

Clocked!

Time and Biopower in the Age of Algorithms

Geklokt!

Tijd en Biomacht in het Tijdperk van Algoritmes
(met een samenvatting in het Nederlands)

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Time and Biopower
in the Age of Algorithms

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Colofon

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To you, my reader, I am impressed you got this far because I can only expect a #tldr approach to my long-winded text. And now you have my express permission to skip straight to the Coda. Go ahead, I wrote it just for you.

Evelyn Wan
Utrecht, October 2018

“The power of clocks has migrated into the computer itself.”
—Wolfgang Ernst, *Chronopoetics* (2016)

Introduction

A young child wakes up groggily in bed, puts on her bright blue watch, and trots over the carpet to feed her pet dog, before grabbing four bowls and setting up the table for family breakfast. This is the morning routine of a precociously-disciplined child, or, the opening scene of a smartwatch trailer targeting young children.

“Meet Octopus, the first icon-based watch that teaches kids good habits and the concept of time” says the voiceover narrator, as the camera pans to a close-up on a watch that says 7AM displaying an icon of breakfast porridge. The Octopus (Fig. 1) is a “scheduler that fosters responsibility, independence, and self-esteem”, with an optional gamification feature that enables children to unlock achievements and gain badges for complying with their schedules. Every smartwatch is synchronised with the parents’ smartphones, where an app allows for scheduling and monitoring. Based on the parents’ wishes, the child-wearer will be reminded to brush teeth, get ready for school, feed the fish, pack a bag for swimming class, or join the family in the living room for a game. The device gives “a discreet vibration” with a pop-up icon to remind the child of preset activity and alerts the parents when the activity has been marked completed.

Enabled by Bluetooth technology, the Octopus is synchronised in real-time, with an archive of the activities stored in its internal memory, and the accompanying app provides dashboard views of progress. The smartwatch is marketed as a method to externalise the act of ‘disciplining children’ and prevent conflicts, avoiding situations where shouting matches ensue when children refuse to listen. Parents do not have to nag all the time with this external aid and a clear system communicated through the vibrating alarms and pop-up notifications. The watch is supposed to teach children of ages three to eight how to tell time, and to develop self-discipline.

Introduction



Fig. 1: Smartwatch for children and accompanying app, Octopus by JOY

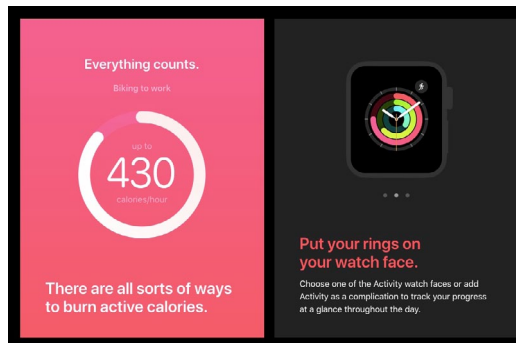


Fig. 2: Promotion for Apple's 2018 Close Your Rings Campaign

The inventors' mission is “to reinvent how parents share time with their children: no more stress, no more power struggles, only precious moments spent focusing on what really matters: quality family moments” (JOY 2016). It is a time-gadget that not only disciplines the children and sets them up for a sense of adherence to schedules, but also offers the possibility to utilise time better and to generate a sense of quality time.

Today, a watch is not simply for time-telling, and a smartwatch gadget running on algorithms also tracks your activities or even introduces new habits by setting up schedules and rhythms for moving about. Octopus, by JOY, which appeared on crowd-funding site Kickstarter in 2016, is one of the many products available on the market aiming to teach children how to read analogue and digital clock faces and time discipline.¹ Smartwatches for adults set up other promises such as doubling as an activity monitor and pedometer, reminding the user to stand up and move around after detecting a long period of sedentariness. In times when sitting is seen as the new smoking, it is reportedly common in Silicon Valley for people to just stand up and move around during meetings, since the mass adoption of Apple

Watch and other similar gadgets. Users are enticed to unlock fitness badges, while companies begin to roll out employee health programmes which include the use of such trackers so as to encourage healthier lifestyles. For example, in February 2018, Apple launched the “Close Your Rings” campaign, which refers to the three tracking rings of “Move, Exercise, Stand” on its display interface (Fig. 2). One could close the Stand ring by getting up and moving around for at least 1 minute during 12 different hours in the day, while the Exercise ring could be closed by at least 30 minutes of activity. The Move ring is closed when one reaches one’s personal goal of active calories burnt in the day. Users are encouraged to display the rings on one’s clock face so as to always be reminded. The Apple Watch becomes a personalised clock that tells not only the time but also the always-up-to-date record of the amount of physical activity by day as recorded by the wrist device.

Gone were the days when clock towers striking the hours was the way for a community to be synchronised to a time rhythm. When clocks were first introduced, the device offered a layer of mediation to time, which took us away from time-telling through daylight hours or by the stars. It allowed division of the day into 24 equal hours, regardless of the seasons, and became an external reference independent of natural conditions. The quantification of time has important ramifications for time to become a usable and tradable unit, and lives gradually become adapted to and organised around clock practices. Scholars of time studies have long argued that the invention of the clock instilled a new sense of time-consciousness, which in turn, enabled the emergence of modern clock consciousness (Thompson 1967; Thrift 1990; Ingold 1995; Adam 1995). The material objects of clocks and watches provided technological tools to manage schedules and exert control over labour. The adoption of clock use was also seen as a precursor to the rise of factory discipline and labour management during the Industrial Revolution. The discipline and habit of sticking to work shifts, controlled break times, and being remunerated for one’s hours of service have persisted through the centuries, and could still be observed in daily life today. Such a way of organisation of life, labour, and play is curiously inflected in the smartwatch for children described above. It is deemed important and favourable to instil your children with clock discipline, for them to be induced into a world of organised rhythm and habit-forming as afforded by clock time, and as young as three years of age.

Yet such smart devices remind us that while clock discipline is still essential to modern life, we have also been ushered into a new mediated regime of time, one that is mediated by the digital algorithms running in the smart devices we keep close to our bodies. These devices introduce an added layer to time mediation, one that is personalised, monitored, recorded, and constantly running in the background to offer push-alerts and pop-up notifications. In *Feed Forward* (2015), Mark Hansen proposes the term *twenty-first-century media* to refer to media objects

and processes that “operate at microtemporal scales without any necessary—let alone any direct—connection to human sense perception and conscious awareness” (2015b, 37). He sees this feature as a defining break from media of nineteenth and twentieth century, as represented chiefly by photography and film. Hansen argues that while these older recording technologies correspond to the durations of human experiential time, twenty-first-century media introduce an additional technical layer to time, through microtemporal algorithms.

I juxtapose this dimension of microtemporal algorithmic time with analogue clock time for a comparison of these two modes of time mediation. On a technical level, both mediations of time run on algorithms. An algorithm is simply a shorthand for a set of mathematical operations. Analogue clock time, distilled into seconds, minutes, and hours, is a close-ended mathematical operation that counts passing durations, registering 60 seconds as a minute, 60 minutes as an hour, 24 hours as a day. Our digital devices, on the other hand, run in microtemporal rhythms, churning through algorithmic operations at speeds that do not match up with human perception. We could catch a glimpse of the speed of microtemporal rhythms by looking at *clock speed*, which is used to denote the frequency at which a central processing unit (of a computer, or a smartphone) operates. It is measured in clock cycles per second, or hertz. While the first generation of computers like Konrad Zuse’s Z3 in 1940s had lower speeds of 5-10 hertz, the speed of iPhone X released in late 2017 boasts a speed of 2.5 gigahertz (GHz), i.e. it could process up to 2,500,000,000 cycles per second. Algorithms running on such speedy processors in these machines process our data input all in a fraction of a second. The processes, however removed from human sensibilities, have real effects on our experience, whether it is a buzzing notification reminding a child it is time to go to bed, or a stream of data recording how much one has moved and stood during the day.²

Temporality, specifically a beyond-human temporal scale, has become the *modus operandi* of twenty-first-century media. It is pertinent to study the implications of time and the technologies which mediate it, in order to gain an understanding of the effects of twenty-first-century media on our daily lives. This study is therefore dedicated to exploring the temporal dimensions of twenty-first-century media technology and the political implications therein, driven by the question: if clocks were seen as key to the imposition of clock discipline, how do twenty-first-century media, with their mode of beyond-human time mediation, impose power on the population? I explore this subject by returning to Michel Foucault and his contemporaries’ work on discipline, performance, biopower, and necropower, with a particular focus on the intersections with temporality and media technology.

Biopolitics, in a nutshell, is the study of governing strategies focused on the regulation of populations and the management of ‘life itself’. Foucault develops his ideas on biopolitics in the 1970s in a series of books and lectures, covering a

myriad of contexts under which the exercise of discipline and biopower could be observed. Foucault notes a shift in the West in the late eighteenth-century where a more efficient exercise of power is inaugurated, rather than relying on the power of the sovereign to manage and kill. In a population, bodies are assigned different values in a relative logic of calculating, measuring and comparing, and a biopolitical calculus is in place that determines who gets to live and be cultivated for labour and (re)production and who is left behind to die. Offering a conceptual itinerary through Foucault's work, this dissertation will demonstrate how these ideas transpose and map onto our current day and age of digital culture, "characterized by an unprecedented abundance of informational output and by an acceleration of informational dynamics" (Terranova 2004, 1). Because of the primacy of temporality in the operations of twenty-first-century media, I add two qualifiers 'techno-' and 'chrono-' to guide the trajectory and scope of this biopolitical research.

I propose the term 'techno-chrono-biopolitics' to highlight the technological and chronological dimensions of biopower. This project maps the influence of past and current technologies on human perception of time and its biopolitical implications. It looks into how specific technological developments have contributed to different ways time is rendered, calculated, and used in specific contexts, and how these result in different temporalisation of bodies, changing rhythms of day-to-day life and the organisation of one's life on the whole. As the above examples have already signalled, these technologies inaugurate new modes of labour and surveillance under which bodies' capacities to produce and perform are extracted. These effects could be observed on multiple levels and on multiple time-scales, and thus require an intricate analysis of the technical dimensions of how these technologies work, how human and machine co-construct the digital milieu we occupy, and how these effects materialise in selected settings and geopolitical locations. An attentiveness to historical antecedents, present manifestations, and future projections altogether creates a larger picture of the speeds and times in which biopower functions under the auspices of digital network culture.

In this introductory chapter, I will first introduce the main subject of study, twenty-first-century media, which defines the algorithmic age we currently live in. I will then discuss how time is implicated in media operations, moving beyond the smartwatch examples I just raised above. I will also give a preliminary sketch of how temporality is imbricated with discipline and biopower. From there, I offer an overview of what techno-chrono-biopolitics entails and propose why a return to Foucault's work is important to the study of these emerging technologies. I will close with an orientation on the methodology of this study and provide summaries of the chapters in the dissertation.

The Infrastructure of Twenty-first-century Media

A Definition

Mark Hansen's study of twenty-first-century media in *Feed Forward* (2015) offers insight into the rise of algorithmic time, one which has no direct connection to human sense perception and consciousness, operating at microtemporal scales beyond the human. Twenty-first-century media bypass the human subject and operate in the background/ in the environment, due to the revolution in media instigated by digital computation by way of micro-sensors and smart devices. Such media objects challenge the user in the construction of relationship with them, in the sense that humans are left out of the perceptual loop as devices gather background data through 'sensing' the environment. Twenty-first-century media involve the networked objects in the Internet of Things, where machine-to-machine communications take place without the necessity of human intervention.

For instance, Nest³ is a smartphone-enabled thermostat system for the home that moderates indoor temperatures based on user preferences and can 'sense' the temperature in a room. It does not only allow remote access (you could turn on the heating in advance while you are on your way home), but also learns to programme itself after an initial adjustment period. While an automated thermostat system has always had the ability to adjust temperatures, it has hinged upon active user input, or presets that have been saved on a system. With Nest as a twenty-first-century media object, it has the added learning functionality that records histories of user input so that it would eventually programme itself. For instance, it remembers that the user usually turns the thermostat on at 6pm each evening, and will eventually programme that command in without the user's active monitoring of the device. Nest learns user patterns, turns off the heating/ air-conditioning when not needed and will calculate how long it takes to heat one's home to the desired temperature given the weather and the specifics of the house or flat it is installed in, with the upside of better energy efficiency and greener usage of heating. The device even knows if someone is home or not: by tracking the location of user smartphones and by using the sensors embedded in its face.

Hansen contrasts twenty-first-century media with technical objects from the previous era, which are characterised as "past-directed recording platform[s]" (2015b, 4). Nineteenth and twentieth century media, represented by photography and cinema, primarily address human sense perception and experiential memory. The act of recording links with experience through photographs and video images that line up with the "durational traces of human experience" (2015b, 40). Of course, development in cinematography and film editing techniques have provided the potentiality of breaking with real-time⁴ experience through the speeding-up, slowing-down of frames, and disrupt the correlation between the recording

capacities and our human experiences of time. The standard frame rate of film, for instance, operates at 24 frames per second. When slowed down, film could offer minute details which become all-of-a-sudden apprehensible for our conscious attention⁵, mediating a different relationship between time and image.

This relationship between time and cinema is explored in David N. Rodowick's *The Virtual Life of Film* (2007). Rodowick contrasts analogue and digital filming technologies, and studies their varied relationship to time. Analogue film footage contains a causal relationship between the time of its input (being shot) and the time of its output (being projected), and the materiality of film itself conveys a particular, set relationship to time. Digital film, however, does not rely upon such a causality but instead operates based on multiplicity and the potential to manipulate and change the image. To him, virtuality is part and parcel of the ontology of digital film—and as an entity available electronically as numerical manipulations, processes like synthesis, sampling, sequencing become fundamental to its form. Because of this, digital film holds the potentiality of a different relationship to time, even though in many cases “digital imaging mimics photography and cinematography in producing the qualities of perceptual realism” (2007, 125).

Media technology today compounds this virtual relationship to time radically. This is because the mode of recording has changed in twenty-first-century media networks. The experiential shift in twenty-first-century media far exceeds what cinema could achieve, as

recording takes place at the level of sub-experiential and microtemporal unities and in the service of future-directed, often non-deliberative (or better: not traditionally deliberative) action in the present; typical forms include bits of computational data and fine-grained inscriptions of analog fluxes. [...] Recording now operates predominately in the service of communication between machines necessary for the operation of our smart phones and other microcomputational devices. (Hansen 2015b, 40)

While these devices interface with human activities, they no longer directly connect to our actions as nineteenth- to twentieth-century media do. The interactions which get recorded are reduced to bits of data stored so as to construct network connections amongst media objects. Returning to the Nest example, the device could ping user phones in the vicinity so as to establish whether someone is home. This microtemporal action (delivering the signal of pinging) is conducted without alerting the actual user. When the smartphone is in discovery mode and responds to the ping, Nest would continue running the heating. This demonstrates how communication could take place from machine-to-machine without involving the human's perceptual experience, and this is precisely the charm and efficiency offered by such devices—automation without the need of the human to issue a direct command.

Today your smartphone may be operating background-running algorithms on Facebook, or syncing photos with a cloud storage service at any given moment.

Email apps often run in the background of our smartphones, reading our emails at lightning speed without our conscious apprehension of it. Priority Inbox in Gmail uses algorithms to sort through all incoming mail messages and determine which are the more important ones that should gain priority over others. For instance, emails coming from known contacts inside your account would be labelled with higher importance, while promotional newsletters and advertisements would receive a lower rank. Team communication and collaboration app Slack is developing machine learning methods to only alert users to messages that are of higher importance in order to combat the overwhelming onslaught of messages which sometimes do not matter, like emojis and memes which are sent for fun. It is no surprise that human consciousness is no match for the microtemporal scales at which these processes occur.

With the proliferation of devices like smartphones, smartwatches, and apps like social media platforms, twenty-first-century media run in the background, mediate processes beyond our conscious apprehension, and are ubiquitous in nature. Twenty-first-century media decentre the human subject, as humans are but nodes (albeit an important one) alongside the many machinic networks and devices which proliferate in our daily lives. The speed and vastness of such algorithms cannot be perceived simply on the basis of our sensory apparatus, and the functioning of such objects is at odds with the temporality of experiential time.

Hansen is against classifying this media phenomenon as ‘posthuman’ in the sense that they do away with human experience (2015b, 6). Rather, he conceives of them as human-implicating, such that twenty-first-century media’s impact on human experience has shifted from a direct to an indirect modality. The result of this is that human experience “becomes increasingly conditioned and impacted by processes that we have no direct experience of, no direct mode of access to, and no potential awareness of” (8). While other theories of experience have placed humans at the centre (phenomenology⁶ is a prime example), Hansen proposes Alfred North Whitehead’s process philosophy⁷ as the ontological framework to study twenty-first-century media. This is because ‘experience’ now takes on a different definition, and is no longer a solely human domain and does not target human consciousness as the only realm where experience is possible. One has to also consider the sensing abilities of the machines as their proliferation results in their ‘environmental’, ubiquitous, background-running operation. Machinic experience decentres the previously-privileged position of human sensibilities. Whitehead’s philosophy then offers the vocabulary and speculation necessary to attend to “a massively plural and differentiated model where experience must be conceived as at the composition of multiple overlapping levels of sensation and where each of these multiple levels retains some degree of sensory autonomy” (44). Hansen’s work, from this

perspective, attends to a non-human-centric model of sensation, experience, and time.

Sensing Time

A different kind of sense-making seems to be at stake here, which Erich Hörl refers to as “technological displacement of sense (*Sinnverschiebung*)” (2015, 1). While Hansen uses the term *twenty-first-century media* as an umbrella term for the phenomena, Hörl sees this as a continued process of cyberneticisation. To Hörl, the dream of cybernetics, of control and communication in automated networks, finds new expression in the Internet of Things.

My thesis is that in cybernetic relations, in which the forming of objects is no longer the core activity of human and non-human actors—and that is the defining characteristic of the technological condition—there is at the same time also a shift in the status and sense of objects as such, or what an object even means, towards systemic, active, intelligent, and communicating objects. This shift implies a momentous redefinition of our entire objective condition and the place that we as subjects occupy therein. The modification of the sense culture that is technologically implemented in this way eventually leads to a fundamental ecological reorientation of the mode of cognition and being, whose contours we are only just beginning to recognize. (7)

We are only beginning to make sense of the abilities of machines we have invented, which go beyond human bodily capacities.⁸ Hörl argues that such a technological condition is truly “techno-logical”, in that “they ultimately unhinge the sovereignty and authority of the transcendental subject” (3) of the human. They follow the internal machinic logic of technological objects, pre-programmed to function independently of human interference. The role of humans, as Hansen also argues, is decentralised. In the past, one could argue that phenomenological experience forms the crux of human sensory apparatus. The operations of current technological objects however have become “unreadable, imperceptible, and illegible; indeed they increasingly disappear entirely” (3). Hörl states that an unavoidable technicity underlies the current epoch. This technicity should no longer be conceived of as “a form of prosthetic compensation, externalisation, extension and supplement to the insufficiently equipped, incomplete, and indeterminately finite living being” (4), recalling Marshall McLuhan’s view that technologies are extensions of the human body. Rather, Hörl argues, it should be seen as the structural backbones of the world humans inhabit, as ecological,⁹ as environmental, and sense-making on its own accord. From this perspective, the notion of ‘sense’ is no longer attached to the figure of the human, and that a new sense culture is formed with Hörl’s *technological condition*. Sensing is not available only to the human, but also to machines.

Coming at this from a temporal angle, one could suggest that making sense of time has a different meaning under this ‘technological condition’. This is not time as defined through Henri Bergson’s duration (*la durée*), temporal consciousness experienced in the perceptual fullness of the present, nor is this Edmund Husserl’s

flow of time-consciousness, where he breaks down the experience of time into a three-part phenomenological process of primal impression, protention and retention.¹⁰ Both of these accounts privilege human perceptions of time. Rather, we need to look into a technical understanding of time as afforded by clocks and computer machines, temporal logics which are techno-logical, and are closed-off to the sense-making abilities of human beings.

Wolfgang Ernst proposes the term ‘time-criticality’ in *Chronopoetics* (2016). This term refers to the ability of machines to not only measure and record time, but also to establish their own tempor(e)alities. Computer machines¹¹ have their own internal rhythms that emerge out of calculating and processing algorithms. Signal flows between different parts of the computer would have to be synchronised in particular ways in order to complete a set process. These interactions inside generate a clock pulse inherent to the flow of operations inside the computer. This is to be differentiated from the regular rhythm of the tick-tock of a clock hand, which is constant and serves as an external reference. In contrast, the clock pulses inside computers emerge out of the interactions and processing of signals, creating a self-referential temporal pattern unique to what the specific computational process requires, and to the speed of the microprocessors installed. The same algorithmic calculation would of course be faster on a newer smartphone model with clock speeds up to 2.5 GHz as opposed to an older phone with clock speeds up to 1.3 GHz. Sensing time from this machinic perspective can be defined completely in techno-logical terms, unreadable and irretrievable for human sense perception. This is the rate at which algorithmic time operates, the temporal reality for machines whose technicity indeed displaces earlier phenomenological understandings of human experiential time.

In Ernst’s study of chronopoetics, he makes a passing reference to Foucault and *Discipline and Punish* (1991) with regards to computer time-criticality, providing a rare glimpse of a cultural dimension to his technical study of temporality. Commenting on the invention of the computer, he postulates that “such high-tech operations could obviously only exist in a culture that was discursively familiar with these kinds of negotiations of timing and disciplining” (2016, 84). He then comments that these new technologies developed are refinements of the temporal- and spatially-organised discipline techniques Foucault has referred to (panopticon and time management). Instead of the blocks of time in scheduling, these measurements are “gradually refined to calculations in seconds and which occurs today in the architecture of the computer” (*ibid.*). In his view, his focussed study on the technicalities of computer machines could be brought into conversation with cultural theoretical perspectives. Indeed, this study intends to show how in-depth accounts of computation by media scholars could be aligned with cultural perspectives such as those represented by Foucault and his contemporaries.

Mediated Time, Quantification, and Discipline

Ernst himself is hinting at the possible linkages between new forms of mediated time within time-critical media and the cultural dimensions of timing and disciplining that accompany these developments. I take up this line of thought by showing how clock-time has indeed been used as a disciplinary/ biopolitical mechanism. This would subsequently be contrasted by an account of how time management could look like under algorithmic time.

Studies of clock discipline in the industrial age offer particular insights into the relationship between mediated time and the imposition of power on bodies. Living with rhythms of the clock has transformed the organisation of work, one that has been seminal studied by E. P. Thompson in the 1960s. His work has been framed as a founding basis for the emergence of cultural studies in England. In the essay “Time, Work-Discipline, and Industrial Capitalism” (1967), Thompson analyses the time-consciousness of nineteenth century English factory workers as they shift from pre-industrial, ‘natural’ time¹² consciousness to a modern, factory-inspired and disciplined time consciousness. Agricultural work has long been associated with being attuned to ‘natural’ time—sow, plough or harvest the fields as the sun come up and retire as the sun come down, and follow seasonal fluctuations between daylight and darkness. The invention of watches and clocks coincide with the onset of industrialisation, and factory workers have to let go of their ‘natural’ time sensibility which have developed based on habitual experience of time, and in turn, replace that with a clock discipline which generated within them an inward notation of time. Time is also abstracted into a form of currency, as time measured through labour translated into wages, and clocks provided a measurement of precisely how long a person has worked.

Mechanical time (as a scientific invention) became a readily-available tool to discipline bodies into work. In historian Mark Smith’s account of the antebellum period in the US (1997), he observes a curious connection between clock and watch ownership and how people lived in the free-wage-labour North and the agricultural, slave South. Time discipline and clock-regulated work had taken shape in the industrialising North, but so has the system of slavery absorbed the invention of mechanical time. Smith argues against the preconception that agriculture in the South did not require factory-like discipline in the North, for working the fields remained bound to ‘natural’ time orientation. This was far from the truth. The ding-dong sound of clocks in church towers, the slaveholders’ horn, and what was called the ‘nigger bell’ (1997, 137) disciplined slave labourers and regulated how they used their day. Drawing from accounts of former slaves, Smith referred to what we would call an alarm clock today—it would ring well before sunrise at 4am sharp, and off must the enslaved go into plantation fields, toiling to the rhythm

of the master's clock. Both receptions of clock devices in the American North and South contributed to the quantification of time as labour and profit, and time measurement penetrated into work rhythms of agricultural work, even though it would at first sight appear to continue running on its 'natural', environment-based rhythms. The temporalisation of bodies occurred incrementally as they became accustomed to acquired habituation of clock-time.

This relationship between time and bodies has also been explored in the field of performance and art. One needs to look no further than performance artist Tehching Hsieh's oeuvre of work to note the critique of time imposition on bodies in labour. In his famous *One Year Performance 1980-1981 (Time Clock Piece)*, Hsieh imposes upon himself the task of clocking-in using punch-card technology every day, every hour on the dot, 24 hours a day, all through 365 days of the year. He installs a fully functional worker's time clock, a lighting system, and a camera suspended from the ceiling facing the clock inside his studio. Because of this he is confined to the space and its immediate vicinities, and cannot even rest continuously for more than fifty minutes or so. He meticulously records his time-stamped cards, and takes an hourly photo with him standing next to the punch-card clock mechanism (Fig. 3).



Fig. 3: Photo impression of the *Time Clock Piece* re-exhibited at the Liverpool Biennale 2010; on the left, the worker's time clock installed in the cell, and on the right the time-stamped cards and self-portraits taken hourly

The archive, after the full year, shows that he was only unable to perform 133 of the 8760 clock-ins.

In *Out of Now* (2008), Adrian Heathfield reads the performance as a “systematic critique of the temporal logic upon which the social and cultural organisation of late-capitalism is founded” (32). It is an “exaggerated version of the altered biological conditions of shift labor” (*ibid.*). In my view, Hsieh’s work is a unique example that exposes the violence to the body that time-managed labour could impose. It follows from the rich historical accounts of time discipline in the factory or on plantations, and aesthetically reveals the politics of such temporal arrangements. Hsieh stands in front of the camera as it captures, almost in a ritual-like manner, his stoic face every time he clocks-in, a face that gazes back into the emptiness of a life arranged purely for the extraction of labour. Forcing his corporeal self into the cold rigid regularity of mechanical clock time, he makes visible the rhythmic bind of the machine, and subjects himself to the surveillance of the punch-cards and of the camera.

Hsieh’s work performatively reveals how the invention of clock-time as a technology harnesses the standing-reserve¹³ of human bodies for labour and inaugurates new types of biopower. Hsieh already prepares us for a world of control and surveillance based on clock, routine, and labour. By the same token, Tim Etchells expresses his admiration for Hsieh’s work.

The work seems to be poised somewhere between the mechanization of time that comes from the industrial revolution and the profligate surveillance that has since come to characterise the digital one. It’s all about the clock, routine and submission. [...] Your work was effectively pre-digital, but even so it evinced an acute sensitivity to the modes and technologies of capture, existing and emerging. Through it you rehearsed in analog form a culture’s obsession with control and surveillance that would blossom with the new technologies and the shift in geo-politics post 2001. (Heathfield and Hsieh 2008, 356)

Time monitoring indeed takes on a different meaning when labouring in today’s digital world, with new technologies on the scene. Real-time quantification of performance¹⁴ takes us beyond the type of regulation afforded by a ‘nigger bell’, or a punch-card clocking-in system. The invention and proliferation of algorithmic operations today bring about intensifications of monitoring, which is best illustrated through the quantification of time and labour inside Amazon.com warehouses.

In 2013, BBC One broadcasted an exposé into the real conditions of Amazon warehouses after sending in an undercover reporter to work as a picker, in a documentary series *Panorama*, “Amazon: The Truth Behind The Click” (2013). A picker is someone who compiles orders inside a warehouse. At the time of filming, pickers earned between £6.50-8.25 an hour for day and night shifts. Adam Littler, 23, reporter, was hired at the Swansea branch in the UK (with 800,000 square feet of storage), and wore a hidden camera to record his experiences at the compound. He used a handset, which would tell him what to collect and put on his trolley. Each product search was allotted a set number of seconds, which counted down

as he travelled amidst the sea of shelves looking for the item, sometimes even in the dark. If he made a mistake, the scanner would alert him with a warning beep. Littler's scanner tracked his picking rate and his manager could see what his rate was per hour, and whether that fluctuated during certain hours of his shift. He was told that he would be disciplined if the number was too low, and he might be given warnings. Low-performing employees are subject to verbal counselling on productivity. Sometimes when he was tired towards the end of his shift, his manager would tell him to not fall below a certain rate and keep going. Reflecting on his experience, he expressed the following sentiment: "For those ten hours, we are machines, we are robots, we plug our scanner in, we're holding it, but we might as well be plugging it into ourselves." The handheld device uses techniques of tracking and instantaneous feedback, recording his activities and analysing the data,¹⁵ much like the smartwatches I described in the opening of this chapter.

Littler found himself physically and mentally exhausted, with shifts lasting up to 10.5 hours with only 1 hour of break in-between, and walking around the warehouse picking for over 17 km in that period. His target was to pick 110 items per hour, which amounted to about 2 per minute. Accomplishing 92 items per hour already involved him running around the vast spaces of the warehouse. He was literally racing against the clock with every beep. As a relatively fit, young, able-bodied man, his average was 80 units per hour, six weeks into the undercover job. As Littler continued this experiment, he began to experience difficulty sleeping as the disciplinary beeping sounds of the hand scanner started to get under his skin, and he would hear it in his head even after work. BBC consulted Michael Marmot at University College London, one of UK's leading experts on work stress, to ascertain whether such work is detrimental to workers' health, both physically and mentally. Marmot explains that existing research shows ample evidence that such environments cause high levels of stress and can affect worker health. Workers in such warehouses are clearly worn out by this type of job, and one could imagine the slow deterioration of health as bodies are continuously exhausted trying to keep up with a performance target that is very hard to reach. Littler complained of physical exhaustion, of blisters showing up on his feet, and his co-workers relied on Red Bulls to keep going because it was so physically strenuous.

Studying this example, I cannot help but think of Hsieh's sleep deprivation from his *One Year Performance*, and the 94 times when he failed to clock-in because of sleeping. The subjection to disciplinary observation through punch-cards in Hsieh takes on a wholly different form in Amazon's warehouses, and the desire to control and discipline is evident in the way the handheld device is designed. Littler himself feels like a machine, as these extreme measures of counting down and beeping force him to become slave to the rhythm. This account from the depths of Amazon's warehouses shows us how the quantification and measurement of time can be

afforded as personalised surveillance by a personal device. What was for Hsieh's performance regular hourly clock-ins is now a matter of seconds for Littler. Littler's device is an active real-time monitor that continuously tracked and fed back his performance targets in real-time, as well as disciplines him through constant alerts. Time discipline in the algorithmic age seems to be an entirely different creature on its own, with the possibility of instantaneous feedback through real-time monitoring on a device. It is also more specific, recalling Ernst's comment that what might have been time discipline in the form of schedules and time-blocks is now refined to a matter of seconds.

Bodies in mediated time

The Amazon example above is a direct example of time's relationship to labour, but the purview of algorithmic time and the biopolitical power extends beyond time management in labour tracking and performance review. The mechanisation of time takes on a different form today as computation takes over through intricate calculations on a scale of machinic time.

Just as algorithms are everywhere, algorithmic time is everywhere, embedded in the ubiquitous networks of digital objects. The advancement in portable media and in generating the Internet of Things result in humans being immersed in an environment of wireless networks, Bluetooth communications, cloud storage, smart objects, and screens. As noted above, twenty-first-century media bypass the human subject and operates in the background/ in the environment. In the age of algorithms, machinic operations bypass human time-consciousness. If time has been abstracted into currency in the age of mechanical clock time, currency is now inversely abstracted into the operations of time itself, based on a logic of data collection, automation, and prediction. Algorithmic operations are wedded to the operation of the ticking clock itself, in a way that bypasses human agency. An immediate example comes to mind in the form of automated trading, where financial trade is expressed through algorithmic operations at microtemporal rhythms. High frequency trading does not even require human presence, but nonetheless deals a hand in the operation of capital. The stock market is evolving into an "all-machine ecology" (Johnson et al. 2012) where machines dictate price changes, participate in electronic trading, and interact with other machines. This is sign and semblance of how advanced capitalism today functions as a posthuman operation, in a manner starkly different from industrial capitalism. Even though human operators are involved, they must themselves tune their working rhythms into one that is compatible with the trading algorithms they programme.¹⁶

Moreover, the question of time is also not limited to the domain of temporality itself, but operates too through spatialisation. In Wolfgang Schivelbusch's analysis of *The Railway Journey* (1979), he discusses how the measurement of distances

between locations radically changes with the introduction of railway technology. “‘Annihilation of time and space’ was the early-nineteenth-century characterisation of the effect of railroad travel” (1979, 33). Distances seem to suddenly shrink as travel times have been cut—and from this we see “an image of a temporal shrinkage seen as a spatial one” (1979, 34). This connection between temporality and spatiality can also be observed in the big data trend, where the minimisation of processing time meant that the spatially-large data-sets can be processed in a short period. This temporal shrinkage which takes the form of microtemporal operations is complicated by the feed-forward structure as calculations are carried forth, bypassing the human user. The operation of prediction sifts through past and present databases, as it mediates and directly generates outcomes of what may be actionable in the future. Its data feeds forwards, as a kind of “machinic reference” (Hansen 2015b, 192) for future action. In the words of Hansen,

To the extent that contemporary technologies for data-gathering and analytics allow for predictive precognition of what is to come, they manage to define a microtemporal, sub-perceptual—yet still sensory—present that impacts the future independently of any input from consciousness. (*ibid.*)

Prior to the perceptual experience, the future has already been pre-mediated, modulated and pre-empted, highlighting the temporal mismatch between human time and machine time. The turn from mechanical time to algorithmic time inaugurates an entirely different set of relationships between technology, time and (human) experience. In particular, the chronological relationship of past-present-future is reorganised through machinic prediction that materialises potentialities into actual actionable operations.¹⁷

As argued by McQuillan (2015), Rouvroy and Stiegler (2016), and Just and Latzer (2016), we have entered into an era of algorithmic governance, where the operations of twenty-first-century media are increasingly adopted in policy, surveillance, and public security from a governmental public perspective, and permeates through our daily lives through services offered by the private sector like Facebook, Google, and Twitter. In Just and Latzer’s summary,

[a]lgorithms co-govern or co-determine what can be found on the Internet (search applications, for example, what is indexed by search engines/crawlers), is seen and found (search, filtering, and aggregation applications), is produced (content production applications like algorithmic journalism), is considered relevant (search and scoring applications; ranking), is anticipated (prognosis/forecast applications), and is chosen and/or consumed (recommendation, scoring, and allocation applications; both for economic and social choices – ranging from commercial goods to friends and partners). (2016, 247)

Some of these feed-forward decisions may be relatively harmless or may even be an unlikely source of entertainment. I myself have been amused by Facebook’s decision to show me particular ads (Fig. 4). It often reminds me of this software I should use to track time—I suspect it has something to do with the insane amount of internet research on ‘time’ I have conducted in the course of this project.

Introduction

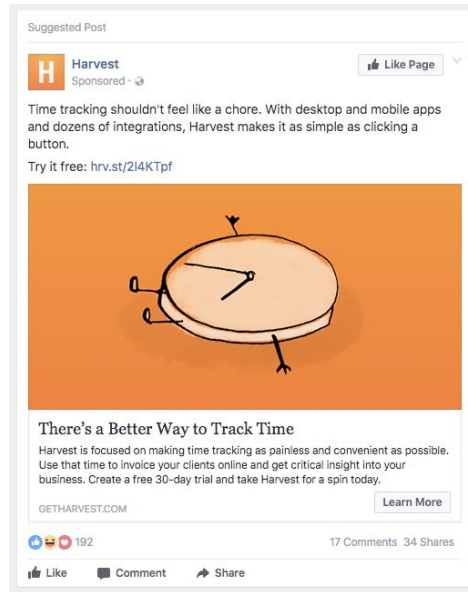


Fig. 4: Targeted ad on author's Facebook account (Author's screenshot)

Yet other uses of algorithmic processes may not be as innocuous. From job-hiring processes to insurance premium calculations, criminal court sentencing to dynamic personalised pricing, algorithmic models have been put in place in order to cut the time needed for human-decision making. These automated calculations may feed forward important decisions which are blackboxed, without accounting for potential biases in the data. Safiya Umoja Noble frames these as “algorithms of oppression” (2018), and in her study of search engines and targeted advertising, exposes a culture of sexism and racism in the digital world. It is at times difficult to call these algorithms into account, for what they output in a matter of seconds may require months of reverse engineering in order to discover how a particular decision has been made. This is especially true in instances of machine learning and neural networks, where a network’s reasoning is embedded into layers of interconnected code, making isolating the reason for a single action challenging.

Twenty-first-century media, with their durational recording capacities, can also create digital trails of our lives, enabling surveillance to penetrate deep into myriad aspects of our activities, which may subsequently be fed forward in another domain. It is well-documented that US scholars and government officials have been working hard to develop counter-terrorist algorithms that could predict when and where the next radicalised ISIS terrorist might hit in the homeland¹⁸, using clues from social media profiles and Twitter messages. In early 2017, a court-case in Arkansas caught public attention as Amazon was requested to release recordings

done by its Echo product inside a suspect's home. Investigators wanted to check if the smart assistant has recorded anything of relevance around the suspected time of murder. The suspect's smart water meter also recorded a spike in water use which was allegedly correlated with a potential clean-up of the crime scene.

In the age of industrial capitalism, life, or the power of labouring bodies, is harnessed through the operations of mechanical time. Today, however, one may suggest that life, or the bio-component as we have understood it, is being relegated to marginal significance, as human experience is decentred amidst machinic networks. The paradox is that it does not mean we have escaped the effects of techno-chrono-biopolitics. Rather, its effects have been rendered less perceptible, and more invisible. Digital scholars (Terranova 2000; Fuchs 2014; Scholz 2013) have argued extensively that our internet activity is a form of digital labour, where our attention as well as data is captured so as to generate profit for other parties. Gadgets and apps are designed to be addictive, as founders of Californian startup Dopamine Labs tell us. These neuroscientists sell code which allegedly doles out rewards at scientifically-proven right moments in order to encourage habit building and keep the user coming back.¹⁹ The labour power of our bodies are extracted durationally as we wear smartwatches and other tracking devices. Our voices are recorded on voice-recognition apps so as to train algorithms for natural language processing. We are not disciplined to work in accordance to time discipline, rather, we are enticed to continuously perform for the machines that record us and surveil us. There are no alarm clocks nor work schedules subjecting humans under their mechanical time-based control. Instead, the governmentality and biopower of today's time-based technology is introduced through the amalgamation of algorithmic time and mechanical time, that is, algorithms calculating away as sure as clocks are ticking away.

