**Wearing Data: Intentions and Tensions of Art and Design in Performance using Wearables** <word count 6140>

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*There are many kinds of technologies that can be deemed* ***‘****wearable.****’*** *From smart fibers and tattoos, biosensing devices and implants, networked jewelry, or an LED**encrusted dress, what, exactly, we mean when we say* ***‘****wearable tech****’*** *is in flux.[[1]](#endnote-1)*

Wearable technologies have evolved over the last few decades, with 2014 known as “Year of Wearables”[[2]](#endnote-2) in *Forbes* and other media outlets. *Wareable* online magazine stated in 2015 that 84 million wearable devices were sold that year, and by 2019 that figure would be 245 million wearable fitness bracelets and other devices. However, a recent report from *Statisitca,* an online business data analysis platform, suggests that the number is actually closer to three times that amount, roughly 742 million.[[3]](#endnote-3) Such reports show how the industry has grown especially in the last five to ten years. Many tech companies and start-ups have been vying to make the next great wearable device or “killer app” for body-data tracking. Physiological, body-based, sensor devices, and electronic technologies have become cable-free, WiFi-enabled,[[4]](#endnote-4) smaller, more powerful, and sewable, using smart or electronic textiles, conductive fibres and other smart materials. Hardware is increasingly smaller, less visible, and more widely connected; data is more seamlessly and ubiquitously harvested.There has been concurrently rapid and extensive explosion in the development of electronic materials, conductive inks and threads, and new smart materials, fabrics, and textiles for use in various fashion, sports, fitness, medical, military, and governmental projects, as well as for artistic and performance projects, such as those by artists like Kasia Molga’s *Human Sensor* project for the Invisible Dust organisation.

 In this chapter I provide an overview of the complex concerns around wearables that draw on datafication and privacy such as using people’s physiological data to sell to health insurance companies to make money off our body data. I begin by discussing the politics of datafication and privacy. I then move on to focus on art, performance and design with wearables and e-textiles, giving examples of my own collaborative wearable performance work and research, to reflect upon some of the novel and productive ways we might think about wearables for future directions in the design of wearables and in the marketplace.

**The politics of datafication and privacy**

Wearable devices collect users’ personal body (physiological) data for medical or fitness monitoring, and this data is owned by the technology companies who make the devices, who then send it into the cloud to physical server farms. Most wearables connect to multiple sensors on the body, via tracker applications on smartphones, facilitating and integrating all data collection. The wearable companies then analyze it, store it, and/or sell it, frequently without overt user consent; for example, personal fitness activity data has been used in numerous cases to monitor workers’ health for job-worthiness.[[5]](#endnote-5)

The exponential rise of wearables has had diverse ramifications. Yet in recent years increasingly more people, including politicians, have had concerns about the amount of personal data that wearable technology companies harvest and sell as their business model. Corporate data harvesting activity reveals a unique set of insidious problems emerging from controversial practices,[[6]](#endnote-6) not to mention related poor labor practices in manufacturing, and mineral sourcing issues existing from electronic technology development and in the supply-chain, including for wearable devices. For example, at a wearables networking event I attended in July 2015, at the Business Design Centre in London, industry representatives were asked to envision future wearables. One representative from one of the world’s dominant fast-food chains was interested in ways to track and monitor their employees,[[7]](#endnote-7) ostensibly to improve their employees’ efficiency and make money from their data. Another participant wanted all employees to have devices implanted into their brains to enforce improved eating habits, increase exercise, and change or stop their chemical dependencies, which impede worker efficiency.[[8]](#endnote-8) Moore and Robinson state:

The [monitoring of employees’ data at work] is thus part of managerial efforts to control and extract value from creative as well as physical labour in more precise, quantified ways. [Wearable Self-tracking Technology] raises new demands on workers, potentially intensifies workloads, and leads to rationalization of staff, whilst displacing accountability. The measure of physiolytics is a way to extract information from wearables data ‘to improve performance’ […] While physiolytics is predominantly used in sport it is ‘spreading to workers in factory and office settings as well.’[[9]](#endnote-9)

Physiological data can also be used against those employees in performance reviews.[[10]](#endnote-10) Moore and Robinson point out:

[…] quantification helps corporations and self-employed precarians to keep up with cut-throat competition […] the spread of wearables in the workplace may be seen as an extension of a control society […] and a subordination of precarious workers’ qualitative being to capitalism in the form of a Taylorism which reaches into the body […] Against a new regime of quantification, social movements can be expected to seek new forms of refusal and exodus, which must increasingly take the form of a refusal of data—a refusal to track the body, a refusal to subordinate the qualitative to the quantitative, a refusal of surveillance, a refusal to share data with corporations and the state.[[11]](#endnote-11)

While corporate data collection has become more regulated since the roll out of the European General Data Protection Regulations (GDPR) in May 2018,[[12]](#endnote-12) similar laws do not seem equally in place across the world or in the US, in particular, where Facebook, Apple, Google, Amazon and other big corporations who harvest and use personal data, operate. With little ethical oversight, many companies try to find work-around for these recent regulations; they continue to develop new ways to use our data to increase their profit margins.[[13]](#endnote-13) Ethics are of no interest to Google, Apple, Amazon and wearables tech companies. We are just data to harvest. We are the business model. As Garrett quotes others:

Facebook knows your friends, what information you provide about them, what they say about you, what other sites you visit (if they include a Facebook ‘like’ button, which most do), what you bought, what device you used to access Facebook, and much more.[[14]](#endnote-14)

Apple collects phone data which they say is collected anonymously while users have no opt out clause.[[15]](#endnote-15)

Yet respecting privacy and security issues for personal data, related to fitness logging activities is increasingly being highlighted by users, researchers, and journalists, more notably due to the growing Quantified Self QS Movement community;[[16]](#endnote-16)

[...] individuals have become information hungry. What started as a slightly awkward hobby in the 80s, the quantified self has now become mainstream with people self monitoring anything from sleep to eating habits, from sport activities to mood […] uploading intimate details such as heart-rate, sleep patterns and whereabouts to corporate servers in order to improve their performance.[[17]](#endnote-17)

Even though more people are becoming aware of how corporations and governments are collecting and using their data,[[18]](#endnote-18) with complex world concerns, such as combating cyber criminals and terrorism, governments are using security and terrorist events to rationalize and legislate for more control, access, and, powers to gather increasing amounts of personal data from all citizens. Without their knowledge and awareness of where and how their personal data is being collected or who owns their data, consumers are left unprotected against corporate and government surveillance. In China, facial recognition software and Artificial Intelligence (AI) are now being used across the country as an overt totalitarian form of social control,[[19]](#endnote-19) which is also being trialed in the UK, Germany, and around the world, in so-called democratic countries.[[20]](#endnote-20)

 We are in a time of public cynicism around mass surveillance, privacy and unethical data collection, as highlighted by Edward Snowden, Wikileaks, as well as the popular TV series *Black Mirror* [[21]](#endnote-21) and *Mr. Robot[[22]](#endnote-22)*. More profoundly, the Cambridge Analytica[[23]](#endnote-23) scandal involving Facebook, Russian interference, impacting two countries’ elections—with wide-reaching political outcomes—users now want to better understand and articulate their rights to access, own, control, and use their body data, and need to play a more active role in interpreting or reinterpreting this data, however they choose. Companies usually sell personal data to insurance or healthcare companies, rarely—or not at all—allowing users to access their data. However, they should be regulated to provide users with open-access and ownership of their own physiological data and enable ways for the public to use these devices and garments for their own personal benefit, rather than for the benefit of the company. As Garrett states:

Haraway proposed that the “proper state for a Western person is to have ownership of the self, to have and hold a core identity as if it were a possession,” and that “not to have property in the self is not to be a subject, and so not to have agency.”[[24]](#endnote-24)

What are the consequences of giving away all your private body data in exchange for free services? Can we somehow own our own data? According to *Wired* writer, Gregory Barber,[[25]](#endnote-25) we can own our own data, but with great effort and expense (almost as a fulltime job), and we will not make much money from it, as the profit is only made in aggregate, as huge datasets, not for an individual’s data.

 Data privacy aside, the significant ethical issues around social, environmental, labor, and supply chain concerns in the wearable and broader tech industry still need to be addressed. We are moving into a time of ever increasing miniaturization of microchips and sensing devices, worn, embedded, or ingested within the body itself.[[26]](#endnote-26) In addition, with the increased sophistication of electronics and smart-e-textiles[[27]](#endnote-27) in our clothing, cars, homes, and ubiquitously in our lives, gathering our physiological, biometric, DNA/Genomic,[[28]](#endnote-28) or other personal data, there will be major implications for increased surveillance with increased corporate and government control over our lives, from inside our bodies. As Petersen suggests, there are already

[…] networks of wireless sensors that can be sewn into clothing, placed directly on the skin, or implanted into the body. Human Body Communication (HBC) or intrabody communication uses the body itself rather than air for wireless transfer.[[29]](#endnote-29)

All this with well-meaning intentions: to keep us, or our children, or elderly parents safe; to prevent or solve crime; for our comfort, or any number of “good” reasons.

As Daniel Howe points out, “[…] there are a multitude of vectors by which corrupt advertisers, repressive governments, and other malicious players can […] identify its user and access valuable personal data without consent.”[[30]](#endnote-30) Petersen demonstrates how the focus in tech industries is now on embeddable, injectables and ingestibles,[[31]](#endnote-31) as well as brain-computer interfaces,[[32]](#endnote-32) to predict our moods, desires and impulses in order to match with AI and machine-learning algorithms, to capitalize on everything we do. She stresses:

[…] new embodied technologies may make people vulnerable to datafication […] I define “datafication” as using devices, networks, and sensors to track human behaviours and responses, monitor them, store them, and control them using algorithms to orient or persuade people (prod them) in a desired direction.[[33]](#endnote-33)

Based on this, what difference will General Data Protection Regulation (GDPR) legislation make? What does ethical data collection mean in the context of such pervasive surveillance? Many companies, such as 23andme—and now governments—have obtained DNA data[[34]](#endnote-34) from a huge number of people who have given their data away in search of their ancestral heritage. In this context, what does privacy actually mean today? As Petersen points out,

The belief is that emerging technologies, network culture, and human and non-human processes of datafication will revolutionize healthcare and everyday life *by directly sensing the body’s core through passive monitoring*. To meet such a speculative scenario, brain, heart, skin, skeletal, and other topological and visceral sensors would need to track biometric data continuously through biomedical telemetry. The bio-surveilled body would be datafied in numerous ways. [[35]](#endnote-35)

*What a terrifying prospect.* This outlook upsets many, alongside the impending climate apocalypse—the future indeed looks dark. What happens when there is no privacy and we are nothing but a dataset to be learned and replicated by machine learning algorithms? Some of these questions pose key ethical issues not only for our present, but also for the future.

