konfektion* (Berlin: Kulturverlag Kadmos, 2011), Dan Bouk, *How Our Days Became Numbered. Risk and the Rise of the Statistical Individual* (Chicago: University of Chicago Press, 2015).

have been in the most intimate and individual domains of our lives.<sup>11</sup> This work shows that the idea that regulating your body is your own responsibility is not a result of a late twentieth-century (neoliberal) transformation; it has deeper roots. New notions about healthy growth, ideal bodies, and proper homes have had a growing influence on people's private lives, especially since the nineteenth century.

There is also a strand of research influenced by Foucault's later work that looks into "care of the self," or as Foucault phrased it, on how "a human being turns him- or herself into a subject."<sup>12</sup> By and large, these self-making practices are practices of introspection such as confession or biography writing, but can also be more systematic and quantified.<sup>13</sup> It is no surprise that it was especially science-minded individuals who considered self-monitoring important. As Jan Golinski describes, practices of "care of the self" were not only important in Antiquity, as Foucault suggests, but continued to be important throughout the Enlightenment when appropriate regimens for scholars were discussed. These regimens did not always include quantified data, but self-disciplining by imposing a systematic order of doing things such as getting up early or keeping a diary.<sup>14</sup> Even though it does not usually contain quantified data, the diary, according to historian of the Victorian diary Anne-Marie Millim, can be defined as a kind of account book, a "numberless balance sheet."<sup>15</sup>

In this special issue, we propose that technologies of self-tracking offer one way to internalize and produce new ideas about personhood. Our aim is to look in greater detail

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11. Nikolas Rose, *Governing the Soul: The Shaping of the Private Self* (London: Free Association Books, 1989), Charles Taylor, *Sources of the Self. The Making of Modern Identity* (Cambridge, MA: Harvard University Press, 1989), Nikolas Rose and Carlos Novas, "Biological Citizenship," in Stephen Collier and Aihwa Ong (eds.), *Global Assemblages: Technology, Politics, and Ethics as Anthropological Problems* (Malden: Blackwell, 2005), pp.439–63.
  12. As quoted in Luther H. Martin, Huck Gutman, and Patrick H. Hutton, "Introduction," in Luther H. Martin, Huck Gutman, and Patrick H. Hutton (eds.), *Technologies of the Self: A Seminar with Michel Foucault* (Amherst: University of Massachusetts Press, 1988), pp.3–8, 3.
  13. About autobiographical writing see Roy Porter (ed.), *Rewriting the Self. Histories from the Renaissance to the Present* (London: Routledge, 1997), M.A. McCarthy, *The Accidental Diarist: A History of the Daily Planner in America* (Chicago: University of Chicago Press, 2013), Arianne Baggerman, Rudolf Dekker, and Michael Mascuch (eds.), *Controlling Time and Shaping the Self: Developments in Autobiographical Writing since the Sixteenth Century* (Leiden: Brill, 2011), and Lee Humphreys, *The Qualified Self. Social Media and the Accounting of Everyday Life* (Cambridge, MA: MIT Press, 2018). One aspect of present-day self-tracking that is less visible in the case studies we present is the need to archive. See also Rebecca Lemov, "Archives-of-Self: The Vicissitudes of Time and Self in a Technologically Determinist Future," in Lorraine Daston (ed.), *Science in the Archive: Pasts, Presents, Futures* (Chicago: University of Chicago Press, 2016), pp. 247–270.
  14. Jan Golinski, "The Care of the Self and the Masculine Birth of Science," *History of Science* 40, 2 (2002): 125–45 and Christopher Lawrence and Steven Shapin (eds.), *Science Incarnate: Historical Embodiments of Natural Knowledge* (Chicago: University of Chicago Press, 1998). See also Simon Shapin, "How to Eat Like a Gentleman: Dietetics and Ethics in Early Modern England," in Charles Rosenberg (ed.), *Right Living: An Anglo-American Tradition of Self-Help Medicine and Hygiene* (Baltimore, MD: Johns Hopkins University Press), pp.21–58.
  15. A.-M. Millim, *The Victorian Diary: Authorship and Emotional Labour* (Surrey: Ashgate, 2013), p.73.

at the kinds of measurements and personhood that state and non-state actors have promoted through their emphasis on personalized measurements and at the ways in which individuals have embraced this self-measuring advice. By looking from below, we can problematize and pluralize stories of measurements and expertise and thereby come closer to individual experiences of measurement, even though lived historical practices are always harder to find than ideals of personhood.

