

Scripts and Re-scriptings of Self-Tracking Technologies: Health and Labor in an Age of Hyper-Connectivity*

Dae-cheong Ha**

Abstract

Diverse future scenarios are presented in the expectation that the so-called “fourth industrial revolution” will come up, and one of them is a hyper-connected society where technologies such as the internet of things, big data and artificial intelligence converge. We, however, have paid little attention to meaningful signs that can be found in practice, allowing our imagination to rely mainly on future societies predicted by technology visionaries. In this vein, this study explores the settings and practices of wearable self-tracking technologies, which attempt to make humans part of complex networks of hyper-connected society. It examines how our bodies and lives are (re)shaped in an age of hyper-connectivity by analyzing the practices of self-tracking technologies, which steadily and automatically transform users’ everyday lives and bodily responses into a series of data. Drawing on the theory of Science and Technology Studies (STS), this article investigates how “scripts,” which were initially written to expect and define both humans’ and nonhumans’ actions and their relationships, have to be re-written in different settings in which these technologies are situated. That is, the original scripts of these technologies written in well-known “Quantified Self movement” are transformed and re-inscribed in concrete settings such as digital healthcare and labor management. Consequently, in contrast to the first script which expected self-empowerment and self-improvement of users, new scripts are rewritten as a “digital nudge,” “extreme Taylorism,” and “intimate surveillance” in these settings. This article concludes that we need to sincerely ask and answer ethical questions concerning these technologies for their realized script to form the world in which we want to live. These efforts to incessantly raise and answer questions concerning decision-making authority, privacy, data ownership, security, and reliability in concrete settings will contribute to making the hyper-connected society that we want to live in.

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** Korea National Institute for Bioethics Policy, daecheong.ha@gmail.com

I. Hyper-connected Society and Self-Tracking

In the dramatic technological changes called the Fourth Industrial Revolution, innovative technology platforms are continuously generated as robots, artificial intelligence, the internet of things, big data, and biotechnology converge.¹ The new revolution is not only promising new opportunities for industry but also is threatening our long-held values and norms, changing everyday life.² A typical example of various social phenomena drawn by the Revolution is a hyper-connected society. In a hyper-connected society, all connected devices interact with each other, achieving optimal functioning through the convergence of the internet of things, big data, and artificial intelligence. The future of hyper-connectivity results in various scenarios including smart homes and smart cities, and it is already realized in part in various sectors such as manufacturing, automotive, finance, disaster response, medical care and security.

Human beings cannot be exceptions to this connected society. Through wearable technologies attached to the body, human beings are also becoming a component of this hyper-connected network. A technology that seamlessly tracks, collects and analyzes information about our bodies and lives regardless of our recognition is often referred to as self-tracking technology. The term “self-tracking” may sound unfamiliar, but picturing Samsung Gear, the Apple Watch or the Fitbit wristband that we already have in our daily lives will help you understand its meaning more easily. Self-tracking refers to activities in which a user attaches a wearable device onto his or her body to record and analyze various reactions of the body and daily lives as digital data. Beyond smart phones, wrist watches, necklaces, and wristbands, new attempts have

¹ The term “the Fourth Industrial Revolution” is in fact a subject of debate. There are many questions and debates on the term, such as whether the related technological change is disconnected from the past enough to be called “Revolution,” or whether the use of this term is just rhetorical or strategic. This article acknowledges that the use of this term has some political effect, and declares that the term has been adopted as the most familiar one to refer to the current situation. See Klaus Schwab, “The Fourth Industrial Revolution: What It Means and How to Respond,” in *The Fourth Industrial Revolution: A Davos Reader*, eds. Gideon Rose and Klaus Schwab (New York: Council on Foreign Relations, 2016); Korean Association of Science and Technology Studies (KASTS), “The Fourth Industrial Revolution and Science and Technology Studies.” Proceedings of the 2017 KASTS Biannual Conference, May 27, 2017.

² Jong-hyun Paek, “The Fourth Industrial Revolution and the Socioethical Challenges.” Presented at the Korean Posthuman Society and Korean Ethics Society “The Fourth Industrial Revolution and New Norms” symposium, Seoul, May 20, 2017.

been made recently like patches attached onto skin or sensors implanted under the skin. Sensors of wearable devices are becoming more and more diverse and now they check user's location, number of steps, amount and quality of sleep, heart rate, electrocardiogram, body temperature, body weight, blood glucose, oxygen saturation and level of alcohol consumption, and calculate calorie intakes and consumption. In the case of a digital thermostat that is connected to a temperature sensor attached to the body, it will adjust the room temperature after checking one's body temperature. Not only are physiological states and daily activities measured, the tone of the brain waves and voices are also checked and combined to analyze the types of emotion and stress level.³

Self-tracking began to seek behavioral or habitual improvement by finding out regular patterns in behaviors or physiological responses through systematic data collection.⁴ Self-tracking is often referred to as personal informatics, personal analytics, life-logging and quantified self, as it records and informs the individual's body, behavior, and life as a whole. This self-tracking, which was once regarded as a geek's experiment, has now become a culture rising in popularity. The measured results of a wearable device are synchronized not only with applications on a smartphone, but also the cloud server as they are compiled as statistics and compared with those of other users. Suggestions on improvement such as exercise and diet are offered to users and are often given rewards combined with games to maintain users' motivation. Some users post their results on social media such as Facebook and Twitter to share them with their friends and compete with each other.