**Art, Performance and Design with Wearables and e-Textiles**

People are becoming more aware and educated about the dark side of wearable and mobile technologies, cloud computing,[[36]](#endnote-36) Big Data, and smart / electronic textiles, which includes not only data privacy issues, but also labor ethics and the environmental impacts of these technologies.

While there are well-intentioned efforts to protect and treat the aging population, and cure medical conditions and diseases, there are simultaneously advertisers, politicians and malicious hackers trying to monetize, manipulate and control our bodies and minds. For this reason, artists, activists and philosophers are increasingly necessary because in making critical work, they educate the public and become a source of resistance, awareness, and change. For example, artist Jennifer Morone has made a performance out of harvesting her body data and making it for sale to anyone to buy, incorporating her body as a business to make a political statement of controlling the sale her data rather allowing others to exploit it, as *Jennifer Lyn Morone™ Inc.*[[37]](#endnote-37)

We are all involved in giving our data away, from the QS movement and health apps installed on our phones, selfie-fixation for Instagram self-promotion, to become “influencers,” or the TickTock frenzied youth, many absorbed in making their own live-streamed video blogs of everything they do every day.

Artists, social scientists, philosophers, data privacy activists and others, have been asking questions about the use and deployment of the wearable devices and related apps. There are now many artists and theorists exploring methods, not only to educate the public to be more aware and wary of government and corporate pervasive surveillance, but also how not to be complicit through self-monitoring and “sousveillance.”[[38]](#endnote-38) As Garrett mentions,

Ippolita, a group of activists and writers, warned how social media promotes emotional pornography, where our feelings are exploited by click baits in exchange for our personal data. We are a rich source of data-mining material.[[39]](#endnote-39)

Meanwhile, facial recognition surveillance is more commonplace (especially in China), and ever more invasion of personal, intimate privacy is taking place in ever-surreptitious ways. [[40]](#endnote-40)

Wearables and smart or e-textiles are increasingly part of a more self-contained system of body-based, skin-like bio-textiles or other forms of mobile and wearable technologies that are finding new roles and manifestations in artworks, performance, fashion and entertainment industries, such as Virtual Reality games. There are now amazing biotech/biofabric projects and research, such that of Victoria Geany’s bioluminescent dress, or Suzanne Lee’s biocouture, and Guilia Tomasello’s Alma, where designers and artists are growing new materials and blending them with (or trying to) conductive and/ or electronic textiles to transmit data (ideally not collecting it), while being recyclable and/ or biodegradable. This is the new direction for new materials and technologies that I have hoped for.

In my recent book, *New Directions in Mobile Media and Performance* about how mobile phones are performance used as tools, content, guides and collaborators within immersive theatre, live art, dance, music and more,[[41]](#endnote-41) I provided examples of art and performance work using mobile phones and wearables as a subset of the larger mainstream fashion and technology industry. While wearable devices and smart or e-textiles do not strictly use the mobile phone, they are mobile media and are used in performance more and more, usually tethered to or linked to mobile applications or laptop computers, to enable the embedded devices[[42]](#endnote-42) to “work,” but also to become artistic collaborators in the piece.

<Insert FIGURE 8.36.1A, 8.36.1B, 8.36.1C HERE>

Figure 36.1: Left: Collage of artist’s works. *Lo Lamento* (2016)by Victoria Geany (Bioluminescent bacteria dress and orbs–Photobacterium *Kishitanii*). Photo credit: *Lo Lamento* (Victoria Geaney, Bernardo Pollak and Anton Kan). Middle: *Alma* (2019) by Guilia Tomasello. Photo credit: Guilia Tomasello. Right: *Human Sensor* (2016) by Kasia Molga. Photo credit: Nick Harrison

How do data surveillance issues discussed herein impact the arts? What can artists understand and effectively question of the relationship between data, wearables and the body in their work for public discussion? How can artists be the watchdogs or ombuds[wo]men around ethics, the body and data privacy for the public? I’m grappling with these questions in my own creative practice and research, while encouraging other artists to explore and tackle them pro-actively within and through their work.

In recent years, my own practice goals have moved to initiate more collaboration between artists and performers with wearable technologists and companies. This creates a mutually satisfactory way forward—to demonstrate how art and performance can influence the research and development in Human Computer Interaction (HCI), interfaces and data collection, not to mention as a means to create more ethical, environmental and sustainable technologies and interfaces for the future.