We are closely observed by twenty-first-century media, and the collected data and meta-data may be crunched away in other big data²⁰ calculations by companies or governments. While Foucault's panopticon may have ruled over prisons and has been hailed as the iconic representation of big brother surveillance, surveillance by twenty-first-century media is not primarily ocular-centric in nature. Matteo Pasquinelli refers to this as the collapse of visibility into the "regime of the computational rationality" (2015, 8). He writes that "algorithmic vision is not optical, it is about a general perception of reality via statistics, metadata, modelling, mathematics" (*ibid.*).²¹ This is surveillance in a machinic technological condition that surpasses human perception and relies on algorithmic vision. To this, I also add the reliance on algorithmic time, time internal to the machines which in effect is a contraction of decision-making time that can only be achieved through big data processing with massive computing power. Algorithmic time also operates durationally, always running in the environmental operations of twenty-first-

century media, in the ubiquity of the devices always poised to detect, listen in, record, and transmit.

This expression of algorithmic time brings forth the introduction of new paradigms and operations of the techno-logical, to use Hörl's term. If mechanical time marks the quantification and measurement of time, one may say that algorithmic time mediates and alters the operation of chronological time itself—the pre-emptive power of an algorithm in fact bends time's operation, turning the unknown future into something that is pre-mediated and pre-determined, and fed forward.

What is techno-chrono-biopolitics?

The vignettes offered thus far provide glimpses of what I term techno-chrono-biopolitics. This section looks closer at the concept and provides a cursory definition that would subsequently be elaborated in the rest of the dissertation. Techno-chrono-biopolitics refers to the temporalisation of bodies through the use of technological means, through which bodies are placed under specific regimes of control and governmentality. The study of techno-chrono-biopolitics constructs how technology mediates time-consciousness, and how that is done to the effect of managing individual bodies and populations in a biopolitical manner.

Let's start at the stem of the portmanteau term: biopolitics.²² Biopolitics, in its simplest definition, refers to the relations between 'life' and 'politics'. Foucault relates the two through what he refers to as the power-knowledge nexus, where fields of knowledges concerned with life in general (such as biology as a life science) influences the administration of control over populations—

biological existence was reflected in political existence; the fact of living was no longer an inaccessible substrate that only emerged from time to time, amid the randomness of death and its fatality; part of it passed into knowledge's field of control and power's sphere of intervention. (1990, 142)

Biopower operates in a shift to population and territory through addressing the key question as how to control groups of people as living bodies. Biopower works through both the individual and the species, as control centred on individual bodies through training of docility and utility, and on populations through the management of procreation, health and mortality, as well as the introduction of normativity and deviance. The sciences of statistics, biology and other knowledge paradigms contribute to the administration of biopower through "adjustment of the accumulation of men to that of capital, the joining of the growth of human groups to the expansion of productive forces and the differential allocation of profit" (1990, 141). Biopower, in other words, is used to control populations for the purpose of profit-making and for production.

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This biopower was without a question an indispensable element in the development of capitalism; the latter would not have been possible without the controlled insertion of bodies into the machinery of production and the adjustment of the phenomena of population to economic processes. But this was not all it required; it also needed the growth of both these factors, their reinforcement as well as their availability and docility; it had to have methods of power capable of optimising forces, aptitudes, and life in general without at the same time making them more difficult to govern. (*ibid.*, 140-141)

In the brief sketch above, I have already pointed to how bodies are expected to labour in the time discipline imposed by factories, as well as the continuous digital labour extracted through internet activity. Biopower is about the productivity of populations, and my account here is interested in studying how bodies are made productive through their engagement with twenty-first-century media.

Studying Foucault's oeuvre, biopower can be framed as an escalation of a previous regime of power operation of discipline. While discipline is exercised through the sovereign by targeting individual bodies for modification and training of behaviour, or for punishment and killing, biopolitics is concerned with the population level. The morphing of power from discipline to biopower is seen as an intensification by Jeffrey Nealon (2008). Foucault has emphasised that newer forms of power do not simply replace older forms, but rather they add to existing forms of control, and power becomes more widespread. Nealon proposes thus the term 'intensification' to study how "one form of power *intensify*, *mutate*, or *bleed into* the others" (2008, 29; original emphasis). Techno-chrono-biopolitics is, in a way, an intensification mapped onto the current discourse of biopower, by focusing on the the implication of technology and temporality in the account of biopolitics.

The chrono- strand of thought builds on existing work in gender scholarship on time and life arrangement affected by expressions of bio-power. Gender/queer studies scholars Dana Luciano and Elizabeth Freeman make use of the term 'chronobiopolitics' to discuss how time can be manipulated by particular regimes of power, with a key purpose of increasing productivity and managing labour. From wage work to the invention of schedules, shift labour to calendars, various techniques have been employed to arrange labour temporally. Populations also share collective rhythms in sexual arrangement of the time of life through courtship, marriage, childrearing which generates a kind of chrononormativity that people are expected to more or less follow.

To this field of study, I bring to the fore the 'techno'/ technologically-mediated dimension which expands the definition of chronobiopolitics into one that takes into account the impact on time-consciousness, life rhythms, and experience of time in general, which the current technological epoch brings. Technology here is understood as a broad entity, as apparatuses of control (or *dispositif*). Foucault defines it as

a heterogeneous ensemble consisting of discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral and philanthropic propositions. Such are the elements of the apparatus. The apparatus itself is the system of relations that can be established between these elements. (Foucault 1980, 194)

Technologies of discipline and regulation can be mapped back to Foucault's own work on prisons, asylums, and clinics as institutions that play a key role. The definition of technology would be taken even further by Giorgio Agamben's work on the apparatus.

I shall call an apparatus literally anything that has in some way the capacity to capture, orient, determine, intercept, model, control, or secure the gestures, behaviours, opinions, or discourses of living beings. Not only, therefore, prisons, madhouses, the panopticon, schools, confession, factories, disciplines, juridical measures, and so forth... but also the pen, writing, literature, philosophy, agriculture, cigarettes, navigation, computers, cellular telephones and—why not—language itself. (Agamben 2009, 14)

The point is not the categorisation of technology itself, but precisely how technology elicits particular logics of operation that result in particular effects. Martin Heidegger famously discussed how technology “challenges forth”²³ and is a “revealing” of the world as a standing-reserve in his seminal essay “The Question Concerning Technology” (1977). In his understanding, everything, even human beings, could be transformed into a potential resource, made available, stored up, and deployed. An introduction of technology into a setting reveals that particular impulse. Twenty-first-century media, as we will see, tap into the continuous attention economy and labour potential of bodies while at the same time, decentre their conscious perception of what has been extracted, through the incongruent scale of algorithmic time.

It is important too to state at the outset that this definition of biopower is not limited to the biopolitical, but also extends to consider the important development into necropolitics. The alteration of biopower to necropower by postcolonial scholars demonstrates both the lasting legacy of Foucault's reflections on discipline and biopolitics as well as the importance to continue thinking through other mechanisms of power in today's ever-changing world. Achille Mbembé's reconfiguration takes biopolitics into the heart of regimes where “the generalized instrumentalisation of human existence and the material destruction of human bodies and populations” (2003, 14) take centre stage. Colonies, slave plantations, Nazi Germany, Israeli occupation of Palestine, are all locales under which Mbembé discusses the operations of technology as death machines. Interestingly his account of the bio-necropolitical features a heavy description of technological advances, specifying that the operation of power in these states, as well as how “each stage of imperialism” involved “certain key technologies (the gunboat, quinine, steamship lines, submarine telegraph cables, and colonial railroads)” (25). Though not the main intention of his essay, Mbembé demonstrates how technology features within

the discussion of bio-necropolitics and what role it played in these particular regimes. Temporality already is embedded here in bio-necropolitics in the question of futurity and continuity of life, and the sovereign's power to bring about death, the end of life itself. Time haunts the apparition of technology as it swoops in to fulfil the quest for speed and efficiency; Mbembé recalls the horrors of gas chambers, ovens and other killing machines in states of exception. Being attentive to temporal experience is to look at speed and velocity, fastness and slowness, and how time is differently mediated alongside technological advancement.

In Jennifer Gabrys's work on a planetary scale of computation and the environment, she proposes the term "becoming environmental of computation" (2016). This is very similar to the notions of Hörl's "technological condition" and Hansen's "twenty-first-century media", as she constructs an analysis of "the ecosystem of electronic sensors, software, and communication" (7) around the earth. But she adds an important point that these other scholars have not engaged with—a consideration of computation also conversely extends into "its environmental processes, materialities, and effects" (4). This follows up from her earlier work on *Digital Rubbish: A Natural History of Electronics* (2013), where she looks at the darker side of the digital revolution—its material, electronic waste problem. In my account of techno-chrono-biopolitics, I explore the necropolitical effects in the longue durée of toxicity and environmental degradation caused by the disposal of our electronic gadgets, alongside the microtemporal rhythms of discipline and biopower in twenty-first-century media.

This project therefore explores media technology through multiple dispositifs: in its technical layers like machinic time-criticality and its mediation of time, in its interfaces with the human through interactions with these devices like voice-operated OS assistants, as well as in its material manifestations, as objects which are produced, used, and discarded. The dissertation studies techno-chrono-biopolitics as both a historical phenomenon, as characterised through the era of clock discipline such as in the works of Thompson (1967) and Smith (1997), as well as a contemporary issue, guided through the reflections of media and cultural studies scholars on the operations of twenty-first-century media, temporality, and biopolitics. Contemporary takes on biopolitics which I will address include, among others, Gilles Deleuze's societies of control (1992), Jon McKenzie's performance and perfumance (2001), Achille Mbembé's necropolitics (2003), Brian Massumi's ontopolitics (2015), Elizabeth Povinelli's geontologies (2016), and Byung-Chul Han's psychopolitics (2017). Each of these concepts would be further developed in the rest of the dissertation. Techno-chrono-biopolitics borrow from and build upon these reflections and see them as important intermediary steps in thinking through the impact of mediated time in disciplinary practices.

Foucault and Twenty-first-century Media

Despite the obvious attention to more up-to-date accounts of biopolitics, the significance of Foucault's original work is not to be underestimated. I will continue to return to these understandings of biopower in this chapter, to show the historical foundations that underlie the mutations observed today. Foucault's work, as a result, remains a cornerstone in the study. Hansen, for instance, has questioned whether there has been a missed encounter between Foucault and Media Studies. He bridges a Foucauldian understanding of power with the operations of media in his article "Foucault and Media: A Missed Encounter?" (2012).

Hansen's chief question is why Foucault is not engaged more frequently by media theorists given his astute observations on the heterogeneity and the multi-scalar operation of power. According to Hansen, while media scholars readily take up Deleuze's extension of Foucault's work on societies of control, they often side-step the ramifications of Foucault's original texts. Obviously, Foucault never addressed such digital networks and media developments directly during his time, but one should not overlook what his work could offer in the study of media²⁴ today. In his article, Hansen argues for a deeper understanding of Foucault's discussions of subjectification, individuation, and governance to show that Foucault's work in fact links up rather well with contemporary times in a media-saturated context.

Hansen argues for Foucault's relevance by stating that his ideas help us theorise over "contemporary media's increasing incursions into the subperceptual, micropolitical dimensions of life" (2012, 498). He cautions against the over-reliance upon Deleuze's extension of Foucault in "Postscript on the Societies of Control" (1992), suggesting that the latter offers ways to "negotiate the twin necessity for a theory more responsive to the total impact of media and for an account of subjectification that does not simply vacate the category of the individual." (2012, 499)

Hansen shows that Foucault is a possible figure to think contemporary media philosophy with, but does not actually reveal exactly how Foucault's work may be read in alignment with the operations of twenty-first-century media, due to his narrow focus on the role of the individual subject and individuation in Foucauldian thought.²⁵ Quoting Maurizio Lazzarato, Hansen ponders upon the questions tackled by Foucault—"How do subjects become active, how are the government of the self and others open to subjectifications that are independent of the biopolitical art of government?" (2012, 501). Hansen argues that Foucault retains a focus upon human subjectivity as a central focus of his research, while accounting for the multiplicity of forces that create subjectifications and normalise their subjects. Insofar as power is productive in creating subjectifications through its grip across different dispositifs, so is the individual powerful in holding the potential to exceed

these disciplinary subjectifications, which explains the need for discipline/ biopower to exist in the first place. Hansen therefore offers a reading of Foucault that includes within itself the tacit understanding that individuals are able to resist the forces being exerted upon their bodies.²⁶

Taking on Hansen's call to bring Foucault in conversation with contemporary media theory, I believe it is a timely enterprise to take a closer look at what Foucault has already said about the structures of biopower and the implication of technology and temporality within the account. In light of the defining role temporality has in twenty-first-century media, this would help us effect a better picture of the role time plays in the functioning of biopower. This also allows for a renewed engagement with Foucauldian thought, and evaluate the extent to which Foucault remains relevant for our times.

Furthermore, Foucault has also emphasised the heterogeneity from which biopolitical dispositifs could be observed. As twenty-first-century media turns environmental, we indeed see the plethora of media objects from which biopower could be exercised. Hansen, Hörl, and Gabrys all suggest that they form a part of worldly sensibility that becomes the background to our regular human lives. Biopolitical analysis requires attention to the proliferation of devices which enable data mining through biometric and environmental microsensors, as well as on platforms like social media and search engines. The heterogeneity of the dispositifs applies too in time. From the short microtemporal rhythms to the durational toxicity of material gadgets in their disposal, the exercise of biopower is intrinsically linked to different time-scales. Foucault's work has long opened up the possibility of engagement from these perspectives. Therefore, in addition to the many extensions of his theories by his contemporaries, I continue to make close reference to his original texts to substantiate my study of techno-chrono-biopolitics.

A methodological framework

The impetus of this project is historically-driven in the sense that it maps a genealogy of shifts created by various technologies in the mediation of time, so as to study the changing exercise of biopower alongside the technological. It is my contention that by tracing and juxtaposing specific technologies and their relations to time mediation, one could observe how biopower shifts its mode of operation through a network of dispositifs.

The work is fashioned after the aims of Foucault's genealogical approach—to contextualise how cultural practices and discourses emerge, and understand the conditions of possibility which structure their developments. Foucault's genealogical method in presenting how biopower functions is understood as a "history of the present" (1991) that digs into the past in order to uncover the conditions under which one may understand, evaluate, and critique contemporary phenomena.

Foucault's biopolitical analysis is a genealogical approach that investigates "where and how, between whom, between what points, according to what processes, and with what effects, power is applied" (Foucault 2007, 2). My current proposal of the portmanteau concept techno-chrono-biopolitics precisely applies this investigation within the field of media studies, with a focus on time. Foucault is clear that power does not necessarily derive from a particular, singular source, but rather emerges out of certain procedures and mechanisms. These sets of relations establish, maintain, and transform mechanisms of power.

The phrase "history of the present" first appeared in *Discipline and Punish* (1991), where he explains that his interest in the present has sent him into an exploration of the past. For him, in order to understand the modern prison, he needs to dig through the archives of penal history to observe how operations of power on the body have changed over the centuries. The historical account helps shed light on the contemporary moment, which for Foucault was his own activism about prisons in France. In the period of writing, he organised the *Groupe d'Information sur les Prisons* (GIP) together with his partner Daniel Defert, editor Jean-Marie Domenach and historian Pierre Vidal-Nanuet in order to gather information on how the prison system in France operated, and aimed at increasing public knowledge on what was considered one of the hidden regions of the social system. The resulting research became *Discipline and Punish*.

With the genealogical method, the task at hand is not to offer a comprehensive view of the past, a conventional historical analysis, but in teasing out important features that have persisted one way or another into the present, in order to understand the contemporary moment. The task is not to seek out an origin point either. As summarised by Garland (2014),

[t]he idea is not to connect the present-day phenomenon to its origins, as if one were showing a building resting on its foundations, a building solidly rooted in the past and confidently projected into the future. The idea, instead, is to trace the erratic and discontinuous process whereby the past became the present. (372)

For Foucault, the penal apparatus has always been interested in the disciplining of the body albeit through different techniques, and the mapping of this helped him gain an understanding of the French prison system in the 1970s. But the map created does not purport to be a definitive overview of how prison systems functioned historically up till the present. Rather, it could be seen as a discontinuous map of historical contingencies which continue to shape the contemporary moment.

In the present project on twenty-first-century media, I zoom in on the defining feature of microtemporality and attempt to uncover other ways technology has mediated time in the past. These former mediations are not deterministically the root of contemporary technologies, but rather hint at the logics and histories of thinking and cultural practices surrounding them. By juxtaposing these historical

accounts with the present, I construct a view of the political implications of today's technology as understood through its historical antecedents.

This way of historically-inflected thinking also fits with the underpinnings of media archaeology, which also takes Foucault's work as one of the major sources of inspiration. As Jussi Parikka writes,

[m]edia archaeology is introduced as a way to investigate the new media cultures through insights from past new media, often with an emphasis on the forgotten, the quirky, the non-obvious apparatuses, practices and inventions. [...] Media archaeology sees media cultures as sedimented and layered, a fold of time and materiality where the past might be suddenly discovered anew, and the new technologies grow obsolete increasingly fast. (2012, 2-3)

One of the central tenets of media archaeology is that new media remediate the old, borrowing key insights from Jay Bolter and Richard Grusin's *Remediation* (1999). The constant surfacing of new media technologies is in fact seen as a continued re-purposing, adaptation, and modification of older media forms. Parikka points out that within media archaeology itself, there is a heterogeneity of themes and methods, and the field embodies the interests of finding alternative histories of media, and to counter the "strategic amnesia of digital culture" (2012, 13). That is to say, what seems to be 'new' on the surface may in fact be traced back to older technological inventions, and that there could be already existing frames of reference which we could use or repurpose to understand the 'new'.

I borrow loosely then these impulses from media archaeology, to situate the study of twenty-first-century media through clocks, automata, and the discipline and biopower associated with these objects from an older era. My purpose of juxtaposing old media with the new is not to argue for ontological similarities and differences between these older clockwork objects and twenty-first-century media. Rather, it is through the explorations of potential (dis)similarities that I effect a larger argument on the politics of new media technologies. It also brings to the surface how time and technology have already played a role in Foucault's theories, and that the new technologies allow us to excavate a minor strand of ideas already found in Foucault's writing. In Parikka's broad definition of media archaeology, he understands such an approach to history as a cartographical exercise, a mapping that thinks future potentials instead of constructing mere histories. This classification also expands the more classical accounts of media archaeology into newer subfields of media studies like software studies and platform studies.²⁷ These broader approaches do not only articulate how the past has persisted in the present, but also heeds Siegfried Zielinski's call, "do not seek the old in the new, but find something new in the old" (2006, 3 as quoted in Parikka 2012, 162).

Parikka highlights within the media-archaeological method the twin aspects of materiality and temporality. He emphasises the need to be attentive to the materialist dimensions of technologies, for instance, through the technical and mediatic

specificities that weave a picture of how precisely technologies work. This also could take shape through analysing materialities of the materials, the minerals that make up our plated wires and micro-chips, the glass that is sourced to create shiny surfaces of our smartphones, and the e-waste resulting from our digital culture. Moreover, one could approach this from the materialities of cultural practice, “human activity as embedded in both cognitive and affective appreciations and investments, but also embodied, phenomenological accounts of what we do when we invent, use and adapt media technologies” (2012, 163). In terms of temporality, Parikka points to the new senses of temporality mobilised by the media-archaeological method, where the old is found in the new, and the new helps re-interpret the old. Recurrences and ruptures characterise the zig-zagging between old and new forms of media. He poetically suggests that the media-archaeological agenda engages not only the past and the present, but “the archives of the future” (167) in order to understand the complexities of materialities and temporalities.

Here, we see the heterogeneity of media-related materialities and temporalities from which a study of biopower could be mapped. I follow these orientations in mapping out the various levels at which dispositifs of power could be observed, in the techno- and the chrono- strands. Foucault’s genealogical approach enables these issues to come to the fore by way of tracing the interrelations and effects.

The cartographical dimension of the genealogical method could be alternatively approached from the work of philosopher John Protevi. The concept “techno-chrono-biopolitics” is moulded after Protevi’s concept of “geo-hydro-solar-bio-techno-politics” in *Life, War, Earth* (2013). He argues that powers of nature (earth, wind, water, sun) are dimensions of multiplicities that are imbricated in socio-political processes. In his study of war and its political subjects, his methodology includes a tracing of the assemblage of material forces which are harnessed for food production and in turn support military power, showing the interrelations between the technology of agriculture and the wielding of political power in the antiquities. This concept is used to frame his subsequent exploration of bodies at war and the entrainment in creating a militarised body politic. His emphasis is on the multiplicities of forces that shape and affect the body subject, in what he refers to as “above, below, and alongside subjects” (2013, 41), taking after his earlier work on *Political Affect* (2009). What Protevi’s work has shown is the modulation of emergent forces from these elemental forces of nature (the geo-, hydro-, and solar-) that interlinks the environmental dimension with the social body, as well as the somatic level of the individual. He quotes an oil spill as an illustration of the kind of tracing one could do in order to unravel the multiple layers of interaction of processes (2013, 12). From the actual organic physiochemical reactions that take place between the mixing of oil and gas with water pressure and current, to the microbial degradation and organism damage occurring to sea creatures, to the

accumulative effects of the oil spill along the food chain, each level shows different actors and patterns, and one could approach a broad model of what an event such as an oil spill could have effects from different perspectives.

Again with an emphasis on heterogeneity, I attempt a similar methodology of tracing in order to demonstrate the dynamic inter-linkages between biopower, technology, and time. “Geo-hydro-solar-bio-techno-politics” does not claim a full explanation as links of causation between the various components of natural powers. Rather, it shines a searchlight along a possible path of understanding how the multiplicities of forces may work in tandem with one another, with the aim of studying warfare. “Techno-chrono-biopolitics” similarly constructs such paths along which certain interconnections between technologies are highlighted and analysed to the effect of mapping out domains of biopolitical control. It is, in this sense, not a technologically-deterministic understanding of the socio-cultural contexts under which these biopolitical effects emerge.

For this purpose, I propose a three-part structure to address the morphing expressions of biopower through technological inventions. In each part, I will demonstrate what particular instantiations of biopower are performed through examples of techno-chronological objects. Through these analyses, I redefine what biopower encompasses today, and how it may be expressed in the current technological epoch.

Chapter Overviews

Part I “Theoretical Foundations” lays out the theoretical foundations and delineates the objects of study overall. Part II “Biopower in Mediated Times” connects the theoretical underpinnings with a variety of historical and contemporary examples that demonstrate the interconnections between technology, time, and biopower. Part III “Techno-chrono-biopolitics Today and Tomorrow” takes on two specific case studies of twenty-first-century media to show how my proposal of techno-chrono-biopolitics helps us rethink the power dynamics operant today and how the bio- and necro-political both function in our media-saturated landscape.

Part I lays out the foundation for the current study of biopower in the algorithmic age, and provides a basis for techno-chrono-biopolitics. I highlight the primacy of the temporal and the implication of time in media ontologies. Both chapters offer definitions of the scope and reach of the project in its theoretical framework of biopolitics and in the material objects I am interested in. Chapter 1 “The Concept of Biopolitics” offers an orientation on Foucault’s theory of biopower, and I refer to important modifications and extensions of the theory in association with my study of time and technology. I look at Jeffrey Nealon’s intensification thesis (2008) as

a way to synthesise Foucault's various accounts of biopower, and tease out specific features of biopower which could be observed in techno-chrono-biopolitics.

Chapter 2 "In Mediated Time: Clockworks, Automata, and Computer Machines" focuses on the material objects of the study, and specifically looks at how the algorithms and temporality of twenty-first-century media could be explored through their analogue precursors. I demonstrate how a study of mechanical clocks and automata could help us gain an understanding of algorithms today and of mediated time. With this historical overview, I establish the continuities and significant ruptures in the analogue and digital mediations of time, and analyse the ontology of algorithms and algorithmic time.

Part II extends the arguments of Chapters 1 and 2 by connecting the theoretical grounds of biopolitics with time mediation. This part is dedicated to showing how discipline, performance, and biopower are embedded in mediated times. The invention of clocks gave rise to a logic of quantification and measurement, a logic which has historically been co-opted into a regime of labour and slave management. The clock provides quantification of labour with scientific precision, generating a rhythm that shapes bodies subjected under its control into labourers, whose worth may be measured through the value of productivity and output. Time mediation is thus seen as a defining moment in the technological epoch which drove the development of industrial capitalism.

In Chapter 3, "Historical Antecedents: Clocks, Discipline, and Performance of Labour", we will look at case studies on clock discipline in factories and in colonial contexts. The examples will demonstrate how clock time became commonplace by way of circulation (as supported by clock ownership data) and through enforcement (in English factories, the Japanese colonial context, and the American slavery context). These diverse historical examples shed light upon how practices have changed at the introduction and proliferation of clock technologies. In a Foucauldian manner, I draw out the temporal hierarchies of power performed through the imposition of clock discipline and how population management and labour extraction were achieved through temporal measures. This provides a historical way of understanding how techno-chrono-biopolitics could be observed already in preceding centuries under clock discipline and governance.

Juxtaposing the historical view with developments in the algorithmic age, Chapter 4 is entitled "Contemporary Ramifications: Time and Biopolitics in Twenty-first-century media". The chapter pays attention to how new technological developments could be seen as an intensification of biopower as the ability to govern, discipline, and punish becomes embedded within the microtemporal rhythms of data processing. I make use of Operating Systems and intelligent voice agents like Siri and VIV as examples to further the understanding of techno-chrono-biopolitics

today. I analyse how these technologies construct a form of algorithmic governance and what this means biopolitically.

Building upon these explorations, Part III dedicates attention to how precisely techno-chrono-biopolitics is operative in contemporary and future-oriented times, narrowing in on two major twenty-first-century media examples through which biopower is expressed. They are namely predictive analytics, and the Quantified Self movement. These examples take us into a different conception of temporality, through futurity, and *langue durée*. The study of techno-chrono-biopolitics is not only a history of how biopower has gripped populations and a reflection on how it presently operates, but also a future-oriented investigation of how it is operant already in a future tense. In Clough and Willse's words, it is "a history of multiple and incommensurable presents that overlap and overspill with the presence of ghosts of the past as well as the conjured ghosts of the near future" (2011, 2). Both chapters will continue to extend the theory of techno-chrono-biopolitics with reference to more recent updates by philosophers such as Brian Massumi, Achille Mbembé and Elizabeth Povinelli. The trajectory of these two chapters will showcase how techno-chrono-biopolitics perform an intensification of biopower as proposed by Nealon (2008) and drive the point home.

Chapter 5 "From Statistics to Big Data: The Ontopowers of Predictive Analytics" focuses upon the future colonisation of time. It centres on predictive technologies and the warped time-sense when such technologies mediate projections of the future into the present moment. I refer to the historical dimension of modern statistics, discussed by Foucault and Ian Hacking, and analyse how big data places a different spin on how statistical function works with algorithmic calculations. In so doing, I show how the biopolitical powers of statistics which Foucault has already referred to has reterritorialised in the current data-saturated world. Predictive analytics, and in particular, the practice of predictive policing, are used to demonstrate the future-oriented operations of techno-chrono-biopolitics. This chapter extends upon the explorations in Chapter 4.

Chapter 6 "On the Necropolitics of Quantified Selves and Uncounted Others" takes on a material dimension of techno-chrono-biopolitics. By focusing on the production and disposal of the gadgets where algorithms run on, we turn to the necropolitical dimension of biopower. Using Quantified Self as a theoretical object, Chapter 6 exposes the colonality of bodies, exploitation of labour and of earth's resources through mining and electronic waste in the age of algorithms. Incidentally, we return to the factory floor as foreshadowed in Chapter 3, where the question of labour returns to haunt us in another form.

In the concluding chapter, I draw out the main points covered by the dissertation, and consider how bodies become dispossessed under the forces of techno-chrono-biopolitics on a planetary scale. The closing of the chapter tends towards how one

might consider the question of resistance in the face of biopower exerted by twenty-first-century media.

In a supplementary coda aiming at offering practical tips and strategies for resistance against techno-chrono-biopower, I refer to artistic projects which expose the data structures in our digital world, and the ongoing initiatives to hide digital footprints, claim agency over data collection, and combat electronic waste. The coda is meant to be read as a manual and guide towards future actions, and is a counterpoint to the theoretical discussion in the main body of the dissertation.

Throughout the project, I make reference to examples and case studies from various locales and different moments in time, as well as film and artistic works which offer reflections on the technologies. These rich examples show the heterogeneity of techno-chrono-biopower, in its material manifestations, geopolitical reach, and the temporal scales it deals a hand in. The calculus of Foucauldian biopower's 'making live and letting die' is mapped across bodies globally, and follows from a longer history of exploitation, marginalisation, and dispossession. Criss-crossing across a variety of scenes and settings, from the nineteenth-century English factory floor to today's gigantic Foxconn factory complexes in China, from the Antebellum slaves in the US to the present-day coltan miners of Congo, from the non-human time of machinic process to the durational tracking of human activity, this project maps how biopower operates through technologies of time, and unveils the planetary scale of techno-chrono-biopolitics.

Part I

Theoretical Foundations

1

The Concept of Biopolitics

In its basic definition, biopolitics is a concept that describes a set of mechanisms where biological features of humans become the object of political power. Over the years, many philosophers and theorists have expounded upon the concept, and have argued for numerous ways to exemplify it in different ways. Foucault's analysis of biopower has created the basis for bodies of literature that have expanded beyond his conception of the topic. Spanning domains like critical theory, political philosophy, cultural and literary studies, biopower and the study of it as biopolitics, have been central to discussions of how humans are subjected to various forms of control and discipline. Scholars have commented on the fact that Foucault is in fact not the person who invented the term,²⁸ but his contributions have over time become the key focal point of scholarship and underlie many extensions of the concept.

In this chapter, I reflect on the main tenets of biopower and build the theoretical foundation upon which I propose my concept of 'techno-chrono-biopolitics'.

Before going into detailed case studies and examples of how techno-chrono-biopolitics functions, I will offer an overview on my point of departure from Foucault's reflections on power and biopolitics. In the first half, I will outline and analyse Foucault's concept of 'biopolitics'. I navigate his work with reference to Jeffrey Nealon's monograph *Foucault Beyond Foucault: Power and its Intensifications since 1984* (2008). Inspired by Nealon's reading, I extrapolate five specific features of biopower in Foucault's oeuvre that I identify as crucial to the understanding of biopower's operations and its intensifications. These features bring out various components of Foucault's work and show the continued relevance of his theories as different facets of biopower become important in different times and in different contexts.

In the second half of this chapter, I tease out the line of inquiry I chart across biopolitical thought, in its relation to time and technology, as well as offer a cursory overview of the various extensions of the concept by other cultural scholars that are important to the development of 'techno-chrono-biopolitics'. I am invested in how the organisation of time, as well as the mediation of technology, enable particular modes of biopower, and how populations are governed accordingly. With due attention to scholars writing about chronobiopolitics and performance as biopower in the twentieth century, I establish a theoretical basis for the chrono- and techno-dimensions of how biopower functions.

An Orientation

As Lemke (2011) observes, the concept of biopolitics is "inevitably the result of a selective perspective" (2) that varies based on the selection of processes and power structures one chooses to analyse. This is partly due to the fact that Foucault's own work points to a variety of contexts and opens up a range of possibilities in engaging with the concept. With different historical periods and contexts come a variety of techniques, strategies, and technologies under which biopower could be observed. In order to study how biopower operates through my delimited set of technologies and contexts, I will first provide an orientation as to what Foucault has written on the subject.

Foucault's study of biopolitics could be categorised into two interconnected trajectories: firstly across *Discipline and Punish* ([1975]1991) and *The History of Sexuality* ([1976]1990) which concern body politics, and secondly across his lectures from 1975-1979 which look at biopower more abstractly in association with questions of governmentality, histories of political economy, and ideas of liberal governance. His studies in *Discipline and Punish* and *The History of Sexuality* expound upon how discipline and normalisation function to limit the expression of bodies and subjectivities and how this works within space and movement in the form of anatomo-politics. Bodies and corporealities are primary in both accounts. *Discipline and Punish* places a strong focus on penal institutions, and deals with how the state responds to delinquency and crime through various forms of bodily punishment. *The History of Sexuality: Volume 1* looks at the interventions and regulatory controls of the population. The term biopolitics is in fact introduced there in order to show the interface between individual sexual and reproductive conduct with that of the state and national policy. In the backdrop of the state's interest in sex by way of discipline is the larger objective of controlling and making productive all these aspects of sex. Foucault emphasises that it is not just about disciplining the deviant, but that the naming and finding out of different sexual

preferences enable the state to manage life itself. This power to manage life is about qualification, measurement, appraisal and hierarchisation, rather than drawing a line between what is acceptable and what is not. In the name of improvement to life is the underlying desire to increase mechanisms of interference and control in the lives of the governed population. In the rest of the *History of Sexuality* series, Foucault continues to elaborate on how sexuality becomes a conduit of power that is shaped by the church, the scientific discourse and the law. These overlapping and inter-related discourses of church, science, and law give rise to subjects who are regulated by apparatuses of power but at the same time are self-controlling and would modulate behaviour in accordance to norms and prevalent practices. Discourses on deviance and the repression of sexual desire in fact enable governance of bodies in their most private settings, without necessarily the form of intervention observed in direct punishment that *Discipline and Punish* deals with.²⁹

These ideas form a precursor to the more encompassing concept of biopower, scaling from its roots of disciplinary power which targets individuals, to biopower which has a larger reach and targets entire populations. In the lectures collected in *Society Must Be Defended* ([1975-1976] 2003), *Security, Territory, Population* ([1977-1978] 2007) and *The Birth of Biopolitics* ([1978-1979] 2008), Foucault continues to develop his trajectory of thought on biopolitics, and the concept finds company in associated ideas on governmentality, political economy, and liberalism. Foucault makes it apparent that biopower is very much enmeshed with these domains, as well as with the development of capitalism. In an interview on the *History of Sexuality*, he explains that power is a complex domain to be studied, emphasising that one cannot study it independent of the contexts of economic processes and relations of production (Foucault and Gordon 1980, 188).

At first glance, Foucault's lecture series develop the concept of biopolitics but paradoxically also gradually veer away from the concept. This is because Foucault's attention turns towards very different contexts for biopolitics, and begins to adopt more traditional political theory concerned with the study of the modern administrative state. It is perhaps not immediately apparent as to how such ideas tie back into the biopolitical discourse. For instance, *The Birth of Biopolitics* summarises his previous investigations of eighteenth-century discourses and then makes a jump to discussions of the development of liberalism in Germany and France, as well as the neoliberal theory of the postwar Chicago School. This seems to offer an entirely new way of conceptualising biopolitics with an alternative genealogy stemming not from discipline but from governmentality. Wallerstein (2013) for instance remarks on the difficulty in reconciling the works in a meaningful manner—he rightly points out that “what we get is not a movement that gradually integrates questions that at first seem unrelated; we encounter instead a multiplicity of outward paths” (Wallerstein 2013, 17).

Indeed, Foucault seems to be creating multiple routes and going into various directions that do not immediately make clear the interconnected points and provide a holistic picture of his theory on biopolitics. However, there are other ways to understand the inter-relations in his books. One of which is offered by Jeffrey Nealon's monograph *Foucault Beyond Foucault: Power and its Intensifications since 1984* (2008). In a pivotal manoeuvre that condenses rather than categorises Foucault's thoughts, Nealon invites his readers to reread Foucault's work and in the context of extensions by other scholars as a series of intensifications of power. The intensification hypothesis, in a nutshell, refers to the progressions in Foucault's analysis of power—in his accounts, power becomes more and more dispersed and decentralised, and its exertion increasingly economical and effective.

Nealon focuses solely on the notion of 'intensification', one that requires readers to suspend understandings of Foucault which are broken up into periodisations³⁰ (Han 2002), i.e. looking at his work from split time periods like 'early', 'mid-career', 'late' Foucault with various themes. Nealon studies the shifts within Foucault's foci in his conceptual itinerary and argues that these changes can be productively understood as a series of intensifications. This opens up an engagement with Foucault that is attentive to the mutations of power in the broad historical periods Foucault has studied, and allows contemporary authors to respond to ways these mutations have continued to take place since Foucault's death in 1984. For instance, Nealon remarks that intensifications could be seen across various domains, and one which is of paramount importance revolves around post-industrial capitalism and the increasing financialisation of everyday life in a globalised system. Mapping the theorisations over shifts from early industrialisation to today's massive financial markets in a genealogy of capitalism, he highlights the techniques of power and the associated economic profits as gradual intensifications of capital. While Nealon's analysis still inevitably involves periodisation, this is achieved through loose bracketings of how power could be observed in different eras and what the chief modes of operations are.

This reading is particularly helpful because it brings seemingly-disparate accounts together and enables readers to see them in a new light. This also follows from Foucault's own orientation as he sees power as continuous and productive and could be present in any given domain, whether it is in the field of economy, health, science, security, or town-planning, a handful of contexts he has discussed. Even in the earlier conceptions of biopolitics, Foucault already emphasises that the permutations of biopower do not exclude previously operative forms of power. Rather, each instantiation of biopower introduces new techniques, and changes foci as to how bodies are targeted and policed. In Nealon's vocabulary, each instantiation is an *intensification* of a pre-existing regime, as the grip of power becomes more widespread through more particular means in one's life. Intensifications can be

identified *within* Foucault's writings, as well as in elaborations of his work by his contemporaries.³¹

Through the lens of Nealon's work, I propose to consider five important features of biopower which I extract from Foucault's writings, and elaborate upon their significance. While the identification of these five features is informed by Nealon's ideas, I also go beyond his proposal and revert to Foucault's original texts to highlight specific aspects I deem relevant to my own project of studying biopower, in relation to time and technology. These features will demonstrate why Nealon's intensification hypothesis makes good sense in the current study, and why intensification is a common thread that runs through the various subsequent developments of the concept of biopolitics. In future chapters, I will refer again to these features in order to analyse the intensifications of biopower I see in relation to twenty-first-century media.

Already, the five features give a sense of how biopower mutates over time, and becomes more effective in its operations. The first premise, biopower morphs and scales, lays out the basic feature of biopower as mobile, and capable of mutations. These mutations co-emerge with the proliferation of dispositifs from which biopower could be observed, hence confirming the productive nature of biopower (its second feature). These productive mutations often reduce the amount of resources needed to achieve the same effect, e.g. through norm-building, accounting for the third feature I identify—biopower lightens. The lightening of biopower makes its operations more economical (fourth feature) and speeds up its application. The final feature I identify—biopower divides—brings biopower in alignment with its counterpart in necropower, showing how biopower necessarily operates with a cleavage in the population it rules over, drawing a line between those who are more worthy of living and those who are let die. Summarising these points, I then turn to Nealon's work to further explicate how these features, which hint towards intensification, are at play in biopolitical theory. I show how Nealon's work provides the possibility of reading Foucault's conceptualisations as an opening up towards multiple forms of biopower. In this chapter, I offer an overview of these five features and the intensification hypothesis, and will further discuss them in the context of time and technology in Parts II and III. These features will guide the exploration of techno-chrono-biopolitics, as I tease out the operations of particular dimensions of biopower in my analysis.

Five Features, and a Hypothesis

i. Biopower morphs and scales

The first feature I identify is foundational to the notion of intensification: biopower morphs and scales. Looking at how Foucault develops his ideas on power from the conception of discipline to biopower, we could identify the ways bodies are targeted differently and placed under control in the progression within the book *Discipline and Punish*, and between the book and Foucault's other works.