The popularity of self-tracking is also becoming a new industrial area. Venture capital and technology start-ups are scrambling to develop self-tracking related devices and applications, and smartphone manufacturers such as Apple and Samsung are taking digital healthcare as their primary business. Approximately 202 million wearable devices were launched in 2016, and by 2021, the number is expected to exceed 500 million units.⁵ Also, self-tracking is being introduced not only in personal activities or commercial

³ Recently, new attempts have been made to combine genome analysis, cloud technology and big data.

⁴ See Gary Wolf, "The Data-Driven Life." *The New York Times*, April 28, 2010; Sang-Min Kim, "I Become My Own Data: Digital Self-Tracking Activity and Data Subject," *Cultural Science* 87 (2016): 57-74; Sang-Min Kim, *Culture and Technology of Digital Self Tracking* (Seoul: Communicationbooks, 2016).

⁵ Jane Wild, "Wearables in the Workplace and the Dangers of Staff Surveillance," *Financial Times* Feb.

planning, but also in large research projects drawing on big data. The Obama administration's Precision Medicine Initiative, launched in 2015, collects and analyzes life-log and genetic information from voluntary participants including cancer patients and the general population with the help of self-tracking devices.

Through journals and memos, the practice and culture of self-tracking has existed in the past, but as sensors become smaller and mobile platforms are introduced, self-tracking is becoming more automatic. With a band or a watch attached onto the wrist, various figures are automatically generated, analyzed and counted. In addition, these automatically generated data create higher objectivity and credibility through quantification and lead to a result different from the previous examples of self-tracking. When the human body and behavior with various sensors are digitized in real time and recorded, stored, analyzed, transmitted and shared in a hyper-connected society, how will humans be transformed? How will labor and health—the key elements of our daily lives—be redefined? And how will our identity be reshaped? This article focuses on wearable self-tracking technology to gauge the possible outcomes of such a hyper-connected society. Rather than attempting to make a futuristic diagnosis which has become a trend these days with the emergence of the Fourth Industrial Revolution, the paper will explore socio-technological issues while following and observing the scenes in which the technology is implemented. Finally, I will take a look at how ethical issues such as responsibility and subjectivity develop in concrete realities and reflect its implications, instead of inferring and taking an ethical stance.

II. Scripts on Wearable Self-Tracking Technology

This study, unlike previous ones, draws on the achievement of “Technology Studies” of Science and Technology Studies (STS) to answer the above questions.⁶ STS, which

28, 2017.

⁶ Recently, much research about self-tracking has been published, though interest on this subject within STS still remains low. Most of them are from the perspectives of media studies, cultural studies, and women's studies. For reference, see Deborah Lupton, *The Quantified Self* (Cambridge, UK: Polity Press, 2016); Gina Neff and Dawn Nafus, *Self-tracking* (Cambridge, Massachusetts: MIT Press, 2016); Rachel Sanders, “Self-tracking in the Digital Era: Biopower, Patriarchy, and the New Biometric Body Projects,” *Body and Society* 23, no.

explores how technology is designed, developed and used in real life, does not sharply distinguish technology and society, technology and value, and technology and morality, unlike other fields that tend to deal with technology in an ideological sense. In fact, when we closely look at the development and implementation of technology, such a dichotomy is not being considered seriously even by engineers. As STS clearly shows, inventors and engineers always link materials and values, and mix up artifacts and morality through the production process. In contrast to previous approaches that clearly separate technology from humanity, thereby viewing technology as just a tool or means to an end, STS recognizes that technology itself is a heterogeneous combination of values and materials, or morality and artifacts, that is, human and nonhuman elements.⁷ Therefore, technology is not a tool or a value-neutral means of simply realizing a human's intention or purpose, but rather it is a subject with which values, morality, beliefs, interests, and imagination of human beings are always intertwined. At the same time, it also materializes and reconstitutes our identity, values and morality. Bruno Latour, a philosopher who pioneered this insight, claims that technology has existed before the emergence of languages. He sees it as an element that has constituted human beings since ancient times and as one of mode of existence that human beings need in order to be human beings.⁸

Understood in this context, technology is not a simple tool for realizing a set purpose, but an "actor" that mediates action in society.⁹ It may allow, prohibit, induce, or prescribe certain actions, and often promise or imply actions. Technology predicts new relationships between humans and nonhumans, assigns new abilities to humans, defines new subjectivity, constructs morality, and distributes responsibility. Madeleine Akrich and Bruno Latour, who focus on this agency of technology, have described the trajectory of technology as a process of script, in-scripting and re-inscription.¹⁰

1 (2017): 36-63.

⁷ Bruno Latour, *Pandora's Hope: Essays on the realities of science studies* (Cambridge, MA: Harvard University Press, 1999); Bruno Latour, "Morality and Technology," trans. Couze Venn, *Theory, Culture and Society* 19 no. 5/6 (2002): 247-260.

⁸ Latour, "Morality and technology."

⁹ Latour, *Pandora's Hope*.