***Hacking the Body 2.0***

*Hacking the Body 2.0* ***(****HTB2.0)*, my main artistic project using wearables in performance, was the second iteration of an ongoing collaboration between choreographer/media artist Dr Kate Sicchio and myself since 2012. It was born of a need to explore and critique how wearable technology can extend our senses, but also from the concern of how personal/physiological data identity can be revealed and understood through layers of “known-ness,”[[43]](#endnote-43) which also exposed personal data privacy and vulnerability issues*.*

The project focus has been on identity and how body data ownership in performance might manifest (if possible). As such, *HTB2.0* uses the latest off-the-shelf wearable electronics and smart materials, alongside “hacked” corporate fitness wearable tech garments, to explore identity and privacy issues within the wearable technology, e-textiles and smart fashion industries, while adding to performance and technology development and discourse.The project focussed on identity and what might body data ownership in performance might manifest as (if possible). As such, *HTB2.0* used modern DIY wearable electronics and smart materials, alongside hacked corporate fitness wearables, to explore identity and privacy issues that exist within the wearable technology, smart textiles and smart fashion industries, while adding to performance technology development, evolution and discourse.

During our research we observed how self-monitoring and quantified-self activities lead to narcissism, while enabling corporate and government exploitation of private, personal data. As Ridgway (2015) stated in her online article “Personalisation as Currency,”[[44]](#endnote-44)

[…] we govern ourselves through our ‘behaviours’ being captured and cultivated in ‘personalised machines, sharing everything we do as huge amounts of data, surrendering our privacy for free services and participation in the attention economy.

Our focus, however, was on interpreting inner physiological statesand processes, interpreted as unique personal identity signatures, which may (or may not) influence one’s movement, gestures, expression, and interaction with others. As researchers and artists for *HTB 2.0*, we questioned data collection agendas, and sought ways to access body data locally (not “in the cloud”), and for performers to co-create and explore how their own physiological changes, movement style uniquely demonstrates who they are, like a new language.

Our primary questions were: Can people be empowered by allowing them to access and use their own personal data as a means to express and perform their own identity?[[45]](#endnote-45) Can we create new forms of non-verbal interaction and communication during performance, using this data and unique data expression? This was intended as a performative confrontation of corporate and government surveillance and data control. The aim was to critically and artistically challenge the control of and patenting/copyrighting of people’s body data from wearables, to expand the concept of the body as part of greater social, political, and technological (opensource) network and for body data rights, as individuals who give consent only to those who ask and respectfully utilise it for non-profit and artistic purposes.

These concerns, as well as the curiosity about how biofeedback data might be used to create a personal bio-signature, led to several iterations and performance outcomes, bespoke costumes embedded with wearable tech, new research insights.

<Insert FIGURE 8.36.2 HERE>

Figure 36.2: @ *Hacking the Body 2.0* (2012–). Photo credit: Kate Sicchio and Camille Baker

***e-stitches* and** ***WEAR Sustain***

The *WEAR Sustain*[[46]](#endnote-46) project was an off-shoot of an in-person, bi-monthly meetup group at the Victoria & Albert Museum in London, which I started in 2014, called *Stitch, Bitch, Make, Perform*, still running and now called *e-stitches*, with now over 160 members, of which about 10-15 attend at each meetup. *e-stitches* initially aimed to address issues of data harvesting, privacy and the sale of personal data by corporations and governments, and to scrutinize poor data ethics, labour and environmental ethics and practices. When starting the *e-stitches*, the intention was to bring women artists, performers and designers together to critically discuss these issues, and be involved in making change, in an evolution toward a more critical making[[47]](#endnote-47) and design practices for ethical ends.[[48]](#endnote-48)

*WEAR Sustain* was developed to build and extend the European dialogue on these ethical and sustainability issues. It reached out and engaged a wide range of stakeholders, with an emphasis on collaborations of artists and designers with engineers and technologists. It focussed on creating a pan-European network, funding 48 example projects, and developing a sustainable strategy that included ethical employment of labor and waste management processes. It also focussed on creating and sharing methods for designers and manufacturers on how to source ethical minerals and materials, and locally made components.

*WEAR Sustain* brought together wearable technology industry experts, technologists, tech companies and entrepreneurs, in an effort to work with designers and artists across Europe. The aim was to shift the methods of development within the EU wearables industry and draw on the extensive landscape of designers and smart textile stakeholders, to further address critical, ethical, aesthetic and environmental issues head on, at the initial research and development stages.

 We were motivated by a passion to change the way the electronics and technology industry and its supply-chain, but also the fashion and textiles industries work, and how they make their products. We wanted these industries to stop harming the environment with mountains of electronic waste, and to limit or stop all surveillance of wearable users, to generally contribute to better ways of making products. We aimed to contribute to innovation with a purpose, with a soul, and aim to build a network of like-minded pioneers. We felt it important to have industry to take responsibility for itself, and to give something positive back for consumers and society.

<Insert FIGURE 8.36.3 HERE>

Figure 36.3: *WEAR Sustain* Call 1 Teams (2017). Photo credit: Heritana Ranaivoson

*WEAR Sustain*’s aims were to:

1. Engage with alternative discourses in the conceptualization and design of wearables and e-textiles by promoting artist-technologist synergies and catalytic thinking;
2. Address issues of sustainability and life-cycle design in both production and end-of-life of wearables and e-textiles;
3. Foreground the ethical issues of privacy and ownership of personal and embodied data, as well as the appalling labor practices in African mines and Asian PCB and component factories; and
4. Build a network of 1475+ like-minded actors in the sustainable and ethical wearable space from hubs to individual artists and technologists, creating a unique and compelling cross-section of the community, and the experts who aim to shape a more sustainable and responsible future for wearables and e-textiles.