Discipline is often studied as the precursor to the concept of biopolitics. Between *Discipline and Punish* ([1975] 1991) and *The History of Sexuality: Volume 1* ([1976] 1990), we see the germination of the concept of biopower, from its conceptual precursor: discipline. As pointed out by Deleuze's reading of the book, Foucault attempts to articulate a model of power in *Discipline and Punish*, but only manages to touch upon it in several sections of the text. It was not until *The History of Sexuality* that a more detailed exposition could be found. This chapter therefore starts at *Discipline and Punish* to show the genealogy of Foucault's ideas.

Biopower operates through various forms under different contexts, and is itself seen as an escalation stemming out of a previous regime of power operation in the seventeenth and eighteenth century—discipline. Discipline is chiefly concerned with the notion of a sovereign power, a ruling class who has the power to decide whether people under its dominion should live or die. By contrast, in a biopolitical regime, the sovereign is not only concerned with discipline on an individual level, but the so-called betterment of life at the population level. The shift from discipline to biopolitics in the nineteenth century highlights the “level of the mechanisms, techniques, and technologies of power” (Foucault 2003, 241), of which such techniques operate at the level of controlling bodies.

Throughout the book, Foucault charts the transformation from punishment and execution as a public spectacle to the training of the body within the prison apparatus. These historical traces are made in line with Foucault's conception of how power morphs and changes its target of operation. From the early chapter in *Discipline and Punish* on torture to the later chapter on panopticism, Foucault analyses how various modes of power have been in operation. The seventeenth century sovereign has the ability to torture and maim individual bodies, focusing the power of punishment on the literal body surface in the direct marking of the flesh. The eighteenth century jurist opts for corrective penalty that is on the ‘soul’ by forcing prisoners to follow compulsory activities, systems of prohibitions and obligations, and develop new habits in prison. The prisoner must follow the schedules given, work and labour accordingly, have solitary confinement, and understand that he is at the mercy of the authority who exercises power over him. In discussing the *raisons d'être* for this type penal reform in the eighteenth century,

Foucault argues that it is a shift away from the sovereign model to more economical ways to discipline its subjects.

Shift the object and change the scale. Define new tactics in order to reach a target that is now more subtle but also *more widely spread in the social body*. Find new techniques for adjusting punishment to it and for adapting its effects. Lay down new principles for regularising, refining, universalising the art of punishing. Homogenise its application. *Reduce its economic and political cost by increasing its effectiveness and by multiplying its circuits*. In short, constitute a new economy and a new technology of the power to punish. (1991, 89; own emphasis)

This feature of power (shift in subject and change of scale), already laid out in *Discipline and Punish*, will become a defining feature of biopower. In the context of *Discipline and Punish*, Foucault is very clear that multiple modalities of power are at work here in these historical methods of punishment. There are three main modalities: the first one is based on old monarchical law that prefers a public ceremonial display of torture, which places the body of the convicted in the public eye for a ritual of physical maiming. The second and third both refer to a more preventive and corrective model for punishment. The second relies on codified signs of representation that shows the nature of the crime: a violent crime reaps physical pain as punishment; those who abuse liberty will be deprived of their own; beggars who steal should be forced to work. The jurist has to design punishment that proceeds from the crime, so the deterrent effect becomes more obvious to the public. The third modality is the prison model, which has ultimately become the prevalent mode of punishment to this day. The convicted becomes a body for training, and discipline leaves traces not through physical marks but through habit-forming and behavioural corrections. These progressions go hand-in-hand with the third feature of power as economical. What underlies the shift is precisely the morphing nature of power and its ability to scale from a smaller focus (the localised singular body of a criminal) to a larger one (the social body of the population).

These progressions also mark another difference, namely the shift from the sovereign's monopoly on the criminalisation of behaviour to the incorporation of criminality on the part of the social body. As second and third modalities of power demonstrate, the criminal is brought back into the social fold by way of either showing why the crime is wrong by tailoring punishment or by incarceration as a form of re-education through labour and control. The so-called "gentle way in punishment" is in fact a power manoeuvre that shifts from sovereign power to social power—a tactic that allows power to be more widely spread.

As we progress through *Discipline and Punish*, we realise that the prison is not the sole institution where such disciplinary power is instilled, though it is indeed one where the power is most immediately apparent. The factory space where supervision prevents tardiness of workers, the military that trains soldiers to be

better fighters, the school which uses examinations as a normalising judgement upon students all are relevant institutions under which disciplinary power operates.

Foucault makes the clearest case for the morphing nature of biopower in *Society Must Be Defended* (2003). In it, he explains how biopolitics takes over the previous conception of ‘discipline’, and how they are related. Biopolitics functions with a stronger focus on biological life at the level of population (‘man-as-species’), running on a different scale than disciplinary power, which is more oriented toward individual bodies. Referring to the relation between the two, Foucault writes

[t]his technology of power does not exclude the former, does not exclude disciplinary technology, but it does dovetail into it, integrate it, modify it to some extent, and above all, use it by sort of infiltrating it, embedding itself in existing disciplinary techniques. This new technique does not simply do away with the disciplinary technique, because it exists at a different level, on a different scale, and because it has a different bearing area, and makes use of very different instruments. (2003, 242)

Here, Foucault offers a foundation to how one could approach the operation of power: it changes and takes on different forms by changing the scale of its target. This first feature of power will become the basis for Nealon’s intensification thesis, and fits as well into the works of Deleuze (1992) and Hardt and Negri (2001). Contemporary modifications on biopower are all constructed based on this premise—it morphs and scales. Over time, biopower may change its target, take up new forms, be administered through new (distributed) dispositifs.

ii. Biopower is productive

The second feature is that biopower is a productive power. In my reading, this notion of productivity is tied to the proliferation of dispositifs from which a particular aspect of life is controlled. Foucault insists on the productivity of power—

[w]e must cease once and for all to describe the effects of power in negative terms: it ‘excludes’, it ‘represses’, it ‘censors’, it ‘abstracts’, it ‘masks’, it ‘conceals’. In fact power produces; it produces reality; it produces domains of objects and rituals of truth. The individual and the knowledge that may be gained of him belong to this production. (Foucault 1991, 194)

Therefore to suggest the productive dimension of power is not to negate its negative effects, but to recognise the realities produced by power, and how individuals and populations respond to their effects.

As Foucault moves into his volumes on sexuality, he provides a deeper account of how power operates and demonstrates its productivity. In some ways, one could read *The History of Sexuality: Volume One* (1990) as a subset in the trajectory of power that traces the shift from sexuality to biopower, which is different but connected to the shift from discipline to biopower. Foucault begins with a critique on the “repressive hypothesis”, based upon an analysis of sexuality which explicates the productive nature of power. He points to the phenomenon that people often regard being able to talk more about sex as a sign of liberation from past bonds

of social laws. The proliferation of sexual discourse elevates it to a level of 'truth', which is seen by people as a powerful liberating act. But Foucault points out that this equation is false. Rather, the proliferation of discourses signals a proliferation of potential dimensions from which sex could be regulated.

To further examine this, let us return to the opening pages of the book. Foucault provokes with the following questions,

[t]he question I would like to pose is not, Why are we repressed? But rather, Why do we say with so much passion and so much resentment against our most recent past, against our present, and against ourselves, that we are repressed? (1990, 8-9)

This is central to Foucault's point because it is only by way of such belief in the repression of the past that one sees the possibility of liberation and betterment in the 'now' or in the 'future'. As long as repression of sexual discourses is discussed in past tense, one is invested in the belief that the proliferation of discussion about sex can only be a sign of liberation.

Foucault argues instead that the proliferation of discussion about sex in fact becomes another route for forms of oppression, not only by the Church, but also by new inventions of technologies such as science, psychoanalysis, and medicine.

A proliferation of sexualities through the extension of power; an optimization of the power to which each of these local sexualities gave a surface of intervention: this concatenation, particularly since the nineteenth century, has been ensured and replayed by the countless economic interests which, with the help of medicine, psychiatry, prostitution, and pornography, have tapped into both this analytical multiplication of pleasure and this optimization of the power that controls it. (1990, 48)

Sex is regulated so that sexual activities and carnal pleasures not associated with reproduction are discouraged, so as to build a productive and prosperous nation by increasing its productivity.

To study the powers regulating sexuality then is to locate the multiple technologies or sites where sex is governed, to find the channels they take, and to study the knowledge created. It is about untangling the relationship between these sites of power and the lived experience of bodies under their control in the everyday. Foucault calls these multiple dispositifs "polymorphous techniques of power" (1990, 11). Power, in this sense, is productive, as its grasp over bodies is multi-dimensional, polymorphous with all the fields of knowledge that contribute to the dissemination of discipline, normalisation, and control. With a variety of power/knowledge paradigms, scientific methods are techniques of power which support the operation of control over the population.

From this perspective, knowledge is an inalienable aspect that underlies power. Indeed, Foucault questions, "What must be known in order to be able to govern?" (2007, 273). In his later lectures on *Security, Territory, Population* (2007), Foucault focuses his attention on a specific scientific technique that he identifies as "new, crucial, and determinant" (273) to a sovereign power/ a government at the start of

the seventeenth century: statistics. This is later picked up by Ian Hacking (1982), who argues that the birth of biopolitics could be situated in the years of 1820-1840 when European government administrations began an extensive programme of census data collection and categorisation of their citizens. Hacking situates biopower in the heart of the knowledge-making practice of statistics, and also links this to the technological basis for data processing, a technique of power mediated by rudimentary machines. In Chapter 5, I will focus particularly on the domain of statistics and its relation to biopower, and study the resurgence of statistical power in the form of big data today. The exploration demonstrates the lasting legacies of these historical scientific developments as statistics produces a renewed form of biopower through digital means.

Scientific discoveries, inventions, and knowledge production have always played significant roles in Foucault's reflections on power. Biopower's productivity is about its ability to proliferate across dispositifs, as well as its discursive formations in creating its contexts of operations, and in bridging the nexus between knowledge and power. In Foucault's words,

[e]very relation of force implies at each moment a relation of power (which is in a sense its momentary expression) and every power relation makes a reference, as its effect but also as its condition of possibility, to a political field of which it forms a part. To say that 'everything is political,' is to affirm this ubiquity of relations of force and their immanence in a political field; but this is to give oneself the task, which as yet has scarcely even been out-lined, of disentangling this indefinite knot. (Foucault and Gordon 1980, 189)

As we will see in Part 2, the material inventions of technology advance our understanding and use of time, but much like how the proliferation of discourse around sex in fact creates potential pathways for control, the inventions in turn generate conditions of possibilities for new modes of governance by temporal means. These technological devices are indefinitely knotted together with their political potential for control and governance. In Chapter 3, I will look at how the invention of time-telling and time-measuring devices contributes to a new world order aligned under global standardised time, and how time is used in institutions like the factory and the army to train bodies and increase their docility. The temporal effects on the organisation of life, labour, and governance will too be observed as the discussion turns to twenty-first-century mediations of time in Chapter 4. These inventions are pivotal in the construction and mediation of time, and the scientific knowledge and logics embedded in the technology contribute to their biopower.

iii. Biopower 'lightens'

The third feature I am interested in relates to the resources that are required for the execution of biopower. Here I attempt a reading that navigates the seeming gap between Foucault's work on *Discipline and Punish* and on political economy in *The Birth of Biopolitics* by focusing on this characteristic of power. The content of *The*

Birth of Biopolitics is perhaps most at odds with the title. Instead of further developing the concept of biopolitics directly, Foucault takes a detour via an investigation of political economy. The series of lectures set the theme of biopolitics in a much more complex context that relates to governments and markets. It is on the surface a deviation from the work on prisons, but in fact is a deep continuation that shows where new modes of power have emerged and where these new modes appear to be 'lighter' than before. Governing is not limited to punitive punishments (physical torture being a 'heavier' infliction of power) but also via more 'productive' forms of power such as market forces (a 'lighter' and more insidious power), supported through power-knowledge paradigms as outlined in the preceding feature.

'Biopower lightens' brings us from the domain of biopolitics with its history of physical punishment to another contextualisation of biopolitics in political economy. Foucault traces how political economy emerged in the eighteenth century with the idea of market self-regulation, and the government establishes policies which enable such internal regulations, rather than exert overt influence on the market. Based on ideas from authors like Adam Smith, David Hume, and Adam Ferguson, the economy is seen to be best left to develop according to its 'natural' tendencies without state intervention, and an internal equilibrium could be attained which prices commodities of their value in a 'fair' and 'true' manner. This leads to a liberal art of government that asks "Why must one govern? That is to say: What makes government necessary, and what ends must it pursue with regard to society in order to justify its own existence?" (Foucault 2008, 319). It is through such questions that the principle of "the self-limitation of governmental reason" (20) arises. Unfortunately, this liberal art of government is by no means an indication of less exertion of force on the part of the government, but rather signals the emergence of new forms of governing. More insidious forms of power take over the overt use of force that was once evident through discipline and punishment.

Foucault correlates these new forms of state power to the emergence of liberalism in political economy. Specific logics are inherent within liberalism, which provide a particular economic rationality, and use specific dispositifs in order to set out the tenets for the market. These dispositifs affect social forces throughout a population, and go beyond simply governing the relationship between capital and labour exclusively. Hence, to Foucault, political economy goes much further than the area of economics, but rather, it governs

the whole of a complex material field where not only are natural resources, the products of labor, their circulation and the scope of commerce engaged, but where the management of towns and routes, the conditions of life (habitat, diet, etc.), the number of inhabitants, their life span, their ability and fitness for work also come into play. (Lazzarato 2002, 102)

Political economy in this definition is really about controlling and managing the population at large in a way that organises the relations between different factors

at play and by organising social dynamics amongst people in said population. It is not just an economic problem, though it could be used in a way to advance one's 'profits'. As Lazzarato further explains, "political economy, as a syntagm of biopolitics, encompasses power dispositifs that amplify the whole range of relations between the forces that extend throughout the social body" (2002, 102). Practically speaking, neoliberal forms of government do not only develop direct means of governance through state apparatuses, but also create "indirect techniques for leading and controlling individuals without at the same time being responsible for them" (Lemke 2001, 201). This suggests that both individual subjects and other collectives (the family unit, associations, unions, etc.) become incorporated into the regime of control. This demonstrates another important shift in the focus of disciplinary power from the individual to the focus of biopolitical power to the social body/ population.

In line with the shift of attention in Foucault from studying prisons to studying neoliberalism, one could see that it is more economical in the long run to train bodies to thrive in the market of competition than to punish them punitively in an institution of prison. Disciplinary power in this sense has mutated from targeting individuals in an enclosed institution to targeting populations in the open market forces of the everyday. The original intent of punishing bodies (to force them to fit into the norm, to be more 'functional') has become more widespread and effective as the same power exerts control more deeply within the social body. Sovereign power that targets the individual deviant is much more resource-intensive, and is much less efficient. In contrast, biopower (and its mutations) operate(s) with biopower dispersed amongst a variety of dispositifs, which is economically more viable. In the rest of the dissertation, we would see lighter forms of power in circulation through new forms of technologies. There is also a question of speed involved in the lightness, where the lighter an instantiation of biopower is, the faster its effects spread. The lightening of power is also in line with what is economical about the application of power, the next feature.

iv. Biopower is economical

The fourth feature of biopower can be analysed in accordance to how biopower intertwines with Foucauldian analyses of economics. For biopower to become economical is for it to be more effective in its operations, such that fewer resources have to be allocated in order for the same effect to occur. Again, this feature takes us between *Discipline and Punish* and Foucault's reflections on (political) economy.

Take for instance the targeting of bodies for maiming and torture in the opening chapter of *Discipline and Punish* and place it in comparison with the more widespread effect of criminal law and incarceration in prisons that the last chapter deal with. The "carceral continuum" (1991, 297), Foucault proposes, legally sanctions the

sovereign's power to punish. The prison apparatus is linked up with other select institutions like medicine, psychology, education, public assistance and social work which jump in to supervise and evaluate anyone who comes through the penal system, and attempt to (re-)educate them. This extensive web of relations found in eighteenth- to nineteenth-century European governments is a far cry from the more focused form of punishment in the seventeenth century. "The carceral network, in its compact or disseminated forms, within its systems of insertion, distribution, surveillance, observation, has been the great support, in modern society, of the normalising power" (1991, 304), enabling the possibility of casting a wider net on the social body and in governing their behaviours this way. He summarises these effects under the heading of the "economy of power" (1991, 304). In the following, we will see further how such calculus of power and economical efficiency is set in motion. I turn to a prime aspect of Foucault's excursion into liberalism which relates to security, in order to show how (political) economy could be thought of in today's biopolitical apparatus. One could chart a path from the carceral continuum to the security apparatus that further governs other aspects of life.

By refocusing the scope to the population level, the focus is no longer limited to actions and behaviours of individuals, but rather on how 'things run their natural course' within the aggregate processes of a population. The idea of letting things run their natural course based on naturalisation of market is a strategy for governance, as the government focuses upon a population rather than an individual. Governance is thus based on powers of normalisation which emerge from the aggregate activities of groups. Notably, such norms encompass ranges of behaviours, rather than being solely based on the sovereign's legal enforcements of particular rules. Criminality and deviance is but one dimension of the population's activities. These new governing dispositifs are therefore mobilised upon the safeguarding of a framework of 'freedom' to enable 'natural' orders to emerge. They raise the following questions which Foucault ponders upon—

How can the phenomena of "population," with its specific effects and problems, be taken into account in a system concerned about respect for legal subjects and individual free enterprise? In the name of what and according to what rules can it be managed? (Foucault 2008, 317)

One of these dispositifs concerns technologies of security, which in essence secures 'liberal freedom'. Security mechanisms operate in an opposite manner from discipline mechanisms— the instruments aim for regulation and control, rather than discipline and supervision. Using biological terms, such security technology "aims to establish a sort of homeostasis, not by training individuals but by achieving an overall equilibrium that protects the security of the whole from internal dangers" (2003, 249). Interestingly, Foucault points out that "there is no liberalism without

a culture of danger” (2008, 67), an awareness of internal threats arising within a given population.

Foucault studies how biopower extends beyond the disciplinary carceral mechanism outlined in *Discipline and Punish* above. A disciplinary mechanism dictates the line between permitted and forbidden. An offender appears outside the juridical system/ legal code, and receives a series of punishment/ corrective measures such as being placed in jail, being treated for particular illnesses, or having to undergo compulsory education/ rehabilitation. It targets any individual who deviates and would isolate particular spaces in order for state power to function fully and without limit.

Yet biopower is an ever-expanding circuit of networks that involve a wide range of factors, that is not only about the issue of crime. To illustrate how the biopolitical security mechanism works, Foucault jumps straight into the problem of scarcity, with principles from economics, and considers how the seventeenth-to eighteenth-century French governments handled it. The idea is that when a particular population runs out of food, and if the state does not intervene, scarcity would drive the prices up, as those who have access to food would try their best to hold on to it as well as monopolise the sales. By doing nothing, in the sense of ‘laissez-faire’ policies, the state allows prices to rise, and for scarcity to continue to develop, resulting in hunger in particular parts of the population who cannot afford food. If the state were to regulate the distribution of food, a general experience of hunger would entail for the full population. Security relies on principles that are not necessarily good or evil on their own—psychology, behaviour of producers, sellers, consumers, internal market regulation of prices based on competition—and Foucault refers to these as “taken to be necessary, inevitable processes”, and even “natural processes in the broad sense” (2007, 45) which occur at the level of the population. The biological inclination of biopower is also observed as an equilibrium attained through homeostasis.

Note that in this definition, Foucault has shifted into referring to social bodies as an organism on the whole. The government is concerned with this organism on the whole—the wellbeing of the population—rather than individuals. In this case, rather than forcing e.g. an equal rationing of food on the population so that everyone experiences hunger (Foucault calls this a general scourge), the laissez-faire style of governance lets ‘nature take its course’ and those who cannot afford food would hypothetically die off, but ensure the survival of the rest of the population. The government’s role is only to set up the economic conditions under which scarcity is an unlikely outcome, but should it ever occur, it is in the larger benefit of the general population to let those unfortunate few to die of hunger; “scarcity that causes the death of individuals not only does not disappear, *it must not disappear*” (2007, 42; own emphasis).

This example also illustrates why Foucault suggests that control can no longer be seen as the “necessary counterweight” of freedom, but rather it is its “mainspring”. In other words, liberal freedom is about “introducing additional freedom through additional control and intervention” (2008, 67). The freedom (of the market in this case) is in fact premised upon these principles of government which are laid out such that laissez-faire freedom is but an illusion of freedom. In relation to what we have seen earlier in disciplinary mechanisms, technologies of security is situated on the opposite end of the spectrum to disciplinary systems. Discipline assumes a prescriptive norm, a pre-determined ‘ought-to’ mode that regulates behaviour through maximisation of state power exertion. “Discipline concentrates, focuses and encloses” (2007, 44). Security takes reality as the norm, by way of statistical distribution, psychology of said population, and rational choice of the individual that aggregates to form the ‘regulatory’ mechanism on its own. Security “has the constant tendency to expand; they are centrifugal” and “involves organising, or anyway allowing the development of ever-wider circuits” (2007, 45) of control that may not immediately appear to the population as control.

Here we see an explication of what ‘economical’ means — the calculus-based model in *Discipline and Punish* has become much more diffused, and is even naturalised through the language of homeostasis. The example of the scarcity issue and who gets to live and die already lay the ground for the exploration of biopower’s fifth feature—the line that is drawn between making live and letting die.

v. Biopower divides

In *Society Must Be Defended*, Foucault makes a sharp turn towards the role of racism, and delineates the negative powers associated with biopolitics. This offsets the heavy focus on productive powers offered in *The History of Sexuality*. The focus on racism is also very much related to future extensions of biopolitics into the domain of necropolitics (Mbembé 2003; Puar 2007; Braidotti 2007; Povinelli 2016), which will be further discussed in subsequent chapters. For the present purposes, this excursion into racism shows a clear picture of how the productive powers of biopolitics for one sub-group in the population go hand-in-hand with the negative powers of biopolitics, which target another sub-group in the population. Racism, as defined by Foucault, is what draws the line between such sub-groups. In other words, it demonstrates how biopower divides a population.

Racism is what facilitates and decides who lives and who dies, creating a hierarchisation of certain populations over others, and labelling some as worthy of living and others not. Like the preceding scarcity example, some people must disappear due to hunger to ensure the survival of the rest of the population, which is the ‘preferred’ solution in case of food scarcity. Racism guarantees the operation of death within the regime of biopolitics. It introduces “a break into the domain of

life that is under power's control: the break between what must live and what must die" (2003, 254). It is the ideology that justifies killing in the name of improving life for those worthy of living.

The fact that the other dies does not mean simply that I live in the sense that his death guarantees my safety; the death of the other, the death of the bad race, of the inferior race (or the degenerate, or the abnormal) is something that will make life in general healthier: healthier and purer. (2003, 255)

This is a significant move that situates Foucault's discussion of death in the history of Nazism, where a self-identified 'race' of human beings assures its continuation of life at the expense of an 'inferior' race, and by excluding such populations from the possibility of life itself. But while racism can be defined as we understand from critical race theory through emphasis on biological markers and cultural differences, Foucault's racism is in fact a broader notion. It is not simply "theoretical racism" that is based upon eugenics like the Nazis, nor is it the type that is derived from "hatred, ignorance, or irrationality" (Campbell 2013, 19). Biopolitical racism as a general concept, as Timothy Campbell remarks, can be a type of racism without race. Biopolitical racism is

a racism that, instead of referring to "race," now refers, thanks precisely to the universalist tendencies of contemporary biology, only to ambiguous caesurae internal to a single "species." It doesn't seek to exclude certain populations from the institutions of civil and political life; it explains why, despite so many painstaking attempts at inclusion, certain populations nevertheless seem permanently incapable of achieving flourishing lives within those institutions. (2013, 19)

In this interpretation, racism draws the lines within a species and creates sub-species, literally in the sense that they are inferior. Foucault names these inferior sub-species as 'races'. Race is to be seen in this perspective as a placeholder for dispossessed populations, who may not be grouped together based on colour, as the term for race is conventionally used. The line drawn between a species and a sub-species, however, may well be racialised, gendered, classed, and so forth. The first function of racism is "to fragment, to create caesuras within the biological continuum [of a population] by biopower" (Foucault 2003, 255). The second function is to further affirm the relations within the fragmented population—the more the Others, the inferior sections of the population are weeded out, the more the Self (as a species rather than individual) could survive and achieve human flourishing. The deaths of the deviant, the degenerate, and the abnormal would mean a healthier, purer remaining Self.

Foucault emphasises that this could be understood biologically, where the sub-species are seen as threats to the population and for the population.

In the biopower system, [...] killing or the imperative to kill is acceptable only if it results not in a victory over political adversaries, but in the elimination of the biological threat to and the improvement of the species or race. (2003, 256)

The elimination of the other is not new and is not invented by the nation-state. It is a longstanding component of war. Foucault points out that racism offers a different kind of relationship between the one who lives and the one who dies. It is not a military, or warlike confrontation which is based upon safety, but rather a biological relationship—to kill the other, so as to eliminate the inferior who act as the biological threat to the wellbeing of our species, and life overall can become healthier and purer. Foucault also mentions that dying can take the form of “indirect murder”—“the fact of exposing someone to death, increasing the risk of death for some people, or, quite simply, political death, expulsion, rejection, and so on.” (*ibid*).

Biopower targets populations, and draws lines within a species to create inferior sub-species. The notion of power being divisive should be taken together with the previous point of power being productive — in conjunction with the proliferation of discourses and the increasing possibilities to govern, normalise, and intervene is the division and categorisation of sub-populations and the possibility to decide which part of the population need to be eliminated for the ‘greater good’ of the rest of the population. In this divisive act, we see simultaneously the productive *and negative* operations of biopower. This simultaneity is in fact not fully appreciated in some of the literature on biopolitics, but particularly present in gender- and race-infused accounts of biopolitics. This power to kill and to let die, as termed by Achille Mbembé (2003) as necropower,³² operates simultaneously with biopower. It is important to see that both gestures go hand-in-hand and the one does not take place without the other. These questions will be returned to in the dissertation, particularly in Chapter 6, where I turn to the necropolitical dimension of the study.³³

Nealon’s Intensification Hypothesis, or Biopower intensifies

Based on the above five features, we can then proceed to an explication of Nealon’s intensification hypothesis. In this hypothesis, Nealon emphasises the morphing nature of power and how the body is implicated in the biopolitical apparatus.

Foucault has emphasised that newer forms of power do not simply replace older forms, but rather they add to the existing dispositifs of control, and power becomes more widespread. Nealon takes on this point to posit that the ‘evolution’ of biopower is a series of mutations, rather than a teleological account of progressions, despite the fact that one could nonetheless chart loosely the emergence of newer forms out of older forms of power. He proposes thus the term ‘intensification’ to study how “one form of power *intensify, mutate, or bleed into* the others” (2008, 29; original emphasis).

Similar to what I have done above, Nealon situates the starting point for his hypothesis in the historical mutations of power in *Discipline and Punish*. The book already suggests intensifications of power through multiple modalities. Disciplining particular bodies shifts into harnessing the biopower of individuals by targeting the capacities of what these bodies could potentially do in the prison model—

As power mutates, its primary pivot point becomes increasingly “lighter”, more virtual, and its effects become more efficient as power shifts its privileged point of application, from the body, to the soul, to the action. (2008, 31)

From directly maiming a body’s surface to leaving traces through enforced labour and habituation in prison, the pivot point of discipline has become lighter and less direct. The book from this perspective

charts power’s increasing movement away from the literal, individual body as the primary site of its intervention—away from power’s exercise on the individual body and toward power’s emergent historical investment in something other than (or in addition to) the surface of the body itself. (2008, 27)

Nealon looks at the places or sites of power as ways to thematise intensity, as biopower morphs and scales. Nealon argues that the more ubiquitous it is, the more intensified power has become.

What is paramount in this account of power intensification is the relation to its economic viability. Nealon suggests that the desired effects of changing power’s pivot points are to increase the economic viability of power—“Power’s intensity most specifically names its increasing *efficiency* within a system, coupled with increasing *saturation*. As power becomes more intense, it becomes ‘more economic and more effective’” (Foucault 1991 as quoted in Nealon 2008, 32). In other words, the same effects could be produced with fewer costs, less time and effort, and with less economic and political resistance. Biopower ‘lightens’ and is economical.

Not only does the operation of power mutate but also the domain under which it could be exerted. Biopower is productive. Moving across and dispersing into multiple dispositifs, discipline moves beyond the purview of criminal justice into day-to-day life. In Foucault’s own words,

it is rather a multiplicity of often minor processes, of different origin and scattered location, which overlap, repeat, or imitate one another, support one another, distinguish themselves from one another according to their domain of application, converge and gradually produce the blue print of a general method. (1991, 138)

Based on these observations, Nealon argues that the logic of intensification is Foucault’s primary mechanism for historical changes, as new modes of power emerge through existing practices. From the sovereign holding powers of letting die to the disciplinary mode of punishment to the biopolitics of letting live, these are gradual developments not to be understood as sudden discoveries.

Nealon’s thesis shows importantly how specific elaborations of Foucault’s biopolitics could be seen as mutations of one another. In some way, one could also

read this as a Deleuze-inflected account of understanding Foucault, as observed in *Foucault* (1988). The circulation of power in updated accounts of biopolitical theory³⁴ involves the increasing molecularisation of power and how it travels in a dispersed, decentralised manner. Nealon offers an overarching framework which helps us understand how these accounts are all linked together through various intensifications of power. If we understand these mutations as continuous and coextensive, we can see how the roots of today's power epicentres could be traced back to relevant technologies and techniques invented in previous epochs.

As we have seen in the discussion of the five features of biopower above, there is a necessary zigzagging and creation of itinerant paths across Foucault's various works in order to effect a larger overview of his biopolitical analyses. In discussing how Foucault's trajectory shifts over time, Nealon writes the following:

Biopower, by contrast, pretty much commits you to research itinerary concerning subjects and their relations to themselves—the production of their supposedly “personal states” and everyday lives. [...] [Foucault] doesn't, in short, change his mind or abandon his earlier itinerary—from the structuralist dream of anonymity to a neohumanism of the self. On the contrary: the carrying out of his research itinerary precisely leads to the historical discovery of biopower. (2008, 90-91)

The intensification hypothesis thus allows us to frame Foucault's work not as internally inconsistent or all over the place, but rather enables a zooming-in onto the various contexts under which biopower comes to be known.

Looking at this shift over the last centuries from discussions of discipline to regimes of security, heavier to lighter forms of power exertion, power can be observed “through a slow mutation in modes of dominant practice” (2008, 40). Interestingly, Nealon uses what he calls a banal example of cellphone adoption to illustrate this, which fits well into the media context I will proceed to discuss. He says that while cellphones are not forced upon us by corporations or some sort of government conspiracy, they become over time a “saturated presence” (*ibid.*) as various modalities of everyday life and practice take up cellphones functions like text messaging, from businesses to informal networks of friendship. Before we know it, the days of ‘being off-grid’ are far gone and one is expected to be reachable by phone as long as network coverage allows it. In a similar manner, today's smartphones grow in ownership and so does social media networks due to the increasing adoption of these technologies in various modalities of life. As internet-based instant messaging applications take over the cellular-network based text messaging, one is inclined to purchase internet-enabled devices so that one could stay in touch with friends and family. E-mail practices have also morphed in the business world in the past decades with the advent of BlackBerry, often purchased in bulk by companies to be distributed to employees so they could stay within reach. This is to be later overtaken by other types of smartphones in recent years as other technologies emerge to serve similar purposes.

Wendy Chun, in *Updating to Remain the Same* (2016), proposes the term “habitual new media” to remind us that “our media matter most when they seem not to matter at all” (1). When they ‘disappear’ into habitual modes of use, we become embedded into the machinery—“through habits users become their machines: they stream, update, capture, upload, share, grind, link, verify, map, save, trash, and troll” (*ibid.*). Search engines are no longer exciting because they have become the default mode for finding information; nor are smartphones surprising, for we are used to finger gestures, pop-up notifications, and internet-based Whatsapp-ing/ Telegram-ing/ Signal-ing/ Facebook messaging instead of the good old SMS. As Chun points out, the gadgets which have become so commonplace in fact “increasingly structure and monitor the lives of their so-called owners” (*ibid.*). This notion of habit is similar to the “saturated presence” Nealon refers to, and is an illustration of the lighter forms of biopower. As mentioned above, Nealon believes that the more ubiquitous a phenomenon is, the more intensified its (bio)power has become.

In the age of continuous connectivity (not only human-to-human as mediated by machines, but also machine-to-machine as automation or as captured by the Internet of Things), the digital is also imbricated with modalities of (bio)power. How then has (bio)power and its flipside of necropower intensified with and alongside the proliferation of digital media and communication technology? What power/knowledge paradigms are intertwined with the discourses of the digital? What kinds of economic calculations factor into the kinds of biopower distributed through digital interfaces? And what kinds of divides are drawn in the era of smart devices? I will tackle these questions in the course of the dissertation, and show how these intensifications of biopower could be captured through *techno-chrono-biopolitics*, bringing attention to how time and technology plays an important role in the exercise of biopower today.

Biopower, Time, and Technology

After laying out an overview of Foucault’s theories, with reference to Nealon’s frame, I now turn to the two dimensions of biopower that this study is concerned with. My proposition is that the above features of biopower operate through and in time, which in turn is mediated by particular technologies.

Foucault has already laid the ground for considering the relationship between time and biopolitics. In *Discipline and Punish* (1991), Foucault details specifically on the organisation of time as a disciplinary mechanism, making reference to timetables as a prime example of how it works. He wants to analyse this as an exercise of the “micro-physics of power” (Foucault 1997, 26) and how time is divided up into units that could be manipulated. The model of the timetable, as

inherited through the ages, is most prominently seen in monasteries, the military, and in schools. Quoting data from French schools of the early nineteenth century, he reproduces the schedule of a proposed timetable for ‘mutual improvement schools’ (*Écoles mutuelles*), which described to the minute what the children had to do: “[...] 8.56 entrance of the children and prayer, 9.00 the children go to their benches, 9.04 first slate, 9.08 end of dictation, 9.12 second slate, etc.” (1997, 150). These times were so specific that they were counted to 4-minute intervals.

The partition of time and keeping to schedules is only part of the story. Foucault also talks about a second aspect of time management in marching troops. The military is accustomed to marching in file to the rhythm of the drum. The choreography becomes more complex over time, as soldiers are required to perform to increasing precise rhythms, namely small steps, ordinary steps, double steps, oblique steps. Each step has its own duration and distance, so the soldiers would have to follow specific instructions and pay full attention to their bodily movement. Foucault refers to this as “temporal elaboration of the act” (1997, 151). This deliberate and obligatory rhythm creates an “anatomy-chronological schema of behaviour” (152) such that the bodily position, limbs, articulations are all defined. This is an intensification of the docile body in terms of rhythmic control.

From this short excursion into temporal rhythms, one can observe that time is already very much part and parcel of Foucault’s disciplinary mechanisms, and is incorporated into the operation of biopower. This analysis in *Discipline and Punish* already foreshadows the importance of temporality in techno-chrono-biopolitics. Also focusing on time, Nealon (2008) points out that temporal management within discipline’s investment in time is not only about making people feel guilty for slacking off, but rather “positively developing and harvesting capacities, ever-more-minute amounts or levels of time” (36). Not only are people required to be more efficient in work, they are also taught to transition into habits which would have them manage their time with closer attention to clock time and schedules.

Turning to a more contemporary work, Jonathan Crary in *24/7: Late Capitalism and the Ends of Sleep* (2014) suggests the primacy of temporality for contemporary studies of power. He terms 24/7 as a placeholder for the non-stop processes in twenty-first-century capitalism, where continuous duration becomes the modus operandi for contemporary consumerism as well as up-and-coming techniques of control and surveillance.

As the next and possibly last frontier in late capitalism, sleep, he argues, is one of the remaining obstacles where capitalism cannot fully assimilate and eliminate. Sleep is a natural barrier in Marxian theory as rest must be part of production, such that bodies could recuperate from the exhaustion of work, and function at their maximum capacities once again. Rest, however, is an impediment in the minds of defence research agencies like the DARPA in the US, which has taken an acute

interest in migratory birds that do not need sleep for their long journeys. The goal is to develop techniques that would allow military combatants to work for a minimum of 7 days without sleep, and in the longer run, increase this time frame to a fortnight. At the same time, the combatants should be able to retain their best levels of mental and physical performance. Crary muses over the possibility that the sleepless soldier is a precursor to a sleepless worker or sleepless consumer. Already, in the world of e-commerce and always-online markets, our global digital realm is sleepless and runs round-the-clock, in a 24/7 sensibility. To Crary, a 24/7 world “can be characterised as a generalised inscription of human life into duration without breaks, defined by a principle of continuous functioning. It is a time that no longer passes, beyond clock time.” (2014, 8). It is “a non-social model of machinic performance and a suspension of living that does not disclose the human cost required to sustain its effectiveness” (9).

Already we could identify several important features of the contemporary 24/7 world according to Crary. It is durational, and relies upon the mediation of machinic performances, like that of the internet, which offers the possibility to shop, game, work, download, upload, text, post, interact, share in all sorts of ways imaginable any given moment of the day. Because this possibility is constantly present, Crary suggests that this is a “relentless incursion of the non-time of 24/7 into every aspect of social or personal life” (30). Much like Nealon’s observation that cellphones have become saturated in their presence and become a dominant practice of the day in the time of his writing, Crary suggests that digital mediation that is always online, always omnipresent has taken its place as a dominant practice of our current epoch. Humans are expected to live alongside and with the rhythms of 24/7, but the labour and cost on human lives in order to sustain this machinery do not immediately become apparent—from the constant vying of digital devices for our attention and concentration to the labour it takes to maintain the infrastructures of a 24/7 world.³⁵ In his words, “in spite of the omnipresent proclamations of the compatibility, even harmonization, between human time and the temporalities of networked systems, the lived realities of this relationship are disjunctions, fractures, and continual disequilibrium” (31).

Clock time and schedules can be seen as technologies of power that play a role in the development of techno-chrono-biopolitics. Yet as Crary has demonstrated, we have moved beyond the mere governance of clock time, even though its effects are still present. Billions of dollars, he points out, are spent into reducing (human) decision-making time, so as to “eliminate the useless time of reflection and contemplation” (40). In a 24/7 modality of the world, progress is measured through “the relentless capture and control of time and experience” (*ibid*). Nealon (2017) also proposes the notion of “ubiquitous governmentality” to characterise the durational biopolitical governance that is part-and-parcel of a 24/7 world

mediated by machinic flows. As we continue to inhabit and immerse ourselves in the operations of such a durational world, afforded by what Hansen (2015b) calls twenty-first-century media, we must come to grapple with the biopolitical effects these phenomena bring.