¹⁰ Madeleine Akrich, "The de-Description of Technical Objects," in *Shaping Technology/Building Society: Studies in Sociotechnical Change*. eds. Wiebe E. Bijker and John Law (Cambridge, MA: MIT Press, 1992) 205-224; Bruno Latour, "Where are the Missing Masses? The Sociology of a Few Mundane Artifacts," in *Shaping Technology/Building Society: Studies in Sociotechnical Change*. eds. Wiebe E. Bijker and John Law

In the planning stage, technology creates expected behaviors for human and non-human as a script (in-scription), but as users, institutions, cultures, and other technologies are in turn involved in actual settings, it generates new action, subjectivity, value, and responsibility distribution (re-inscription). For example, cochlear implant technology created a script that promised users the ability to overcome hearing impairments; however, the deaf community resisted the use of it, saying that the technology otherizes a deaf person's difference as inferior.¹¹ The script of technology is always uncertain because it cannot fully predict or control the contingency of reality, and is re-scripted within the context of users and specific settings. Therefore, the execution of technology does not simply mean the intended function is implemented, but rather indicates that unexpected newness always emerges through re-inscription. In other words, technology itself can be referred to as an actor.

The script of wearable self-tracking technology, which is the theme of this paper, has been formulated through a social movement. The Quantified Self movement (QS movement) was initiated by *Wired* Magazine editor-in-chief Kevin Kelly and Gary Wolf, and its slogan is "self-knowledge through numbers." The so-called "self-trackers," scattered around the world and indulged in pursuing data on the self, began to share their own experiences and experiments at regular meetings thanks to the movement. In an article in *the New York Times* in 2010, Wolf explained the significance of this movement by introducing various techniques and attempts related to self-tracking.¹² He argued that if psychoanalysis had analyzed people with "language," self-tracking was an attempt to understand ourselves with "numbers." He said, "Instead of interrogating their inner worlds through talking and writing, they [self-trackers] are using numbers. They [self-trackers] are constructing a quantified self."¹³ According to him, various experiments of self-tracking are to seek not "general solutions" but "particular solutions." He argued, "The goal isn't to figure out something about human beings generally but to discover something about yourself."¹⁴ If knowledge about ourselves depends

(Cambridge, MA: MIT Press, 1992), 225-259.

¹¹ Dae-cheong Ha, "Disabled People Turned Superhumans: *Avatar*, Transhumanism, Imperative to Fix," in *The Human in an Age of Posthumanism* (Seoul: Akanet, 2016), 127-152.

¹² Wolf, "The Data-Driven Life."

¹³ *Id.*

¹⁴ *Id.*

on memory or intuition, it can easily be distorted. On the other hand, objective data tell us what we are without distortion. Self-tracking advocates argue that such knowledge about ourselves will eventually help us make better decisions and bring about self-mastery and self-improvement.

This explanation of the QS movement is based on several interesting presumptions. These presumptions are that having self-tracking data will lead to a better understanding of oneself, that is, the tracking data is objective and so it better explains the self (“My data is I” or “a device that understands me better”), which means that I can make better choices and reach self-control or self-improvement through information provided by these data. Wolf believed that we could optimize our bodies with the help of digital devices, like tuning cars or optimizing the assembly line. Thus, the script of self-tracking technology is based on the idea of “empowerment,” in which quantified data, either through knowledge or behavior improvement, will provide more power to individuals. Also, the script of self-tracking imagines a rational and autonomous individual. Individuals using this technology become rational and autonomous subjects if they rely on objective data rather than intuition, and so they can reach self-understanding and self-improvement through experiments on themselves.

Is self-tracking technology really a means of empowerment to help make better decisions based on objective numbers in our daily lives? Or, like critics say, will this technology bring about a so-called “Datafication” society in which our daily lives are automatically transformed into data and modified into surplus value or another form of surveillance society?¹⁵ To answer this question, this article takes a look at how the script of self-tracking technology is re-scripted or re-inscribed in specific scenes. With the use of this technology, whether the autonomy and rationality of the individual is extended in accordance to the original script or whether another subjectivity and morality take form will be investigated in this paper. In answering the question, this article will observe the practices of healthcare and labor management, two typical scenes in which self-tracking technologies are implemented. Thus, I will reflect on how human beings and their lives will be transformed in a hyper-connected society.

¹⁵ José van Dijk, “Datafication, Dataism and Datavilliance: Big Data between Scientific Paradigm and Ideology,” *Surveillance and Society* 12 no. 2 (2014): 197-208.

III. Re-scripting I: Healthcare and “Digital Nudge Technology”

As self-tracking technology has been introduced in healthcare beyond the QS movement, the most notable area is so-called digital healthcare or mobile health (mhealth). In Korea, digital healthcare has been overshadowed by political and social debates on the introduction of telemedicine, but in Western societies, it has spread widely through self-tracking technology for individual healthcare and fitness. A consumer survey found that 21% of Americans use self-tracking technology for a variety of purposes, including health improvement and fitness management.¹⁶ Those who actively advocate this technology think that the technology can solve many of the problems facing modern society. They argue that the aging population and the increase of chronic diseases are making healthcare finances more burdensome in advanced industrial countries, and thus the traditional healthcare system cannot be a solution for them. The so-called “one-size-fits-all” system, in which everyone is given the same treatment, is neither effective for the individual nor efficient for the group, and thereby preventative intervention and personalized care are needed.¹⁷ This approach, called “personalized healthcare” underscores individual data.¹⁸ Data on an individual’s biology, environment, and lifestyle are needed to design personalized preventative measures and treatments, and in this sense, self-tracking technology can be seen as a part of the current “data-driven healthcare” trend.