## A history of self-tracking

Although today the options for measuring and monitoring oneself have multiplied, people have reflected on the states of their bodies and minds for centuries using analogue devices to do so. Individuals have used scales to measure body weight, and thermometers to record temperature, and used pen or pencil and paper to record systematically – although not usually quantified – their physical condition, habits or mindset. We see two entangled strands of history here: the measurement of the body in its healthy or less healthy state and the measurement of morality, each linked to the goal of improvement.<sup>16</sup>

Famously, Santorio Santorio (1561–1636), a physician based in Venice and at the University of Padua, expended a great deal of his energy on monitoring his body and its weight changes through his food ingestion and discharges. For this purpose, he devised a weighing chair, a chair attached to a steelyard balance.<sup>17</sup> In his work, Santorio emphasized that weight-watching made it possible to maintain the body at the same weight, by eating and drinking just as much as the body had discharged, not only in faeces and urine but also in “insensible perspiration.” By doing so he connected the measurement of the body to individual wellbeing. In fact, the weighing chair was a mechanical version of what modern devices try to accomplish by nudging us with buzzes or thumbs up, as in practice it was meant to be used next to the table where one ate one’s meal. And, “as soon as one had eaten enough [ . . . ] the seat of the Sanctorean chair would drop down as an effect of the increase in weight. As a consequence, all the food and drink would get out of reach, thus sanctioning the end of the meal.”<sup>18</sup>

As Lucia Dacome shows in a beautiful article, Santorio’s chair was received with a mixture of ridicule and interest in the seventeenth and the eighteenth centuries. Quite apart from

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16. For the less healthy state see also Kathy Charmaz, *Good Days, Bad Days: The Self in Chronic Illness and Time* (New Brunswick, NJ: Rutgers University Press, 1991). An article about the Fitbit also cursorily mentions Dorothy Wordsworth’s diaries, in which she records her daily walks: Kate O’Riordan, “Fitbit. Wearable Technologies and Material Communication Practices,” in Jeremy Wade Morris and Sarah Murray (eds.), *Appified: Mundane Software & the Rise of the Apps* (Ann Arbor: University of Michigan Press, 2018), pp.115–24.
  17. Santorio’s many other inventions, such as the pulsilogium to measure pulse and a thermometer, made an even more thorough monitoring possible. Natasha Schüll Dow also mentions Santorio in “LoseIt!: Calorie Tracking and the Discipline of Consumption,” in Jeremy Wade Morris and Sarah Murray (eds.), *Appified: Mundane Software & the Rise of the Apps* (Ann Arbor: University of Michigan Press, 2018), pp.103–14.
  18. Lucia Dacome, “Balancing Acts: Picturing Perspiration in the Long Eighteenth Century,” *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 43, 2 (2012): 379–91, 381.



the investments needed at the dinner table, the method was dismissed as tedious and unnecessarily concerned with single drops of sweat. In France, for example, Antoine Lavoisier and Armand Séguin argued, after an eleven-month digestive experiment that also involved weighing the subject, food, perspiration, and excrement, that “absolute weight of food consumption was unrelated to bodyweight,” and therefore a Sanctorian style that rigorously calculated food intake and regimen was unnecessary.<sup>19</sup> Nevertheless, thanks to Santorio, dietetics became a more individual, experimental, and quantitative pursuit, and although self-measuring at this point was more for the scientifically inclined than an everyday practice, Santorio did have a number of devoted followers who tried to replicate his findings about intake and output and followed his regimen to maintain a balanced lifestyle and healthy weight.<sup>20</sup>

A century later, on the other side of the Atlantic, Benjamin Franklin was influenced by Santorio, whose work started his fascination for moderation and the balance of fluids and solids entering and leaving the body. But Franklin also monitored his moral behavior and kept a record of his sins.<sup>21</sup> For that purpose, he created a list of virtues that he valued highly, and each day placed a dot next to the virtue he had violated, so his sins were tabulated and could be quantified. There is a strong sense of self-improvement inherent in this diary and Franklin’s aim was to keep the number of dots as low as possible. Franklin’s approach is now copied by self-trackers who call it a “life hack,” among them American self-experimenter David Allen, who tried Franklin’s method because “tracking and accountability are two key components of successful habit formation.”<sup>22</sup> After ten years of tracking, although not perfect in personality, he was satisfied with the result.