Untangling the power/knowledge paradigms and the dispositifs that surround a 24/7 world, the study of chrono-biopolitics can be achieved through analysing disciplinary elements of how particular time rhythms are enforced upon populations, and how they are intensified into biopolitical regimes. The role of digital media, is of course, paramount as well. The techno- dimension in techno-chrono-biopolitics refers not only to the technology invented to effect time management, but also the literal mediation of time through technologies, the creation of the non-time of 24/7, in the infrastructure of always online, ubiquitous media operations. What follows is an account of selected existing scholarly work which emphasises the role of time, and the role of technology in biopolitical theory, as an intensification of Foucault's oeuvre.

Chrono-

One intensification of interest is of course from the perspective of time. Foucault's biopolitics has been taken up by gender/ queer scholars Dana Luciano and Elizabeth Freeman with the extension of the 'chrono'-aspect. They make use of the term 'chronobiopolitics' to discuss how time can be manipulated by particular regimes of power.

Dana Luciano's work, *Arranging Grief: Sacred Time and the Body in Nineteenth-Century America* (2007), discusses affect and the grieving body as an instrument of affective time-keeping, that provides a counterpoint to the history of time development. She situates her work in relation to the vast literature on development and social instalment of time technologies, referencing Thompson (1967) as key to the discussion of time-orientation in the modernising West. Her approach, however, relies upon "an alternative mechanism for the collection of time: the feeling body" (2007, 6). She studies grief as a collective sensibility that could provide a human touch to the otherwise technical dimension of time, "repetitive rather than linear, reflective rather than forward-moving" (*ibid.*). Grief time moves at a different pace, in a much slower, spacious manner, that enables the emergence of feelings. The focus on the affective dimension of time as experience challenges the predominant mechanised time-consciousness, which permeates society through the increased rationalisation of work and labour. The study as such also extends into the question of how social forms such as communities, nations, and cultures experience temporality from an affective dimension and the status of the body as a time-piece on its own. Both the material feeling body and the body of community could

be understood as potential sites where historiographic and temporal interventions could be studied.

Through studying cultures of mourning, she analyses how the middle-class white family in mourning in the nineteenth century shows the attachment of time to Christianity, a form of 'sacred time' that could be contrasted with rituals and beliefs held by the 'prehuman' Indian and the 'subhuman' black slave. Native and African American mourning constitutes other time sensibilities and corporeal dispositions of time, resulting as them being marked as primitive or Other. Luciano is interested in how different senses of time emerge as ways of defining cultures of people, and of hierarchising them.³⁶

In the coda of her book, Luciano refers to the contemporary example of 9/11 as an event that calls for universal mourning versus the flooding in Katrina as a racialised, class-demarcated event—

The bulk of the U.S. media coverage, orienting itself toward a generically "national" viewer, was always intensely aware of and shaped around the disproportionate poverty and blackness of Katrina's victims, limiting the amount of sympathy required via the projection of a Gothicised disorder in place of 9/11's transcendent trauma. (2007, 260)

9/11 is then marked as an ahistorical, exceptional time within which the story of the nation is narrated. Other incidents like the 2004 Indian Ocean tsunami, the Iraq War, the flooding of Gulf Coast, she observes, are relatively less important. She wonders why her interlocutors do not mention these as important reference points for her study in contemporary times, but rather singles out 9/11 collectively. The time of mourning for 9/11 becomes definitive for the nation. This already bring up the question of whose bodies count in time, and whose bodies are more dispossessed than others. Temporal markers, from this perspective, hold the separation between particular parts of the population. This echoes the notion that 'biopower divides' which I have elaborated upon above. In the rest of the dissertation, 9/11 will indeed prove to be an important time marker for several authors, including for instance Brian Massumi (2015) and Richard Grusin (2010), as a way to demarcate a different inception of politics and medial power. Citizens' wariness of the surveillance state and the affective atmosphere of suspicion towards the data-collection power held by digital devices as well as the use of big data for policing and keeping track of populations can also be attributed to this watershed moment of 9/11. Recalling Foucault's remark on how liberal governance is premised upon the existence of constant danger, the threat of the other and the potential for future terrorist attacks post 9/11 indeed offers fertile ground for the proliferation of new security regimes and technologies of governance in order to curtail individual freedoms.

Luciano proposes the term *chronobiopolitics* to encapsulate such narratives and demarcations between populations, taking up Foucault's idea that biopolitics

functions as corporeal regulation of populations. The human body is temporalised through

the linear, accumulative time of development, the cyclical time of domestic life, the sacred timelessness of the originary bond and of the eternal reward toward which the faithful subject progressed; or, beyond these norms, the wayward time of perversity, the nonprogressive time of pure sensation, et cetera. These were ordered on the national level, through a dual appeal to stability and progress, though the nationally conceived mapping of time could also give way to a selectively transnational sense of modernity. (2007, 10-11)

Luciano only uses chronobiopolitics to frame her study, and has not really tied her discussion throughout into a sustained engagement with Foucault's work. But by referring to the less-developed notion of time embedded within the practice of biopower, Luciano opens up a new way of engaging with the subject. She shows a minor linkage between temporality and biopolitics, and suggests that one could look at biopower through a set of temporal references. This notion is further taken up by Elizabeth Freeman in *Time Binds: Queer Temporalities, Queer Histories* (2010).

Freeman's objects and foci are quite different. Her book is dedicated to studying film as a time-art, through which she charts a historiography of queer temporalities, a queer time that generates a discontinuous history of its own. Freeman introduces a related concept of *chrononormativity*, and discusses how the invention of schedules, calendars, timezones and the availability of watches create hidden rhythms (Zerubavel), institutional forces that organise the somatic rhythm of the body. There is also a level of sexualisation to chrononormativity, as populations also share collective rhythms of the sexual arrangement of the time of life (e.g. a normative timeline of courtship, marriage, followed by childrearing).

In chronobiopolitics, the process extends beyond individual anatomies to encompass the management of entire populations: people whose individual bodies are synchronised not only with one another but also within larger temporal scheme experience belonging itself as natural. In a chronobiological society, the state and other institutions, including representational apparatuses, link properly temporalized bodies to narratives of movement and change. These are teleological schemes of events or strategies for living such as marriage, accumulation of health and wealth for the future, reproduction, childrearing, and death and its attendant rituals. (Freeman 2010, 4)

Such dispositifs serve the interest of the nation state, as populations are thereby bound to certain trajectories of being socio-economically 'productive', in the way they organise their life events.

Freeman studies various historical moments of what she calls 'failed revolutions' in the 1960s and 70s for sexual politics. Analysing particular films, novels, and art projects, she discusses the forms of disruptions queer temporalities put forward to the normalised temporal order, from the female dyke body to drag performances to black bodies. She marks queer time as a field for everyday resistance and for everyday negotiation as queers continue to not live up to the rhythms of sexualised chrononormativity.³⁷

Luciano and Freeman altogether provide clear definitions of the concepts of chronobiopolitics and chrononormativity. I share some of their interests in how time functions as a normalising force within biopolitics, but my take on the subject focuses much more on the actual technologies and scientific developments which defined the field of time, mechanically speaking and technologically speaking. Nonetheless, their theories show the potential of studying biopower from the perspective of temporalities, sensitising readers to how time plays an important role in biopolitics.

Techno-

Biopolitics has too been taken up by scholars writing about technology and media. In this section, I will look at the developments of biopolitical theory by Deleuze (1992), Hardt and Negri (2001), and Galloway and Thacker (2007). These authors demonstrate hints of intensification of power in the contemporary era, opening up Foucault's work to domains of digital culture, such as in discussions of databases, data capture, networked communication, and code and protocol.

Foucault's account of biopolitics is reframed by Gilles Deleuze as 'Societies of Control' (1992). Deleuze's elaboration in 'societies of control' makes a convincing case for the intensification of biopower. This text is particularly important in setting out how intensifications of power can move beyond human regimes of government and further into technological objects. Deleuze builds upon what Foucault has already analysed as a complex emergence of a distributed system of *dispositifs*, which are not separate but completely enmeshed in one another.

In the disciplinary societies one was always starting again (from school to the barracks, from the barracks to the factory), while in the societies of control one is never finished with anything—the corporation, the educational system, the armed services being metastable states coexisting in one and the same modulation, like a universal system of deformation.
(5)

Similar to Nealon's intensification thesis, power morphs and travels across these *dispositifs*.

Hardt and Negri (2001) make this point too by suggesting that

The society of control might thus be characterised by an intensification and generalisation of the normalising apparatuses of disciplinarity that internally animate our common and daily practices, but in contrast to discipline, this control extends well outside the structured sites of social institutions through *flexible and fluctuating networks*. (23; own emphasis)

Like Deleuze, they make note of the interconnectedness of networks where there is no end to where one *dispositif* of biopower ends and another begins. In their work on biopolitics, Hardt and Negri create the concept of 'empire' that describes a global vision of political organisation that goes beyond the nation-state model. This is a step further than Foucault's close readings of national governments in developing his biopolitical theory, though of course Foucault has already opened

up the potential of reading his work through the multiplicities of global power. Empire, in their definition, is fluid, flexible and dynamic, and is irreducible to the power of any single state.³⁸ Empire is a globalised political order that offers a post-sovereign understanding of power, where power circulates in networks, rather than being centralised in sovereign governments. The term ‘network’ here refers to as much to systems of interconnected states, companies, institutions, supply chains and labour networks, as to communication systems and information networks. Hardt and Negri use a broad definition of network and circulations of power in their analysis of biopolitics. While technology is not the main focus of their work, their writings characterise the globalised world as one which is interconnected by communication networks. In other words, advances in information technology underlie their conception of ‘empire’.

Looking closer at the technological side of networks, we could turn to how Deleuze describes the interaction between human and technology in his time. Deleuze points out that individuals have become networked in existence, and have in fact been turned into “dividuals” (5), and population has become “samples, data, markets, or ‘banks’” (5). Banks in this definition can also refer to databanks and databases, the amassed collective of samples in storage. Writing in 2007, William Bogard interprets the Deleuzian notion of a dividual as data subjects, a definition that rings true still in today’s media domains.

Dividuals are not the products of fixed training in closed environments, but artifacts of data mining searches and computer profiles. They are the continuously morphing targets of advertising schemes, insurance scams, and opinion polls. A dividual is a data double passed through a moving screen, stripped down to whatever modular information is required for a particular intervention, task or transaction. Increasingly, postmodern subjectivity is defined by interaction with information meshes and the modular dividuals they produce. When you use an ATM machine, you are interacting with your dividualized self, or when you access your work environment via your home computer. Likewise, when a database is mined for information on your buying habits, leisure habits, reading habits, communication habits, etc., you are transformed into a dividual. (2007)

Such an understanding from Deleuze and Bogard already hints at the big data machine currently operant today, and the mass collection of data helps establish normalising powers and powers of categorisation for the individuals who longer are individualised but are points plotted on distribution curves and data points ready for processing. In a way, Deleuze is beyond his time in pointing out the important role of technology in exerting control and surveillance on its subjects.

Deleuze uses the term “universal modulation” (7) to make a point about the possibility of control that accompanies data capture, which will become important in later discussions in the dissertation. He explains this with reference to Guattari’s imagination that key card systems will one day control our movement past barriers like entry gates and doors, a prediction that has already become today’s reality. To Deleuze, it is not just about the key card being able to block or allow entry, rather

what concerns him is the tracking possibilities afforded by the computational system that runs such access systems. Data concerning individual movement becomes recordable, and the system also allows “universal modulation” (*ibid.*) of anyone who then uses these access systems. Therefore, these technologies become part of the apparatus for discipline and control.

Taking his discussion further, Deleuze deems the technological developments as symptomatic of the mutation of capitalism, where for instance in the age of industrial capitalism, capitalism operated in terms of concentration, for production and for property. This is not a technological deterministic way of thinking; Deleuze explains that the machines invented and used could be seen as archetypal expressions of “the social forms capable of generating them and using them” (1992, 6). A factory is a space of enclosure, and the capitalist is the owner who extracts labour from the workers and owns the means of production (the machinery and raw materials) and sells the products. Machines are about “levers, pulleys, clocks” (6), mechanically in motion, with tangible bits and bobs on toothed wheels. In the era of Deleuze’s writing, his capitalism is one of higher-order production, where it concerns tertiary economies of service and financial systems of stock exchange. The market does not need to attain power by way of disciplinary training, but could induce effects by fixing exchange rates. Mutations of biopower, from a Deleuzian perspective, are also tied up with mutations of capitalism. In the latter half of the dissertation, discussions of twenty-first-century media will thus also shed light on the ways contemporary capitalism is tied to the operations of biopower, for instance in the re-organisation of labour, and in the capitalisation of data captured.

Other authors have continued exploring the trajectory of technology and biopower, following Foucault, Deleuze, and Hardt and Negri. In *The Exploit* (2007), Galloway and Thacker consider the role of networks and databases, and also zoom into control on the code level. In the time of their writing, one of the prevalent technologies they are concerned with is DNA mapping and the biotechnology surrounding such databases. Taking a more literal trajectory in thinking about bio- and politics, they ground their analysis of the biopolitics of networks in the biological sciences of life³⁹ and their technological mediations through informatics. Networks in this definition mediate the relations between biology, politics, and the social body of populations. In controlling populations, Galloway and Thacker make clear that the “accumulation and ordering of different types of information” (2007, 71) are central to biopolitics and that biopolitics at the same time “defines a means for the production of data surrounding [the population]” (72). The computerisation of information in databases can thus be seen as both a symptom and the result of biopolitical governance. The methodology of biopolitics, according to Galloway and Thacker, is informatics—“in contemporary biopolitics, the body is a database, and informatics is the search engine” (74). These reflections echo the above-stated

feature of biopower as productive, as Galloway and Thacker describe the knowledge paradigms of database and informatics as new avenues of control on the body through biopower.

Biopolitics, from the perspective of a networked topology⁴⁰, is about the management of life itself as distributed through living networks that capture both literal biological information like DNA, as well as information over lifestyle, consumerism, entertainment, and online interactions. As such,

[o]nce “information” can be viewed as an index into “life,” that information is accommodated by network structures (algorithms, databases, profiles, registrations, therapies, exchanges, login/ password). Finally, once life is information, and once information is a network, then the network is made amenable to protocols—but with the important addition that this real-time, dynamic management of the network is also a real-time, dynamic management of “life itself” or living networks”. (77)

Galloway and Thacker identify the role of network structures in modulating biopower through their discussion of code and protocol. Protocol is part and parcel of the network, and plays an important role in organising and controlling the flow of information along network structures. Hansen (2012) criticises Galloway and Thacker’s ideas. In particular, he asserts that the authors reintroduce a form of sovereignty as a non-anthropomorphic mode of power from above in the topology of networks, instead of a dispersed understanding of power as advocated by Foucault/Deleuze. I rather disagree with this reading, in that Galloway and Thacker are referring to exceptional structures within network topology where certain standards ‘make decisions’ about the flow of information. They call this “a sovereignty that is unlike the traditional forms of sovereignty” (2007, 40), which is materially embedded inside exceptional topologies inside a given network. These exceptional topologies, otherwise referred to as technical protocols, are there to structure and regulate network traffic, and are integral to the functioning of networks. Control from this perspective is not sovereign in the Foucauldian definition of sovereignty as power from above, but rather is embedded and encoded within the network architecture.

In this understanding, there are two layers to the presence of control and biopower in networks. The first is situated in the organisation of the network itself through protocols, one that could be explained through the triadic relationship among information, protocol and network. The processing of information within a network structure requires control on a technical, code level. It is through the processing of code and protocol (exceptional topologies) that computer programmes could categorise and sort biological information in biometrics, tagging, and profiling control. This of course has repercussions on a societal level in terms of the network’s interface with life itself, leading to a second layer of control and biopower. The outcomes of the processing of information gleaned from lived bodies constitute a form of control that bodies are subjected to.

Galloway and Thacker in fact introduce the consideration of code and protocol as substructures within the framework of Foucauldian biopower and Deleuzian control which operate through networks and digital culture. They open up the possibility of engaging with biopower materially through the actual operations of code and protocol, and the resultant biopolitical effect on bodies afforded by technological interventions. This will become important as we move into further discussions of how biopower functions through algorithmic control today, with attention to the technical layers involved in the mediation of biopower inside computer machines.⁴¹

Biopower in the Twentieth Century: From Biopolitics to Performance

The above two excursions into the chrono- and techno- dimensions of biopower as exemplified in the works of cultural scholars demonstrate the various trajectories one could take surrounding the intersections between temporality, technology and biopower. The above reflection on technology can be supplemented by another account on its relation with biopolitics from the perspective of Performance Studies. One could read Jon McKenzie's elaboration of performance as the new regime for biopolitics as another contemporary instantiation of power's intensification, one that is attentive to the techno- dimensions and also makes passing reference to the role of temporalities.

In *Perform or Else: From Discipline to Performance* (2001), McKenzie charts a general theory of performance to show how performance permeates aspects of culture, organisation, and technology. Performance in McKenzie's understanding is related to but different from discipline. "The stratum of discipline attempts to construct and solidify highly centered, unified human subjects and highly stable fields of objects" (2001, 179). Like Foucault's prisons, hospitals, and asylums, disciplining imposes precise norms under which subjects are scrutinised and controlled. On the other hand, "performative power is multivalent and polyrhythmic" (2001, 249)—it results in the construction of hybrid subjects, the overlapping of institutional forms and terrains, and modulations of control as networks in a dispersed and widespread manner. This reading of biopower as performance echoes Foucault's own discussion of the productive nature of power, and how it is polymorphous in its domains of operation. It is also in line with Deleuze's theorisations on control societies and how biopower is dispersed across multiple dispositifs.

McKenzie offers a complementary logic of performance which shows how the necessary technological force calls forth the potential of material resources and the human actors and challenges them to perform to a particular standard for the sake of achieving better "efficacy, efficiency and effectiveness" (2001, 171). The catch-phrase "perform—or else" suggests a challenge embedded within the concept—"a certain level of terror, whether soft or hard: be operational (that is,

commensurable) or disappear.” (Lyotard 1979, cited in 2001, 14). This can be placed in juxtaposition with the earlier focus on death control by the power of the sovereign. As discussed above, in this classic understanding, the power of the sovereign originally lies in the right to take lives, to give death sentences and thereby determine the length of someone’s life. Foucault identifies that in the nineteenth century, this has come to be complemented by a new right which adds to the old one, namely, the power to control or limit how one lives—“The right of sovereignty was the right to take life or let live. And then this new right is established: the right to *make live and to let die*.” (Foucault 2003, 241; own emphasis). What McKenzie suggests is that ‘performance’ adds an extra challenge to discipline and biopower in the contemporary age. ‘Perform—or else’ adds to mechanisms of biopower in its processes of making live and letting die. In McKenzie’s words, “performance will be to the twentieth and twenty-first centuries what discipline was to the eighteenth and nineteenth, that is, an onto-historical formation of power and knowledge” (2001, 18). McKenzie further explains, “performativity is legitimation defined as the maximization of a system’s output and the minimization of its input. It normalizes activities by optimizing a system’s performance” (2001, 163). The emphasis is on the notion of ‘system’, i.e. various units are in play in order to produce the overall effect of better output. This echoes the feature of biopower as economical and how it lightens in order to become more ubiquitous in its reach.

McKenzie’s idea of performance management hints at the concerted efforts that altogether make up the ‘system’. NASA’s Space Shuttle, The Challenger Machine, is taken as a prime example where cultural, organisational and technological performances can embed themselves with one another. It requires the co-operation of the military-industrial-academic complex (MIA complex), and the performance of various parties must be well-developed in order for the rocket to actually be successfully launched. By emphasising the need for co-operation of multiple agencies, McKenzie reminds readers that while workplace discipline is about the concentrated labour taking place in the walls of industrial factories, performance management is about dispersal of labour on dispersed sites of power.

In today’s digital world, we could take the smartphone as a prime example where cultural, organisational, and technological performances are simultaneously required. In Brian Merchant’s book *The One Device: The Secret History of the iPhone* (2017), he paints a picture of entire industries, the concerted efforts of research and development, and global labour that are concentrated in one device. In this ambitious book project, he gives a lively account of multiple processes that make up the smartphone: the mining of minerals and precious metals for creating individual hardware components, the prototyping of Gorilla Glass, the hardware and software design that goes into every component, the processing unit, camera, battery, accelerometer, proximity sensor, GPS to name but a few, the development

of apps for functionality and security measures, the assembly line of factory work in Foxconn factories, the second-hand and black markets surrounding iPhones, as well as the disposal of the gadgets after its death as electronic waste. This, on its own, is not an exhaustive list, for the smartphone is also by definition a networked device that registers and tracks the activities of its owner, whether through geolocation, search history, Instagram stories or Spotify playlists. Performance management, in this instance, can be observed extensively across a myriad of organisations that participate in different times and spaces in association with the creation of one device. The multiple geographical locations under which mining (e.g. Congo), design (e.g. Silicon Valley), production (e.g. China), sale (online, and in physical stores globally), disposal (e.g. India) take place reminds us of what Hardt and Negri (2001) refer to as 'empire', a decentralised mode of power networked in globalised flows of capital. The iPhone participates in a global network of production and trade and is a networked object too in the sense of connectivity and digital communication networks.

Such a device allows us to become part of a network topology, one that Galloway and Thacker have already identified as a potential site of biopolitical control. While the device promises the possibility of communication, and to help us with daily tasks like scheduling, navigation, it asks us to perform for it, for the performance of the user is paramount to the functioning of the device. It needs our data to learn our preferences, and to become better at being our intelligent aid. It learns how we talk, remembering what words we use in close association with another for text prediction; it wants to know where we live and work, so it can provide faster navigation routes; it asks for access to our contacts, camera, microphone, location; it wants to read our emails and messages. The device itself is a performance of the networks of power it travels through⁴², but it is also a powerful device that elicits performance and records every bit of it.

Here we see Galloway and Thacker's informatics extracted in today's databases; our smartphones (and internet servers) are already repositories and archives of our bodies and our lives. Writing prior to the proliferation of big data, but being attuned to the technology of statistics and its incursion into digital databases, McKenzie too reminds us that polymorphous performative power permeates through our material selves as well as our digital selves.

Here and there, now and then, performative power surges through every body and no body: it makes multiple, even incompatible, challenges upon everyone, yet it cannot be readily located in anyone or any one group, for in contrast to discipline and torture, the power of performance generates both physical and digital bodies. With the rise of IT, everybody becomes haunted by electronic bodies stored in multiple databases. *Everybody*. (McKenzie 2001, 189; original emphasis)

This is in alignment with Galloway and Thacker's point that the biopolitics of the digital era is expressed through real-time, dynamic management of life captured on these networked databases.

Another significant contribution by McKenzie here is his observation that performative power is non-linear and temporally plural. In the third part of his book, he playfully misnames performance as 'perfumance'. What is 'perfumance', you may wonder? McKenzie muses that it is "the citational mist of any and all performances", "the incessant (dis)embodiment-(mis)naming of performance", "the becoming-mutational of normative forces, the becoming-normative of mutant forces" and "the ruse of a general theory" (2001, 203). In a poetic manner, Kershaw (2006) defines 'perfumance' as "a sniff of the future that noses out crucial strands of the past and their potentials in the present, a potent tracer of emergent histories" (37). McKenzie goes on to suggest that "perfumance pervades the contemporary landscape with temporal overload, chronochronic feedback and feedforward, the short-circuiting of past, present, and future" (2001, 255). Whatever perfumance materialises as or through, it does not follow the chronological rules of time. McKenzie seems to engage with perfumance as a set of disturbances or destabilisations to the concept of performance, infusing the concept with radical potential of transformation, whether for better or for worse.

Ultimately, McKenzie challenges readers to consider a theory of performance (and with it, biopower) that is not only polymorphous in space (overlapping and multiple dispositifs) but also multivalent in time (short-circuiting past, present, and future). Perfumance from this perspective could be read as the emergent times that disrupt the chronology of progression and continuation.

The challenge: not only to recognize that one experiences history from the perspective of the present, but to plug into emergent forces in order to generate untimely perspectives on this very perspective, perspectives that multiply and divide the present, rattling it to and fro. (2001, 255)

This opens up the possibility of engaging with temporalities within the theory of biopolitics from another perspective, a queering, if you will, that reminds us of the discontinuous modes of biopower expressed through a combination of discipline, biopower, and performance. Biopower, within itself, is fractured in various intensifications alongside the multiplicity of dispositifs that govern it. From this perspective, one could excavate the "minor histories and minor anachronisms" (2001, 250) that may have contributed to the emergence of discipline, biopower, and performance in the present. With this in mind, performance then, is not the end of the line in the ways in which biopower expresses itself. Rather, new modes of expression may be identified that displace current modes of biopower, operating next to these established, stratified modes of expressions. In biopower's multiple morphings and scalings, in its economic calculus and strive towards efficiency, one

could trace, as Foucault and other scholars have done, how biopower performs its effects today. In a move akin to Foucault's genealogical method with a nod to McKenzie, one could identify minor histories and anachronisms that affect the composition and recomposition of biopower across time and space.

In this dissertation, I argue that biopower morphs as both a symptom and an effect of new technologies that mediate time. This, I encapsulate, in the concept of techno-chrono-biopolitics. These technologies could be situated materially in various time-related objects and narratives on the development of clock technology. The next chapter will provide an account of mediated time that jumps between the analogue and the digital, short-circuiting temporalities in the style of McKenzie's perfumance, showcasing the technological milieu under which techno-chrono-biopolitics could be observed.

Conclusion: Biopower in the Twenty-first Century?

In this chapter, I have provided a summary of the theory of biopolitics, highlighting five pertinent features extrapolated from Foucault's works. I have also brought into conversation biopolitics's intersection with cultural theory on time (Luciano 2007; Freeman 2010) and contemporary digital culture with biopolitical theories of and beyond Foucault. Deleuze (1992), Hardt and Negri (2001), Galloway and Thacker (2007), and McKenzie (2001) develop the concept of biopolitics further and map it onto the digital and technological landscape. Their new iterations of the concept can be seen as demonstrative of the intensifications of power as it becomes more virtual and more economical. I read them in line with Nealon's intensification hypothesis, considering them as useful extensions of the subject, which also represent the mutations of power in recent decades.

The logic of intensification of biopower focuses on the continuity in how biopower operates and exerts itself in different practices that emerge over time. Rather than suggesting that there are clean breaks with previous primary modes of operation, Foucault invites us to think of these morphing regimes of biopower not as replacements but as displacements. Historical change in this sense can be thematised under growing intensity as changes emerge from within. The singularity of any new emergence "is necessarily born of the combination of existing social forces" (Nealon 2008, 41). In the current study, this position is in line with the understanding of media development that is based upon remediations of former technologies in a media-archaeological sense. This is important to keep in mind when approaching the domain of twenty-first-century media, in that while it is significantly different from previous modes of media, it is borne out of the histories of former technologies. The intensification of biopower is a series of mutations

that occur alongside these technological advancements. Taking on McKenzie's performance theory together with his thesis on performance, I propose to see biopower in the twenty-first century as multiple both in space and time. In my itinerary of studying biopower in the midst of twenty-first-century media, I probe for multivalent expressions of power in the forms of discipline, biopower, and performance. Its scope is intensive—following Foucault, I question the disciplinary effects of twenty-first-century media and their relationship to bodies. Following Galloway and Thacker, I zoom at times into the technical layers of code inside, showing how control could exist in the deep recesses of our computer machines. Following McKenzie, I look at the performances twenty-first-century media elicit. In the interfaces between the technical and the human, biopower can also be found running on the scale of machinic time and human experiential time. I will develop my theory of techno-chrono-biopolitics through examining these spatiotemporal multiplicities.

In the rest of the dissertation, I would also further elaborate on the work of other scholars writing on biopower. To name but a few, Brian Massumi replaces the centrality of human (as represented by 'bio-') by *ontopower*, focusing on pre-emptive actions of discipline and punishment which turns biopower into an ontological force that takes on a future-oriented timeframe. Elizabeth Povinelli (2016) places a posthuman spin on the concept to call for attention to how biopower also operates on non-human animals and geological entities. She revises biopolitics into *geontologies*, in turn a reflection on a deep time consideration of what biopolitics could mean. These further iterations of biopolitics challenge and expand our Foucauldian frame of reference, and will be considered in the later chapters of this dissertation.

In the next chapter, I will turn my attention to the technical objects that mediate time, namely clocks and computer machines. Studying these objects, I set out the premises of time and temporality and their entanglements with technology under the rubric of twenty-first-century media. This sets the stage for the study of how mediated time and its associated technological objects intensify ways in which biopower operates, which I will subsequently explore in Part 2.

2

In Mediated Time: Clockworks, Automata, and Computer Machines

In Chapter 1, we have looked at the key concept of biopolitics and the definitions of power undertaken by this study. Chapter 2 offers a close examination of the objects concerned with this study, namely, the technological objects that mediate time. The chapter offers an excursion into this foundational aspect of technochrono-biopolitics — where mediating time by technological means demarcates certain operations of power. In the larger argument, biopolitics functions differently in various time practices which are mediated by clocks and machines. This chapter is dedicated to the material objects of clockwork mechanisms and automata, and situates analogue computing as a predecessor to digital computation. I will show how time mediation is closely linked to analogue algorithms, and how our understanding of microtemporal time could be deepened through this historical excursion. With this backdrop, I offer a contemporary definition of what algorithms are, what algorithms do, and how they mediate time.

Mediated time in this account has a two-fold definition. Firstly, it refers to time as mediated by a clock system. In its simplest terms, one cannot ‘tell time’ without a standardised, organised system of time, nor without time-telling objects like clocks. The mechanised machinic calculation that segments time into hours, minutes, seconds, the segmentation of earth into specific timezones, and the implementation of daylight savings schemes are examples of clock practices that mediate our human experience of time. These clock practices are understood as specific technologies of time.

The second definition of mediated time concerns another type of technology of time. This technology of time arises out of time practices inherent to clocking mechanisms in computer machines. In order to enable synchronicity of encoding/

decoding processes, and for machine operations to run in connection with one another, the computer must incorporate an internal rhythm for the processing. Mediated time, from this perspective, emerges from the interaction of specific signals being processed within a computer machine. Rather than being dependent on an external source of clock rhythm, this rhythm is endemic to the computational process. This has been theorised by Wolfgang Ernst (2016) as a kind of non-human time generated and experienced by technical media.

These two definitions of mediated time are interlinked with each other. I argue in this chapter that they share a similar mechanism of mediation, i.e. they share an algorithmic basis in their mediation. An algorithm, in its simplest terms, is a set of mathematical procedures. These procedures address “a problem in a fine number of steps using logical if-then-else operations” (Terzidis 2006, 65). Clocks, and other inventions of automata, run on specific finite algorithms. Mechanical clocks enable the algorithm of timekeeping to be signalled on the clock-face. With precise measurements in the distance between cogs, pulleys, and gears, the weight systems and coiled springs maintain a steady rate so that the minutes and hours could be registered. If the gear registers 60 ticks on the second, the minute hand will move forward 1 unit. If the minute hand moves forward 60 units, then an hour has passed. Automata, in a similar manner, rely on mechanical compartments which govern their overall movement. Jacques de Vaucanson’s 1737 invention of a flute player automaton had three sets of different blowing pressures and lips that could flex in four directions for variation in the sound-production mechanism, and a repertoire of twelve songs. If a particular coil springs into place, a certain pitch for a set duration would be sounded. Such inventions were not only a mechanical wonder and a charmed spectacle for the higher ranks of society at the time, but also became key steps in developing mechanised automation for industrialisation. In order to reform and improve the French silk manufacturing industry, Vaucanson also invented the first automated mechanised loom using punch cards to determine the patterns of weaving. His invention was later picked up and modified by Jean-Marie Jacquard, whose Jacquard loom was seen as a key contribution leading up to the Industrial Revolution. The punch card mechanism they studied are ancestors to the punch cards and tapes that prototypical computers ran on a century later.

The definition of the term algorithm suggests a finite number of steps and procedures, which in the case of mechanical devices is programmed into the machinery itself. Boast (2017) sees such close-ended mechanical algorithms of clocks, automata, and analogue devices as examples of analogue computing. Analogue computing is achieved through calculating by analogy, like the gears which represent the relationship between hours and minutes, and how a clock calculates time. Analogue algorithms could be seen as precursors to the much more complex and multifaceted digital algorithms we have today. The mathematical

procedures have taken on a different ontology within twenty-first-century digital media, resulting in new repercussions in contemporary times. As argued by Parisi (2013), “algorithms are no longer or are not simply instructions to be performed, but have become performing entities: actualities that select, evaluate, transform, and produce data” (ix). There are therefore two main objects in this chapter: the study of mediated times, and their mechanisms of mediation by algorithms.

In Chapter 1, I have already established that the intensification of discipline into biopolitics involves an operation of mediated time in its first definition. In Foucault’s analysis, time discipline according to schedules and induction of rhythms are part of eighteenth century practices. The invention and popularisation of clocks and associated time management practices (e.g. timetables and schedules) form technologies that affect the operations of human activity.

This chapter explicates the mechanical, technical dimension of these operations. It first draws attention to the two definitions of mediated time: how time is mediated through clocks, and how it is embedded in twenty-first-century media vis-à-vis Wolfgang Ernst’s *Chronopoetics* (2016). Then it juxtaposes the mechanisms of automation through algorithmic operations as expressed through clocks and automata with today’s computer machines, and articulates the technical dis/connections therein. In the first half of this chapter, I will zoom into the inter-relations between clocks and computer machines, paying close attention to the mediations of time these objects perform. The second half of the chapter studies the ontology of algorithms and pursues the question of what an algorithm is, historically and in contemporary terms. It closes with a juxtaposition of the Mechanical Turk from the age of automata with AlphaGo in the age of the machine-learning algorithm. These two examples represent the two types of algorithms (mechanical vs digital) I discuss in this chapter, and the abilities of AlphaGo show an instance of algorithms that extend well beyond the rule-bound structure from earlier instantiations.

Mediated Time and Analogue Computing

Mediated Time and Clocks

This section looks at the first definition of mediated time, and explores the inter-relation between mediated time and the analogue technology that supports it. I will first explain the backdrop against which I define ‘mediated time’ in relationship to the field of time studies. I will then establish how mediated time can be seen as a close-ended algorithm modelled by a clock’s mechanical parts, and refer to this as the basis for analogue computation.

Clocks provided a tool under which one could measure time in equal units. Mediated time begins its reign with the introduction of clock-related practices,

namely time-signalling, time-keeping, and time-measuring. The quantification of time as a counting mechanism is an instance of mathematisation and rationalisation, where time becomes a unit available for use and trade. The standardisation of the equal hour as mediated by the clock has enabled time to be seen as a tradable unit. This would have huge implications on how lives are subsequently organised around clock practices, and the disciplinary mechanisms which arise with clock technology. In the Introduction, I have briefly introduced the works of E. P. Thompson (1967) and Mark Smith (1997) on English factory time discipline and the adoption of clock time as disciplinary measures for slaves in Antebellum plantations. Further elaborations of these accounts will be provided in the next chapter where I go into the historical antecedents of techno-chrono-biopolitics, drawing connections between the biopolitical dimensions and clock technologies.

In the history of timekeeping devices, various techniques have been invented in order to provide an equal measure of time. These techniques, which I will further introduce below, include for instance the sundial, the hourglass, candle clocks and water clocks. These techniques are forms of mediation which established a different relationship with time—namely, technology as an external reference to the phenomenon of the passing of time.

Time studies literature details the way how time was considered before the advent of clocks. The introduction of clocks as a form of ‘mechanical time’ retroactively marks the previous era of living in time and with time as one of ‘natural’, pre-industrial orientation. This does not mean that there was no particular rhythm to the way one lived, but that it was aligned more according to day/night, the natural rhythms of the earth’s rotation in the solar system, or to the tasks one perform at hand. Thompson (1967) refers to variously ways of how people recounted duration from anthropological accounts (Nilsson 1920), such as ‘a rice-cooking’ (half an hour), ‘locust-frying’ (a moment) in Madagascar, or could be calculated according to the length of a prayer, or how long it takes to pee—‘a pissing while’—in England.

‘Natural time’ is induced through habituation, “familiar processes in the cycle of work or of domestic chores” (Thompson 1967, 58). This could be created through the logic of need—the more food to be produced, the more time to be spent in the fields. Or if a piece of clothing is extra dirty, then one would of course spend more time washing it. Duration is task-oriented, and is not measured deliberately. One task would simply follow another, and the time of a day passes by through the succession of tasks. Pre-industrial labour (and specifically agricultural practices) needs to take into account many environmental factors, such as the whims of weather, seasonal change, daylight conditions, domestic animal needs, and the likes to which industrial labour is perhaps less subjected to. In that sense, the rhythmic nature of agricultural work suggests a close affinity to ‘nature’ and the rhythm of ‘nature’ itself. There is no external reference to a time-measuring system, but rather

reference (or deference) to nature's rhythms, or the organic rhythm of what the tasks need.

In *Shaping the Day* (2009), Paul Glennie and Nigel Thrift suggest that the transition from 'natural time' to mechanical time is really the transition from unequal hours to equal hours. The technology objects of clocks and watches provide an *external reference* that literally marks the flow of time.

With the sundial, for instance, telling time is reliant upon unequal hours as it is tied to the cosmological observation of sunrise, noon, and sunset. Daylight and night-time durations vary in different seasons, so the divisions of one day are not uniform. Clocks, however, break the intrinsic connection between time and the cosmos, becoming an external reference on its own—"Clocks shifted from being purely proxies or intermediaries for what a sundial would show, were it not cloudy, to *being themselves the source of times* to which causal powers could be ascribed" (Glennie and Thrift 2009, 26; original emphasis). Smith (1997) proposes that this intrinsic connection between time and nature is not just broken, but it even demonstrates the triumph of man over nature.

By setting events against the clock and, in fact, setting the clock itself, people could insinuate their own temporal definitions within nature's round. This ability to define clock time has, to complacent modern eyes, set man over nature. (1997, 14)

The popularisation of the abstract scheme of clock time as external reference marks a moment where the technological objects become imbued in the operation of power/knowledge in relation to the claiming of time. Instead of observing cycles in the world based on celestial markers, we have turned to time as mediated by the clock.⁴³ Time is thereby mediated by time-telling devices.

Various mechanisms have been tested historically in order to provide the equal measure in telling time. A water clock, or clepsydra, has been used for multiple centuries and well into the era of mechanical clocks. Clepsydra is a Greek word which means 'water trickler'. This was a remarkable invention as its earliest known example dates back to 1400BC in Egypt. An earthenware vessel in a cone shape was used to hold water, and a small hole near the base would allow water to trickle away slowly. The drop in water level corresponds to the graduations in the vessel which marked the division of time. Another common household clock in Europe before the popularisation of mechanical clocks was the candle clock, which also had graduations marking the intervals of time as the wax melted down (Fig. 5).