Besides a script that the introduction of self-tracking technology will reduce the financial burden on healthcare, another important script is the realization of “participatory medicine.”¹⁹ In addition to the fact that data is critical, self-tracking is characterized by the participation of citizens or patients. It automatically calculates the number of steps, heart rate, and sleep patterns through a mobile device and, along with daily diet and body weight, the algorithms analyze a user’s health status. Based on the

¹⁶ James, H. Wilson, “Wearables in the Workplace,” *Harvard Business Review*, September 2013, accessed April 28, 2017.

¹⁷ European Commission, 2012. “eHealth Action Plan 2012-2020: Innovative Healthcare for the 21st Century,” Brussels, http://ec.europa.eu/health/sites/health/files/ehealth/docs/com_2012_736_en.pdf (accessed February 10, 2017).

¹⁸ In addition to self-tracking technology, the rise of personalized health care is a feature shared by recent emerging technologies such as stem cells, cell therapy, and genomics.

¹⁹ Barbara Prainsack, “The Powers of Participatory Medicine,” *PLOS Biology* 12, no. 4 (2014): 1-2.

results of the analysis, users are asked to increase their exercise or change to a low-calorie diet, and are expected to gradually change their lifestyle. “Self-trackers” do not passively entrust their health to experts, but rather try to be responsible for their own health by producing data on themselves and actively adjusting the health plan according to the result. The experience of Larry Smarr, known as a hero in the QS movement community, illustrates this well. A professional astrophysicist himself, he used a variety of self-tracking devices for weight management and as a result, found his disease before his physician.²⁰ He asked, “Who is crazy if a person, who thinks that a doctor who can only spend one-ten thousandth of the time I can spend on myself can accurately pinpoint my problem, is not crazy?” In this sense, Eric Topol, a cardiologist and researcher of the digital medical revolution, calls the recent trends, including self-tracking, “democratization of data” and “socialization of medicine.”²¹ In some ways, the alleged “empowerment” script from the QS movement has been transformed into “participatory medicine” in digital healthcare.

Self-tracking is portrayed as a sort of empowerment in which one can improve his or her own health without intervention or assistance from medical professionals, but it can be seen differently by critics. They argue that self-tracking is not taking power from doctors but rather putting an eye of medical power onto mobile devices and monitoring the individual’s daily life with it. With this technology, all daily functions of the individual are monitored and data is transmitted to the server of the enterprise or institution. Individual daily routines are automatically assessed and requested to be improved in accordance with the recommended exercise amount, recommended calorie intake, and normal sleep pattern determined by experts. Individuals are required to work constantly in their daily routine to be included in the categories of “normal” and “healthy” as defined by health care professionals.²² Goals are displayed in graphs,

²⁰ Luke Dormehl, *The Formula: How Algorithms Solve All Our Problems...and Create More*, trans. Seung-Young Noh (Seoul: Bandi Publishing, 2014).

²¹ Eric Topol, *The Creative Destruction of Medicine: How the Digital Revolution Will Create Better Health Care*, trans. Jae Young Baek, Jeong Tak Park, and Eun Lee (Seoul: Cheongnyeong Uisa, 2012).

²² There are many studies of political, social, and economic aspects of “healthy” and “normal” as defined by experts. For the representative studies related to chronic illness and treatment, see Joseph Dumit, *Drugs for Life: How Pharmaceutical Companies Define Our Health* (Durham, NC: Duke University Press, 2012); Jeremy A. Greene, *Prescribing by Numbers: Drugs and the Definition of Disease* (Baltimore, MD: Johns Hopkins University Press, 2008).

and emails and notifications are continuously delivered to users. In this sense, rather than being free from medical experts, recording and analyzing healthy people in terms of their daily life and routines leads to the constant monitoring and disciplining of daily life in its entirety, such as eating, sleeping, and exercising, according to the perspective of medical experts. This raises the criticism that it will bring a new form of a surveillance society unlike the expectation that self-knowledge and self-improvement will bring health and wellness.²³ Unlike the past direct monitoring by external powers, the authority of the numbers induces individuals to perform “self-surveillance.”²⁴ According to this assertion, the script of this technology weakens the autonomy and power of the individual through a kind of self-monitoring mechanism, rather than strengthening the user’s power and autonomy.

Self-trackers who are wary of disempowerment resist against the self-monitoring mechanism, for they are suspicious of the criteria set by medical professionals. Some experimenters attending the QS movement conference often hack their self-tracking devices and modify already-set parameters and analysis categories to make them suitable to their personal specifications.²⁵ However, the use of self-tracking technologies for healthcare may not fit exactly into the dichotomy of autonomy versus self-monitoring, because one cannot change behavior or habits immediately even if one knows all the figures about oneself. There is no guarantee that if one knows today’s daily calorie intake has exceeded the daily recommended level, he or she will refrain from nighttime snacking to comply with the standard. To assert that autonomy has increased, or conversely that it is weakened by surveillance and control, it should be possible to say that these self-tracking techniques specifically enforce or limit one’s behavior, but the restraint of this technology’s script is not obvious as seen from users’ experiments. In a similar vein, it is also not clear whether self-tracking devices help promote health,

²³ Deborah Lupton, “M-health and Health Promotion: the Digital Cyborg and Surveillance Society,” *Social Theory and Health* 10, no. 3 (2012): 229-244.