*WEAR Sustain* also examined the recycling and/or upcycling of both non-electronic and electronic parts, and how to avoid waste by fabricating made-to-measure wearables, economical application of new materials, replaceable components, as well as the careful separation of new and traditional materials, with lifespan considerations. It encouraged new and more established companies to employ strategies for recycling or disposal, and to use modular system for wearable hardware, not only to ensure that the garment/device can be worn longer and be washed, but also that electronic technology and carrier material can be separated once one of them outlives the other, as well as other sustainable and end-of-life/life-cycle approaches.

The *WEAR Sustain* partners ensured that the funded teams were supported by matching them with experts, mentors, local hubs and services providers, during the development of their prototype(s), and encouraged to implement their novel solutions to sustainable and ethical and innovation. In addition, partners conducted large-scale knowledge exchange activities, gathering experts, mentors, and service providers in ethical and sustainable wearable and e-textile design, manufacturing business services, legal support services, as well as other support services to help them with the whole life-cycle of the design, from production to the commercialization of the products. This led to the development of the first version of the *Sustainability Strategy Toolkit.*

 The goal of the *Sustainability Strategy Toolkit* (SST) was to develop best methods for enabling, facilitating, and connecting future collaborations, designers, resources, experts, as well as development, production, manufacturing, and end-of-life / waste management solutions for wearable technology and smart/e-textiles, built on ethical and sustainable foundations. The *SST* was based on the UN’s Sustainable Development Goals and was expanded into a toolkit for partners to use to advise teams and provide access to online resources, a bespoke knowledge base, as well as mentors, hubs and services, focusing on the environmental and socio-cultural impacts of wearable technologies. More specifically, the strategy aimed at providing a position on sustainability and ethics, with detailed recommendations, resources, best-practice examples, case studies, and real-life outcomes with sustainable materials, energy sourcing, ethical data choices and data security, sustainable financing and funding, privacy, ownership and control of data. Labour conditions and mineral sourcing were essential aspects addressed in the innovation process.

 The *SST* and *Wear Sustain Knowledge* platform was built to cater to these challenges and provide e-textiles and wearable technologists with sustainability and ethics resources, techniques and tools, a viable network of peers, as well as thematic hubs, to provide hands-on support for design and development teams. Its aim is to support design efforts and advise, inform and empower artists, designers and technologists to implement a more sustainable and ethical approach to their practice.

The *WEAR* *Sustain* database is an expanding, user sourced resource from the online *WEAR* community, with over 1687 design and development resources, from which 1435 are uploaded just for the teams themselves, and 152 available to the public (as of this writing), such as local legal or IP adviser, living labs and hubs for design projects, articles on the processes, and much more. It also includes a guided self-assessment tool, along with a comprehensive flowchart and decision-making-tree. This helps current and future design teams to identify areas for improvement in their design and manufacturing processes and suggest to the team members how they might identify next steps necessary in the design process.

<Insert FIGURE 8.36.4 HERE>

Figure 36.4: *WEAR Sustain* *Sustainability Toolkit, Self-Assessment Tool*, Click-Dummy v.2 [50]. Photo credit: Florian Sametinger

The project funding ended in April 2019, but several of the consortium members are now carrying on with the work started, as a non-profit ethics and sustainability consulting, training, advisory and brokerage firm, in which I will continue as an academic advisor.

**Conclusion**

If Petersen’s forecast does become true, the world of wearables will soon disappear and we will all have embedded, ingested, and injected technologies along with brain-computer interfaces. At that point, if we are not all controlled by AI driven social media messages, we will be presented with consumer products just as we begin to form thoughts about or desire them. All diseases will be cured as they begin to manifest via nanobots delivering medicine to us as well start to develop symptoms, and if we *do* live 50 years longer, we may feel we have nothing else left to live for, apart from virtual reality dreams, if the planet can still support us, we will be continuously surveilled in every breathing moment.

In this scenario, the natural world will have entirely collapsed, and we will no longer go outside due to extreme weather and climate collapse. We will be barely able to feed ourselves, as there will be no animals left and food will no longer grow. This is not the future I want, but this vision is now a real possibility unless humanity takes a stand. Artists have a role to play in changing this scenario, and I am now focused on this agenda too. I highlight the dangers of wearables data collection, as one way to achieve this goal. Making work that impacts others is another way to change the future. It is vital that we make and use wearable technologies—smart/e-textiles in design, art, performance in order to provide the catalytic creative and critical thinking necessary to experience more in life and the planet than consumption. Our technologies and artworks need to be more ethically, sustainable, and critically designed if we want a brighter future. In the words of Greta Thurnberg, Swedish teen environmental activist, “our house is on fire,”[[49]](#endnote-49) and we need to radically change the way we do things in every sphere of our lives. We need to do it now! As artists, we have a huge role to play in creating the future we want to live, or any future, really.