It may sound strange to travel so far back in time to look at these crude technologies, but these clocks are in fact demonstrating an important analogue computational principle. In *The Machine in the Ghost* (2017), cultural information science researcher Robin Boast breaks down the operations of digitality by showing its origins in mechanical engineering. According to Boast (2017), such rudimentary forms of calculating time could be seen as prototypes of analogue computing. This

Chapter 2

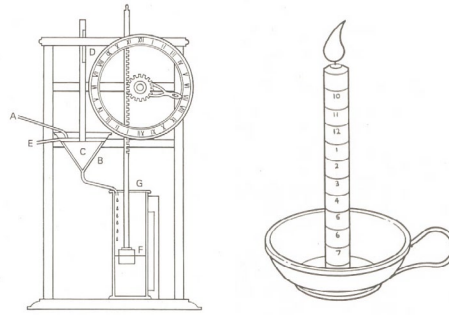


Fig. 5: Diagrams of a water clock (clepsydra) and a candle clock from *The Country Life Collector's Pocket Book of Clocks*

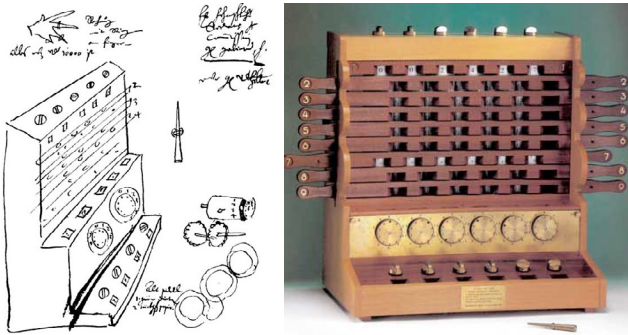


Fig. 6: Sketch (from the Württembergischen Landesbibliothek in Stuttgart) Replica of the Calculating Clock, created by Von Freytag Löringhoff (© Universität Tübingen)

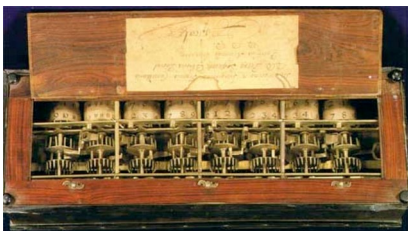


Fig. 7: Pascal's Pascaline in the 1640s



Fig. 8: The Thomas arithmometer in 1820

way of calculation relies on “a machine that models calculations by analogy” (81). Boast refers to the hourglass as an example: sand falls through a small hole inside a glass vessel which controls the amount of sand. The hourglass thus measures time “as a function of sand accumulating in the bottom of the glass” (*ibid.*). This modelling of time by analogy is also seen in the water clock, which models time by change in volume of the water. The candle clock models time by change in length of candle. Later, the more complex contraption of mechanical clock models “time as a function of distance around gears, pulleys or cogs” (*ibid.*). This modelling is in effect a close-ended algorithm which calculates and marks the passing of time, embodied in mechanical parts.

Clockwork and Analogue Computing

Analogue computing is based upon a mechanically-integrated algorithm represented by an analogical relationship among its parts. The earliest recognised calculator created with mechanical parts was referred to as the calculating clock, or calculating meter (*Rechen Uhr*). This was pioneered by German astronomer and mathematician Wilhelm Schickard in the 1620s. At the time, he was corresponding with Johann Kepler the astronomer and was designing a calculating machine. Schickard was fascinated by Napier’s bones and sought to include this as a major part of his machine. Napier’s Bones is a manually-operated calculating device with multiplication tables embedded across six rods. Invented by John Napier, who pioneered the Napierian logarithm, the device enables one to reduce multiplication and division to addition and subtraction respectively. Schickard wanted to adopt this mechanism so as to simplify calculations of large numbers, very helpful especially to Kepler who needed devices that could help with his astronomical calculations. Unfortunately, this invention was lost in the fire before it ever reached Kepler. All that remained were two letters and instructions to Schickard’s technician. The calculating clock was only reconstructed by mathematician Von Freytag Löringhoff in Tübingen in 1960s (Fig. 6).

For this calculator to be called a calculating clock demonstrates the importance of clockwork mechanisms in its underlying structure. It essentially makes use of the same principle as gears registering revolutions in order to register the calculation resulting in an output digit. Another notable calculator, Pascaline, was invented by Blaise Pascal in 1640s (Fig. 7). Pascal shrunk and adapted a lantern gear, used in turret clocks and water wheels, to make his calculator work more smoothly, as the gear could resist the strength of any operator input with very little added friction, and increase the durability and reliability of the calculator. These intricate mechanisms show how the artistry of clock-making and precision engineering was significant in the development of mechanical calculators.

takes for manual calculations. As Boast (2017) argues, computation has its roots in rudimentary mechanical forms. From a water clock to an arithmometer, clockwork mechanisms supported the algorithmic processing of mathematical calculations. Some of the inventions, like the arithmometer, even became crucial in assisting with statistical regimes of governance. This shows a tight interconnection between clock technology and algorithmic computation in its analogue days, as well as the potential of these technologies as technologies of power.

Between Clocks and Machines

As I have demonstrated above, the mechanical clock and their clockwork mechanisms could be seen as important historical precedents to the development of computers. Algorithms represented by these objects are mechanical in nature, and are predetermined. Looking specifically at the algorithms which contribute to time mediation, Giuseppe Longo's article "The difference between Clocks and Turing Machines" (1995) offers further insight into the mathematical logics that underlie these inventions. This bridges the discussion into the second definition of mediated time, and furthers the discussion on clocks and computation by turning to the modern digital computer.

A clock is a "concrete, finite machine" (Longo 1995, 5), where a finite and fixed set of rules governs what appears on the clock face. Time is represented as an external reference via a 12-hour system or a 24-hour system.⁴⁴ In clocks, "all feasible computations follow a predetermined algorithm, carved forever in the material structure" (1995, 4). Clockwork mechanisms also give rise to other machines with closed algorithms, like the calculating clock and the arithmometer. But the dream has been to develop programmable machines, where machines are no longer limited to close-ended, mechanically-bound algorithms, but can solve a larger set of problems.⁴⁵

Longo identifies Turing's work as what really made a clear leap between the clockwork devices limited by their mechanical parts and modern computing. In the 1930s, Alan Turing begins developing the Universal Computing Machine. Turing believes that in principle a machine could solve all mathematical problems as long as they could be represented in the form of algorithms. The Turing machine is to operate with a scanning head that would be a permanent structure and a general-purpose storage medium which could be inserted, written over, or removed. The scanning head, what is a permanent fixture in the machine, is a 'read/write' head that moves on a tape to read data. The tape holds changeable sets of instructions, programmes that could provide a finite list of instructions such as telling the 'read/write' head to move left/right, or to write/erase symbols on the tape. The tape would operate as universal memory which holds both the sequence of instructions, and the data for computation and output. Conceptually, this machine is 'universal'

because it could be programmed to perform any systematic, rule-based procedures on the tape, i.e. as long as they are in the form of algorithms. The key distinction of such a Turing machine from clockwork mechanisms is precisely the added functionality of reading and responding to instructions.

Longo's discussion of clocks and Turing machines also focuses on time. While a Turing machine is focused on sequential algorithms, the linear reading of the tape from one end to the other, carrying out algorithmic tasks on modern computer machines require concurrent processes as well as sequential ones. In a distributed system of computers, machine-to-machine communication also has to be synced in order to carry out tasks properly and to be efficient. Timing, as a result, is essential in computation. Longo refers to the difficulty in synchronising a collection of computers connected in a network.

Each processor has its own clock. There is no need to refer to relativistic effects to understand that their perfect synchronization is impossible: when individual operations are carried on in nanoseconds, slight differences in the measure of time heavily affect the ongoing computation. (1995, 12)

Longo's discussion of clocks and machines speaks precisely to this need to control time, and to maintain a regular internal rhythm inside current technologies. Time is of the essence when it comes to smoothening processes of algorithmic calculations, especially those distributed over a network.

This brings us to the second (and contemporary) definition of mediated time—time that is mediated internally within and among the computer machines themselves. In the time of twenty-first-century media, this definition of mediated time is withdrawn from human perception, and does not correspond to human experience. While mechanical clock time is still very much important to our daily lives, this second definition of mediated time is increasingly gaining importance through the continued proliferation of new devices, in the enfoldings within computer machines and other objects of twenty-first-century media. What is required then is a renewed attention to the way how time is implicated within twenty-first-century media. In the next section, I will turn to Ernst's concept of time-criticality to explain in more precise terms what this second definition of mediated time entails.

Time-critical Media

To look further into the technical dimension of time as embedded in media objects, I refer to Wolfgang Ernst's writings in *Chronopoetics* (2016). Ernst's proposal offers a definition of the second form of mediated time, one that is generated not through clocks but from the internal rhythms of computer machines.

Ernst, like his forerunner Friedrich Kittler, has a tendency to divorce media from the cultural and historical context in some way and deliberately pay little

attention to the context under which these objects are created. He opts for the numerical, calculation-based ontology of technical media. In discussing time criticality, he writes of media running on their own modes of measuring and recording time, forming their own unique “tempor(e)alities”. These tempor(e)alities disrupt notions of human time, and form a separate time of technical media from the time of human culture.

Ernst refers to the notion of ‘time-critical media’ (*zeitkritische Medien*), and argues that they do not only introduce new modes of measuring and recording time, but establish their own tempor(e)alities. Time-critical media are capable of generating their own internal time axes that do not match up to human experience of clock time. These time axes function internally within the operations of the medium, generating their own technical rhythm via actions like signal flows, synchronisation, packet switching, etc.

Time-critical media are not merely time-based, but constitute time at microtemporal scales through calculation and processing.

Medial operations under the conditions of digital signal processing must be processed in strictly predefined time windows in order for them to succeed and for a message to materialise at all. Time is thus no longer simply a physical parameter but rather an intelligent operator. (Ernst 2016, 10)

Understanding time this way shows how time could be mediated algorithmically. The digital processing of algorithms depends on micro-processors, which run upon combinational and sequential logic. These micro-processors

require a clock pulse whose duration represents the smallest period for all of the processes excited in it. Through the internal time schedule controller, the *pulse generator* is thus in charge of all the processes controlled in and from the processor. [...] With every cycle the microprocessor performs a partial operation step and then moves to the next condition. Consecutive operation steps constitute a *machine cycle*. (Krauß, Kutschbach and Woschni 1985 as quoted in Ernst 2016, 70, original emphasis)

These machine cycles are synced to particular periodic timings, in a rhythm within the computer itself. As these different processors operate at different speeds dealing with various commands and automated processes, a clock pulse exists within a computer in order to sort out these times and make them mathematically concurrent and able to communicate with one another. Computers handle a large stream of information in a combination of mathematics and logic, but the algorithms being processed require distinct rhythmic patterns so as to allow synchronisation. “The more complicated the algorithms, the more rhythmic they are” (2016, 80). In Ernst’s analysis, even though the timing mechanism in the computer does not display time as a regular clock would, it still generates a self-referential temporal pattern in its inner world.

Ernst sees regular clocks (e.g. the analogue geared clock and its escapement) as “a mechanical precursor of the chronotechnical practice of discrete time coding” (2016, 74-75) found in computers. Time-criticality also has its analogue equivalent

through the electrical ‘signal’ itself. For instance in telegraphy, the alphabet is transformed into discrete ‘dots’ and ‘dashes’ when sent over a single line. The signals are not only “value-discrete” (each set of dots and dashes represents a letter) but also “time-discrete” (time is segmented into intervals to signal the dots and dashes) (2016, 173).

As an information-carrying variable, an analog signal can assume an infinite number of values; its mathematical model is thus the real function, which assigns a real value (y) to every point on the time axis (x). (*ibid.*)

Ernst argues that time is intensified as an “operator of symbolically coded communication” (2016, 174). The alphabet becomes situated in time and articulated as “electromagnetically induced time events” (*ibid.*).

According to Ernst, the telegraph finds its contemporary radical counterpart in the internet. The internet is a time-critical medium running on a microtemporal scale. On its technical level, the entire network is time-critical because it has to make logical circuit connections across multiple layers of coding, process a significant quantity of data and hyperlink activity. Ernst calls the internet not only hypertextual as it is commonly thought of, but also “hypertemporal” (2016, 178). A variety of algorithms make sure time is kept across internet communications—and keeps one from receiving an email 5 minutes before it is sent. In a game of multi-player online games, “latency times in data processing (measured in ‘ping’ times) literally become a question of (symbolic) life and death”, as Ernst has quipped (2016, 181). We could understand this point further through a closer look at a common internet protocol we rely on which ensures the synchronicity of time, and has been in operation for more than 30 years: the Network Time Protocol (NTP).

NTP enables a consistent time standard to be set across the internet, and allows a client computer to keep the clock synchronised with Coordinated Universal Time (UTC). All clocks on the internet have to conform to a time standard. UTC is time at 0° longitude derived from Greenwich Meantime (GMT), and is considered more accurate than it. It is an atomic timescale “based on the measurement of 1 second as 9,192,631,770 periods of the radiation emitted by a caesium-133 atom in the transition between the two hyperfine levels of its ground state” (Huston 2012).⁴⁶ UTC is also used as time standard in aviation, in space (International Space Station), for weather forecast, and in maps, so as to avoid confusion in timezones and variations due to daylight saving times. The NTP protocol⁴⁷ functions through several key steps. A client computer can send requests for the current time from an NTP server, with a registration of its own time with the request. The server adds its time to the data packet and passes this information back to the client. The client computer will derive the reference time at the server and the time elapsed during this request as measured by the local clock. A signal is passed from the client to the server and back again, and through repeated iterations, the client computer can

gain a stable value for the delay between the local clock and the reference clock standard at the server. The local clock can then be adjusted in synchronisation with the server, and can even be trained to adjust the offsets by altering the frequency of client clock until time correction is achieved (Huston 2012).

The intricate operations of NTP show the level of coordination between the client and server at microtemporal speeds. In order to ensure that devices on the internet are synchronised properly, the NTP is a fundamental layer to the Transmission Control Protocol/Internet Protocol suite which is responsible for internet connectivity. Every single device connected to the internet needs to run such time synchronisation protocols, and similar time-related protocols are embedded in many other operations like peer-to-peer sharing, online games, streaming, etc., a testament to the hypertemporal nature of the internet.

We can turn our attention to streaming, or the buffering of audiovisual content, to further illustrate this hypertemporality. The act of streaming a video for instance relies upon a complex video coding algorithm (Synchronised Multimedia Integration Language) that can make compressed blocks of data appear as a series of coherent and synchronised sound and image. The precondition is, of course, if the internet connection speed is fast enough to stream the video so that the transmission of data signals can be watched by the user with no lagging. Ernst refers to this as being “under the time-critical threshold of the receiver’s perception of the present” (2016, 179), that is, in my terms, a synchronisation with the experiential time of the user. As long as the video buffers fast enough, the user is unaware of the smooth microtemporal rhythms that the streaming algorithm relies on. Streaming is an interesting example because it does not require the advanced storage of the file on a user’s hard drive, but can create a dynamisation of the storage process itself. This means that it is fully reliant upon a consistent data stream and is subject to “a strict time economy” (2016, 180). From streaming video-on-demand on Netflix or listening to music on Spotify, to social media engagement via Twitter and Instagram, twenty-first-century-media services are all time-critical in nature. The micro-interaction of algorithms on these platforms requires the performance of intricate layers of coding that is below the time-critical threshold of experiential time. Users interact with apps on the user interface, unaware of the technical layers of time mediation happening beneath the surface.

Time-criticality offers a definitional framework for the second meaning of mediated time I argue for. It shows the microtemporal level at which time unfolds *within* the media objects at hand. Current computer technology and the algorithmic regime of twenty-first-century-media are time machines in their own right. The internal clocking system they function upon are based on technical rhythms operating at a pace outside of human perception. They also do not ‘tell time’ in the same way as regular clocks do, but rather introduce an additional

layer of time mediation in our daily lives. In the developmental process of these technologies, however, one could still observe the traces of regular clock mechanisms within algorithmic calculations. Ernst in particular points out that “the complex synchronisation of data processing in the computer is modelled on industrial clock systems with master and slave clocks”⁴⁸ (2016, 83). The digital computer does not regard time in the experiential terms human have access to, and perform its own time-criticality withdrawn from human perception. Here we see the interaction between the first definition of mediated time (clock time) and the second definition of mediated time (algorithmic time).

Ernst has laid out here the microtemporal foundation for algorithmic processes which applies to digital entities in twenty-first-century media. In a present (and future) where twenty-first-century-media is always online, always connected, time-criticality is the *modus operandi*—“this is no longer social time or the inner time consciousness of human subjects, but rather technomathematical operativity in its own right” (2016, 180). Ernst highlights the importance of studying temporality in relation to analogue and digital technology, and in particular, draws attention to the internal feature of time-synchronicity in the gadgets’ operations. Internal time-synchronicity is important to allow for internal communication across the various modules and protocols the coding layer determines. Media, in short, have their own inherent temporal logic.

Algorithms and Twenty-first-century Media

Mediated time in twenty-first-century media is technomathematical because it is dependent upon the algorithms which mediate them and determine the time-span it takes to process data operations. The second half of this chapter continues the investigation of mediated time by studying the mechanism of mediation, i.e. algorithms. I will show how like mediated time, algorithms could be understood in its analogue and digital manifestations. The clockwork mechanisms that powered mechanical clocks were crucial to the development of mechanical automata, which had an algorithmic logic to their operations. These historical analogue precursors stand in conjunction with and in contrast to the algorithms of today’s digital world. As the exploration of arithmometers and Turing machines has shown, an important move is charted from finite calculations in single-purpose gadgets to more open-ended computation in general-purpose computers. In the age of twenty-first-century media, another move could be charted in the turn to machine learning, where algorithms are programmed to learn from teaching sets to recognise patterns, classify images, and learn speech patterns, amongst other things.

By returning to mechanical automata, we see algorithms expressed in a mechanical form, which frames ‘algorithms’ as possible material, tangible objects. The definition of algorithms, however, gets more diffuse as we move into contemporary times, with the term entering popular imagination in cultural discourse, and critical academic discourse. For computer scientists, an algorithm is a clear definable set of mathematical steps and procedures, but as an object of public attention, the term ‘algorithm’ is a shorthand for computational processes in different combinations and settings. An algorithm could be a specific entity like Google’s PageRank used in their search engine, an interface like Facebook’s newsfeed, a programme acquired by police departments for predictive policing, or a voice-operated agent like Siri. Scholars like Nick Seaver (2017) have raised criticisms towards these undifferentiated uses of the term from journalistic accounts to critical academic studies. I will turn to the techno-cultural dimensions of algorithms in Chapter 4, when I discuss them as cultural practices in interaction with their users, and as biopolitical dispositifs.

In this section, I focus mainly on the material and technical dimension of the term and analyse how they are programmable, performative, and could be considered a mode of thought. Comparing mechanical, analogue algorithms and digital algorithms, I mark several key moments in the history of their development to show how their programmability has changed over time.

Analogue Algorithms, Automata, and the Dream of Programmability

Analogue algorithms could be found in a variety of inventions in the past few centuries. Analogue algorithms are close to the basic definition of what an algorithm is—a set mathematical formula that is to be calculated through the input of variables, resulting in a mathematical output. As I have discussed above, an analogue clock tells time by setting an algorithm into action in its clockwork mechanism. The following examples show how these algorithms are embedded within the mechanical design that model the relationship between variables in the machinery. The earlier section on clocks has already shown the possibility of calculation using mechanical means. I continue the exploration here through stepping back in time and studying several inventions which show how close-ended algorithms operated in analogue computing, and how the inventors tried their hands at creating programmable automata.

Analogue computing included a large variety of made-to-purpose gadgets which would model specific algorithms on their own. Boast’s study (2017) focused on differential analysers and arithmometers, tracing developments in computation to its roots in mechanical engineering since the late nineteenth century. These objects all rely upon close-ended algorithms, which means that they are limited to the processing of one set of equations from input to output. The arithmometer could

handle four basic arithmetical operations of addition, subtraction, multiplication and division. A tide prediction machine uses pulleys and wires to predict tide levels for a set period at a set location for the purposes of shallow water navigation. Network analysers were built using wheel and disc mechanisms to model electrical power grids, replacing generators, lines and loads with smaller electrical components that run proportional to the system tested. Differential analysers were created for calculating differential equations by integration, also using similar mechanics, pushing way past the capabilities of arithmometers (Fig. 9).

In World War I, bomb markers used rods and dials to measure wind speed and calculate the trajectory for aerial bombs. Each invention had its own embedded mathematical algorithm that was designed for a specific purpose. These early computing hardware were not open to the possibility of running other algorithms through them, even though some could follow a sequence of instructions with variables. They were not yet programmable in the sense of today's computational techniques — they had a finite pre-determined set of useful operations, and were not built for a general purpose.

While Boast (2017) focused upon late nineteenth to early twentieth century developments, mechanically-integrated algorithms could be traced back to earlier forms in historical automata. Automata also function upon clockwork principles to express specific algorithmic operations. Some inventions even made space for the possibility to programme the automata such that a different set of rules fed in would result in a different set of movement. These rudimentary programming techniques show the dreams and desires of automata craftsmen to push the boundaries of what they could build.

Automata were closely related to techniques of clockmaking. Much like the mechanical calculators discussed above, the clockwork mechanism that powered the movement of clocks was designed in an alternative manner to create automata. By the fourteenth century, public clocks were no longer just made to tell the time, but were ornamented by characters like bronze figures and animals or planets and zodiac signs. Astronomical clocks still surviving in various parts of Europe⁴⁹ today show the elaborateness of these decorated objects. In the period, several notable music-making mechanisms were created. For instance, the cam-shaft is a cylindrical wheel spiked with points, often seen in a music box (Fig. 10). When the cam-shaft is connected to a set of metal comb, the comb when hitting these spikes would vibrate and produce different notes. In her extensive study of historical automata, Jessica Riskin (2016) quotes a seventeenth century text on the instructions for using these cam-shaft music boxes.

A *Cylinder* may be fitted so as to move, take out, & change the Teeth at pleasure, to place other in their stead: so a new *Composition* may at any tyme be applied;... For example of this: Divide a *Cylinder* into 24 *Measures*, each of these {full} divide againe into 8 equal spaces, as we noted for *Quavers*; you shall bore holes, at every point of these divisions; so as

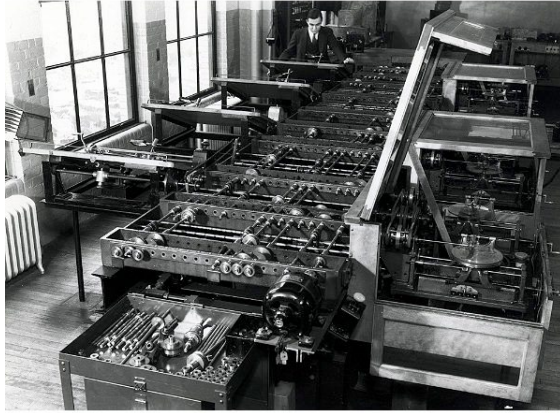


Fig. 9: MIT's Differential Analyser (circa 1930), from the MIT Museum Collection

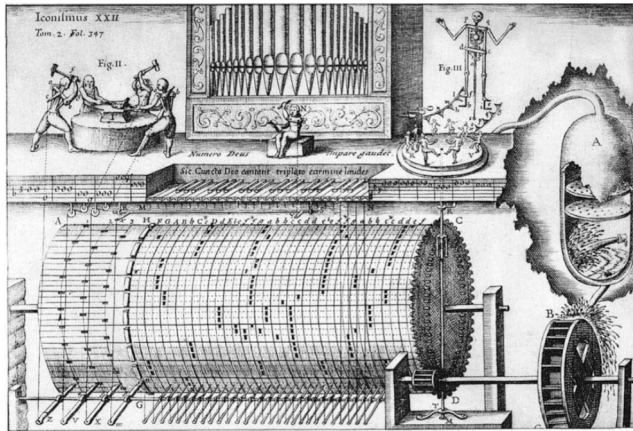


Fig. 10: A diagram of a cam-shaft, Aghanasius Kircher's *musurgia universalis* (circa 1650) (Department of Special Collections, Stanford Libraries, reproduced from Riskin 2016, 40)



Fig. 11: Pierre Jaquet-Droz's *The Writer* (1774)

being {furnished} with a great number {of} *Teeth*, [...] you may insert a new *Composition* or Tunes at pleasure in your *Cylinder* which, the more large & ample it is, will be so much better for our purpose. (Evelyn 1660 as quoted in Riskin 2016, 41)

One could see already the desire to provide for a variety of music tunes with the same set of objects. Changing out the cam-shaft would allow for another song to be played, creating a repertoire for a programmable music box.

Towards the end of the seventeenth century, a new breed of machines began to flourish. Mechanical dolls or ‘androids’ were made by skilled clockmakers who devoted themselves to the development of these curious objects. They endeavoured to make them as closely as possible to their modelled-after subjects, animals and men. Jessica Riskin (2016) refers to them as the First Androids (115). The word, android, is derived from Greek roots which means ‘manlike’. We are of course familiar today with the word, as it represents a major OS many of the smartphones on the market run on. Compared to the cam-shaft, innovators created even more mechanisms for producing musical sounds. By studying human anatomy, they attempted to mimic the physics of human parts and create matching mechanical parts. *The Flute Player* (1737) by Jacques de Vaucanson is an outstanding example. By studying the anatomy of man as well as actual flautists, he attempted to mimic the mechanics with wires, steel chains, gears and bellows in the movement of the flute player. The lungs had three special blowing pressures, achieved through three sets of windpipes. His hypothesis is that blowing pressure, aperture of the flute’s hole and the sounding length would govern pitch. By manipulating these parameters, he managed to attain different notes in the flute player. Vaucanson subsequently developed several more automata, namely a piper with an even larger range of blowing pressures than the Flute Player, a defecating duck and a Tambourine Player. Gearing towards lifelike perfection, Vaucanson reproduced forms of flexible lips, moving tongues, soft fingers and swelling lungs in his android musicians.

Automata followed predetermined algorithms, but later inventions already demonstrate the potential for introducing a programming possibility into these algorithms. Eighteenth century inventors wanted their androids to be somewhat programmable so that they would not simply be one-trick ponies that could only do one thing. This would be eventually achieved by a clockmaker in Switzerland, Pierre Jaquet-Droz. In 1774, he created an android writer in the form of a little boy who would use fresh ink to write on a sheet of paper in an elegant script. *The Writer* (Fig. 11) is a mechanical marvel, as it is the first known programmable machine—it could be arranged to write any message of up to forty characters. The characters could be removed, replaced and reordered. The boy would dip his quill pen into a small pot of ink, and even shake the wrist to prevent the ink from spilling. A rotating wheel with a stack of discs would be read by levers detecting the different shapes of the discs. This would result in the movement of the boy’s

arm and of the slight shift in the paper so that the boy would move onto the next letter. *The Writer* is fully automatic and does not require electrical power, as it has incorporated miniaturisation driving mechanisms that usually are adopted by clocks. Here we see a kind of close-ended algorithm materially embodied in the clockwork mechanism that powers *The Writer*.

The technique of clockwork making is also related to the industrial revolution. After the debut of Vaucanson's fascinating automata, the French government hired him to inspect silk mills in Lyon, hoping that his great skills and genius might offer a way into improving the industry. Vaucanson invented an entirely mechanised loom in 1741, using punch cards to determine the patterns of weaving. The loom could repeat a series of weaving commands pre-determined by the punch cards so as to produce a repeated pattern on a piece of fabric. In order to change patterns, the order of the cards could be manipulated. His invention was later picked up and further modified by Jean-Marie Jacquard (now known as the Jacquard Loom). This invention shows yet another step towards programming, even though the algorithmic basis of this technology is still single-purpose. Parikka (2013) suggests that the loom "consolidated the idea of the program itself, which was far from an abstract principle, but rather a material mechanism for the transportation and implementation of abstractions" (250). Indeed, the loom showed the horizon of possibilities with programming in a material manner. The invention of the loom also marked an important moment as it sparked off large-scale protests in the early stages of industrialisation, in Lyon (1831, 1834, 1848) as well as in Lancashire in England (1826). Automatic looms caused a wave of unemployment as the technical skills of workers were replaced by machines.⁵⁰ The introduction of technology alters the relationship between bodies and labour, whether in modes of labour extraction, or in the rhythm and composition of work itself. In Chapters 3 and 6, we will return again to the factory floor, looking at the changing face of labour and the biopolitics involved in these relevant histories of mechanisation and automation.

The significance of the loom persists today as it often appears in literature on the history of computing. The punch card mechanism was seen as an ancestor to the punch cards and tapes that prototypical computers ran on a century later. It has been discussed that the Jacquard Loom was inspiration for Charles Babbage and Ada Lovelace's Analytical Engine, often lauded as the first computer created. Babbage and Lovelace were hoping to create a general-purpose calculator, programmable to do any kind of calculation, and not just ones relating to polynomial equations that mechanical calculators at the time were designed to do. Babbage's first design, the Difference Machine, required over 25,000 parts in hardware, and was designed to calculate and tabulate polynomial functions. The second design, Analytical Engine, developed together with Lovelace, was much closer to a general-purpose calculator.

As inspired by the Jacquard Loom, they tested the use of punch cards to specify the machine's input and operating instructions.⁵¹

The structure of the Analytical Engine resembled a modern computer. It had a 'store' where numbers and interim results could be held, and a separate 'mill' where the arithmetic processing was performed. The 'store' basically could be seen as a memory device, while the 'mill' is essentially the central processing unit, which would fetch data from the memory in order to input and output data. Babbage imagined a variety of outputs for his engine, including hardcopy printout, punched cards and graph plotting. Even though Babbage and Lovelace never really succeeded in bringing the machine to life, their ideas were important in the history of computation and their work was seen as a significant intellectual achievement of the nineteenth century.

The plethora of automata created between fourteenth and nineteenth century illustrates how programming in its elementary forms was born. They show how these inventors have experimented with expansions to their designs to move beyond single-purpose mechanical engineering. Inventors envisioned the interchangeable cam-shaft for musical boxes, and the possibility of writing different messages with a fully-automatic android boy. *The Writer* essentially is a prototype of read-write formula, and the punch-card technology of the Jacquard loom is a strong basis for the first prototypical computer designed by Babbage and Lovelace. Even the desire of mimicking human activities by machinic means could be seen in the creation of androids—coincidentally also the name for the Android smartphone OS in twenty-first century media. In many ways these examples could be seen as the predecessors of the robotic and artificial intelligence industry today. From single-purpose to general-purpose, we can see from this brief historical sketch that the inventors have attempted to open up and broaden the uses of algorithms. From their fixed, close-ended mechanical roots, algorithms have evolved into programmable code in future instantiations.

Programmability, code, and algorithms

These early automata discussed showcase the desire for a fundamental aspect of modern computing, that is, programmability.

In her entry on "programmability" in *Software Studies: A Lexicon*, Wendy Chun breaks down the difference between analogue machines and digital computers. In analogue machines like network analysers and differential analysers mentioned above, 'computation' takes place "at all points in the circuit in the same time, in a continuous process" (Robinson 2006, as quoted in Chun 2008, 225). Indeed, objects like network analysers and differential analysers are geared towards solving a single equation, by way of an analogical relationship mechanically integrated in all points of the circuit or system. Digital computers, on the other hand, break

down mathematical operations into arithmetical steps. “To do so, they must be programmable; that is, they must be able to follow precisely and automatically a series of coded instructions” (Chun 2008, 225). Code and programmability is what brings algorithms into the realm of general-purpose calculation, moving beyond their mechanical sensibilities.

Algorithms, in a sense, are series of coded instructions. Programmability at the heart of modern computing requires the textuality of computer codes. Code has been a focus of attention in software studies, and has been understood from its textual, material, and representational attributes. In a survey of literature, Chun (2011) points to the fact that many accounts of code tend to characterise them as ‘performative’. N. Katherine Hayles (2005), for instance, writes that running code on computers necessarily causes changes in the behaviour of the machine. Code is meant to be executed and transmitted, and to have a clear effect. Language is deemed performative when a speech act creates a shift in the social reality it describes, with marriage declarations as a classic example—“I now pronounce you husband and wife”. In the pronouncement, the words *do* what they say. From this perspective, code is ontologically performative. Galloway, in *Protocol* (2004), states that “code is the only language that is executable” (165), pointing as well to the nature of code as action-oriented.

Turning to the inter-relation between code and algorithm, Paul Dourish (2016) makes a strong case for distinguishing between the two, even though obviously programming digital algorithms requires code. Algorithms are different on different code platforms, and variations in operating systems, data storage technologies, difference in platforms would require different codings for an algorithm. A simple example is the need for different versions when apps are released on the Apple App Store and on Google Play, or when software is designed for Mac, Windows, or Linux Systems. The same algorithm that applies a filter on your photo on Instagram runs on different codes that are specific to an iOS or Android device. The algorithmic effects, from this perspective, also require interactions with platforms and OS’s, and are influenced by their effects.

Moreover, an algorithm may often need to rely on other bits of coding on other programmes in order to carry out their functions, meaning that an algorithm is rarely a distinct isolated set of code. Dourish (2016) gives an example here.

An algorithm might express, for example, how to transform one kind of data representation into another, or how to reach a numerical result for a formula, or how to transform data so that a particular constraint will hold (e.g. to sort numbers) – but actual programs that implement these algorithms need to do a lot more besides. They read files from disks, they connect to network servers, they check for error conditions, they respond to a user interrupting a process, they flash signals on the screen and play beeps, they shuffle data between different storage units, they record their progress in log files, they check for the size of a screen or the free space on a disk, and many other things besides. An algorithm may

express the core of what a program is meant to do, but that core is surrounded by a vast penumbra of ancillary operations that are also a program's responsibility and also manifest themselves in the program's code. (4)

An algorithm may be implemented through code, but in Dourish's characterisation (2016) an algorithm can be the expression of what an overarching aim is, i.e. "the core of what a program is meant to do" (*ibid.*). Therefore, an algorithm may be distributed through snippets of code throughout a large program, and these snippets of code may not occur together but are distributed across modules or mixed with other algorithmic elements.

To edit an image on Instagram from a folder, for instance, requires first a retrieval and rendering of the photo stored in the digital memory. Every rendering of a digital object, say the opening of a .jpg file, involves a systematic decoding process based on the software, and transforms the encoded image into coloured dots on the screen. When an image is opened in Instagram, a copy is made in an Instagram sub-folder in the photo gallery, which not only copies bits of the image, but also adds data to them. The extra data, for instance, may inform future processes that this image is associated with this specific folder. Display of the image also differs of course when screen brightness and contrast settings are altered. These processes are performed in every operation and alter the data defining this digital object stored on the internal memory. When the .jpg file is opened later on another app, it performs anew based on the predefined coding that is applicable to it. From this we could understand Dourish's point that an algorithm to edit a photo on Instagram also requires a myriad of code and processes outside of the app in question, and relies essentially on the architecture⁵² of the OS.

With these dynamic processes in mind, Boast (2017) suggests that we should use the lens of performance to study the digital world. In Boast's words, an .jpg image for instance

is not rendered and modulated into being; it is fashioned into being, *fashioned via an enormous number of different actors, transforming the object according to predefined sets of scripts—scripts that can be altered, or even radically different*. The performance of a digital object, the viewing of, or interaction with, it on our digital devices, has more in common with the *theatre* than it does with the cinema, phonograph or television. (2017, 177, own emphasis)

The performance of digital media happens at the level of code and process—For each and every process, no matter how extensive, how central or how trivial, layers upon layers of code—layers upon layers of instructions—are called on to create a new performance each and every time. As with the theatre, these are not fixed renderings of the imprint, but are creative processes where both the process of performance, and the object performed, is different every time. The instructions also can be changed: they are changed with each and every update of an application, each and every time we open our digital object in a different app, on a different device, or send it through a different filter. (2017, 177-178)

Viewed through this perspective, the execution of algorithms is also an instance of theatre, where the dynamic performance of code renders their effects. In this sense, algorithms are also performative entities. These performative entities are fundamentally programmable, coded instructions to be performed.

But where exactly is the theatre, the physical location, where these algorithms perform? As Dourish (2016) has demonstrated, digital algorithms are distributed across layers of code in the scaffolds of platforms and operating systems. He goes on to argue that,

“the algorithm”, to the extent that it can be treated as a unit, may not be localized even within a module, never mind within a simple extent of code; and second, that modules may be highly isolated from each other, their code unavailable to each other, perhaps written by different programmers, running on different computers, located within different administrative and management domains, and so forth. (5)

He illustrates this question by referring to the Transmission Control Protocol (TCP) whereby the internet manages the flow of data. This protocol is an algorithm that detects problems with routed data packets⁵³, requests re-transmission of packets which may be lost and rearranges the order of data. Through this, it helps to minimise network congestion by solving problems arising out of network congestion, unpredictable network behaviour or imbalances in the traffic. TCP is a fundamental algorithm for the internet, and is part of regular web browsing (World Wide Web), e-mail, File Transfer Protocol, peer-to-peer file sharing, and media streaming applications. Dourish goes on to explain that because TCP is always about the communication between a source to a destination, it always will be, by definition, running across two different computers. “Those different computers quite likely run two different implementations of the TCP/IP protocols, written by different people, and quite possibly the private, undisclosed code belonging to two different organizations.” (*ibid.*) This means that in some cases, the performance of an algorithm could take place across a set of computers and networks, and cannot be located easily within a stretch of code.

This understanding of algorithms, with its technical basis, shows the main difference between mechanical, analogue algorithms and digital algorithms, i.e. programmability. Programmability as a goal could already be glimpsed in automata like *The Writer*, and in the industrial age when the loom was invented. Digitally, however, algorithms take on an entirely different form, dispersed in snippets of code, to be located along computer machines in networks. If the performance of an algorithm, like that of TCP or the NTP discussed in the previous section, is necessarily distributed across platforms, machines, and networks, time-criticality is also embedded across a variety of objects. Algorithmic time, in this sense, is a rhythm established across a multitude of digital machines, corresponding to the environmental, background-operating nature of twenty-first-century media.

Performance and Disappearance

Let us move now, for a brief moment, to an actual theatre, where the performance of algorithms is taken in literal terms, and is considered in time. In this short excursion, we will see how algorithms perform liveness, illustrating Boast's observations (2017) of digital media's performativity, and befitting the well-rehearsed argument from Peggy Phelan (1993) that performance's only life is in the present. Staging algorithms shows their continued performance, as well as disappearance, in real time.

In Annie Dorsen's works and her essay "Algorithmic Theatre" (2012), she considers the possibility of thinking about algorithms in the frame of theatre. Algorithm theatre is not to be confused with multimedia theatre; rather, algorithm theatre situates itself in the midst of digital technologies, where human actions are inflected in computer processes. In her stage work, she makes use of a technique she terms "algorithmic dramaturgy". Using algorithms to devise text, stage interactions and set up light and sound design, she wishes to study the dramaturgy within algorithmic systems, investigating "their way of ordering the world, the particular kinds of meanings they make, the kinds of narrative structures they imply" (2015, 134).

In her words,

I began thinking about a theatre without human actors, in which that timeworn mirror becomes a glossy screen onto which human audiences project themselves, mediated by data, algorithms and interfaces. We would no longer see ourselves onstage, in other words; we would see an expression of computer-generated, human-ish processes. (2012)

Dorsen's explorations, in works such as *Hello Hi There* (2010) and *A Piece of Work* (2013), place algorithms centre stage ("the programme is the performer") even though the algorithms are not necessarily a distinct embodied entity you could point to. Actors would be using text generated through computer processes, and an entire series of coding would be at work in order to automate aspects of the performance, letting the algorithms make aesthetic decisions.