²⁴ The reason that this self-monitoring is novel is that the existing privacy concept can be dismantled. Unlike any surveillance program enforced by public health authorities for public health purposes, self-tracking users publish their private information voluntarily and share it with their friends through social media. This behavior, in which users themselves expose their personal information, is contrary to the existing privacy idea of protecting the private domain based on the dichotomy of the public domain and the private domain, which is why it is called “the end of privacy.” *See Id.*

²⁵ Tamar Sharon, “Self-Tracking for Health and the Quantified Self: Re-Articulating Autonomy, Solidarity, and Authenticity in an Age of Personalized Healthcare,” *Philosophy and Technology* 30, no. 1 (2017): 93-121.

and some studies have reported that wearable devices in clinical trials are not effective in weight loss.²⁶ The claim that individuals can achieve health goals through management with self-tracking sensors and related applications is still a controversial issue and continued to be a subject of proof and refutation as their accuracy and effectiveness are suspected.²⁷

Critics also believe that self-monitoring emphasizes “self-responsibility” on health. Self-tracking that continuously monitors oneself through wearable devices idealizes a responsible citizen. Self-tracking targets not only patients with chronic diseases but also those who are healthy without any symptom. It allows people manage their own risks by measuring, recording and analyzing their bodies and activities, even though they are not ill.²⁸ A citizen, who can monitor the current body state constantly to prevent future illnesses and thus change and plan his or her own lifestyle and habits according to the results, is an ideal user as defined by this technology. Citizens who perform these obligations imposed on themselves are more like “entrepreneurial subjects,” which biopolitics researchers also call neoliberal subjects.²⁹ A citizen “aspiring for autonomy” is the subject who anticipates the future and optimizes his or her current life. As critics claim, this emphasis on self-responsibility makes health problems a personal responsibility, not a subject of social solidarity. As with the advance of genetic technology, it becomes individuals’ responsibility to predict and to manage disease risk through genetic testing rather than the responsibility of the state or enterprise;

²⁶ See Julia Belluz, “Your New Apple Watch Isn’t Going to Make You Exercise More,” *Vox.com*, Sept. 10, 2014, <https://www.vox.com/2014/9/10/6128193/will-the-new-apple-watch-improve-your-health-wearable-technology> (accessed May 21, 2017); John M. Jakicic, “Effect of Wearable Technology Combined with a Lifestyle Intervention on Long-Term Weight Loss: The IDEA Randomized Clinical Trial,” *JAMA* 316, no. 11 (2016): 1161-1171.

²⁷ Kyu-Jin Choi, “Wearable Device and Health Information: Current Status and Issues.” Proceedings of the 2017 KASTS biannual Conference; Iltifat Husain and Spence Des, “Can healthy people benefit from health apps?” *BMJ* 350 (2015): h1887. Doi: 10.1136 / bmj.h1887.

²⁸ As genetic testing technology evolved, the notion of susceptibility, which indicates the likelihood of disease, has been emphasized, and at-risk groups have newly emerged who are highly susceptible but are neither healthy nor diseased. See Thomas Lemke, “Susceptible Individuals and Risky Rights: Dimensions of Genetic Responsibility,” in *Biomedicine as Culture: Instrumental Practices, Technoscientific Knowledge, and New Modes of Life*, eds. Regula Valérie Burri and Joseph Dummit (New York: Routledge, 2007); The spread of self-tracking has also created similar results. “At-risk groups” is a new category, as health habits are distinguished from “risk factors” in blood glucose, blood pressure, brain waves, exercise and diet. See Lupton, “M-health.”

²⁹ Nikolas Rose, “Biological Citizens,” in *The Politics of Life Itself: Biomedicine, Power, and Subjectivity in the Twenty-First Century* (Princeton, NJ: Princeton University Press, 2007).

it is an individual's responsibility to maintain health and predict disease through self-tracking.³⁰

However, it is not so clear that this "neoliberal subject" emerges in actual use of this technology. While this technology makes more and more individuals' bodies and routines subject to monitoring and analysis, it is difficult to affirm that users are becoming subjects who actively pursue autonomy and take responsibility for their bodies and choices on their own. As mentioned earlier, however, it is also hard to see that individuals are disciplined by numerical standards as surveillance is extended to everyday life. Of course, such ambivalence may be solved differently depending on the detailed context in which the technology is implemented, but anthropologist Natasha Dow Schüll offers a different perspective on this self-tracking technology.³¹ According to her, self-tracking technology can help modern humans make many choices in spite of ignorance and fatigue. When it is difficult to calculate and judge every decision as to which action is most effective or which action is most reasonable, self-tracking technology allows one to navigate through such situations. In front of selection and decision, an individual does not reject the responsibility of calculations and reasoning that he takes on, and instead delegates this responsibility to self-tracking devices and big data analysis. It also allows technology to influence an individual's choice through computation and fine intervention, which Schüll calls a "micronudge." In this sense she, drawing on the famous nudge theory, calls the self-tracking technology "digital nudge technology." For one example, though not exactly in the context of health care, if one is on a couch and watches TV for a long time, a tracking device that calculated the time spent doing so darkens the lighting in a living room and lets him or her make a choice to stop watching TV. For another example, a device could produce a small vibration when the sensor detects the user's slouched posture for a long time and allows him or her to make the choice to straighten his or her posture.³²

³⁰ Lemke, "Susceptible Individuals."