Franklin’s system is reminiscent of a similar system that was in place in sixteenth- and seventeenth-century China, where individuals also counted their individual worth. Popular ledgers of merit and demerit were used to “quantify the deeds they list, assigning a certain number of merit or demerit points to each.”<sup>23</sup> Users of these ledgers recorded their daily good and bad deeds, and could check their monthly progress so that, at the end of the year, they knew what the gods had in store for them for the year ahead.<sup>24</sup> Although many religions espouse the idea of balancing virtues and sins, and bookkeeping has

19. Emma C. Spary, *Feeding France: New Sciences of Food, 1760–1815* (Cambridge: Cambridge University Press, 2014), pp.119–21. Other scientists, such as Johannes de Gorter in the Netherlands in the 1720s, experimented with the Sanctorian chair but were concerned more with the process of perspiration than with individual health: see Ruben Verwaal, *Fluid Bodies. Physiology and Chemistry in the Eighteenth-Century Boerhaave School* (PhD thesis, University of Groningen, the Netherlands, 2018), pp.144–6.

20. Dacome, “Balancing Acts” (note 18).

21. Joyce Chaplin, *The First Scientific American: Benjamin Franklin and the Pursuit of Genius* (New York: Basic Books, 2006). As Chaplin writes, his insistence on moderation and temperance did not prevent Franklin from becoming “Dr. Fatsides” in later life.

22. He used different virtues. David G. Allan, “Ben Franklin’s ‘13 Virtues’ Path to Personal Perfection,” *CNN.com*, 1 March 2018, <<https://edition.cnn.com/2018/03/01/health/13-virtues-wisdom-project/index.html>> (5 November 2019).

23. Cynthia J. Brokaw, *The Ledgers of Merit and Demerit: Social Change and Moral Order in Late Imperial China* (Princeton: Princeton University Press, 1991), p.4.

24. These gods have now been replaced by the Chinese state, which is rolling out its social credit system, in which every individual citizen (and business) is given a rating based on government data about their lives, such as their financial situation and online behavior.

always had an overtone of discipline and morality, Franklin's moral bookkeeping and the ledgers of merit and demerit share a utilitarian approach and calculation that resemble present-day self-tracking practices.<sup>25</sup>

In France, Marc-Antoine Jullien, a revolutionary-cum-pedagogue, was inspired by Franklin and extended his thirteen virtues to physical and intellectual activities.<sup>26</sup> As we can read in Harro Maas' article, he devised several kinds of pre-printed logbooks in which individuals could write down everything that happened to them in a systematized fashion. His *Agenda général* (General Diary) had a space for each day and included a column in which the day could be judged as good, bad, or average. His most quantitative logbook was the *Biomètre, ou Mémorial horaire* (Biometer, or Hourly Memorial/Day Book), and he also developed a monthly graph on which individuals could record their daily satisfaction on a scale of 0 to 20, which made progress or the lack thereof visible. The aims were self-control and happiness, and its designation as a "moral thermometer," "moral compass," "moral spring," and "moral pair of scales" leaves no doubt that the system was inspired by tools used in the natural sciences.<sup>27</sup> According to Philippe Lejeune, Jullien was obsessed with efficiency and terrified by the idea of waste, and he suggests that the diary became the end rather than a means to the end.<sup>28</sup>

So already by the nineteenth century, middle-class individuals were sometimes active monitors of their own health and behavior, and possessed bodily self-knowledge that they would use as an argument when they communicated with doctors.<sup>29</sup> In the late nineteenth century, however, with the increased quantification of science and society and a more scientifically literate people, technologies for self-measuring found an increased