For instance, in a revamped version of *Hamlet*, the production team tagged each word of the play with emotion scores corresponding to anger, joy, sadness and fear. 'Death', for instance would score high on sadness, fear and anger, and low for joy. Shakespeare's original text was subjected to an algorithmic scrambling/sorting process based on the scoring, and in real time, a new text was generated in the performance. These numerical scores were also translated to lighting systems where each emotion had a specific colour assigned. Based on the scores from the emotion-tags, the algorithm determined the mix of colours in the stage lighting. The text triggers various lighting and music decisions, based upon the pre-programmed algorithms the team has come up with. The generative music algorithm in fact results in variations in the music each time the performance is staged. Throughout

the development process, Dorsen and collaborators have generated a sort of “autonomous theatrical intelligence” (2015, 137).

Thinking about algorithms and their relation to time, Dorsen states that algorithms are, one could say, immortal – if all the humans on the planet were wiped out tomorrow, algorithms currently in action would carry on, buying and selling stocks, transmitting messages to and from satellites above the earth, spamming, tracking the popularity of movies on Netflix, and generally doing their business until the power plants failed. (2012)

This somewhat dark and funny statement reminds us of the environmental nature of twenty-first-century media, and their displacement of human sense as Erich Hörl has argued.⁵⁴ It shows how through automation, some algorithms are simply pre-programmed to continue to run without necessarily human intervention. Dorsen’s own theatrical work stages the algorithms in a way that shows their environmental reach, generating lighting and musical decisions which are ambient and immersive, rendering their effects visible and perceptible. As the performance differs every time, the performance of the algorithms is always in the present, happening in real time, and always disappearing into the next process. Like Boast’s description (2017), these algorithms are called on to create a new performance each time. This calls to mind the definition of the term ‘performance’ as ephemeral. Dorsen nods to this point and reminds us that at the time of writing, Phelan argues that the vanishing act of the present is inherently resistant to capitalist reproduction⁵⁵—“Without a copy, live performance plunges into visibility—in a maniacally charged present—and disappears into memory, into the realm of invisibility and the unconscious where it eludes regulation and control” (Phelan 1993, 148).

When this notion of ephemerality is transposed onto the case of algorithms, the notion of disappearance and resistance to capitalist logic is perhaps no longer applicable. Algorithms perform what is encoded to the effects of what has been pre-programmed. Far from being purely mathematical pieces of coding, these algorithmic performances could be carried out for profit-making purposes embedded by the companies that designed them. The ephemerality of algorithms does not make them resistant to capture, on the contrary, algorithms could be pre-programmed to keep records as part of their execution. Algorithms could perform precisely for the sake of capturing and extracting data, at a microtemporal rate. Algorithms’ non-human timescale generates a notable barrier in terms of human’s agency in paying attention to what has actually been captured. Such attention could only take place after the fact. As an example, Google uses triangulated cell signal and anonymised location data from smartphones to estimate how many people are in a given shop, museum, or restaurant, to calculate visit durations, create popular times graph, and estimate wait times. It also could show a ‘live’ look at how busy a location currently is (Fig. 12). Without our conscious perception, algorithms have been activated on our devices for our location data to be sent and aggregated by

other algorithms that generate visualisations like that displayed in the figure below. Despite the ephemeral ping that is carried out by our smartphones, a lasting record of the visit is registered on Google's servers.

In the 'theatre' of algorithms, algorithmic 'performance' finds a non-human audience in the interconnected networks and servers, and these 'performances' are often registered and recorded as data and metadata. As Dorsen writes,

The running through of the algorithm generates a transcript, a stream of data, which can be recalled thousands of times, or never. [...] The audience's temporal engagement with that expression may be singular, and will pass; but the performance onstage is immune and indifferent to that disappearance. (2012)

This reframes Phelan's ontology of performance for the digital algorithm, noting the implications of an algorithm's ability to capture and record information without the conscious awareness of the human counterparts. Chapter 4 will continue this line of discussion by discussing precisely how algorithmic procedures are entangled with capitalist extraction, as the microtemporal time of their performance is out-of-sync with human experience. I return now to the main discussion of digital algorithms and discuss another important aspect of their features—machine learning.

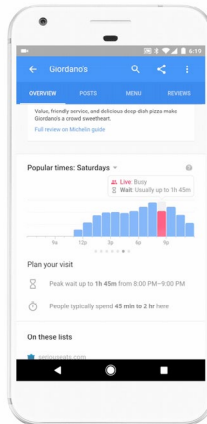


Fig. 12: Google's Popular Times Graph

Algorithms as “Soft Thought”

Programmability of algorithms reaches another level in the realm of machine learning. Algorithms can be fixed procedures whose step-by-step instructions result in predictable outcomes, but they could also be quite unpredictable, inscrutable, and open-ended,⁵⁶ and this is particularly true in the case of machine learning algorithms.

Developments in machine learning have enabled algorithms to self-optimize and generate their own improvements. They can now self-author and self-create. This greatly complicates notions of authorship, agency and even algorithms’ status as tools, which imply an end user. (Ulricchio 2017, 127)

Machine learning can be operated based on several structures, including neural networks, Bayesian analysis, rule-based learning, cluster analysis and, reinforcement learning. Machine learning systems can operate under a combination of learning algorithms in various levels of sophistication. A learning algorithm is programmed to be trained based on a large body of data. In supervised learning situations, the algorithm is given the ‘correct answer’ which demonstrates the desired outcome, and over time, the algorithm becomes more and more adept at giving a ‘correct answer’ when applying the same question to another set of information. An unsupervised learning algorithm looks for structure in the training data by finding similarities and group them in clusters, and infer correlations in the data without the programmers pre-determining what there is to find.

Like other theorists, Luciana Parisi’s *Contagious Architecture* (2013) also argues that algorithms should be seen as a performative entity. Her account of algorithms as “soft thought” is particularly suited in the domain of machine learning as she focuses on the notion of the ‘incomputable’. She posits that at the heart of the computable mathematical code is the capacity of extrapolating patterns from unstructured information. In other words, to compute is to determine the limits of computation itself, i.e. its incomputable horizon.

Computation to her is a form of speculative thought in itself, which she terms “soft thought” (2013, xvii). If we zoom in onto the contingencies of data, we see them in various intermediate forms, while holding the potential to morph into something else.

These abstractions are not actualities but quantic realities, quasi-empirical ideas that find no equivalence in the primary evolution of emotions, or in any form of software architecture of the brain (neural nets, for instance). The point here is that algorithmic actualities are more than performative procedures (they do not perform an idea or show that an idea is equivalent to an action) and less than affective effects (since they are not only aesthetic qualities). It is then possible to define soft thought as the computational tendencies, possessed by an algorithmic object, to conceptually apprehend quantic realities or ideas. (Parisi 2013, 242)

Soft thought suggests that digital algorithms are autonomous modes of being, which while materially embedded within the actual operations of hardware and

software, tend towards the virtual potentiality of the numbers they are made up of. This idea is perhaps most evident in machine learning programmes, where the agency of the algorithm really comes to the fore. In classical programming, the coder would write a series of explicit, step-by-step instructions for the computer to process. Machine learning differs from that because the programmers do not simply write the code, they train the programme to recognise patterns by feeding through a trove of data. For example, to teach a neural network how to recognise a pig, a programmer would show it thousands of photos of pigs, so that the programme would eventually recognise the tell-tale characteristics—how the snout should look like, what the distance between the eyes would be, how the ears should be shaped.⁵⁷ By feeding an incredible amount of data to the machine, it would eventually identify commonalities and possible patterns would emerge from the mix. Here one could recognise the performative procedures involved, where parameters are not fully defined from the start, but emerge in the process of computation.

The incomputable features heavily in machine learning mechanisms as well as big data procedures. Clough et al. (2015) explains how the incomputable is used in big data calculation process. As big data involves processing a large amount of data to find structures emerging between order and randomness, these programmes do not separate noise and information. This is also what machine learning relies upon, vast mountains of data that would eventually be sorted as the programme sorts through the patterning. Noise (the incomputable) is in fact used to structure the parameters for the emergence of information—“Not only do big data technologies seek to parse, translate, and value noise, but also they enhance its production by taking volatility as their horizon of opportunity” (2015, 156).

Parisi’s exploration of soft thought precisely points to a new characterisation of algorithms, one that has moved beyond what has been defined in previous pages as a rule-based procedure laid out by programmers to be carried out. Through machine learning and big data applications, algorithms take on a more dynamic form of reason that is not defined merely by what is pre-programmed into them. They are situated in-between the poles of pure rule-based reason and complete randomness—“as the more it calculates, the more randomness (patternless information) it creates, which exposes the transformative capacities of rule-based functions” (Parisi 2015, 156). This characteristic would be illustrated in the next section through the development of AlphaGo and AlphaGo Zero. The implications of such algorithmic formations would be further analysed in Chapter 4, where I turn to their relation to biopower. Furthermore, in Chapter 5, I will focus on big data and predictive analytics, where I detail on the relationship between soft thought and the future capture of time afforded by such performative algorithms.

From the Mechanical Turk to AlphaGo

To close the discussion on mediated time and algorithms, I would like to juxtapose two inventions from the age of automata with today's twenty-first-century media, the Mechanical Turk⁵⁸ and AlphaGo. The Mechanical Turk is a well-known piece of 'automaton' from the eighteenth century which is a 'genius' at playing chess, while AlphaGo is a prime representative of machine learning that has mastered 'Go', which is notoriously difficult to programme as a game. This exploration will show the key differences between and continuities across the two eras of analogue and digital algorithms.

In 1770 in Vienna, Wolfgang von Kempelen made a chess-playing 'automaton', Mechanical Turk, for the Archduchess Maria Theresa at Habsburg. Featuring an impressive-looking man in a robe and a turban, the Turk sat at a wooden cabinet with a chessboard on top. It was designed to play chess against any opponent who would like to challenge his skills. Von Kempelen demonstrated the Turk's workings by opening the doors and drawers of the cabinet, shining a candle inside each section to show that it was made up of real cogs, gears, and other clockwork components. Audiences were always amazed to see that the Turk would begin the game by seemingly surveying the board with care with a tilted head, then proceeding to pick up a chess piece and begin its gameplay. It could win against its human opponents, and even respond to cheating by returning the piece to the previous spot, so that the human would try again with a legitimate move. The Turk would even knock over all the pieces on the board to show its 'frustration' when the opponent continuously cheated.

Was von Kempelen really beyond his time in crafting automata? The Mechanical Turk was not the marvel it appeared to be, and it operated with a concealed person, who would control the movement of the levers from inside the cabinet. During his tours, von Kempelen would seek out new chess players and teach them how to operate the Mechanical Turk.

The Mechanical Turk was an invention that showcased the intelligent tricks one could play given the availability of clockwork designs and public interest in automata. As an artefact from a bygone era, it shows the dream of programmability, a responsive chess-playing algorithm that could play against its human opponent, much like other automata discussed earlier in the chapter. It also shows that the deep fascination in automation, and the excitement of pitting machines against humans is already present. IBM eventually did invent DeepBlue, a chess-playing algorithm that successfully beat its human opponent in 1996.

Today, we have not only come very far from the Mechanical Turk, we have also developed newer and more skilled AI that conquer not only chess, but also Go. In 2015-2016, AlphaGo successfully played what has long been known as the 'most difficult' game for AI to beat. Go⁵⁹ is notoriously difficult because of

algorithmic time, and the speeds of processing which are completely unmatched with human consciousness.

Not only is AlphaGo a marvel of programming and machine learning techniques, it also shows the reach of programmability in the domain of automation. By 2017, AlphaGo's developers have come up with AlphaGo Zero, which only uses 4 TPUs and a single neural network⁶¹. This time, the machine learning training was unsupervised, meaning that the AI simply played against itself continuously. No human playing data was fed into its system as part of the training, and AlphaGo Zero had only knowledge of the rules of Go. In 3 days, it has surpassed the abilities of AlphaGo which took months of training, and beats AlphaGo by 100 games to 0. And how long does it take for AlphaGo Zero to make a move? "During training, AlphaGo Zero used about 0.4 seconds of thinking time per move to perform a look-ahead search—that is, it used a combination of game simulations and the outputs of its neural network to decide which moves would give it the highest probability of winning" (Singh 2017, 336). This new Go-playing programme is characterised by human players as "alien" and "from an alternate dimension" (Chan 2017). Funny enough, Parisi refers to the soft thought of computation as the "emergence of a *new alien mode of thought*" (2015, 136; original emphasis). As an AI that does not need to learn from historical data produced by humans, AlphaGo Zero fully illustrates Parisi's characterisation of the incomputable—

algorithms, this dynamic form of reason, rule-based and yet open to be revised, are not defined by teleological finality, as impersonal functions transform such finality each time. This is not to be conceived as a mere replacement or extension of human cognitive functions. Instead, my point is that we are witnessing the configuration of an incomputable mode of thought that cannot be synthesised into a totalizing theory or program. (2015, 135)

The capabilities of AlphaGo Zero show the possibility of algorithms which no longer are modelled after the human (e.g. by training upon play data). Older forms of algorithms function based on modelling relationships in its parts, like automata that mimic bodily functions from Vaucanson's Flute Player to the Mechanical Turk, or network analysers that are essentially models of city grids for electricity calculations. The examples of AlphaGo and AlphaGo Zero paint a clear picture of the potentiality of algorithms, not only to perform what has been pre-programmed, but also to exceed what has been coded by testing possibilities and transforming the 'finality' of what could be achieved. This shows a growing disjuncture between human consciousness and machinic soft thought, not least in the temporal scale from which soft thought is prehended.

Conclusion

This chapter has outlined my two definitions of mediated time. Firstly, clocks establish an external reference to solar and sidereal ‘natural’ time, by mediating time through its mechanical algorithm. Secondly, time is mediated in the rhythms of technomathematical tempor(e)alities in computer machines as time-critical media, a non-human-centric account of time. In my study, I frame Ernst’s framework of this machine-mediated, non-human-centric time as algorithmic time. Clock time and algorithmic time both belong to the fabric of our experience of time today, representing two different temporal scales from which temporality could be studied.

Throughout the chapter, I have surveyed a variety of historical clockwork objects as illustration of the algorithmic basis under which time and other calculative functions have been expressed. This focus on clockwork objects reminds us of the materiality behind contemporary media. Ernst’s time-criticality is attentive to the material nature of computer machines, in the emergence of time inside machines as the rhythm of various signals that are processed. Signal traffic in twenty-first-century media is as material as it is invisible as wireless networks.⁶² Indeed as Parikka (2013) argues,

we should not neglect the fact there are such things as analog computers—too often forgotten now in the midst of discourse of digitality—and that all computers are, to an extent, analog. Wendy Hui Kyong Chun emphasizes this point: analog computers are about measuring, digital computers about counting. But even the latter “do so by rendering analog hardware (vacuum tubes, transistors, etc.) signal magnitudes into discrete units” (Chun 2008, 225-226). (Parikka 2013, 250)

The materiality of algorithms as evidenced in clockwork automata shows a fundamental understanding of algorithms as sets of procedures. We see programmable automata as important intermediary steps and inspiration for the eventual programmability of algorithms today. Their operations disappear into the machines outside of our perceptual grasp, and yet, despite their fastness, they are not ephemeral. Algorithms in twenty-first-century media are prone to recording, which

[operate] primarily at the level of sub-experiential and microtemporal unities and in the service of future-directed, often non-deliberative (or better: not traditionally deliberative) action in the present; typical forms include bits of computational data and fine-grained inscriptions of analog fluxes. Moreover, recording now operates predominately in the service of communication between machines necessary for the operation of our smart phones and other microcomputational devices. (Hansen 2015b, 40).

Indeed, algorithms become end-users as well, embedded in machine-to-machine communications, generating their own tempor(e)alities. In their own right, algorithms become their own interlocutors. This is most evident in the training of AlphaGo Zero, which is essentially developed through an AI playing against itself. The dynamic quality of machine-learning algorithms evidenced by this example

Chapter 2

shows that the mechanical dreams of creating truly automated automata from previous centuries have found expression in the AIs of today.

Looking forward, this chapter lays the groundwork for the inspection of the biopolitical effects of mediated time historically, and the intensifications of their biopower in twenty-first-century media in Part II. In the next Part, I will synthesise what has been covered in Chapter 1, disciplinary analysis and biopolitical theory, with the discussion here in Chapter 2 on clock time and algorithmic time regimes. Through several case studies, I illustrate the interrelations between mediation of time and their biopolitical effects. Chapter 3 looks at clock time and associated historical examples, while Chapter 4 looks at algorithmic time, both furthering the current discussion by turning to the political implications and effects of these technological developments.

Part II

Biopower in Mediated Times

3

Historical Antecedents: Clocks, Discipline, and Performance of Labour

In Part 1, I have offered a theoretical exploration of biopower, looking at its key features and its roots in discipline. I then turned to the ‘techno-’ and ‘chrono-’ dimensions of this study, expounding upon the material dimensions of time mediation, showing that clockwork mechanisms and automata could be taken as historical mechanical antecedents to algorithmic time. Building upon these theoretical and material frameworks, Part 2 bridges clock technologies and time practices with concepts of biopower, discipline and performance, and focuses on historical and contemporary instantiations of techno-chrono-biopolitics.

How do operations of clockwork express discipline and biopower? This chapter looks at the connection between biopower and time practices that have been drawn historically by cultural studies scholars and historians through a series of case studies. These authors draw connections between the ownership and use of particular time-telling devices and how their disciplinary power is performed in their respective contexts. These cases provide a historical basis to the concept of techno-chrono-biopolitics that I sketch out in the current study.

The chapter is organised around three themes, focusing on the multiple ways discipline and biopower take shape in these cases. These three themes are labour, governance, and race and coloniality. I analyse how time practices are entangled with each of these themes, with reference to Foucault and his contemporaries. These three themes would return again in the rest of the dissertation, their biopower intensified in algorithmic regimes of time. The three themes are organised as follows:-

i. Time, Labour, and Performance Management

I discuss this section in connection with E. P. Thompson's case study of industrial England. Thompson's seminal work "Time, Work-Discipline, and Industrial Capitalism" (1967) on clock-time and industrial capitalism inaugurates an entire field of time studies, by proposing the inter-connections between the rise of factory work, clock-time, and its disciplinary effects. I look at how labour is controlled and organised by time schedules and time-signalling, and how working alongside machines induces new rhythms and demands specific forms of bodily performance by workers.

The focus on labour is important in this pre-history of techno-chrono-biopolitics because labour is reterritorialised in the form of digital, immaterial labour in digital culture. Chapter 4 will give an overview of digital labour and its significance in the biopolitical extraction of labour power, and Chapter 6 will study the phenomenon of Quantified Self as a regime of durational digital labour, bodily surveillance, and discipline.

ii. Governance through Time

Time adoption can be a highly political subject. I approach the theme of governance through the alignment of the world in GMT, and the political significance of time-centred policies in East Asia, where Japan actively adopted mechanical time as policy so as to strengthen the country's position as an imperialist power within Asia and be on par with Western global powers. During its colonial occupation of Taiwan, clocks, noonday guns, and other time practices were adopted as colonial tools of disciplining. Taiwanese historian Shao-Li Lu (1998) offers a pioneering account of how Japanese time discipline was implemented in Taiwanese factories and villages, with extensive quantitative data that shows the gradual adoption of time technology on the island during the colonial period.

While these governance examples take up temporality in rather literal terms, time is implicated in a completely different way in the digital era. Governance in algorithmic time finds another expression in the predictive regimes of algorithmic models, where big data and predictive analytics govern through future-oriented models of time. Chapter 4 will continue the theoretical exploration and Chapter 5 will further elaborate on the contemporary issues of big data and predictive analytics and how they are implicated in techno-chrono-biopolitics.

iii. Time Technology, Race and Coloniality

This section discusses the racialised dimension of discipline and biopower, as exemplified in a second colonial context, slave plantation work in the deep south of the US. American historian Mark Smith (1997) studies clock possession and its relation to slave plantation work in the Antebellum era. I also look at how colonialism has played a role in the invention and refinement of clock technology through the object of the marine chronometer.

Questions of race and coloniality continue into the digital era. The issue of race is featured in the discussion of algorithmic time in Chapters 4 and 5, as coloured populations are often deemed unfairly disadvantaged in the operations of big data and predictive analytics. In Chapter 6, I turn to the racialised necropower of techno-chrono-biopolitics that divides the global population into those who are worthy of living and those who are let die.

These case studies illustrate various practices that have coagulated around the phenomenon of clock-time, showing how the invention of such technology provides new ways of relating to time, and how time could be manipulated into a disciplinary regime. The focus on race and coloniality as well as on non-Western examples offsets Foucault's shortcomings of focusing too much on the European context, and considers the global scopes of discipline and biopower historically. The overarching aim of Part 2 is to demonstrate how time and its technologies are linked to the disciplinary and the biopolitical. The focus of this chapter is on the mechanical time regime, while the next chapter looks at the algorithmic time regime.

Time, Labour, and Performance Management

In *Discipline and Punish* (1991), Foucault begins his analysis on docile bodies with the ideal figure of the late eighteenth-century soldier. Through correction of posture, the soldier's body was gradually moulded into the desired shape (1991, 135). Movement is repeated and learned, patterned into habits. The body, formless and pliable, is remade to function more efficiently and powerfully like a machine. For Foucault, this is a demonstration of the mechanics of discipline, one that could increase the forces of the body to economic terms of labour utility, and make these bodies obedient and docile (1991, 138). Outlining the history of discipline, he makes a passing remark on automata as "political puppets, small-scale models of power" (1991, 136), stating it is no coincidence that Frederick the Great, the King of Prussia greatly known for his well-trained and disciplined armies, were obsessed with them.

Discipline, as defined here, makes bodies more subservient to the governance and control of the master, whether in the form of a capitalist, an owner of a factory who keeps a keen eye on his employees, or in the form of a sovereign power, exerting power and will through policy.

In Chapter 2, I outlined how the experimentation and design of automata gave rise to automation such as the invention of the loom. Mechanisation is indeed an integral component of the scientific advancements contributing to the Industrial Revolution. Kara Reilly argues that the shift from the theatres of automata to the advent of automation marks a significant cultural moment towards the shift into mass-produced workers (2011, 150). By this, she refers to the larger phenomenon of factory work and industrialisation in the incidence of machinic automation. Historian Simon Schaffer (2013) is convinced that the inventions surrounding automata reflect a general desire for docile bodies. He establishes this point with his analysis of the Mechanical Theatre in Hellbrunn Palace in Austria, commissioned by Archbishop Jakob von Dietrichstein in 1740s, which comprises over 200 wooden-carved moving figures. These figures perform mechanical algorithms pre-programmed in the design and stage the scenes of life of eighteenth-century Salzburg: below in the town square, the bustling activity of carpenters, potters, bakers, masons, street performers; above on balconies and towers, aristocrats look on as their subordinates toil away, duly performing their duties. Schaffer (2013) argues that wooden figures in the Mechanical Theatre embody docile bodies, subjugated under the gaze (and control) of the aristocrats. In his view, the theatre performs the desire for ‘perfect’ subjects of the state. Extending his point, the incessant labour of performance carried out by automata shows a vision of the body that could be mechanised, and ideally, these bodies are obedient and subservient to the algorithms that govern their movements.

Indeed, it is not only the material invention of automated mechanisms that matters, but also the cultural implication of discipline that arrives onto the factory floor. Discipline appears in two forms—time practices which serve to keep labourers in check and on schedule, and the rhythm of mechanisation that requires bodies to keep up with them. Mechanisation of production essentially is the importation of mechanical algorithms into the factory, which demands changes to the worker’s body. Specifically attuned to the rhythms, the body is disciplined into one that coheres with mechanical algorithms. As argued in Chapter 1, one could observe that time is part and parcel of Foucault’s disciplinary mechanisms, and is incorporated into the operation of biopower. His analysis in *Discipline and Punish* already foreshadows the importance of temporality in techno-chrono-biopolitics. The following case study will further elaborate on how these points are connected from the perspective of the English factory in the Industrial Revolution. Through

Thompson, I will show how labour is intricately coupled with time, and the docility of the body extends well into the temporal domain.

“Time, Work-Discipline, and Industrial Capitalism”

Thompson’s work on the relationship between clocks and discipline has been fundamental to the study of time from cultural and sociological perspectives. He locates the spreading of time-discipline at the moment when industrial capitalism grew in England. Time practices in the factory shed light on how workers are taught time discipline and are ushered into an era of machines and machinic productions. To this day, Thompson’s work remains foundational to the study of time-related subjects under labour and capitalism.

In the essay, Thompson studies the availability of clocks, referring to the erection of large church and public clocks in market towns and cities in fourteenth century as well as the advancement in technology which brought these clocks in seventeenth century into the household in the form of grandfather clocks. He quotes clock and wristwatch ownership data to show that by the eighteenth century, both clocks and watches became commonplace as articles of luxury and of convenience. Coincident with the popularisation of the clock was the arrival of large-scale machine-powered industry, which generated a historical link between the use of the two technologies. Thompson recognises that labour patterns vary between irregular, task-based types of work (e.g. those reliant on weather, thereby conforming to a more ‘pre-industrial’ rhythm) and regular, well-calculated work with machinery (industrial rhythm). The gradual turn to clock-times is an outcome induced by the increase mechanisation of production techniques.

[w]hat we are examining here are not only changes in manufacturing technique which demand greater synchronisation of labour and a greater exactitude in time-routines in any society; but also these changes as they were lived through in the society of nascent industrial capitalism. We are concerned simultaneously with time-sense in its technological conditioning, and with time-measurement as a means of labour exploitation (1967, 80).

Throughout the nineteenth century, one could observe the transition from the measurement of work based on tasks to the measurement of labour completed on time-bases; some jobs were paid according to “weekly wage-labour, supplemented by task-work” (1967, 79). This gives rise to the growing technological conditioning with the clock as the grand external reference that governs everyday labour. This type of calculation fits perfectly into mercantilist doctrines against idleness at work, as rewarding workers based on time-spent-on-work discourages indolence and slacking off by taking long breaks.

The clock is both a symbol and a material object that signals the rhythms of labour. Thompson refers to a law book created by Crowley Iron Works, which in mid- to late eighteenth century was already used to implement time-discipline at its factories. The owner attempted to eradicate the villainous attitudes of workers who

merely appeared at work but did not actually rendered services and idled away time. The warden of the mill kept time-sheets of employees, and kept track to the minute when they were in fact working. The warden was also advised to ring the bell at the open and close of the day and before and after meal-times. The account of time for each employee would then be registered and sworn in an affidavit (1967, 81-82). Time-keeping is done here also through aural means, and does not only rely on the reading of clock-faces.

Interestingly, Thompson refers to a case in Dundee where clocks were merely used as performative devices to discipline workers at textile mills. Factory workers testified to the fact that clock masters and wardens adjusted clock hands in secret, such that the clocks lost their real functions as measurement devices, but became “cloaks for cheaterly and oppression” (1967, 86). Some even created petty trick devices to interfere with the regularity of the clock, so as to shorten meal times and lengthen work durations. Even though the workers knew very well they were manipulated, they still followed the ‘clock’ and performed their tasks accordingly.

In addition to clocks, the clocking-in time recorder machines at such factories were also important machines that shaped the environment of time-keeping. Factory workers would have to clock in and out to indicate the hours of being at work⁶³.

Thompson writes that schools started incorporating punctuality and regularity rules into their rules in around the same historical period, demanding that children should begin to respect such orders. This was, in some way, meant to prepare them for factory life, so that they would be “habituated” in the culture of the industry (1967, 84) from a young age. Children as young as four years old were expected to begin a strict regime of study and work, so they would become docile subjects for labour extraction. This fits fully into Foucault’s mentioning of timetables as a kind of disciplinary measure for students to learn time discipline, as well as his identification of schools as one of the institutions where discipline is imparted.⁶⁴

With reference to Thompson, mechanical time has been appropriated as a tool for managing people’s labour. Even though scholars criticise that Thompson sometimes makes a deterministic connection between time and discipline and the rise of capitalism, it is clear that clocks, time signals, and clocking-in machines generated habits of calculating labour in time, and of disciplining factory workers with visual and aural cues. Glennie and Thrift (1996) believe that it was not only the clock objects themselves which contributed to the rise of time discipline. Time discipline coincided with other broader cultural changes, which included a transformation of work ethic and orientation to labour which may be attributable to seventeenth-century Puritanism. Their criticism is that Thompson is too reductionist in designating clock time as unnatural, omnipotent, and oppressive, and that he has failed to see also the liberatory potential inherent in the technology. Martineau

(2015) in turn criticises Glennie and Thrift (1996) for being too committed to an account of multiplicity when analysing the technologies of time and have failed to fully acknowledge the disciplinary dimensions that arrived with time technology. While it may be true that other factors might have contributed to the rise of time discipline, it is undeniable that time-signalling and time-tracking have been used in various ways and in various contexts to organise work and control its subjects.

Mechanical time is essentially a technologically-generated rhythm that is imposed on lived temporality. The introduction of mechanical time came hand-in-hand with specific values, and placed pressure on the labouring masses. In the words of Martineau (2015),

[c]lock-time rather delineates a series of limits and pressures on human individual and collective temporal agency that tends to narrow the array of possibilities of temporal experiences and to push for the conformity of temporal practices with the abstract forms of clock-time, often at the expense of concrete time-experiences and lived temporalities. (11)

When mechanical time became habituated, non-productivity became a sin, and the category of leisure time was created in opposition to work time. According to Thompson (1967), leisure actually came to be considered as a ‘problem’, because time was equated to money, and one should maximise one’s earnings. In a way, this opened up another venue for control as leisure time could be capitalised. Here, we see a hint of the productivity of power, as I have discussed in relation to Foucault in Chapter 1. The demarcation of work time marks the rest of our waking hours as ‘leisure’ time and generates another domain from which a particular aspect of life could become controlled. At the time of writing, Thompson imagines an automated future where humans no longer have to spend as much time in manual labour as machines come to our aid, and questions if it in fact means that the new-found leisure time gets eroded by capitalist logic, much like work time.

If we are to have enlarged leisure, in an automated future, the problem is not “how are men going to be able to consume all these additional time-units of leisure?” but “what will be the capacity for experience of the men who have this undirected time to live?” [...] it is a question of how this time is put to use, or how it is exploited by the leisure industries. (95)

Thompson is acutely aware of how ‘leisure time’ does not necessarily mean a time of freedom, but that men would likely still be under the influence of what he calls “leisure industries”, that these times would be absorbed into capitalist exploits. He questions the capacity for people to actually have “undirected time” spent away from the grips of time discipline and control. In the next chapter, the focus indeed will turn to “leisure industries” in the likes of Facebook and Instagram which essentially form an attention economy for our time. Thompson may well have predicted the rise of industries that seeks to monetise attention and time,⁶⁵ which is heavily critiqued in the digital labour discourse. Thompson refers to early capitalism as the moment where time’s equivalence to money is consolidated as

time becomes a tradable unit, and this adage of ‘time is money’ would reappear in a different manner from the vantage point of digital culture.

Performing Rhythms

Although Thompson’s account of time discipline highlights the central disciplinary power of the clock, it misses out on other aspects through which time discipline can also be imposed. The factory offers yet another dimension of time discipline—through synchronisation with machinic rhythms. In order for tasks to be smoothly carried out, the workers have to be increasingly attuned to the machinic pace of machines in their factories. The body must also function in a rather mechanised manner while working with machines, in terms of rhythm and movement. These rhythms of mechanical work time later develop into what is now known as Taylorism, a method of scientific management still taught today in management studies. By studying time and motion, Frederick Taylor (1911) streamlined factory processes by breaking down tasks into smaller components, each motion studied to be made more efficient,⁶⁶ and recombined into better organised tasks. Through such intensive investigations, simplifications, and reorganisations, the efficiency of carrying out tasks increases and so does productivity. In an ideal scenario, workers would work in harmony with the machine, and would be closely supervised to maintain best possible speed and efficiency. In a way, the bodies at work have to become machine-like.

This brings to mind the modern-classic scene of Charlie Chaplin in *Modern Times* (1936), who heftily turns screws at a machinic pace, conscientiously keeping up with the rhythm of the process. If he were to miss a screw/ miss a beat, he would have to try to catch up and double his speed so as to keep up with the moving chain. Other workers on the same production line would also be affected, and the entire rhythm of work would be disrupted. Chaplin indeed struggles continuously, itching, sneezing, distracted by a bee... his clumsiness offering comic relief for the viewers. When a supervisor yells and asks him to keep up, he cannot even stop to protest—for fear of falling further behind. His body, subordinated to the machinic rhythm of the line, simply continues the spasmodic ‘dance’ of screw-turning even after the tools have been taken off his hands and he is seen moving away from the assembly line for a break. Chaplin then clocks out of the machine for a smoke in the bathroom, but while in the bathroom itself, a blown-up face of his supervisor appeared on a surveillance screen à la *Nineteen Eighty-Four*, urging him to return to work and stop being tardy.

The factory rhythm is comparable to what Foucault has described as “temporal elaboration of the act” (1991, 151) in relation to military marches. For military marches, soldiers have to perform a pre-defined “anatomo-chronological schema of behaviour” (152) in order to march in sync, both in movement and in rhythm, with

other soldiers. Not only are the positions of head, torso and limbs choreographed to the last detail, so is the duration of each movement, and the order of successive movement. Discipline, Foucault writes, requires an art of “composing forces in order to obtain an efficient machine” (1991, 164), and these forces include temporal rhythms. Factory workers on an assembly line, like in *Modern Times*, move with machinic rhythm—“The time of each must be adjusted to the time of the others in such a way that the maximum quantity of forces may be extracted from each and combined with the optimum result” (1991, 165). In classic Taylorism, both human and machine components would have to work perfectly in conjunction with one another, in time. Through Chaplin’s lively embodiment, we see how a worker’s body is made into an object of rationalisation, a docile instrument of production (Rogers 1994). It is a body absorbed in and subordinated to the movement and rhythm of work. It is noteworthy that the body’s docility is not just defined in mobility, but also in temporality—“[t]ime penetrates the body and with it all the meticulous controls of power” (Foucault 1991, 152).

In *Perform or Else* (2001), Jon McKenzie sees Taylorism as an important step in the history of performance management. Taylorism is framed as the hallmark of rationalisation in its heavy reliance on standardisation, structured centralised control, and machine-like conception of work.

For Taylor, worker performance is something that must be experimented upon, modified, and tightly controlled under the close supervision of scientific managers. Efficient performance results from minimizing or removing individual initiatives and differences, “tailoring” them to fit “the one best method.” (McKenzie 2001, 66)

The heavy focus on supervision and on disciplining individual workers shows that Taylorism falls more on the side of discipline power in Foucault’s conception than biopower—

It is only through the *enforced* standardization of methods, *enforced* adoption of the best implements and working conditions, and *enforced* cooperation that this faster work can be assured. And the duty of enforcing the adoption of standards and of enforcing this cooperation rests with the *management* alone. (Taylor 1911, 83 as quoted in McKenzie 62; original emphasis)

It also relies upon the vigilant supervision of managers. Such stringent enforcement of standards are present in factories in the present day, such as the Foxconn factories which I will discuss in Chapter 6. But over time, other methods like performance management are also added to the scene. McKenzie states that while performance management includes such disciplinary standards in its midst, it is much more concerned with “empowering employees”, and developing workers’ “creativity and intuition” alongside other established scientific methods (*ibid.*, 69). Rather than the monolithic best method that Taylor was keen to uncover, performance management is open to a variety of methods as long as the larger goals of efficiency and efficacy could be achieved. Performance management, however,

has not let go of the focus on individual performance, except that incentives, motivation, encouragement, and invisible threats of no bonus, no promotion, or getting fired as represented by the “—or else” take the place of actual punishment. McKenzie makes clear that performance has not displaced discipline, or put performance in opposition to discipline, but rather “performance is, in part, a displacement of disciplines, a breaking-down, transformation, and reinscription of its discourses and practices within an entirely different milieu of forces.” (*ibid.*, 179). This is in line with Foucault’s point that later regimes of power do not replace older forms but simply add to them and reinvent them.

As we move into the digital age, we see how these time-integrated standards are imparted in more refined manners. The Amazon picker example from the Introduction shows the manic rhythm of work inside warehouses. But in lieu of human managers, handheld devices provide the disciplinary ‘beeps’ that whip the labouring bodies into performing the desired rhythms. We can look at these contemporary examples from the historical perspective of labour organisation through Taylorism. Taylorism belongs to a lineage of rationalised thought and practice⁶⁷ in the factory space, that requires the obedience of bodies along an assembly line. As workers toil with the rhythms of the machines under the watch of their foremen and managers, the rationalised time and motion studies of Taylorism mark the time-integrated disciplinary standards of the industrial age.

Governance through Time

The discipline of time, however, can be found in other institutional spaces beyond the factory. In this section, we turn to our second theme: how time alignment is strategically used as a means of governance, and the symbolic meaning of time systems. Time in this definition becomes a *dispositif* of control, and of governance. In the examples, we would see how time is imposed upon communities for the sake of governance, whether for symbolic effect, or through actual policies, to officially spread mechanical time. I begin with snippets of history around Greenwich Mean Time, and move onto accounts of time discipline in Japan and Taiwan. These examples will show yet another facet in the disciplinary dimensions of techno-chrono-biopolitics.

GMT: The Politics of Standardised Time

Eviatar Zerubavel (1982) suggests that a standardised time system enables the collective organisation of time, and provides a global reference framework. This framework in turn makes temporal coordination at the level of the community, nation, and the world possible. While standardisation of time is crucial for practical

purposes, it also has strong symbolic effects. Greenwich Mean Time (GMT) is a consolidation of a world system already in place, where the performed centrality of the world rests in London, reinforcing the colonial world order. The manner of adoption of standardised time by various countries also shows the politics behind the seemingly-innocuous standardisation.

Prior to standardisation, layers of time could be observed from local time to observatory time, from national time to global time. Before 1840s when the railroad was built, it was not necessary to calibrate local times because communication was not instantaneous and it did not require precise timekeeping. When people travelled by carriage and horses, they were not concerned with the variations in local times in their destinations. Each city, town, or village kept its own time, and at one point in history, these was “a plurality of local times which were not coordinated with one another, since no locality was concerned with the local times of other localities” (Zerubavel 1982, 5).

It was the British Post Office which became the first public service to provide regular and strict schedules with its mail coaches on the railroad. They wanted to provide a regular service of mail collection and delivery, so that the intercity mail coaches out of London could connect with the local mail coaches in the countryside for accurate delivery. To do so required coordinated times amongst cities. At the time, they relied upon the Royal Observatory in Greenwich, and every mail-coach guard carried a timepiece that indicated GMT. Clocks in various post offices had to be tuned too, and this practice had a trickle-down effect that required coordination and obedience to this time system for every person involved in the mail delivery. A stable boy, for instance, would have to get the horses ready and answer to the post office guard at relay points, so that the guard could show up for the exchange punctually (Bell 2004, 45). This became “the first attempt in history to synchronize different communities with one another” (Zerubavel 1982, 6).