³¹ Natasha Dow Schüll, "Data for Life: Wearable Technology and the Design of Self-Care," *Biosocieties* 11 no. 3 (2016): 1-17.

³² It is difficult to say that all devices belong to digital nudge technology because self-tracking devices come in various forms and are still evolving. However, more and more devices seem to be actively implementing the concept of the "nudge" in recent years because the function of providing only statistics and information

This concept of “digital nudge” does not accept the script of the technology of increasing autonomy, but it does not recognize the script of critique that the technology reinforces discipline and surveillance either. The individual who self-tracks is not an entrepreneur who is responsible for managing his or her own life, nor is he or she a passive object of surveillance and discipline. Rather, a user “delegates” the calculation responsibility to technology, letting himself or herself and technology make alternative choices and decisions together. Thus, it is difficult to call users autonomous agents, for they rely on the computational power of the technology and the agency of the device. It is also hard to say that users are disciplined by technology, for users have a chance to make a new decision every time technology “nudges” them.

Self-tracking technology has envisioned increased autonomy and self-improvement in the area of healthcare, but it has also raised the opposing script of self-monitoring and control. However, as the “digital nudge technology” concept shows, it is being rewritten as a script where technology and human relationships remain in the boundary between autonomy and surveillance, leaving opportunities and possibilities to be redefined. From this point of view, the debate over how self-tracking devices in digital healthcare are beneficial to health is difficult to be judged easily. Some ethicists and medical scientists have criticized that wearable devices are useless for health improvement, but such criticism may not be adequate if the action of the technology is regarded as a “digital nudge.”³³ It is because those who are actively responding to the potential of the technology and its “micronudge” can still benefit from health management. In other words, the usefulness of this technique is unlikely to allow one clear conclusion since it can be changed in connection to the relationship between the individual and the technology.³⁴ Attempts to criticize health management using self-tracking technology on the basis of its effectiveness do not seem to be successful, both in terms of the technology as it is now, as well as what it will be in the future.

is limited in inducing human behavioral change.

³³ See Husain and Des, “Can Healthy People Benefit from Health Apps?”; Kyu-Jin Choi, “Wearable Device and Health Information.”

³⁴ A nudge is basically a kind of “liberal intervention,” so it is effective in some contexts to induce human behavior change, but not in other contexts. For example, men who use flies painted on toilet seats improve their “aim” no longer find them effective after some time and return to their careless habits.

IV. Re-scripting II: Labor Management, Taylorism and Intimate Surveillance

Self-tracking is not only used in the areas of health and fitness management. The possibility of being able to monitor human beings and change their behavior was also immediately accepted at the workplace, where the willingness to control human beings was the highest. This technology is actively introduced to the workplace in order to monitor and manage the productivity and performance of workers in various enterprises. Employees' location, activity, level of alertness, mental performance, and dialogue are measured and analyzed by various sensing devices. According to one survey, more than half of human resource departments in U.S. companies say they rely more on data analytics now than they did three years ago.³⁵

The most representative example is an attempt to maximize efficiency by tracking the position and movement of workers in a physical work environment. So-called "Quantified Workplace movement" is a good example of a new Amazon's logistics warehouse in Rugeley, England. The Amazon's warehouse, which was originally highly anticipated in the region where the old mining industry had collapsed, has mostly employed non-regular workers and introduced self-tracking technology to deal with the "precarious labors." According to a *Financial Times* article on the subject:

The last group, the 'pickers,' push trolleys around and pick out customers' orders from the aisles. Amazon's software calculates the most efficient walking route to collect all the items to fill a trolley, and then simply directs the worker from one shelf space to the next via instructions on the screen of the handheld satnav device. Even with these efficient routes, there's a lot of walking. One of the new Rugeley "pickers" lost almost half a stone in his first three shifts. "You're sort of like a robot, but in human form," said the Amazon manager. "It's human automation, if you like."³⁶

³⁵ Hannah Kuchler, "Data Pioneers Watching Us Work," *Financial Times*, April 18, 2014, <https://www.ft.com/content/d56004b0-9581-11e3-9fd6-00144feab7de> (accessed April 28, 2017).