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25. For moral bookkeeping, see James Aho, *Confession and Bookkeeping. The Religious, Moral, and Rhetorical Roots of Modern Accounting* (Albany: State University of New York Press, 2005), Jason Scott-Warren, "Early Modern Bookkeeping and Life-Writing Revisited: Accounting for Richard Stonley," *Past & Present* 230, 11 (2016): 151–70 and Harro Maas, "Letts Calculate: Moral Accounting in the Victorian Period," *History of Political Economy* 48 (2016): 16–43.
26. P. Lejeune, "Marc-Antoine Jullien: Controlling Time," in Arianne Baggerman, Rudolf Dekker, and Michael Mascuch (eds.), *Controlling Time and Shaping the Self: Developments in Autobiographical Writing since the Sixteenth Century* (Leiden: Brill, 2011), pp.95–120, 107.
27. The idea of the "moral" thermometer or barometer is as old as the instruments themselves. See Terry Castle, *The Female Thermometer: Eighteenth-Century Culture and the Invention of the Uncanny* (New York: Oxford University Press, 1995), p.21, cited by Deanna Day, *Fevers, Fertility and Patient Labor of American Medicine* (PhD in History and Sociology of Science, University of Pennsylvania, 2014). See also Sam Ferguson, "Why Does Life Writing Talk about Science? Foucault, Rousseau, and the Early Journal Intime," *Biography* 40, 2 (2017): 307–22.
28. Lejeune, "Marc-Antoine Jullien," p.104 (note 26).
29. See for example Shapin, "How to Eat like a Gentleman" (note 14), Steven Shapin, "Was Luigi Cornaro a Dietary Expert?" *Journal of the History of Medicine and Allied Sciences* 73 (2018): 135–49 and Michael Stolberg, "'Mein äskulapisches Orakel!' Patientenbriefe als Quelle einer Kulturgeschichte der Krankheitserfahrung im 18. Jahrhundert," *Österreichische Zeitschrift für Geschichtswissenschaften* 7 (1996): 385–404.



usage and numbers became integral parts of individuals' definitions of health and beauty.<sup>30</sup> The focus on health and wellbeing then seems to overtake religiously inspired tracking, but in fact there is a considerable overlap in themes: virtues such as moderation and diligence continue to be important. What was different in the late nineteenth century is that the standards were usually defined by the medical profession, insurance industry, or the state, whereas the data from early modern self-trackers such as Santorio could only be judged against earlier measurements of their own bodies and behavior.<sup>31</sup>

One well-known example of a late-nineteenth-century measurement technology is the thermometer. After 1850, thermometers became easier to use and calibrate. Like with other measuring instruments, they then left the exclusive domain of the doctor and were increasingly used by nurses or other medical personnel, a development that decreased the status of the measuring itself and made the interpretation of the data the quintessential expert's job.<sup>32</sup> But when thermometers were introduced into homes, they also changed the relationship between doctor and patient. As Volker Hess describes, home thermometers "permitted the patients to form their own judgements about their illness – something that physicians did not always like."<sup>33</sup> According to Hess, the effects of this were not so much a Foucauldian internalization of medical norms, but a democratization of health that created responsible and active patients.

In her thesis on the uses of the consumer thermometer in the United States, Deanna Day places a different emphasis. Instead of Hess' active patient, she portrays female self-trackers who turned to temperature tracking to chart their fertility or to look after a sick child as women who internalized a "particular kind of regimented and predictable bodily functioning, as well as blame for its failure." This development, according to her, prefigures the neoliberal bodily management of today's self-tracking practices.<sup>34</sup> Fertility tracking with temperature became a more common practice in the course of the twentieth

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30. Patricia Cline Cohen, *A Calculating People: The Spread of Numeracy in Early America* (Chicago, IL: University of Chicago Press, 1982).

31. Of course, those unique measurements were also used to make universal scientific conclusions about the human body.

32. Volker Hess, *Der wohltemperierte Mensch. Wissenschaft und Alltag des Fiebermessens (1850–1900)* (Frankfurt am Main: Campus, 2000), p.229. For the same development in blood pressure measurements, see Eberhard Wolff, "Das 'Quantified Self' als historischer Prozess. Die Blutdruck-Selbstmessung seit dem frühen 20. Jahrhundert zwischen Fremdführung und Selbstverortung," *Medizin, Gesellschaft und Geschichte* (2018): 43–84.

33. Volker Hess, "Standardizing Body Temperature: Quantification in Hospitals and Daily Life, 1850–1900," in Gérard Jorland, Annick Opinel, and George Weisz (eds.), *Body Counts: Medical Quantification in Historical and Sociological Perspective* (Montreal: McGill-Queen's University Press, 2005), pp.109–26, 119.