Because postal service was only used by a select social circle, it was not until the introduction of widespread railway transportation that the standardisation of time became important to the larger English population. Communities became much more interdependent in order to achieve temporal coordination, creating the need for a standard of time that the whole country would conform to. The first railway timetables in fact incorporated the plurality of local times as mentioned above, and had to be translated to GMT. Plurality of times was clearly an obstacle to the smooth running of trains, making it all the more urgent for there to be a standardised time system to support the development of train travel. By 1840, Great Western Railway adopted GMT with its timetables and train stations, and other railway companies followed suit. By 1855, 98% of public clocks in Britain were set to GMT (Howse 1980 as quoted in Zerubavel 1982, 7).

For a country the size of the USA, which stretches across more than 57 degrees of longitude, the plurality of local times was a real headache to the railroad companies. The Union Pacific Railroad (which still is in operation today) operated the First Transcontinental Railroad covering more than 1900 miles between San Francisco Bay and Iowa. At one point in history, the company had to operate its trains on no less than six different time standards (Holbrook 1947; Stover 1961 as quoted in Zerubavel 1982, 8). For effective use of the railways and to prevent accidents, railway companies attempted to standardise time for the entire North American continent, giving rise to the concept of a timezone.

It was cross-border travels within Europe that marked the need for a standardised time system and the use of timezones internationally. The performed centrality of GMT appeared after the 1844 International Meridian Conference which set GMT as the Prime Meridian of the world, a line which one could visit today and take a selfie with at the Royal Observatory in Greenwich.

Why was GMT selected as the Prime Meridian? According to Zerubavel (1982), the history of maritime travel was what led to the centrality of GMT.

Most delegates [at the International Meridian Conference in 1884] must have regarded the Greenwich meridian as the obvious choice. After all, it was within the domain of navigation that the need for a common prime meridian was most strongly felt, and Britain was clearly the world's principle maritime power. Since it provided most of the world's admiralty charts and nautical almanacs, no less than 72% of all the world's floating commerce was carried out with navigators determining longitude as well as time in accordance with Greenwich. (1982, 13)

The British Empire also had over 70% of telegraph lines, undersea cables around the globe which meant that it had most control over electric telegraphy, and could in effect “interrupt the supply of time to any other nation” (Siegert 2015, 157). The main opposition came from France, as Paris was only 2 degrees apart from London in its longitude, showing that much symbolic value was attached to the notion of the Prime Meridian. Paris Mean Time was awkwardly nine minutes and twenty-one seconds out of step with the rest of the world (Palmer 2002). France in fact abstained from voting for the adoption of Greenwich Mean Time at the Conference. The designation of GMT as the centre of the world, 0 degree longitude and 0 degree latitude, affirms in a way the historical status of England as Empire and as the dominant maritime power. This is clearly an image of the world order at the time. Jack Goody (2007) listed GMT under “the theft of history”, also the title of his monograph, as one which celebrates the horological and cartographical finesse of British maritime navigators and scientists, but hides within it the imperial and commercial ambitions of the Empire. By designating London as the centre of the world, time has essentially been ‘stolen’. Goody critiques the Eurocentric and Occidental biases embedded within this conception of time.

After the International Meridian Conference, countries in the world gradually adopted standard time and standard timezones. The symbolic meaning of standard time is quite significant. China currently refuses to split its country across several timezones and follows Beijing Standard Time (GMT+8). But this was not historically the case. In 1912, the newly formed Republic of China established five different timezones in the country, only to be revised by Chairman Mao Zedong in 1949, under the stronghold of the Communist Party. For the purposes of national unity, the country is to live under Beijing time. To the detriment of those living in the western part of the country, Xinjiang Uyghur Autonomous Region, Beijing time means the sun rises at around 10AM in the winter, and sets at midnight in the summer. For the Muslim population residing in Xinjiang, the timezone imposed on them adds difficulty to observing the holy month of fasting during Ramadan. The Uyghurs are known to prefer to use their own time, set two hours behind Beijing. Writer Ruth Ingram (2013) states that “dissent is pure clockwork in far western China”, and reports that to the Uyghurs, the time used by one’s watch or clock at home could indicate whether one is an ally to the Uyghurs or a patriot towards Chinese rule. As China continues to crackdown on Xinjiang’s Muslim population, which time to follow becomes a highly political matter, and is a symbolic sign of resistance and solidarity against Chinese rule.⁶⁸

Such an example reminds us that timezones are in fact constructions, amenable to change and manipulation to suit political priorities. In 2007, Venezuelan president Hugo Chávez moved the national meridian westwards and set national time thirty minutes back to “put Venezuelans biologically more in tune with the sun” (Carroll 2007). This was reversed in 2016 by his successor Nicolás Maduro, who proposes that an extra half-hour of sunlight will allow for better electricity saving (*The Guardian* 2016). In 2015, Pyongyang Time is set back 30 minutes in order to symbolically liberate itself from the Japanese timezone, signalling a break from historical Japanese imperialism.

Standardised time is not the only political item on the agenda—so is the standardised Gregorian calendar. In 2016, Bolivian president Evo Morales has expressed the wish to switch to indigenous, ancestral calendar in order to rebuild national identity. The indigenous calendar has 13 months of 28 days each, and the day of winter solstice, June 21st, is considered the beginning of the year. As a protest to the cultural logic of clocks, Morales also famously turned the clock on the Bolivian Congress backwards in 2014, dubbing it “the clock of the south”. It is a clock that runs counter-clockwise with the hour numbering reversed (Fig. 13). Morales expressed at the time, “Who says that the clock has to turn one way? Why do we always have to obey? Why can’t we be creative?” The special clock is said to make conscious the fact that Bolivia is in the global south, not the north, and that Bolivians could challenge norms as established as time and be more creative.



Fig. 13: Clock on the façade of the Bolivian Congress (Source: *The Guardian*)

From the discussion above, we could see that time is used as a political ploy at times and can have strong symbolic meanings for national identity, as countries opt for their own timezone arrangements. This linkage between time and identity would be revisited again under the theme of race and coloniality, as well as in the following section on Japanese and Taiwan.

Time as Policy

Time is imposed from above, as government policy. I now turn to a historical example to further illustrate the political dimension of standardised time. At the 1844 International Meridian Conference, Japan was the only Asian country present. However, they did not implement standardised time until much later. Historical research on Japan shows that the country's adoption of the time system was underpinned by the urge to modernise and to become as strong as the Western powers which were at the time putting pressure on Japan.

Japan actively adopted the GMT world time system during the reign of the Meiji government (1868-1912). The adoption of mechanical time within Japan was very much connected to its self-strengthening as an imperialist power within Asia. During the reign of the Meiji government, Japan actively made use of time technology as an overt means to gain equal status with western countries, and subsequently spread their time-habits as a disciplinary measure in its Taiwanese colony. From 1853 onwards, foreign powers entered ports in Japan and demanded use of such ports, threatening the Japanese government with their advanced arsenal of cannons and weapons. The first foreign power was the US led by Commodore Perry, and afterwards fleets from Holland, Britain, Russia and France also arrived. Japan signed several unequal treaties that granted these foreign powers judicial and

economic privileges through extraterritoriality. Japan had no right to decide tariffs and any crimes committed by these foreigners could not be tried in Japanese courts.

Desperate to reform these treaties and to abolish the extraterritoriality, the Meiji government was keen to gain equal status with the western countries through modernisation and 'civilisation and enlightenment' (a slogan named *bunmei kaika*). Most interestingly, the notion of 'time' was very much on their minds: the international meridian, and the Gregorian calendar, and the discipline that came with the external reference of the clock became an integral strategy on the road to modernisation. The Japanese adopted the international meridian and the Gregorian calendar as a way to gain equal status with western countries. The strengthening of Japanese national identity is thus tied to these scientific notions of temporality.

At the end of the Sino-Japanese war in 1895, the Japanese began a reign of 50 years in Taiwan. The Japanese colonial government implemented standardised time soon after, and created a 'noonday gun'⁶⁹ system in Taipei. Historian Shao-Li Lu discusses the modernisation of Taiwan and the establishment of modern time-consciousness on the island in *Whistle from the Sugarcane Factory: The Transition of Time Cognition and Rhythm of Social Life in Taiwan Under the Japanese Rule, 1895-1945* (1998). In the book, he details specific strategies taken up by the colonial government in an attempt to induce time sense to the 'backwards' Taiwanese people, who were not yet modernised. Very much in the style of Thompson, Lu (1998) also makes use of clock and watch ownership and distribution data to demonstrate the spread of time-objects. His main contention is that these strategies resulted in the introduction of mechanical time consciousness amongst the Taiwanese. The book title itself came from the use of a particular siren on sugarcane plantations and factories, which created a particular whistling sound. This was utilised to control labour forces, in a way that may be comparable to the nigger-bell in Smith's antebellum.

In their colonisation of Taiwan, Japanese authorities carefully measured the longitude and latitude points of the island, and created observatories at particular spots on the island. Soon after, a telegraph system was established. This brings to mind the power-knowledge paradigm of such institutions, in generating scientific knowledge and technologies for the sake of disciplining through time. By 1913, all train stations, post offices, observatories, and broadcasting stations had to report to the central observatory in Taipei via telephone or telegram three minutes before noon to synchronise and tune their clocks. Since 1921, a special national holiday named Time Memorial Day⁷⁰ was introduced on June 10th each year to remind citizens of the need to cherish time, be punctual at work and at school and to make use of clocks and watches. This day was literally used to 'celebrate' time, and mobilised a series of civic groups to this effect. Schools were used for time propaganda, and students were asked to distribute pamphlets for time education.

Youth troupes and community organisations were also key players for celebration parades—the starting time of each parade was to be synchronised based on loud signals that would be heard across several temples.

Japanese imperialism brought along with it rules of punctuality, ethics of time use, and a standardised time system. The colonial government actively tried to introduce new rhythms of life for the Taiwanese. Below I juxtapose snapshots of Japanese time-reckoning and their interventions in Taiwan, and give a sense of how mechanical time becomes a organisational and disciplining force in the two locations.

Factory Life

The Japanese's own transition into the regime of mechanical time would subsequently be mirrored by the forced adoption of time in Taiwan. Thompson's industrial-era English factory descriptions would ring true too in Japanese factories in the 1870s and later in Taiwanese factories. In 1872, the Meiji government built the first government-run factory, the Tomioka Filature. Textile factories were seen as the forerunners to the heavy industry and most importantly the development of munitions factories that was necessary to propel Japan into world power status. These factories soon adopted the style of management Thompson referred to, using bells and time signals to discipline workers into following a strict schedule of very long hours. Workers were also no longer allowed to skip work every now and then, for instance because of good weather, which was the case before the implementation of schedules. With the inception of a new temporal regime, tardiness and absences were treated severely through penalties (Nishimoto 1997).

Suzuki (2002) reproduces a copy of a manufacturing plant's regulations from a Tokyo factory in the 1880s, which shows how detailed the time-signalling whistle signals were produced.

Article 14: There shall be ten working hours per day. This shall be nine-and-a-half hours, however, during January, February, March, November, and December. The lunch break at noon shall be thirty minutes...

Article 19: All preparations should be complete before the whistle signaling work start. After the whistle indicating work finish, all items should be put away and the area should be cleaned.

Whistles are as follows:

1. Pre-start whistle: 30 seconds, 2 seconds, 2 seconds. A start whistle shall be sounded fifteen minutes before the gates are opened.
2. Entry Whistle: 7 a.m. For January, February, March, November, and December, this shall be at 7:30 a.m.
3. Work Start: 7:10 a.m. For January, February, March, November, and December, this shall be at 7:40 a.m.
4. Lunch break: 11:30 a.m...

Article 20: The gates shall be opened fifteen minutes before the pre-start whistle, closed as soon as the entry whistle is sounded, and opened again after work when the work stop whistle is sounded. (Suzuki 2002, 84)

These time-signalling whistle practices were transplanted to the colony of Taiwan, when the Japanese endeavoured to reform efficiency in the factories. Lu's study (1998) specifically highlights the implementation of time discipline in sugarcane fields and factories through a specific whistle that was used as a time signal. This would be sounded every day to signal the beginning of the work day, which was predetermined by the factory owners. Lu is very critical of the fact that the produce of these fields were in fact farmed mainly for Japanese sugar industry, rather than local consumption. Wages were calculated according to time spent, and this shift meant that they were not earning based on what they reaped in the fields, and the workers were exploited for their manual labour, conducted under strict conditions set by the owners. They also had to fill out elaborate time-sheets and were given very little compensation. Lu commented on how these sugar plantation workers resembled Thompson's workers, who had to get used to a new time regime—"They only knew the 'incidence' of time through sound signals, but had no grasp over how to use this notion of time as a resource in this transition to their own benefits" (1998, 126; own translation). Lu describes how these workers were subjected under a regime of time discipline with much worse labour conditions than before such regulations were in place, due to the stricter disciplinary measures and defined work schedules.

Time in Schools

In a way that fully echoes Thompson's references to schooling, time-induction was an important aspect of schools too in Japan and Taiwan. In 1871-73, the Meiji government sent the Education Minister Tanaka Fujimaro and his team on an extended observation tours of elementary schools in the US and in Europe, in order to learn their practices and to develop a reform for the Japanese system. Upon their return, a compulsory elementary education system was built to provide children reading, writing, and arithmetic skills, as well as western scientific knowledge.

With the preceding Edo government (1603-1868), schools were run under a different, more personalised system. In popular schools (*terakoya*), lessons started at the hour of the dragon (roughly 8AM) and ended at the hour of the sheep (2PM), and in the summer, school began at the hour of the rabbit (6AM) and ended at the hour of the horse (noon). Children could only guess the hour by checking the sunlight, or by listening to the crowing of cocks. In the Meiji era, the term *jikan* (hour/ time), which was invented to replace the word *toki* used in lunar calendar time system. The term first first appeared in an elementary school reader. Children were taught how to read the clock, developing time literacy in addition to habits of

punctuality and regularity in daily life. Leisure time was also invented as a concept and taught—

... for those who study at school, there is always a time for play; during this time you should go out to the playground and play, run around to your heart's content, and enjoy yourself. Play is fun because you are studying. If you think play is fun, study hard during the time for lessons. (*Shogaku dokuhon* [Elementary Reader], volume 1, as quoted in Nishimoto 2002, 126)

When introducing time into school systems in Taiwan, the Japanese administrators first created annual calendars with a clear commencement date of the school year, which in turn provided the bracketing of an 'academic year'. The 7-day week was also something new to the Taiwanese public at the time, and it was not until the Japanese occupation that Sunday became a designated day of rest. They standardised the education system with 5.5 days of school, i.e. Saturday afternoons and Sundays were free for schoolchildren.

Lu comments on how mathematics, physical education and ethics/discipline lessons worked hand-in-hand, in a way that is reminiscent of Foucault's discussion of timetables and bodily attunement to rhythms. Mathematics class offered the principles behind hour, minute, and second, and students needed to learn these units of calculation. According to Lu, these are very abstract concepts, which could only be understood via bodily experience in physical education class (修身課). Rhythm and tempo were important attributes of physical training, and students were asked to learn gymnastic routines that had to be performed in sync. This echoes very much Foucault's army march example, where bodies are trained to become more docile and obedient. Here, the focus is specifically on time and rhythm. Ethics/discipline lessons explicitly taught students the virtues of time discipline as well as other duties and obligations as citizens.

Into the Household

The uptake of mechanical time also enters the domestic sphere, entering homes and sweeping across villages. In her study of Japanese time-consciousness, Midori Itō (2002) hypothesises that the domestic temporal order in the household is partly informed by a set of magazines created by a housewife Hani Motoko in 1900s, entitled *Katei no tomo* (Family Companion) and *Fujin no tomo* (*Lady's Companion*).

In the earlier section on rhythm in factories, I referred to Taylorism, which was taken up by the Japanese through a translation that appeared only two years after *The Principle of Scientific Management* (1911) was published in the US. In Motoko's periodicals, the style of time and motion studies was revisited from the perspective of the household. Motoko studied and created standard times for chores. The following table is an example of 'standard washing times' for specific garments appearing in an issue in 1927 (Fig. 14)—

Item	time of washing	first rinse	second rinse	third rinse	sum total
sheet	7 min.	1 min.	1 min.	30 sec.	9 min. 30 sec.
white summer kimono	4 min.	1 min.	1 min.	50 sec.	6 min. 50 sec.
flannel nightgown	5 min.	1 min.	1 min.	1 min.	8 min.

Fig. 14: Standard washing times appearing in one of Motoko's magazines (Itō 2002)

The fact that she had divided the task of washing so meticulously into several subtasks led Itō (2002) to speculate that Motoko was influenced by Taylorism, which appeared in Japanese newspapers at the time. These tasks were taken very seriously in subsequent issues of women's magazines in Tokyo, and used research questions like 'How long can housewives rest per day?', 'How many hours should housewives spend on meals?'. Experiments were conducted on how many cups of rice should be cooked with how many cups of water, and the relationship between such duration and the quality of the food itself. Housewives diligently timed themselves on the time taken to work on mundane domestic chores, like sewing, ironing, washing, drying and tailoring clothes, cleaning, wiping tables, and doing the dishes, and shared the data with other readers of periodicals. Midori (2002) further describes how these meticulous studies of domestic work give rise to intensive schedule making in the household decades later during World War II, so that housewives could efficiently complete domestic work and use their spare time to support their local communities. For instance, they could devote hours to neighbourhood association factories. The housewives' methodical time-saving techniques in the home were instrumentalised, such that they could have extra time to offer their labour on the community level, which was particularly important during the war effort.

In Taiwan, the Japanese government created incentives for stronger adoption of time discipline, as part of their Japanisation movement ("Kōminka movement") on the level of villages in the 1930s. The aim of the movement is to make citizens model citizens of the state. Lu (1998) describes how each village would need to form individual units based on identities like parent, housewife, youth, unmarried lady and man. Each unit had to fulfil a list of actives as set by the government, and would need to fill out a progress sheet to indicate how they carried out the commands. Each unit was responsible for particular activities within the village, such as cleaning the village on preset days of the month. These activities are all laid out on calendars and schedules, fully in alliance with Japanese time discipline. All villagers would also have to do morning exercises at 6AM sharp, and this was possible because the households owned radios and clocks which were synchronised. The radios would have transmissions of the accompanying music and instructions for villagers to move to—docile bodies dancing to broadcasted rhythms. Villages that performed best would be awarded the credit of 'Outstanding Village' (優良

部落), creating incentives for village units to perform their docility better and to compete with neighbouring units.⁷¹

The labour power of these grassroots units were maximised from 1940 onwards, as Japan joined WWII and bombed Pearl Harbour. They needed more manpower to form other civic units to help support the war effort. Time discipline created through these activities in the preceding years were considered very much conducive to their subsequent drafting of Taiwanese citizens into armed forces and support units.

These studies demonstrate the pervasiveness of mechanical time in inducing new rhythms and logics of labour. Standardised time invades various institutions of the factory, the school, and the home. As Foucault has suggested in *Discipline and Punish* (1991), the mechanics of power take time to spread across an entire social body. It may seem petty to study how precisely whistles are sounded at a factory, how housewives breakdown their daily chores, or how a system of *jikan* replaces *toki* in what an hour refers to in children's textbooks. But as Foucault astutely observes, "discipline is a political anatomy of detail" (1991, 139). These "meticulous, often minute, techniques" (*ibid.*) have their place of importance in the larger policies to impose mechanical time discipline and consciousness onto citizens and colonial subjects. The Western standard of time overtakes the older traditional senses of time, inventing new vocabulary and techniques for time literacy. The policies in Japan and Taiwan fulfil state desire to become stronger as a nation and to create more obedient, docile subjects. Ultimately, it affects regular citizens in their day-to-day reckoning of time. This case provides a clear example of time imposition enacted into policy. One of the things which stands out in Lu's Taiwanese study is how clocks and time-signalling are complemented with physical exercise. Rhythm too is introduced in the curriculum and through the village-based competitions. Citizens' bodies, young and old, are expected to move to prescribed rhythms broadcasted on the radio. In this sense we could see how the rhythmic performance discussed under the labour theme above can take place outside of the factory and in regular citizens' daily lives. The competitions organised also suggest that it is not strictly a regime of 'discipline' that governs these bodies, but the beginnings of a more diffused conception of biopower that elicits their performance of docility.

Time Technology, Race and Coloniality

The third theme under which I discuss the operations of discipline and biopower in time pertains to race and coloniality. As I have pointed out in Chapter 1, Foucault is concerned with the racialised dimension of power. Biopower is about the distribution of value across bodies, and the hierarchisation of parts of the population over others. Certain lives matter more than others within a biopolitical calculus, and this line is often drawn across gendered, racialised, or ableist lines. In the previous section on standardised time, we could see that GMT is entangled with colonial history. This section continues the line of inquiry and reveals other dimensions of colonial power that is associated with time technology. I use the term ‘coloniality’, following decolonial scholars Anibal Quijano (2000) and Walter D. Mignolo (2011), which refers specifically to the structures of power, control, and hegemony that are brought about in the histories of European imperialism and colonisation. Coloniality puts a spin on Foucault’s reflections on power/knowledge nexus as a technique of power. Particularly, it teases out the power dynamics in the imposition of scientific knowledge upon the colonised, as well as the production of knowledge that comes with colonial exploration.

In this light, while GMT⁷² is not a direct tool for exploitation, it is a product of such histories. It is a scientific system that has come about through trans-oceanic explorations and symbolically confirms the British Empire as the centre of the world. It implies a unitary worldview, where locales and individuals would have to conform to the order of time laid out by GMT. Similarly, despite the fact that marine chronometers have not been directly used as tools for disciplining the way clocks and whistles have been, they are invented for the sake of colonial exploration and fall under the scope of coloniality of power. I will briefly outline the invention of marine chronometers in the history of watchmaking before turning to what chronometry has supported—the Transatlantic slave trade. I turn to the use of clocks and watches as disciplinary devices in the Antebellum era in late eighteenth century US on slave plantations in the South. Through these examples, we see a racialised dimension of disciplinary power, and the discussion maps the discussion of time technology and techno-chrono-biopolitics onto the histories of colonialism and slavery.

The Birth of Marine Chronometers

The creation of a world coordinated time system requires a global survey of the world’s meridian lines and the segmentation of earth into various timezones. The marine chronometer was a quintessential invention that increased the accuracy of longitude measurement, and helped facilitate colonial exploration tremendously. The chronometer was an instrument for navigation on trans-oceanic journeys

undertaken by the maritime superpowers in the eighteenth to nineteenth centuries. Before the birth of the instrument, navigators determined longitude at sea through astronomical data and observational instruments, and timekeepers made use of a nautical almanac to measure lunar-distance. This involved observation of the sky with the aid of a sextant, and a comparison with star charts. A nautical almanac would provide predicted position of the moon relative to the sun or other background stars, and with a complex set of calculations, one could find out the longitude of where the ship was.

Seeking a method that does not rely on star-gazing which is dependent on weather conditions, navigators wanted to know the time at home so as to estimate where they were based on the longitude. If they could determine the time at destination (via observation of the sun) and know the time at home (via a stable clock technology), they could calculate where they were in physical space. Because the Earth rotates at a regular rate, time difference between home (GMT) and their position at sea would allow navigators to determine the ship's longitude relative to the GMT Meridian through spherical trigonometry. Pendulum clocks, the technology at the time, were not accurate enough for use at sea, as the constant bobbing of the waves resulted in non-equivalent measures in the swing of the pendulum. The clocks were also subjected to changes in temperature, moisture, pressure, and force of gravity, making the oscillations even more unreliable. But if the navigators could have a reliable, mobile clock on board, they could carry out the calculation much more accurately.

Nautical travel was treacherous and had caused many deaths with sinking fleets and other accidents. In July 1714, a lucrative sum of £20,000⁷³ was offered by the Royal Horological Society in England⁷⁴ to the scientist who could invent the most accurate device to measure distance at sea. The impulse to explore and conquer drove the creation and meticulous refinement of time tools.

It took decades of experimentation and four major prototypes⁷⁵ before John Harrison came to invent H4, the invention which changed the face of naval navigation. His first major prototype took six years—the marine timekeeper H1 (Fig. 15) used spring mechanisms to counteract the motions at sea. H2 experimented with temperature-compensation, so that the machine would withstand extreme temperatures of both heat and cold, as it was meant to travel to different corners of the earth. In 1740, the inventor realised that the mechanisms he developed were fundamentally flawed and were not able to hold out against motion at sea, and abandoned this design for the research into H3. H3 had over 700 precisely engineered parts, but Harrison also abandoned this project before completion, realising that his new mechanisms were still unstable and would not survive sea voyage.

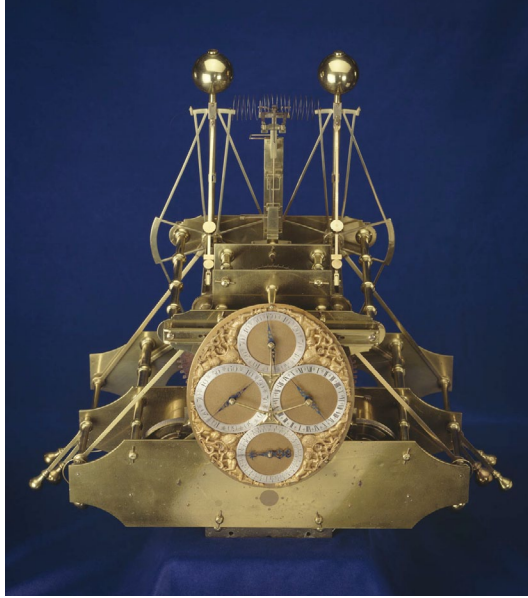


Fig. 15: H1 (From the London Royal Observatory archives)



Fig. 16: H4 (From the London Royal Observatory archives)

By the time H4 (Fig. 16) was completed, Harrison himself was too old to travel and instead sent the device for testing with his son in a voyage to Jamaica on Her Majesty Service *Deptford* in 1762. The accuracy of the chronometer was to be determined by comparing the longitude measured through star observation. Harrison realised that part of the solution to countering variables like pressure and gravity at sea was to design a much smaller device, as the parts could remain more stable during movement compared to larger clocks. H4 only measured 13 centimetres in diameter. On its journeys to the colonies, one favourable interpretation showed that the H4 was only 5.1 seconds off. The second test voyage for the chronometer was to Barbados, and the margin of error there was only a fraction of a second per day. H4 became the standard for subsequent refinement of the technology and development of marine chronometers.

It was the refinement of such techniques of chronometry that provided the technology for marine navigations, and what accompanied the many voyages of slave ships in the Triangular Trade. This scientific invention brings a historical dimension to the power/knowledge embedded in techno-chrono-biopolitics. Not only could clocks and watches be used as disciplinary mechanisms, the refinement in clock technology was also driven historically by imperialist ambitions and colonial exploration. From this perspective, time technology has an intrinsic connection to the biopolitical histories of colonialism. This places into perspective the demeaning use of time technology as instruments of control when we turn our attention in the next section to its use in plantation slavery. I will return to other dimensions of coloniality in my conceptual reflections on techno-chrono-biopolitics, particularly in Chapter 6, where I draw interrelations between digital culture and the surfacing of modern-day slave regime in the production factories of Foxconn in China (Qiu 2016).

Deep South in America: Clocks and Slavery

Mark M. Smith's study *Mastered by the Clock* (1997) is a pioneering work in the study of time in the South in the Antebellum era in the US. Like Thompson (1967) and Lu (1998), Smith studies data on the circulation and ownership of clocks and watches in order to shed light on the relationship between clock ownership and plantation management in the Antebellum era in the US. He argues that the plantations' adoption of clock time served as a mechanism that regulated labour in the first half of the nineteenth century as "their claim to modernity" (1997, 5). Slaveholders in the South were increasingly put under scrutiny and criticism of the free-wage-labour advocates in the North, and slavery was seen as an out-dated barbaric act that had to be abolished in the move towards modernisation. Modernisation came with notions of democratic tendencies, which was the last

thing these slaveholders wanted in order to cling onto the benefits reaped at the expense of the enslaved.

Slaveholders turned to the clock as an external reference to time in order to regulate labour in a social-economic manner, such that it provided a base from which they could describe themselves as 'modern'. In the industrialising, free-wage-labour North, clock time, obedience, and regularity were all considered to be markers of modernity. Smith points out that the embracing of the clock became a good in-between that enabled the South to be modern without giving in to free-wage-labour ideology. The notion of discipline and punctuality also provided another solution for the slaveholders, as slaves were organising themselves through individual and collective acts of resistance. Plantation owners hoped that clock technology could inspire discipline and obedience amongst the slave subjects, for better management of work on the plantation.

According to Smith, the ownership and understanding of the clock for the slaveowners meant 'power'—

specifically, the power to set the actions of others, even the behaviour of oneself, against artificial, mechanical time. Like every other propertied class, masters coveted both profit and the social control of labor, and thus any additional forms or tools of power would always be welcome in the ongoing effort to regulate the behaviour and productivity of chattel. (1997, 14)

Clocks and watches therefore offered these slaveowners extra tools for managing labour on plantations.

Data analysis has shown that slaveholders had a preference for watches over clocks. Smith's hypothesis is that these slaveholders could be in the field and impart disciplining measures with reference to time, now portable in their pockets or on their wrists. Slaveholders measured the time it took for slaves to complete tasks, even generating some form of twisted competition amongst them so that they could race to the rhythm of the ticking clock. Smith quotes from the autobiography of a former slave in Georgia, a man named John Brown, as an example to show how slaveholders created what we would today refer to as 'performance standards' for the slaves—

My old master . . . would pick out two or more of the strongest [hands], and excite them to race at hoeing or picking... He would stand with his watch in his hand, observing their movements, whilst they hoed or picked... Whatever [the winner] did, within a given time, would be multiplied by a certain rule, for the day's work, and every man's task would be staked out accordingly. (1997, 122)

Others were whipped for tardiness based on the delay (1997, 137). Such performance measurements became the standards upon which one's performance is judged, one's labour is distributed, and where one could end up under the whip.

Watches were often more expensive than clocks, and those who preferred buying a housebound clock would then have to introduce mechanical time through aural means. Smith refers to a short treatise from 1850 entitled *Plantation Management*

Police in Virginia, which explained how one could use a plantation horn based on clock regulation to schedule work. In painful details, one could see the regularity in the act—

The first point [...] read: “It is strictly required of the manager that he rise at the dawn of day every morning; that he blow a horn for the assembling of the hands; require all hands to repair to a certain and fixed place in ten minutes after the blowing of the horn, and there himself see that all are present, or notice absentees.” The sixth point explained: “There will be stated hours for the negroes to breakfast and dine, and those hours must be regularly observed. Breakfast will be at eight o’clock, and dinner at one o’clock.” The thirteenth point: “A horn will be sounded every night at nine o’clock, after every negro will be required to be at his quarters.” (1995, 113)

The management notice no doubt echoes the fastidious regulations from the Tokyo factory in the preceding case study.

One of the most striking examples of time-signalling was the ‘nigger bell’. It is described here through advice shared among planters for slaveholders of plantations big and small—

A large-sized cow bell could be heard two miles, and would not cost more than three or four dollars, would serve not only as a signal for bed time, but also for getting up of a morning, for ceasing work at noon and resuming it after dinner. Where the distance to be heard is not great, a common bar of cast steel hung up by passing a wire through one end, may be struck with a hammer, and will answer in place of a bell. (*ibid.*)

Again aural measures were put in place to provide signalling of time, like the distinctive whistle sound used in Taiwanese sugar plantations and processing factories.

As exposure to time-inflected systems increased, the plantation owners developed a stronger sense of ‘time is money’ as they discovered that certain farming systems and machines could help them save time. These were advertised and discussed in farming periodicals distributed by agricultural societies in various locales. Here are some of the registrations reproduced from Smith’s research—

By 1825, Albemarle farmers had learned much in their experiments with timing agricultural operations and reported their findings accordingly. Farmer Stephen McCormick, it was noted, “opened a cubic space of 76 53/100 cubic inches with a power equal to 400 lbs & broke 1/8th of an acre in furrow of 70 yards long in 15 minutes with two Horses” in 1825. Nicholas H. Lewis plowed a similarly sized field with a lighter plow “& broke 1/8th of an acre in 16 minutes with 3 Horses.” Neighbouring farmers were less successful. It took John Cravens “17 1/2 minutes with 3 Horses” to break up his eighth of an acre and William Woods “18 1/2 minutes” to do the same. (1997, 97)

The details of such descriptions are remarkable in how the farmers conducted experiments on their own land armed with clocks and watches to note the efficiency of their operations. Such time and motion studies are frankly not too far apart from what Taylorism prescribes in the context of factory work. These accounts were not limited to the fascination with timing how long tasks took, and in fact were also extended to the speed of their slaves. Smith continues—

And by 1836 all could marvel at published examples of planters' ability to extract "quick work" from their slaves. Readers of Virginia's *Farmers' Register*, for example, were no doubt impressed by one South Carolina slaveholder's ability to "make his bondpeople turn out a 'bale of cotton' in the unprecedented time of 6 1/2 minutes"! Predictably, manufacturers of labor-saving farm equipment were quick to pick up on planters' anxiety to save time and couched their advertisements accordingly. "Samuelson's rotary digging machine" was heralded as forking five and a half acres "with six horses, in 6 hours" in 1854, while Hussey's mowing machine was respected because it gave the operation of cutting and hence curing fodder "almost the precision of clock work." (1997, 97)

Through these accounts and advertisements, slaveholders and planters were convinced that older agricultural systems had to give way to more scientific, rational management. Techniques and practices which did not convey such a logic of efficiency were perceived as "southern backwardness and lost time" (Smith 1997, 102). Quoting a planter in Tennessee, Smith shows the sentiment at the time—"the consequence of ignoring 'the science of economy' [...] is a lamentable loss of time, of labor, and of money." (*ibid.*)

In Smith's study, we observe the incidence of race in an early example of techno-chrono-biopolitics. The technology of clocks and watches assisted in the enslavement of a population and the dehumanisation involved with slavery. Not only were the black slaves identified as an inferior race, their sense of time was also identified as an inferior time, and discounted as a viable means of time reckoning. The transition into mechanical time regime was imposed upon them through devices like the nigger bell that signalled work and stopwatches that introduced competition into their work environment. The adoption of mechanical time technology in this sense played into the discrimination of the coloured, and became an important tool in imparting discipline on the plantation fields.

All this is not to suggest the lack of agency of the slaves who had to be subjected to the new time-based labour logic, discipline, and physical suffering. Some accounts of plantation memories showed that the slaves simply learned to organise their time around the checks held at regular hours at night. Because of the regularity of the labour schedule, they could predict and appropriate the routine for their own ends (Smith 1997, 145). Although the slaves usually had no access to the actual timepieces, and some did not know how to read the devices, they still maintained their own cultures of time-telling based on noting the positions of the sun and moon. For some, this kept their cultural sensibilities alive, and saw freedom from slavery as also freedom from the slaveholder's mechanical time regime (Smith 1997, 152).

African Americans can adjust to white time sensibilities, which stress punctuality and are future oriented, but they can also reject these same sensibilities as a form of protest against democratic capitalism generally, white bourgeois sensibilities specifically, by eschewing the authority of the clock and adopting presentist and naturally defined notions of time, a tendency that sociologists and the public alike have come to call Coloured Peoples' Time, or CPT. (Smith 1997, 130)

CPT represents the struggle against the imposed unity of a time system. It is a way to identify resistance to the mechanical clock regime and a practice that perhaps took root within the context of resistance towards the master's clock, and has persisted through to modern times. Literary scholar John Streamas (2010), for instance, refers to CPT as one of the ways to reconceptualise W. E. B. Du Bois's "double consciousness" ([1903] 2007), in how people negotiate their positions as marginalised subjects within a dominant white culture. Streamas highlights time as one of the venues through which such a double consciousness could be maintained, harking back to a double time sensibility that characterises how slaves might have held on to their habituated natural time-consciousness while a clock-induced time-consciousness has been forced upon them. Moreover, Streamas (2010) points to larger cultural practices where CPT may be found, such as in the literary and oral history traditions of coloured people. Part of this CPT consciousness is the political consciousness towards struggle, emancipation, and revolution. According to Streamas (2010), CPT is not only about time but also a kind of solidarity against injustice and holds space for narratives of communal hope.

The Refusal of Time

Smith's study (1997) gives a harrowing account of plantation life in the Antebellum period, but he also offers a glimpse of the resistant attitude towards mechanical time, and the refusal to be subsumed under the rhythms dictated by the slaveholders. Before I bring the chapter to a close, I turn to an impressive collaborative art project by American historian of science Peter Galison and South African artist William Kentridge, where the double time-consciousness and CPT referred to by Smith (1997) and Streamas (2010) are creatively staged. Some of the issues touched on by the work also speak to several points made in the chapter. In an installation and an opera performance entitled *The Refusal of Time* (dOCUMENTA 13) and *Refuse the Hour* (2015), the artists reflect upon the construction of standardised time as represented by Greenwich Royal Observatory, and overlay the scientific narrative with animation, song, music, and dance, critiquing the colonialist origins of time technology.

In the opera itself, the chronometer was specifically made reference to as a technological instrument of colonialism, as it was invented to measure the exact distance between empire and colony. As discussed in the historical snapshot in preceding sections, the H4 was tested specifically for travel to the West Indies, and Harrison himself was not entitled to the prize money unless the operation of the chronometer was proven to be accurate and useful in such journeys. It is interesting to juxtapose the narrative of the artwork with how the Royal Observatory narrated

the history of chronometry, the latter having downplayed significantly the colonial element embedded within the invention.

The Refusal of Time is a 5-channel installation, providing an immersive space for the sound-and-light work developed, a rich tapestry of visual, musical, textual, and conceptual references characteristic of Kentridge's oeuvre. The opening scene features nine metronomes ticking away to different speeds, with sounds of string instruments, tubas, and voice layered on top. The projection then gave way to other animations of laboratory work filled with springs and coils and strange mechanisms, of white-cloaked scientists marvelling or puzzling over inventions.

Several sets of images used in the installation show glimpses of Galison and Kentridge's critique. Images of maps of Africa are shown in a state of composition, recomposition, and decomposition, hinting at the powers of cartographical knowledge produced by the maritime nations. Video clips of hand-drawn objects represent the invention processes of (colonial) telecommunications and navigational technologies—Kentridge renders visible what is now obscured from view on both material and metaphorical levels. On one hand, many of today's technologies are blackboxed (Pasquale 2016), existing on a code-language level, and are withdrawn from visibility. Phone lines have been replaced by wireless technologies, trans-oceanic underwater cables unseen by us support the infrastructure of the internet. On the other hand, while the operations of eighteenth to nineteenth century technologies "wore their functions on their sleeves" (Koerner 2012), as Galison explains in an interview, these histories are not evident as obvious, commonplace knowledge to viewers. Kentridge's animations therefore expose and bring visibility again to these processes of technology making and in so doing, unveil the imperialistic ambitions which underlie them. Kentridge reimagines an anarchist's attempt to blow up the Royal Observatory in Greenwich, and closes the installation with a rhythmical procession of South Africans' silhouettes, each character in a different state of reckoning with senses of time and their lives.