What are the intentions and tensions around art and design for performances and wearables with regards to data? Artists are now shining light on the issues, creating more awareness and actively encouraging the public to demand more transparency in corporate and governmental practices. Artists need to find new ways to work with data instead of treating it as the “new oil,” a commodity to be excavated regardless of all the dirty polluting and environmentally devastating connotations. We must turn to “good data,” using data for good, rather than through exploitation, or to be sold useless goods and services, or to control us.

 My own efforts are just at the beginning of what I hope to achieve, as I become clearer about how to make direct changes and impact, along with the efforts of other artists and designers,[[50]](#endnote-50) in our own practices, while educating the public on stewardship of the Earth, and influencing others to make critical changes to secure a better future.

**Endnotes**

1. Wissinger, Elizabeth. 2017. "Wearable Tech, Bodies, And Gender". *Sociology Compass* 11 (11): e12514. doi:10.1111/soc4.12514. [↑](#endnote-ref-1)
2. Discussed on these media outlets at the time Forbes, "2014 Will Be The Year Of Wearable Technology". 2019. *Forbes.Com*. <https://www.forbes.com/sites/ewanspence/2013/11/02/2014-will-be-the-year-of-wearable-technology/> and;."The Past, Present And Future Of Wearable Technology". 2019. *Grace College Online*. https://online.grace.edu/news/business/the-past-present-future-of-wearable-technology/. [↑](#endnote-ref-2)
3. See the report in *Wareable* here "245 Million Wearable Devices Will Be Sold In 2019". 2019. *Wareable*. https://www.wareable.com/wearable-tech/245-million-wearable-devices-sold-2019-1606.and in “Global Connected Wearable Devices 2016-2022 | Statista". 2019. *Statista*. https://www.statista.com/statistics/487291/global-connected-wearable-devices/.. [↑](#endnote-ref-3)
4. In Petersen, Isabel. 2019. "Bodynets: Datafied Bodies And Critical Approaches To Body Area Networks". In *Embodied Computing,4*. Cambridge, Mass: MIT Press. (February 2019:4) Petersen points out: “Depending on your viewpoint, Bluetooth is either the invisible lifeline or the prison chain between people, embodied devices, and highly profitable corporations […] Embodied communication is on the brink of exponential change and moving toward networking the body directly to the cloud.” [↑](#endnote-ref-4)
5. Information can be found on for-managers.com and personneltoday.com [↑](#endnote-ref-5)
6. More on the terrible practices of data collection in Silicon Valley in Big Think. 2019. *Data Spies: The Dark And Shady Practices Of Silicon Valley*. Video. https://youtu.be/C2Ag1iQKWeM. [↑](#endnote-ref-6)
7. In Moore, Phoebe, and Andrew Robinson. 2016. "The Quantified Self: What Counts In The Neoliberal Workplace". *New Media & Society* 18 (11): 2774-2792. doi:10.1177/1461444815604328 the authors note that,“*ABI Research predicts 13 million wearable fitness devices in workplaces by 2019 […] more than 13 million fitness tracking devices will be incorporated into employee wellness programs by 2019 (Nield, 2014) […] in order to* ‘learn how human behaviours impact productivity, performance.’” (Moore and Robinson 2016, 2276). [↑](#endnote-ref-7)
8. Moore and Robinson *also say* “Amazon and Tesco [UK] warehouses monitor every minute zero-hour contracted workers spend on the performance console using arm-mounted terminals. The ‘wearable terminal’ is in effect a streamlined replacement for the clipboard […] Information from barcodes, or location information is listed on the upper section of the terminal that is strapped to the forearm.” (2016, 2277). [↑](#endnote-ref-8)
9. Wilson 2013, 1(Moore and Robinson2016,2278) [↑](#endnote-ref-9)