34. Day, *Fevers, Fertility, and the Patient Labor* x (note 27). For a similar perspective see Martina Schlünder, "Die Herren der Regel/n? Gynäkologen und der Menstruationskalender als Regulierungsinstrument der weiblichen Natur," in Cornelius Borck, Volker Hess, and Henning Schmidgen (eds.), *Maß und Eigensinn. Versuche im Anschluß an Georges Canguilhem* (München: Fink, 2005), pp.157–95. For other female trackers see Laura Doan, "Marie Stopes's Wonderful Rhythm Charts: Normalizing the Natural," *Journal of the History of Ideas* 78, 4 (2017): 595–620.

century, especially among Catholic women, until it started to face competition from the pill and the diaphragm. It is making a digital comeback today.<sup>35</sup>

Like the thermometer, weighing-scales are one of the more common of our self-tracking technologies. Hillel Schwartz's history of dieting in the United States, which also starts with Santorio Santorio's continuous self-scrutiny, follows the introduction of the weighing scale in the household in the first half of the twentieth century. Their introduction went hand-in-hand with an increasing concern with the normal, average, and desirable weight and an emphasis on self-responsibility for one's weight and a healthy and beautiful body, of which the scales were the judge.<sup>36</sup> In the UK, as Roberta Bivins and Hilary Marland have shown, the bathroom scale only became a common domestic utensil in Britain by the late 1960s to early 1970s. Here again, the medical and the moral are two sides of the same coin: "Weight, its surveillance, and its control are, it seems in the home to stay—demonstrating not only the durability of the bathroom scale, but of moral, rather than exclusively medical systems, for managing embodiment." However, according to Bivins and Marland, the bathroom scale did not necessarily mean the domestication of medicine or passive self-surveillance but left plenty of room for individual agency to do whatever a person wanted with the bathroom scale information.<sup>37</sup>

Similarly, calorie counting has also shaped the life of many dieters since the early twentieth century.<sup>38</sup> Choice of diet had always been one of the few aspects of health and sickness that was under human control, and keeping a record of what one ate made people aware of their intake and brought structure to eating habits. Calorie quantification added to that a more numerical and objective approach to individual foodstuffs. Rather than weighing what went in and out like Santorio, calorie counting provided a complex system in which different foods had a different caloric value and were therefore anything between safe to eat or dangerously unhealthy. In the United States, as Schwartz details, the first popular calorie-counting diets appeared around the First World War, including notebooks to keep track of the calories consumed.<sup>39</sup>

35. For a sociological analysis of digital temperature trackers in the 1980s see Ingo Braun, *Technik-Spiralen: vergleichende Studien zur Technik im Alltag* (Berlin: Edition Sigma, 1993), pp.200–43. See also Deborah Lupton, "Quantified Sex: A Critical Analysis of Sexual and Reproductive Self-tracking Using Apps," *Culture, Health & Sexuality* 17, 4 (2015): 440–53.

36. See for example also Hillel Schwartz, *Never Satisfied. A Cultural History of Fantasy and Fat* (New York: Free Press, 1986), pp.165–71 and Hieke Huistra, "Standardizing Slimness. How Body Weight Quantified Beauty in the Netherlands, 1870–1940," in Claudia Liebelt, Sarah Böllinger, and Ulf Vierkepp (eds.), *Beauty and the Norm: Debating Standardization in Bodily Appearance* (London: Palgrave Macmillan, 2019), pp.45–73.

37. Roberta Bivins and Hilary Marland, "Weighting for Health: Management, Measurement and Self-Surveillance in the Modern Household," *Social History of Medicine* 29, 4 (2016): 757–80, 780.

38. Nina Mackert, "Feeding Productive Bodies: Calories, Nutritional Values and Ability in Progressive Era US," in Peter-Paul Bänziger and Mischa Suter (eds.), *Histories of Productivity: Genealogical Perspectives on the Body and Modern Economy* (London: Routledge, 2016), pp.117–35.

39. Schwartz, *Never Satisfied*, 176–7 (note 36).

Perhaps the experts who knew most about their bodies and disease in the twentieth century thanks to self-tracking were diabetes patients. As Arleen Tuchman shows in her article about the management of diabetes in the United States in the early twentieth century in this issue, diabetes patients were told to monitor and record their bodies carefully, including the weighing of food and the counting of ingested calories, their physical activities, and, once it became available, the administration of insulin, all to find a perfect balanced lifestyle and medicine intake. This knowledge of their bodies, Oliver Falk has shown, changed their relationship with doctors, who were dependent on the information of their patients to learn more about the disease and what worked as a therapy.<sup>40</sup> It is no surprise that even today, diabetes patients are seen as the most avant-garde self-trackers of their age.