³⁶ Sarah O'Connor, "Amazon Unpacked," *Financial Times*, February 8, 2013, <https://www.ft.com/content/ed6a985c-70bd-11e2-85d0-00144feab49a> (accessed April 28, 2017)

The only brain that knows where all the things are in this warehouse is the computer. For Amazon's efficiency and speed, which receives 35 orders per second, this computer brain used self-tracking technology to command "robots in human form." Tesco's distribution center in Ireland was similar. Instead, workers in the area are commanded by an armband attached to their arms. This tracking device informs workers of the shortest distance traveled and the task completion time, and confirms with feedback when the mission is completed. Since 2004, when this tracking technology was introduced, Tesco was able to reduce about 18% of its regular workforce.³⁷ Such Quantified Workplace movement is reminiscent of Taylorism, which was popular in the United States and Europe in the early 20th century. At that time, Taylor saw that the highest efficiency could be achieved by creating an engineering department in the factory and studying laborers' movements with the scientific method.³⁸ He subdivided the specific movements of the workers into several factors, measured the time spent to determine the most productive working standards, and applied these findings to the workers. The ideal of Taylorism at the time inevitably declined due to great resistance from the workers, but it is now reemerging with the introduction of self-tracking technology.

However, recent self-tracking technologies do not just include the extreme facet of Taylorism, and are not applied to simple physical labor. Numerous consulting companies are developing a variety of methods to use self-tracking technology and big data for labor management. In the past, internet usage monitoring would check how long an employee spent on actual work or if the person browsed the internet for a new job; now self-tracking devices quantify and analyze both an employee's work and social activities. An outsourcing call center company has measured and calculated the voices and behaviors of call center employees and found out the characteristics of successful staff. In addition to reducing the time spent on the phone by one minute, the company applied the characteristics of the "ideal" employee to the recruiting process, and shed the amount of time spent on interviewing by twelve minutes and decreased its turnover rate by 39 percent.³⁹ This technology, called

³⁷ Wilson, "Wearables in the Workplace."

³⁸ Frederick Taylor, *Principles of Scientific Management*, trans. Jin-woo Park (Seoul: Parkyoungsa, 1994 [1911]).

³⁹ Kuchler, "Data Pioneers Watching Us Work."

sociometric solutions, attaches a sensor to the workers' name tags and measures how they move within the workplace, with whom they communicate, and which language habits and gestures they use. As another example, Bank of America wanted to measure these social activities to find out a productive employee behavior pattern. The company concluded that resting with, relieving stress with, and sharing customer response tips with other colleagues were such productive behaviors, and thus introduced collective rest time; as a result, there was a 23 percent improvement in performance and a 19 percent reduction in the amount of measurable voice stress.⁴⁰

This is not a top-down approach that applies pre-determined assumptions to workers in order to increase work time and efficiency, but rather a more flexible way of seeking out rules through continuous data provided by self-tracking devices. The ultimate goal of increasing productivity is the same for these two approaches, but the latter is "soft biopower," based on Foucault's concept, in that the labor management system finds and reconciles norms while constantly observing and calculating workers' gestures, dialogue habits and interactions.⁴¹ If self-tracking technology is used for simple manual workers with unstable employment in a top-down approach that was similar to traditional Taylorism, it is also used for white-collar workers as "intimate surveillance" by observing and finding out productive behavior in the company.

Even with intimate and soft surveillance, the use of this self-tracking technology raises several ethical issues, such as the breach of privacy for workers. Everything in the workplace, including personal daily life, is subject to observation and surveillance, and sometimes to evaluation. Some companies ask employees to regularly input the amount of water consumed and body weight in order to monitor their health, and then disclose the figures to everyone to encourage health management. It has a purpose of improving the health of employees, but the reduction in health insurance premiums paid to ill-health workers is a greater goal for the company.⁴² Furthermore, these

⁴⁰ *Id.*

⁴¹ Christopher O'Neill, "Taylorism, the European Science of Work, and the Quantified Self at Work," *STHV* 42, no. 4 (2017): 600-621.

⁴² In countries where there is no national health insurance system, like the United States, employee health premiums are a big burden on business owners, so helping employee's health management also fits in with the economic interests that reduce corporate spending. It may also be interpreted as transferring the responsibility of the employer for healthcare to the workers.

results can serve as a basis for discrimination for employees who are not willing to manage their health. Because of such issues, some companies have allowed an opt-out system so that employees can anonymously halt the self-tracking at any time. Also, the employees in this company can see their own data, but employers cannot access to the data and are allowed to see only the overall statistics.⁴³

Those who participated in the QS movement saw that self-tracking technology would contribute to self-improvement by increasing individual self-understanding, but self-tracking technology was written as an entirely new script in the workplace. Rather than the expected expansion of autonomy and self-control, it is becoming a means of more thorough exploitation (for blue-collar workers) and more intimate monitoring (for white-collar workers) in the workplace. In the absence of proper regulation, workers often do not have the right to opt out, or they are secretly tracked, and this can be called “imposed self-tracking,” as sociologist Debora Lupton describes it.⁴⁴ If self-tracking was operating on the basis of ambivalence and possibility that cannot be determined through autonomy or discipline in an individual’s healthcare, this technology removes such ambivalence and plays a more explicit role in the labor management. There might be many reasons for such difference, but as mentioned in the conclusion later in this study, this is probably due to the difference in settings and contexts in which the technology is placed. At this point, issues related to the setting of this technology bear major social and ethical implications.