10. Forrester, Ian. 2014. "Quantified Self And The Ethics Of Personal Data". *BBC*. http://www.bbc.co.uk/rd/blog/2014/06/qs-ethics-ofdata. [↑](#endnote-ref-10)
11. Moore and Robinson2016, 2281. [↑](#endnote-ref-11)
12. An explanation can be found at "GDPR Explained". 2018. *GDPR Explained*. https://www.gdprexplained.eu/. and European Union, Council of the European Parliament. 2018. "Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 (General Data Protection Regulation) *Publications.Europa.Eu*. https://publications.europa.eu/en/publication-detail/-/publication/3e485e15-11bd-11e6-ba9a-01aa75ed71a1/language-en. [↑](#endnote-ref-12)
13. Data Collection is a multi-billion-dollar business in the US according to Routley, Nick. 2018. "The Multi-Billion Dollar Industry That Makes Its Living From Your Data". *Visual Capitalist*. https://www.visualcapitalist.com/personal-data-ecosystem/. [↑](#endnote-ref-13)
14. Garrett quotes Hachman, Mark. 2015. "The Price Of Free: How Apple, Facebook, Microsoft And Google Sell You To Advertisers". *Pcworld*, <http://www.pcworld.com/article/2986988/privacy/the-price-of-free-how-apple-facebook-microsoft-and-google-sell-you-to-advertisers.html>. in his journal article Garrett, Marc. 2017. "Reclaiming The Corporate Owned Self". *State Machines, Aksioma*. <https://aksioma.org/Marc-Garrett-Reclaiming-the>. [↑](#endnote-ref-14)
15. Garrett quotes Marco, Meg. 2010. *Consumerist.Com*. https://consumerist.com/2010/06/21/privacy-change-apple-knows-your-phone-is-and-is-telling-people. [↑](#endnote-ref-15)
16. This worldwide community that uses wearable devices monitor their own health and bodily functions, as a way to improve fitness and health, as a hobby, or as a narcissistic preoccupation. Official definitions can be found here at Quantified Self". 2019. *Quantified Self*. https://quantifiedself.com.; What Is Quantified Self?". 2019. *Quantified Self Institute*. https://qsinstitute.com/about/what-is-quantified-self/. [↑](#endnote-ref-16)
17. de Valk 2016 in Garrett 2017,7. [↑](#endnote-ref-17)
18. See Endnote 6. [↑](#endnote-ref-18)
19. Which is paired with social media tools to “out” or shame citizens into good behavior (like in Brooker, Charlie. 2016. *Black Mirror Season 3, Episode 1, “Nosedive*. Video. United Kingdom: Netflix.) and discussed in Botsman, Rachel. 2017. "Big Data Meets Big Brother As China Moves To Rate Its Citizens". *Wired.Co.Uk*. https://www.wired.co.uk/article/chinese-government-social-credit-score-privacy-invasion. [↑](#endnote-ref-19)
20. #  More on Chinese facial recognition technology in "China's 'Big Brother' Surveillance Technology Isn't Nearly As All-Seeing As The Government Wants You To Think". 2018. *Business Insider*. <https://www.businessinsider.com/china-facial-recognition-limitations-2018-7?r=US&IR=T> and the mini-documentary by The Economist. 2018. *China: Facial Recognition And State Control*. Video. https://youtu.be/lH2gMNrUuEY.. See activities being trialled in the UK and Germany, discussed in Delcker, Janosch. 2018. "Big Brother In Berlin". *POLITICO*. https://www.politico.eu/article/berlin-big-brother-state-surveillance-facial-recognition-technology/., in *Wired* UK magazine by Burgess, Matt. 2018. "Facial Recognition Tech Used By UK Police Is Making A Ton Of Mistakes". *Wired.Co.Uk*. https://www.wired.co.uk/article/face-recognition-police-uk-south-wales-met-notting-hill-carnival., and *The Independent* video report by Dearden, Lizzie. 2018. "Facial Recognition Cameras Are Scanning Tourists And Christmas Shoppers In London's West End Without Their Knowledge". *The Independent*. https://www.independent.co.uk/news/uk/home-news/facial-recognition-cameras-london-met-police-suspects-arrests-identity-a8687481.html.