## Conclusions and suggestions

From moral accounting in the early nineteenth century to late-twentieth-century devices for measuring blood sugar, in this special issue we analyze the implications of measuring in the lives of individuals. With five papers on a variety of self-monitoring and measuring tools, we show how individuals have appropriated these techniques and how they have impacted on the most intimate spheres of life. There are several points to which we want to draw attention.

The first of these is the progress of measurement into the household and schools, a process that has been neither even nor universal but shows us how homes and schools have become sites of quantification for the sake of oneself. Elise Smith shows in her article that Francis Galton and Charles Roberts were propagating the domestication of measurement, not so much for the good of individuals as for their own, but they understood that personal details about growth were best gathered by self-tracking at home, and not in the doctor's surgery. As Arleen Tuchman shows in her article about the management of diabetes in the United States in the early twentieth century, diabetes patients increasingly needed "number producing" tools at home to control their lives and keep their blood sugar at the desired level: measuring cups, spoons, and scales for weighing food; and once insulin became available, calibrated syringes and home kits for determining the amount of sugar in the urine. Jim Wynter Porter, on the other hand, emphasizes the introduction of measurement into schools rather than households, where, in the late 1950s, the measurement of "intelligence" (or "academic talent" or "ability") began to shape the future school careers of U.S. pupils much more systematically. This, he shows, was not only meant to change the self-understanding of the newly measured individual but also to spread the ideology of individual "intelligence."

Second, we emphasize how numbers are empty symbols unless they can be compared to other data and standards produced by scientists. Individual growth has been tabulated against growth curves, intelligence scores against average scores, diabetes patients have learned to understand which number indicated that the amount of glucose in their urine

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40. Oliver Falk, "Der Patient als epistemische Größe. Praktisches Wissen und Selbsttechniken in der Diabetestherapie 1922-1960," *Medizinhistorisches Journal* 54 (2018): 36–58, 38. See also Christiane Sinding, "Making the Unit of Insulin: Standards, Clinical Work, and Industry, 1920–1925," *Bulletin of the History of Medicine* 76 (2002): S. 231–70, 261.

was fine and which number signaled that they were in the danger zone. In the case of the moral accounting of the Genevan pastor Naville in the early nineteenth century, such a comparison is with earlier selves. As Harro Maas describes, Naville tracked his moral behavior from day to day over a number of years against lists of moral goals and noted his scores for the day or week. Like Benjamin Franklin's moral accounting, this made weekly or monthly scores easily visible. In his case, the possibility of self-improvement was an inbuilt feature of the system, because Naville hoped to keep his score on virtues higher than that of the week or month before.

Third, although in Naville's case the relation between measuring and morality is straightforward, in the other cases too there was no measuring without morality. The rhetoric that accompanied the insistence on measuring was also highly morally charged. In the case of monitoring diabetes, as Arleen Tuchman shows in her article, patients managed the disease in their bodies much as they quantified their character: "a high sugar count suggested a life of 'self-indulgence'; a low or 'normal' count indicated an appreciation of the virtues of living modestly." In Roberta Bivins' article on professional and popular discourses about overweight and weight self-management in the UK, quantified by weight or body mass index (BMI), mental, moral, and physical fitness are often conflated and weight is increasingly seen as a personal, not a political, issue, and self-measuring a mode of self-control. Interestingly, as Bivins shows, weight measurements are usually represented as private and personal activities with room for individual interpretation. BMI, on the other hand, despite using almost exactly the same measurements to quantify the individual, was imposed by a state that was increasingly cost-conscious, and was tied to a rhetoric of relative health in relation to an abstract population that was (and is) becoming increasingly overweight. In all the articles in this special issue, the supposed objectivity of measurement and the disciplining of applying it are regularly linked to the virtues of self-control, self-regulation, and self-improvement.