V. Ethics in a Hyper-connected Society: Asking Questions to the Setting of Technology

The further we advance into a hyper-connected society, the more we will become familiar with self-tracking devices. As mentioned above, self-tracking has become an everyday culture and more and more people’s everyday functions such as sleep, eating, exercise, moods, and physiology are constantly monitored and calculated by algorithms. We have almost become a walking data generator, producing data ceaselessly

⁴³ Wild, “Wearables in the Workplace and the Dangers of Staff Surveillance.”

⁴⁴ Lupton, *The Quantified Self*.

and sending it to a server somewhere. On the other hand, self-tracking devices and data algorithms are becoming our new senses like a kind of prosthetics.⁴⁵ Self-tracking devices are increasingly becoming part of us, providing new information and knowledge about ourselves that we would not know otherwise.

However, as we have seen so far, the initial script of self-tracking technology has been constantly modified in actual practice. The self-tracking script of personal health management and workplace behavior is being rewritten as nudge technology, automatic control, and intimate surveillance, rather than increasing autonomy and self-improvement. It may also be written in another version within the same script, depending on whether it is a health promotion program in a workplace or a game in social media gathering, even if it is under the same goal of health management. Taking this into account, Kim said that self-tracking is a “somewhat heterogeneous grouping of activities and cultures that can be differently categorized according to the size of the work or the purpose and the viewpoint.”⁴⁶ As self-tracking technology is close to a platform where various scenarios can be inscribed, it can be used for various purposes such as self-understanding, healthcare, and labor management, and can be realized as another script according to the specific setting or arrangement in which the technology is located.

So the important question in relation to this technology is how the setting or arrangement is constructed. And the factors that determine the composition of this setting will be answers to the following questions: who decides to allow data tracking (permission decision); to whom this information is disclosed (privacy); who owns this data and analysis information (data ownership); who makes the final decision based on this information (decision-making authority); to what extent data will be trusted (reliability); and whether the collected information is securely managed without security risks (security). For example, in the setting of self-tracking technology used in Amazon’s warehouse mentioned above, there is little that a worker can decide for himself or herself. The rejection of data tracking means dismissal, so that the employee cannot disagree and cannot decide not to disclose such data to management, and a route in connection to the tracking data is decided exclusively by the central computer. In this

⁴⁵ Melanie Swan, “The Quantified Self: Fundamental Disruption in Big Data Science and Biological Discovery,” *Big Data* 1, no. 2 (2013): 85-99.

⁴⁶ Kim, “I Become My Own Data,” 5.

setting, there is a script of control and surveillance rather than a script of self-knowledge and self-improvement, and individuals are not allowed to resist. Workers do not have the authority to decide to allow data tracking, so as seen in the digital healthcare context, they cannot respond by taking off their self-tracking wristbands and putting them in drawers or removing healthcare apps from their smartphones.

In this situation, opinions that there should be ethical guidelines for self-tracking technology and data use are getting more and more attention. In accordance with the guidelines, companies should inform employees in transparent way and get approval prior to introduction of the technology on how long and in which way they monitor voices and behaviors of employees, how they store collected data and whether they sell it to a third party, even if it is under a wellness program for the employees. Also, as personal health-related habits are very valuable data for insurance companies, it is necessary to properly regulate the secondary use of collected information.⁴⁷ Recently, the European Union announced the General Data Protection Regulation (GDPR), which will be implemented in 2018, and set up a specific legal framework for this. Article 88 of this Regulation stipulates that all Member States shall be able to provide detailed regulations on data processing in the employment through law or collective agreement. This provision sets out not only the protection of workers' data, but also the right of workers to participate in considering its application.⁴⁸

In addition, it is also an important issue regarding how much confidence we will have in the future. The extent to which a user believes in the data collected by a smart-band device for healthcare may be a matter of personal judgment, but the problem is different if the data analyzed by the device and the algorithm are used as evidence in a court of law. In Canada, one person claimed his previous health condition based on data from his Fitbit device to prove recent injury, and the court will make a judgment differently based on how much it will believes in this data. In the United States, a woman who was trying to prove that she had been attacked while sleeping was arraigned on false claim because data from her Fitbit denied her claim.⁴⁹ The level

⁴⁷ Wild, "Wearables in the Workplace and the Dangers of Staff Surveillance."

⁴⁸ Rüdiger Klause, "Digitizing the Labor World: The Need for Tasks and Regulations," *International Labor Brief* 15, no. 3 (2017): 9-21.

⁴⁹ Bthaj Ajana, "Digital Health and the Biopolitics of the Qualified Self." *Digital Health* 3 (2017): 1-18.

of trust in self-tracking devices and algorithms affects judicial decisions like seen in these cases; appropriate consideration will be also needed in the future.

Eventually, in the future, in order for the script of self-tracking technology to become the future we want to live in, we must constantly raise and answer the above questions in the concrete setting in which this technology is performed. Rather than being overwhelmed by future scenarios drawn by advocates of self-tracking technology, one should keep asking questions while closely observing and analyzing the specific settings in which the technology is implemented. Also, rather than just accepting the arguments of the innovator and futurist who claims the initial script of this technology, one should meticulously make an observation about how the technology is re-scripted or re-inscribed, who decides such settings that lead to re-inscription, and if the decision process is transparent and democratic. Whether or not the hyper-connected society, brought about by the “Fourth Industrial Revolution,” is a world that we want to live in will depend on how sincerely we respond to these questions.

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