 [↑](#endnote-ref-20)
21. Brooker, Charlie, *Black Mirror*, 2013–2018, Netflix. [↑](#endnote-ref-21)
22. Esmail, Sam. 2016. *Mr. Robot*. Video. Hollywood: Universal Pictures. [↑](#endnote-ref-22)
23. As explained by Wong, Julia. 2019. "The Cambridge Analytica Scandal Changed The World – But It Didn't Change Facebook". *The Guardian*. https://www.theguardian.com/technology/2019/mar/17/the-cambridge-analytica-scandal-changed-the-world-but-it-didnt-change-facebook. [↑](#endnote-ref-23)
24. Garrett 2017, 16 [↑](#endnote-ref-24)
25. In his article, Nast, Condé. 2018. "Here's How Much Money I Made When I Sold My Own Data". *Wired*. https://www.wired.com/story/i-sold-my-data-for-crypto/. [↑](#endnote-ref-25)
26. “Ingestible devices, for example, are being developed to travel inside the body, collect information, and send it to servers to report on an individual […] They are intended to visualize, monitor, and diagnose internal processes such as blood pressure, PH balance, core body temperature (Nikita, 2014), and ultimately report to an external receiver.” (Petersen 2019, 21). [↑](#endnote-ref-26)
27. The definition of “e-textiles” from WEAR glossary in Greinke, Berit, and Camille Baker. 2017. "Wearables & Smart/E-Textiles - Wearsustain". *Wearsustain.Eu*. https://legacy.wearsustain.eu/about/wearables-e-textiles/. [↑](#endnote-ref-27)
28. See Dubbeldam, Barbara. 2019. "Institute Of Network Cultures | Not As Good As Gold: ‘Goodness’ Of Genomic Data". *Networkcultures.Org*. https://networkcultures.org/blog/2019/01/22/not-as-good-as-gold-goodness-of-genomic-data/. [↑](#endnote-ref-28)
29. (Petersen 2019,12) [↑](#endnote-ref-29)
30. Howe, Daniel C. 2015. "Surveillance Countermeasures: Expressive Privacy Via Obfuscation". *APRJA* 4 (1). http://www.aprja.net/surveillance-countermeasures-expressive-privacy-via-obfuscation/. [↑](#endnote-ref-30)
31. *“[…] ingestible technology is a new frontier under much development in the sphere if visceral computing […] The idea of swallowing a computer device, allowing it to either act on or surveil the body from within […]”* (Petersen 2019,28) The European Commission also wrote a paper in December 2016 on this and a feedback paper in 2017, confirming these insights by Petersen, found at “Feedback From Stakeholders On The Smart Wearables Reflection And Orientation Paper - Digital Single Market - European Commission". 2016. *Digital Single Market - European Commission*. https://ec.europa.eu/digital-single-market/en/news/feedback-stakeholders-smart-wearables-reflection-and-orientation-paper. [↑](#endnote-ref-31)
32. “*Cognitive experiences will not only be used for digital telepathy (i.e. moving computer interfaces with the brain), they could be stored by third parties, or they could be used in predictive models to draw conclusions about thoughts and feelings (Nick, Berman, and Barnehama 2015).”* (Petersen 2019, 24). [↑](#endnote-ref-32)
33. Ibid, 11. [↑](#endnote-ref-33)
34. Bruce Baer Arnold and Wendy Elizabeth Bonython discuss Genomic/ DNA Data with Barbara. Dubbeldam and what might constitute the “good data” in this context in their chapter “Not As Good As Gold? Genomics, Data and Dignity (Barbara. Dubbeldam 2019) [↑](#endnote-ref-34)
35. (Hernandez, 2014, in Petersen 2019, 5 - my italics). [↑](#endnote-ref-35)
36. “*Taken critically, personal cloud computing involves a depoliticized ideology that rhetorically justifies bodily surveillance and […] the “the subjugation of the body through the acquisition and assimilation of data*.”(Manley et al. 2012, 313 in Petersen, 2019, 11) [↑](#endnote-ref-36)
37. Ibid Garrett (2017) and see the work of Morone here http://jenniferlynmorone.com. [↑](#endnote-ref-37)
38. ‘Sousveillance’ is a term coined by wearable-computing pioneer Steve Mann in 2004 to describe inverse surveillance *[…] Mann suggests that societies may employ sousveillance “as a way to balance the increasing (and increasingly one-sided) surveillance*”. More here Mann, Steve. 2019. "Sousveillance". *Wearcam.Org*. http://wearcam.org/acmmm2004sousveillance/mann.pdf. [↑](#endnote-ref-38)
39. Sulleyman 2017 in Garrett 2017, 6. [↑](#endnote-ref-39)
40. “*Seamless interaction with cognitive processes, if networked, would* risk parasitic relationships where humans (i.e., thoughts, ideas, memories, lies, etc.) are the source for data, *rather than positioning humans as the benefactor of (seamless) services*,” (Petersen, 2019, 26 - my italics). [↑](#endnote-ref-40)
41. Baker, Camille C. 2018. *New Directions In Mobile Media And Performance*. 1st ed. Oxford, New York: Routledge, Taylor & Francis Group. [↑](#endnote-ref-41)
42. Petersen points out that: “*Connecting wearables, implantables, and ingestibles, through body networks would eventually treat them as one data system […] that would funnel data to and from the body to third parties. It would also require human users committed to the practice of sharing bodily data in everyday life (e.g., working, staying healthy, playing, shopping, dating, etc.).*” (February 2019: 10) [↑](#endnote-ref-42)
43. This concept is unpacked, especially the about the concept of *unknown knowns* in his book Žižek, Slavoj. 2006. *How To Read Lacan*. New York: Norton, Granta, 52-53. [↑](#endnote-ref-43)
44. In Andersen, Christian Ulrik, and Geoff Cox. 2015. "Datafied Research". *A Peer-Reviewed Journal About* 4 (1): 4-5. doi:10.7146/aprja.v4i1.116100. [↑](#endnote-ref-44)
45. 48 Originally, this concept was inspired by Butler, Judith. 1990. *Gender Trouble:: Feminism And The Subversion Of Identity*. New York: Routledge. [↑](#endnote-ref-45)
46. See the full *WEAR Sustain* project website here <https://wearsustain.eu/dashboards/home> about the project <https://wearsustain.eu/static/about> and the legacy website <http://legacy.wearsustain.eu/> [↑](#endnote-ref-46)
47. Term and practice instigated by Matt Ratto as described here Ratto, Matt. 2019. "What Is Critical Making?". *Current*. https://current.ecuad.ca/what-is-critical-making.  [↑](#endnote-ref-47)
48. Baker 2018. [↑](#endnote-ref-48)
49. Thunberg, Greta. 2019. "Environment | The Guardian". *The Guardian*. https://www.theguardian.com/environment/2019/jan/25/our-house-is-on-fire-greta-thunberg16-urges-leaders-to act-on-climate. [↑](#endnote-ref-49)
50. #  Such as the work of the WEAR Sustain funded teams, artist Kasia Molga [kasiamolga.net](http://kasiamolga.net), designers CuteCircuit https://starts-prize.aec.at/en/soundshirt-2-0/ and non-wearables focussed data artists, such as Ciutat Vella https://starts-prize.aec.at/en/ciutat-vellas-land-use-plan/, Kate Crawford AI Now Institute and Vladan Joler https://starts-prize.aec.at/en/anatomy-of-an-ai-system/, Leon Baauw, Marcha Schagen https://starts-prize.aec.at/en/project-kovr/, James Bridle https://jamesbridle.com/works/citizen-ex-installation and Julian Oliver https://julianoliver.com/output/category/projects.

 [↑](#endnote-ref-50)