Finally, we want to emphasize how quantification has introduced new conceptions of body and self to individuals by creating measurement data that were previously unknown. "Intelligence," for example, as we understand from Jim Porter's paper, is held to be an objective, scientifically measurable, individual difference and hence is allegedly a far more reliable predictor of future academic success than the subjective, partial – even prejudicial – assessments made by teachers. This also means that numbers have become the new criteria for what is counted as real knowledge, while other senses or selves, embedded in cultural and social practices and based on haptic knowledge or intuition, have been relegated to second place, as in the case of the measurement and calculation of BMI.<sup>41</sup>

Several recent commentators on contemporary self-tracking and quantification practices have suggested that these data create a new sort of extended or outsourced self: Lupton, for example, writes about a "type of selfhood that is distributed between different and constantly changing data sets."<sup>42</sup> Others speak of "a sort of fourth-person

41. Sharon, "Self-Tracking for Health," p. 102 (note 5).

42. D. Lupton, "The Diverse Domains of Quantified Selves: Self-tracking Modes and Dataveillance," *Economy and Society* 45, 1 (2016): 101–22, 115.

perspective”<sup>43</sup> on the self or a “scaffolded” self.<sup>44</sup> In a different context that is more applicable to the historical cases in this special issue, Joseph Dumit has introduced “objective self-fashioning”: a kind of selfhood developed through references to expert knowledge and invoked through facts that bear the authority of science.<sup>45</sup> Since “intelligence” has been defined as a score on a standardized test, for example, we have become used to understanding our intelligence as part of our personal identity. In the historical practices we describe in this special issue, we recognize this increasing widening of what the self entails when individuals incorporate a supposedly detached and objective new perspective. It is no coincidence that the French inventor of the biometer, Jullien, also suggested that people write their diaries in the third person.<sup>46</sup>

Is this then a history of growing scientific surveillance that has become internalized? Were the body and behavior reshaped “as a project to be managed in a way that aligns with medical regimes, thus extending the reach of medical power”?<sup>47</sup> We want to emphasize that the difference between autonomous self-making and self-surveillance is not very clear-cut.<sup>48</sup> While new knowledge, in the case of the Genevan pastor Naville, for example, could sometimes shed light on aspects of the self and, to a certain extent, he decided on the categories he found important, he was nevertheless guided by a strong sense of religious duty. Temperature measured by a thermometer could be used as an argument in better informed discussions with physicians, but measurement without the standards provided by institutions was rarely seen as useful. And Arleen Tuchman shows, for example, that although diabetic self-trackers might have gained new insight into their diseased bodies and hence developed a new sense of self-control, they were no less dependent on their medical specialists and continued to long for a more independent life.

As is the case in the history of all emerging technologies, the introduction of self-tracking and personal quantification has never been a natural or frictionless process of increasing options for everyone by which to learn to know the body and self. We see traces of several historical periods and developments in today’s use of self-tracking technologies. Some users are closer to Santorio in the sense that their tools make it possible for them to experiment with their health and habits with only their past selves as the standard. Other users, however, are more like those early-twentieth-century weight watchers who weighed themselves in the privacy of the bathroom, and looked up the

43. Melanie Swan, “The Quantified Self: Fundamental Disruption in Big Data Science and Biological Discovery,” *Big Data* 1, 2 (2013): 85–99, 96.

44. Joseph Heath and Joel Anderson, “Procrastination and the Extended Will,” in Chrisoula Andreou and Mark D. White (eds.), *The Thief of Time: Philosophical Essays on Procrastination* (Oxford: Oxford University Press, 2010), pp.233–52, 233. See also Farzana Dudhwala, “Redrawing Boundaries around the Self: The Case of Self-Quantifying Technologies,” in Rebecca Lynch and Conor Farrington (eds.), *Quantified Lives and Vital Data. Health, Technology and Society* (London: Palgrave Macmillan, 2017), pp.97–123.

45. Joseph Dumit, *Picturing Personhood: Brain Scans and Biomedical Identity* (Princeton: Princeton University Press, 2004), pp.163–4.

46. Lejeune, “Marc-Antoine Jullien: Controlling Time,” p.103 (note 26).

47. Sharon, “Self-Tracking for Health,” p. 98 (note 5).

48. For surveillance see Michel Foucault, *Discipline and Punish: The Birth of the Prison*, translated into English by A. Sheridan (London: Allen Lane, 1977).

ideal in height and weight charts, and who suffered under the combined expectations of science and society as to what a healthy and beautiful body looked like.

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