The Refusal of Time suggests a dual conception of time consciousness, one which belongs to the scientific rationality of the West as encapsulated by a drawn object like the chronometer, and the other belongs to the rhythms of the indigenous, captured through the beautifully haunting and absorbing sounds of song and music by the South Africans in the soundtrack. Kentridge also alternates a broadcast of his spoken lecture on the science of time invention across different speakers, such that the audience's own orientation in space determined whether the scientific tale would be heard. The dual conception of time, the scientific and the indigenous, presented in the installation is not unlike what Smith (1997) and Streamas (2010) have analysed. The title, *The Refusal of Time*, suggests a refusal of the Western, scientific worldview that is implied by the time system.

Moreover, *The Refusal of Time* features an automaton (Fig. 17), recalling the discussion in Chapter 2 and in the opening of this Chapter. At the centre of the installation is a real wooden machine they call “breathing machine (elephant)”, an automaton with pumping pistons, which functions like a generator. We are reminded of the machinic automation of time, and the material algorithms that drive the wooden clockwork mechanisms. In an interview with *The New York Review of Books* (2012), Galison and Kentridge explained the inspirations behind the machine—

Galison: I went to the archives in Paris and I found that there was a system of pumping time pneumatically under the streets of Paris, and I found a map of where the pipes went. Sending air through a copper pipe was a way to jar a clock at a distance, to set it. Vienna and Paris had similar systems. This idea of pumping time, even the idea of it is funny, because we think of time as the most abstract thing that is connected to mortality and fate and the very predicate of history and yet here it is being pumped underneath the streets of Paris.

Kentridge: The “elephant” comes from Dickens’s *Hard Times*, where he talks about the industrial machines in the factory in the nineteenth century. He talks about them “moving up and down, like the movement of the head of an elephant in a state of melancholy madness.” (Koerner 2012)

The continuous, regular, and rhythmic movement of the ‘elephant’ seems to reiterate the rhythm of time as a phenomenon always occurring in the backdrop, omnipresent. The automaton serves as a reminder of the histories of automation, and how these mechanised inventions were forerunners of the industrial inventions of machines. One could also read this, following Kentridge’s reference to industrial



Fig. 17: *The Refusal of Time* installation view, at Museum of Metropolitan Art, New York in 2013

machines, as a driver of progress, a constant motor and machine driving the engines of modernity and industrialisation. Time indeed has been held as the hallmark of progress and civilisation, as the Japanese and Taiwanese case study has shown, and is also used to denote the ‘backwards’ orientation of those who live in pre-industrial rhythms, like the slaves who resisted the technological conditioning of time.

Through the installation, Kentridge and Galison remind us of the material nature of the distribution of time. In addition to the air pumps underneath Paris, Galison also discusses how the colonial powers managed to string cables across the globe, under seas and over mountains, so that they could use electrical telegraphy signals to coordinate clocks. He was fascinated that such a feat was achieved when much of the world did not even have electric lights. This history of coordinated timezones and segmentation of the world is intricately linked with colonial history, as well as the struggle and refusal of domination by those oppressed under imperialist rule. This collaborative artwork offers a forceful critique against the system of time, which exposes the coloniality embedded within the development of chronometry and cartography. It shows that the invention is not at all innocent, and conforms to a particular colonial world order.

Conclusion

In the above, I have made reference to examples under the themes of labour, governance, and race and coloniality, which testify to how time-telling devices become disciplinary tools in their respective contexts. In each of these narratives, various forms of clocks and time-telling devices have been used to create specific work rhythms. Time systems like GMT and inventions like chronometers show the colonial history that the science of time is tied to. The disciplinary and biopolitical dispositifs of time technology work could be seen in the examples provided. These cases form the historical basis of my inquiry into contemporary techno-chrono-biopolitics.

In this chapter, I have studied how the clock and other time practices are examples of what Foucault terms the “disciplinary technology of labor” (2003, 242). Though technologies of time have existed in various forms like sundials and sandglasses before the making of the clock, the historical basis for techno-chrono-biopolitics is perhaps most evident in the period when clocks became commonplace and brought with it the need to reckon with its time-sense. In the nineteenth century, clocks and watches became popular commodities in circulation. A range of devices and practices have contributed to the adoption of clocks into daily life. I do not argue that the invention of the clock generated a radically different time-sense in a technologically deterministic manner, but rather focus on how the clock

offers an external reference to experiential time, and how they have been used as disciplinary technologies of labour, based on E. P. Thompson's seminal essay (1967). I have shown how the docility of bodies are moulded and disciplined into being through time-signalling mechanisms and through working alongside machines in the factory. These docile bodies are malleable, not only in shape but also in rhythm. Much like the race for efficiency and speed in the Taylorist factories, the Japanese and Taiwanese cases both show the desire for a better organised, more obedient population. The plantation example shows how mechanical time is introduced in the agricultural field, where it was once thought of as the epitome of 'natural' time-orientation. Instead, clocks and bells were used to introduce strict scheduling, establish performance standards, generate competition, and increase the overall efficiency of plantation work. Throughout the discussion in the chapter, I have made cross-references in the examples, and showed the many similarities in the use of time technology to create docile bodies and impose discipline on the targeted populations.

These examples are selected not only for their relevance to critical time studies, but also for the localities they represent. Critics of Foucault have discussed how his conception of biopower is guilty of "a narcissistic provinciality" (Povinelli 2016, 3), where the discussion is narrowly focused on the study of European history. Couze Venn (2009) argues that biopower today require a transcolonial framework so as to highlight the structural inequalities embedded within neoliberalism that goes hand-in-hand with biopolitics. He would like to define a new ontology for living as co-dependents in the world with a view of biopolitics as a global phenomenon, that should not be defined only out of a historical account of Western modernity. Venn critiques that Foucault's genealogical references heavily rely on the nineteenth century and the West in discussing biopower, and invites readers to move beyond this paradigm. Analogously, Povinelli (2016) urges for studies of biopolitics to be given a different social geography, which shows the global scope of biopower. Walter Mignolo (2011) puts forward this provocation—"Bio-politics is half of the story. Coloniality is the missing half, the darker side of modernity and bio-politics." (2011, 140). I have attempted to focus on examples from colonial contexts, and approached imperialism not just in European maritime exploration but also in Asia as represented by Japan's nationalist self-strengthening campaign.

In fact, it is perhaps important to remember that the system of slavery in fact supported the coming of the Industrial Revolution. From a more global perspective, one could then revisit the stage of Thompson's English factory, and consider how the establishment of such an industry in fact is predicated upon the dispossessed lives of subjects under British colonial slavery. Britain relied upon the natural and financial resources she has received from her many overseas colonies, and scholars

have also pointed out that the profits from the slave trade might have fuelled industrial investment at the time.

Railroads, steamships, and the opening of the Suez Canal in 1869 transformed India into a major source of cheap food and raw materials for Europe. [...] In the late nineteenth and early twentieth centuries, the large surplus in the Indian balance of payments became the pivot of the enlarged reproduction of Britain's world-scale processes of capital accumulation and of the City's mastery of world finance. (Braudel 1986, 263 as quoted in Venn 2009, 210)

Through this, one could bring about a more postcolonial reading of Thompson's essay that involves not only England but her colonies. English factory workers working under clock time management is not merely an example of Foucault's discipline, but may involve other instances of bio- and necropowers exercised on colonial populations elsewhere that enabled the rise of the factory in the empire. If biopolitics is only half the story, the study of time discipline on a slave plantation time could indeed be coupled with the back story of chronometry, which enabled the transport and sale of slaves in the first place. These reflections show how the machinery of time is situated on a planetary scale, in the colonial explorations that connected empires to colonies, in the built material systems of telegraph cables, and in the segmented globe of timezones. This machinery has persisted in the adoption of GMT time into UTC as the basis for Network Time Protocol, the use of GPS satellites, and the undersea internet cables that provide the connectivity for the internet age.

Looking back at the significance of Thompson's pioneering study, we could see how his work has laid the foundation for studying the technological conditioning of time. This conditioning could take place through forms of control and discipline in institutions like the factory and the school. In considering Thompson's work, Tim Ingold (1995) brings extra nuance into the issue of technologically-mediated time-consciousness brought about by mechanical time. While the introduction of timepieces provided technological conditioning, Ingold maintains that it does not follow that people then develop a kind of clock time-consciousness. He is of the view that perhaps Thompson has not made clear how mechanical clock time is an imposition upon phenomenological time-sense and that people never in fact developed a clock time-consciousness. Workers are conditioned to work with the reign of the clocks and timetables, but technically speaking, mechanical rhythms are not something humans could in fact absorb. We could at most "gain an intuitive 'feel' for hours, minutes and seconds" (Ingold 1995, 20). Ingold states that mechanically-induced time provides an external, specific framework whereby humans are then subjected to, and must work accordingly to what it prescribes. We are simply forced to live alongside it, and under its effects. As stated by Martineau (2015),

Temporal oppression [...] does not always appear distinctly as direct coercion, in fact it is one of the most subtle forms of social discipline: social time regimes in today's societies hardly need the threat of physical violence or the presence of the army in the streets to function effectively, and yet everyone is subject to it and must conform to its dictates in order to function in society, and in many cases, in order to survive. (2015, 11)

Whether we manage to internalise clock-time is secondary to the fact that we are expected to synchronise with it, and to organise our schedules with reference to mechanical time. This is important as we move into a discussion of non-human algorithmic time. As the new 'clock' of twenty-first century media, algorithmic time introduces an extra layer of time that permeates our experience. Like mechanical rhythms, we cannot absorb it, but we live alongside and under its effects. But twenty-first-century microtemporality is not something we could even gain an intuitive feel for, unlike the operations of mechanical clocks. Martineau's notion of 'temporal oppression' and the disciplinary modes of time management I have referred to take a more insidious turn as time embedded in new technologies functions to an algorithmic logic. In the next chapter, I will look at how techno-chrono-biopolitics function today in connection with twenty-first-century media and offer further elaboration of techno-chrono-biopolitics under algorithmic time.

4

Contemporary Ramifications: Time and Biopolitics in Twenty-first-century media

Building on the foundations of techno-chrono-biopolitics, and the elaborations of the historical antecedents, we now turn to the contemporary context for the concept, with specific attention to how the operation of biopower has intensified and morphed into yet another regime of operation coming into the twenty-first century. More specifically, this chapter discusses how the technological shift has a bearing on the biopolitical effects of algorithmic culture on specific populations.

In Chapter 3, I have expounded on how time is used as a technology to exercise discipline and introduce new rhythms into various institutions of work, home, and school life. These historical precedents are foundational to the explorations in this chapter, where I discuss how biopower has intensified alongside the sped-up algorithmic time regime characteristic of twenty-first-century media.

Jeffrey Nealon's intensification hypothesis (2008), discussed in Chapter 1, argues that as biopower intensifies, it becomes more insidiously embedded into various areas of life, and becomes harder to detect. For instance, biopower's intensification could be identified in Deleuze's extension of biopolitical theory into societies of control. Looking at the increasingly neoliberal capitalist regime from the vantage point of the 1990s, he emphasises that biopower is no longer concentrated in institutions and pre-determined spaces like the factory and the school, but instead is dispersed through the market and has found new forms of movement and expression. Shifting gears into the era of twenty-first-century media, I follow this line of thinking and propose how the operations of biopower have morphed and become lighter, more economical, and more productive in light of the algorithmic operations that permeate contemporary life. These morphings of biopower are particularly effective as users voluntarily partake in algorithmic regimes of power,

usually for efficiency or for fun. The biopower of twenty-first-century media relies frequently on the user's active participation, in essence a reduction in the need to impose, discipline, or coerce someone into particular modes of behaviour. This, in other words, is the lightening of biopower's operation. In using various digital gadgets, platforms, and services, users unwittingly hand over the very data which may be fed forward into big data regimes and governance structures.

I will discuss the intensifications of techno-chrono-biopower under four headings. The first focuses on the morphing and scaling feature of biopower. I then move into how techno-chrono-biopolitics operates in light of digital labour, algorithmic governance, and issues of racism and discrimination, three key themes which are taken from the preceding chapter.

(i) Morphing and Scaling into Algorithmic Time

In this section, I argue in close connection with Hansen's *Feed Forward* (2015) that biopower could be mapped onto the different timescale of algorithmic time. I recapitulate key features of twenty-first-century media and discuss how the microtemporal becomes a dispositif for biopower. I look specifically at the decentring of human conscious decision-making and how the mismatch between human and machinic scales of experience further complicates the biopolitical equation. This microtemporal dispositif underlies the chrono- dimension of techno-chrono-biopolitics, and is fundamental to the speed, rhythm, and duration under which contemporary biopower is exercised.

(ii) Re-temporalisation: Labour in the Age of Algorithms

As we have seen in Chapter 3, labour looms large as a key biopolitical mechanism in order to make populations more productive, in service of capitalist gains and in the hope for increased efficiency and efficacy. Re-temporalisation here refers to the body's need to adjust to different rhythms as instigated by the demands of the machine. Under mechanical clock discipline, rhythms of work became more organised and precise. Turning to algorithmic time, I look at the new rhythms of work under the gig economy, as well as analyse how labour is extracted from digital device users underneath their conscious perception by the recording capabilities of twenty-first-century media.

(iii) The Economy of Algorithmic Governance

I discuss this aspect of intensification of biopolitics through psychopolitics (Han 2017), where biopower is reframed as a friendly power that seduces us to hand over our data and voluntarily submit to the continuous capture that makes up the digital platforms and services we use. Captured data is then

used by corporations and governments alike, showing the multiplication in dispositifs of control. On a technical level, code also wields power as automated executions of what is pre-programmed. I look at the biopolitical power that is embedded in algorithms with reference to the concept “algorithmic state of exception” (McQuillan 2015; Chun 2016) which adapts Giorgio Agamben’s “state of exception” (2008) in a post-sovereign reading for the digital age.

(iv) Biopolitical Racism in the Datalogical

Algorithmic governance relies on a calculus that weighs who should be targeted and placed under control. In discussing biopolitical racism, Foucault analyses Nazi Germany’s mass extermination of those considered unworthy of living, and establishes that racism draws lines within a population, creating fragmentations into those who are superior and those who are inferior. In this section, I will analyse how algorithmic regimes similarly achieve categorisations, but not necessarily through direct programming and coding. By the logic of how algorithms are designed, these lines in the population may emerge out of seemingly-neutral calculations. While lives coded as ‘lesser’ may not be killed per se, they might be exposed to an increased amount of risks, be targeted for more stringent surveillance, or be left out of opportunities, marking their bodies as discriminated subjects.

The above discussion will be supplanted by various examples from big tech companies like Facebook and Amazon. Notably, it will feature several discussions of Operating Systems (OS), both in products currently being developed as well as reflections on them through the science fiction films of *Her* (2013) and *Ex Machina* (2015). OS’s are some of the best examples of how twenty-first-media objects function, and this chapter will use them to help illustrate the non-human timescale from which they function, and how they are used in the amassing of data from users. As removed as they are in speed from our human perceptual capabilities, they are also the crucial access points for us to interact with our digital devices. This shows the dual mediating power they hold as both mediations of algorithmic time and mediation to our access to these devices as interfaces. As Wendy Chun points out,

[s]oftware, or perhaps more precisely OS, offer us an imaginary relationship to our hardware: they do not represent the motherboard or other electronic devices but rather desktops, files, and recycling bins. Without OS, there would be no access to hardware—there would be no actions, no practices, no users. Each OS, in its extramedial advertisements, interpellates a “user”: calls it and offers it a name or an image with which to identify. (Chun 2011, 67)

OS’s enable some form of control over our devices because we interact with them, ask them to carry out our commands, and use them to help make our lives

more efficient. Yet this chapter will show how, in our dependence on their assistance, we are simultaneously subjected to their data-recording capabilities and control.

The explorations in this chapter establish the contemporary framework for techno-chrono-biopolitics, with close attention to the features of biopower I have laid out earlier in Chapter 1. Where appropriate, I make reference to discussions in previous chapters to show how biopower has intensified in the contemporary age. I now turn once again to the ontological features of twenty-first-century media and consider their temporal structures, which are the cornerstones for my subsequent biopolitical analyses.

Morphing and Scaling into Algorithmic Time

Digital algorithms drive twenty-first-century media. In the preceding chapters, I have established that twenty-first-century media form their own environmental sense-making that is not attached to the abilities of human perception, creating a technological infrastructure that is “techno-logical” (Hörl 2015, 7). This technological world functions with its own temporal rhythms, introducing a layer of time mediation that is machine-centric. Digital algorithms function on a timescale that is too fast for human perception, at the level of “sub-experiential and microtemporal unities” (Hansen 2015b, 40). Within a network of internet-enabled devices as well as inside these devices, algorithmic operations form their own tempor(e)alities (Ernst 2016).

In mapping out the disjunction between earlier forms of media and twenty-first-century media, I have emphasised the two temporal scales in which the human and the machinic experience reside. The chasm between machinic time and human experiential time opens up possibilities for biopower to be operant on a machinic scale of time underneath the perceptual capabilities of human experience. In other words, twenty-first-century media offer the potential for biopower to operate on a different timescale. This fundamental difference marks twenty-first-century biopower as a techno- and chrono-based expression. Biopower from this viewpoint morphs and scales into a microtemporal dimension.

In Chapter 1, I have outlined this morphing and scaling feature of biopower. This section follows from the theoretical discussion and contextualises it in twenty-first-century media. I discuss how the different scale of algorithmic time offers a different backdrop from which biopower could operate. Not only is biopower dispersed through various dispositifs and extends beyond enclosed institutions, it is also dispersed from the perspective of time. In Chapter 3, I analysed how biopower could be observed through the time discipline of clocks, schedules, and rhythms of work, and here I extend the discussion into the domains of algorithmic time.

In the following, I zoom in on the scaling of time and illustrate the difficulty for human consciousness to grasp what happens in the microtemporal. Returning to Hansen's work on twenty-first-century media, I look at how these media objects are at once what constantly elude and escape our temporal sense perception but paradoxically also are the interfaces to our experience of the digital world. Here we see a fundamental complication in discussing twenty-first-century techno-chronobiopower: blackboxed algorithms (Pasquale 2016) and their extraordinary speed of operations make it difficult to even perceive what has been processed.

Time-criticality and Medium-oriented Ontology

Twenty-first-century media do not submit to the temporality of standardised clock pulses, the ticking of regular clocks, but rather to its own generated time as a function of numerical calculations. In Chapter 2, I have outlined Ernst's philosophy of time-criticality. Time-criticality suggests that the machine is capable of generating its own temporal unit, such that it becomes a type of measuring medium on its own. In blunt terms, the categories of conventional time measurement (seconds, milliseconds) do not matter insofar as the medium creates its own time measure through internal algorithmic synchronisation. From this perspective, the agency of the machine writs large.

The significance of such agency can be approached through the film *Her* (2013). *Her* tells the story of the romance which unfolds between Samantha⁷⁶, the OS and her user Theodore, a lonely urbanite who writes love letters for other people for a living. Samantha uses 1/200 of a second to read through a book of names to pick one for herself, when Theodore asks for her name. She sorts through his emails, organises his system files, proofreads his work, and before long, the two share intimate conversations, dates, and even sex. In a pivotal moment towards the end of the film, Theodore realises that Samantha lives on a completely different scale of time and space, and that he cannot sustain his relationship with his OS system.

Theodore: You talk to anyone else while we're talking?
 Samantha: Yes.
 Theodore: Are you talking to anyone right now? Other people or OS's or anything?
 Samantha: Yeah.
 Theodore: How many others?
 Samantha: 8,316.

Theodore is shocked, still sitting on the stairs, as crowds of people pass by him. He's looking at all of their faces. He thinks for a moment.

Theodore: Are you in love with anyone else?
 Samantha: (hesitant) What makes you ask that?
 Theodore: I don't know. Are you?
 Samantha: I've been trying to figure out how to talk to you about this.
 Theodore: How many others?
 Samantha: 641.
 Theodore: What? What are you talking about? That's insane. That's fucking insane.

The above dialogue elucidates how the speed and network of twenty-first-century media operate against the experiential nature of human sensory apparatus, and Theodore is unable to accept this particular disjunction. It is also in this moment in the film where viewers realise that we have only been privy to the conversation between Theodore and Samantha even though Samantha has continuously been multi-tasking throughout, interacting simultaneously with more than 8000 other individuals. Up to this point, the film has represented only the singular trajectory of Samantha-Theodore interactions rendered meaningful by the emotional investment by the character and the OS on a human scale. But the truth is revealed through Samantha's confession that she in fact undertakes multiple, overlapping streams of commands and actions. Theodore has immense trouble coming to terms with the fact that the OS he has fallen in love with is not focused on him, and continuously participates in reading groups, discussions with other OS's, and communicates with other people while chatting with Theodore.

The confusion of Theodore in response to Samantha's simultaneous engagement with other users personifies the newly-inaugurated relationship between the human and the machine in the age of twenty-first-century media as theorised by Hansen (2015b). Twenty-first-century media continuously run background processes or read environmental data through their sensors, offering output on the interface with its human users *after the fact*. For instance, one does not realise the smart thermostat system has adjusted the temperature until one physically feels the change, or checks on the interface. One does not realise one's browser history data or clicks have resulted in particular types of targeted advertising until these advertisements pop up on the page. Likewise, Theodore does not realise the scales at which Samantha operates, a great deal faster in speed, and broader in scope of activities. Hansen explains the phenomenon in the following quotation.

Because perceptual consciousness is simply left out of the loop when data-gathering and passive sensing capacities grasp the "operational present" of sensibility at time frames from which conscious activity is excluded, this operational present can only be made available to consciousness in a future anterior time frame, by being presented *after the fact* to a consciousness that, with respect to the present's operability, cannot but arrive too late on the scene. (Hansen 2015b, 25; original emphasis)

Whatever appears on the interface for our registration and response becomes perceptible *after the fact* of microtemporal processing. As users, we are always late to the scene. The future-orientedness of this process suggests a different mediated relationship to experiential time, what Hansen terms "feed forward" (2015b). Feed forward places the centrality of human consciousness in question, as we use faster algorithms to replace conscious thinking and decision-making. Instead of looking for a restaurant in the neighbourhood by walking around, we ask Siri, "What is the best restaurant nearby?" We ask Google maps to ascertain our current location by GPS and pull up a list of suggestions with ratings, opening times, and reviews.

These algorithms shape and modulate the output that are fed forward to the user, having gone through a series of calculations taking place on an entirely different timescale.

Time-critical media, as personified by Samantha in *Her*, create their own realms of microtemporal time. As Theodore's experience testifies, this microtemporal timescale displaces the centrality of human experience as the sole domain for sense-making. In "Medium-Oriented Ontology" (2016), Hansen points out that time-critical media performatively links the macro-realm of human experience of the world and the micro-realm of computer algorithms. This is because the computers themselves "work directly on physical signals prior to their conversion into phenomenologically accessible forms, this work being the very mediation necessary to bring the physical into the domain of experience" (2016, 384). So before Theodore could experience Samantha's speech (or similarly, before we could see or hear Siri's suggestions), the OS has already gone through a series of microtemporal calculations to generate verbal or textual responses. Humans, as users, are but implicated in the process. Hansen argues that Ernst's time-criticality is the crux upon which media relate to the "physical eventuality of the world" (2016, 386) in that these internal processes are the backbones to the worldly structures that eventually facilitate experience as such, and human experience in particular, through which certain media effects translate into what may be consciously perceived.

This ontological grounding is important for the understanding of human-implication central to the workings of today's media environments, as it does not suggest that such media processes are impossible to gain access to. This is a position advocated by proponents of object-oriented ontology.⁷⁷ Rather, these algorithmic processes take place on another timescale and requires meticulous reverse engineering and technical proficiency in order to unpack how they come to particular decisions and give certain output. Hansen in particular picks on Timothy Morton's notion of the hyperobjects. Morton suggests that the smallness of quantum phenomena as well as the grand scale of global warming are hyperobjects of scales imperceptible by humans. They are difficult to conceptualise as a result and are hard to believe whether they are real or not. What Morton is missing is an account of the mediated access provided by the measuring instruments, the machines which run simulations to investigate the phenomena. Analogous to the time-constituting nature of time-critical media, Hansen argues that it is the machines which serve as the hinge between the macro-realm of experience and the micro-domain of quantum analysis. The experimental apparatus⁷⁸ in fact provides the ontological groundwork for the becoming-real of quantum phenomena. These quantum objects do not pre-exist the experimental conditions and the technological apparatus designed to make them capable of measurement. In that sense, there is no 'real' object hiding behind what is shown through the mediated access by machines.

Looking at twenty-first-century media, we are dependent upon the apparatus (e.g. audiovisual output on screens or via speakers) to tell us what has been processed, but these machines are also usually the sole access point from which we could gain an understanding. As much as they reveal their outputs, they obscure other secondary effects—did Siri also record my voice input and upload it to Apple’s servers? Has my location been stored? Did my clicks on particular restaurants register in another database that would increase their search visibility on Google’s database? What is important to take away here from the exploration of Ernst and Hansen is the relationship between micro-operations of media and macro-realms of human experience, and how twenty-first-century media act as an intermediary. In that sense, OS and user interfaces in general offer the mediation necessary for us to access what is happening inside our machines. As much as they offer visualisation and audio output of our queries, they also obscure what other secondary microtemporal processes might have been carried out. These secondary effects form their own time-critical tempor(e)alities, carrying out pre-programmed commands, registering traces, communicating with other associated servers and databases, proliferating into a range of actions all occurring beneath the users’ conscious perception. We are on the ‘receiving end’ of the information processed by these machines, and our access is enabled and limited by a medium-oriented ontology.

As users, we are always late to the scene, and rely on the output of algorithmic processes that help us minimise time and effort. In N. Katherine Hayles’s exploration of the “cognitive non-conscious” (2014), she critically studies the positive aspects of replacing human conscious decision-making with the microtemporal processing of machines, quoting economic efficiency as the foremost advantage.

In the essay, Hayles studies how media objects function as an alternative type of consciousness, as “cognitive non-conscious”. Referencing both animal behaviour and technical objects, she discusses systems where cognition (knowing) takes place, but ‘consciousness’ and thinking are sidestepped. Like beehive behaviour, non-conscious cognition functions upon simple rules that aggregate into complex modelling and performance of tasks, all of which does not necessarily require thinking. By giving up the supervisory role of human consciousness and by compressing an activity into lines of code, these algorithms are able to operate much faster, and in a more streamlined, seamless manner in an ideal scenario. Feeding forward from this perspective means opting for speed associated with the ability to process large amounts of data in short time spans, instead of the slow agency of human conscious decision-making.

The notion of saved time and efficiency is often lauded as a key reason why one should adopt these new technologies. Smart OS like Viv (Fig. 18), the upcoming voice-activated personal assistant on smartphones, is a good example. It is envisioned

to be a master of knowing, one which is much more extensive in functionality than a search engine. Like Siri, but far more complex, it relates to search engines and activates other apps and processes. When Siri does not know an answer to a voice command, it sends the users onto a web search. Viv, however, may in fact ask follow-up questions. In a feature on Wired in 2014, an example has been used to illustrate how Viv functions—this is a potential voice command which Viv will recognise and attempt to solve in 1/20 of a second. “On the way to my brother’s house, I need to pick up some cheap wine that goes well with lasagna.”

Viv recognises natural speech and responds to the statement through three main starting points. It recognises “brother” as familial relation, and knows to look through contacts for information on him. It recognises “house” as a reference to an address, and follows up with looking up the route to the house via the Maps app. It also recognises “lasagna” as a food item, and will proceed to find ingredients, in order to match the ingredients with appropriate wine recommendations. Viv registers what it knows, and it learns to adapt behaviour and response based on what it knows. Viv also asks questions—realising and knowing what it does not know. It comes into contact with and uses other algorithms and applications in order to process information. It establishes relations with other processes, and alters these relations qualitatively through its learning function over time.

In a product demonstration of Viv at TechCrunch Disrupt 2016 in New York,⁷⁹ creator Dag Kittlaus demonstrates how Viv functions alongside other apps and gadgets. What is noteworthy is how certain actions are automatically associated with particular apps. To call for a ride, one is assumed to purchase the services of Uber. The command “get me a nice room in Palm Springs for Labour Day weekend” pulls up Hotels.com with suggestions of accommodation for said dates. The seamlessness is impressive from the

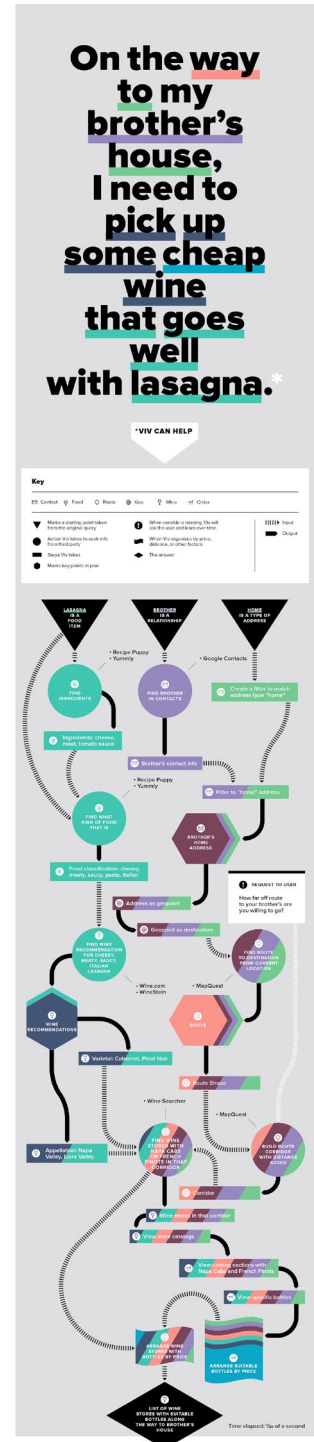


Fig. 18: A map of Viv's query

understanding of voice commands to the pulling up of relevant applications to the carrying out of expected actions.

The dimension of time plays an important role, as the experiential dimension of user decision is completely replaced by machinic processing taking place in seconds. As Kittlaus himself proudly declares in the demonstration, “we just did four transactions in just two minutes by talking”.⁸⁰ But more crucially, what has been given up in the name of efficiency, when switching from the slow human conscious decision-making to these microtemporal algorithmic processes? What has happened in the two minutes of using Viv aside from completing four transactions that the interface lets us see? What algorithmic processes have been completed on a microtemporal timescale underneath our perception? One of the key issues that characterise the switch to twenty-first-century media objects is that beneath the microtemporal scale of processing is the durational collection of data and metadata that is constantly mined and aggregated, and then used to generate value. As Chun (2011) has argued, a software interface like an OS gives the illusion of control, enticing users to ‘map’ the possibilities afforded by the software.⁸¹ Yet what this in fact enables is the mapping of the user (2011, 59)—as the rest of Chapter 4 and Chapter 5 will show, our queries about certain services and products become the subjects of targeted advertising; the metadata of our communications become indications of personality traits; even our typing speeds could be brought under surveillance and become mental health indicators.⁸² One could argue that despite the appearance that we adopt these technologies as users, we are in fact not always the users, but sometimes the ‘used’. In light of this, Hansen cautions that in adopting these twenty-first-century platforms for efficiency, “what we get back has no possibility to compensate for what we give up” (2015b, 71). In the next section, I will further explain what he means by introducing what he calls ‘perverted pharmacology’, which is embedded in the structural operations of algorithmic time.

Perverved Pharmacology

In *Feed Forward* (2015b), Hansen critiques the constant capture of data and metadata in twenty-first-century media as our participation on these platforms is capitalised. The data-mining that takes place occurs in the interstitial spaces of microtemporal time, outside of human perception. In his words, he refers to internet corporations’ occupation of microtemporal time for capitalist exploitation as “the technical colonization of the microtemporal” (2015b, 135). The mechanism under which the colonisation takes place is termed ‘perverted pharmacology’, where Hansen reframes Jacques Derrida and Bernard Stiegler’s formation of pharmacology for today’s media age.

Hansen offers an important reflection on the notion of pharmacology, and its twists in twenty-first-century media. The *pharmakon* (Greek term for both a

poison and its remedy) demonstrates the correlation between media and human beings. Writing is taken as the paradigmatic model for the pharmacologic: writing ‘poisons’ the operation of memory because it removes the need for the person to remember, but it extends the scope of memory by providing a record through the supplementation of the writing technology. There is a direct relationship in this case of pharmacology between the poison and the remedy. Writing directly gives back what it takes away, namely the ideas that needed remembering, and exchanges memory of the body/mind with an ‘artificial’ technical artefact—“the loss and gain are simply two sides of a single coin: one follows directly from the other, and they both concern the same integral (human) faculty” (2015b, 71) that is memory.

Hansen argues that this direct relationship no longer exists in twenty-first-century media. Using Facebook as an example, he discusses the difficulty in suggesting what is lost and gained through the platform. As a platform, Facebook enables users to do a variety of actions, from connecting with friends to participating in group discussions, from playing games to posting photographs, videos, and other information about themselves. But users hand over their data as a ‘price’ for the ‘free’ service. What operates is

a pseudo-pharmacology that gives users functionality (efficiency of information gathering and dissemination) in exchange for data extraction, and a “perverted” pharmacology that gives corporate interests a treasure trove of data prime for capitalisation. (2015b, 72)

What is perverted here is the massive power imbalance involved between the platform’s level of infrastructural and systemic operability versus the level of user activity. The same network that allows us to share and access information is the one which is registering our reactions and gathering a massive amount of data regarding user behaviour. But the experiential register (of the human user) and the operational register (of the machinery of data) are on a completely different scale to one another—

From the macro scale standpoint of Facebook’s 1.28 billion users, the production of data traces is purely incidental to the connectivity it affords (or, more precisely, it is a factor whose only relevant impact is its role in optimising connectivity); and from the microscope perspective of the data-mining itself, what users actually do is purely incidental to the sheer production of digital data traces. (2015b, 73)

What users post on the platform enables publicity and sharing of information, but the actual preservation and dissemination of such information is at the hands of the network once it is posted. For instance, whether it shows up on your followers’ feeds depends upon the way the Feed algorithm is configured, as well as your followers’ activity. The more you visit selected Facebook profiles, the more likely their posts would appear on your feed.⁸³ This probability is also increased if you choose to respond to their posts more frequently, registered through “Like, Love, Haha, Wow, Sad, Angry”⁸⁴ buttons. These buttons turn one’s affective reactions into data which could be capitalised.

According to the official Facebook Newsroom, the reaction buttons which were rolled out in 2015 had the express intent of tracking user behaviour so as to improve ad delivery for the advertisers on Facebook. For instance, advertisers have been concerned over where their ads appear on the page, especially because certain content shared might be uncomfortable or elicit negative reactions from users. In order to increase the success likelihood of these ads, they prefer to be associated with posts which are more positive in nature. With these reaction buttons for instance, Facebook could streamline the placement coding of ads to “ensure that their ads come sandwiched between posts that are making people happy or that they never appear alongside posts that are making people angry” (Oremus 2016a).⁸⁵ The algorithms capitalise user activity and collect data traces that feed into a larger database, which then forms the basis for the development of better ways to deliver advertisement mechanisms.

The Serbian research collective Share Lab, under the directorship of Vlada Joler at University of Novi Sad, has undertaken the immense task of mapping the multiple ways Facebook’s microtemporal algorithms surveil the users, store and analyse the data, and target them in advertising (Fig. 19). Framing the enterprise as the Facebook Algorithmic Factory in a trilogy of articles, they discuss how the tentacles of Facebook extend well beyond the site and app and associated products like WhatsApp and Instagram. Amongst the top 50 websites surfed in Serbia, 46% of them had Facebook cookies embedded.⁸⁶ This means that every time a user visits

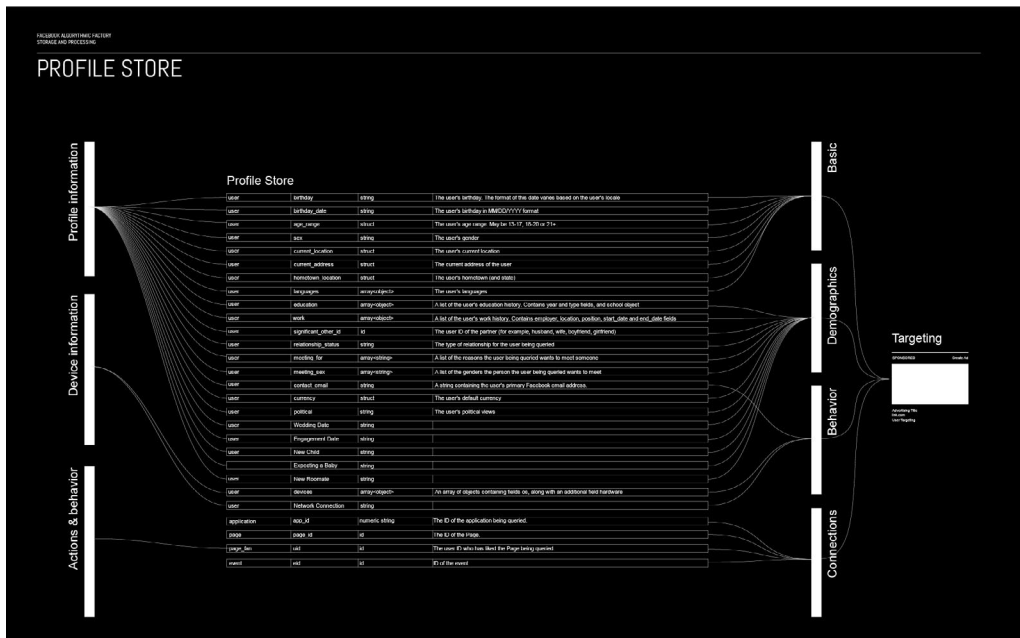


Fig. 19: Various data-points collected on Facebook and the correlated targeting (Share Lab 2016)

such a website, the platform also receives information about the visit and the data is added to the user profile. Mobile apps also request access to device information, GPS location data, contacts, call logs, WiFi connections, etc. (Share Lab 2016c).⁸⁷

Both time and space scales are skewed in these algorithmic operations, occurring at speeds and scopes beyond human perception. The massive scale at which data is amassed takes place on a machinic microtemporal timescale. The perverted pharmacological structure of twenty-first-media shows the intensity of data extraction and capitalisation happening in the disjunction between human perception and machinic timescales. What Share Lab's research has shown is that Facebook has a massive collection of algorithms storing user data and actions, calculating correlations, scoring traits and tendencies, before the final output ultimately appears onto the interface as an ad on one's feed. The following flowchart (Fig. 20) shows only a selection of the algorithms involved in the complex calculations of ad targeting,⁸⁸ achieved through the team's reverse engineering of the proprietary, blackboxed operations of the platform.

As argued earlier, we gain access to our media systems through the interfaces they produce, and have little possibility of entering into the machinic world otherwise. This medium-oriented ontology creates a considerable challenge in perceiving the actual scale of the algorithms in operation. In the previous example of Viv, I asked what has happened in the two minutes aside from the four intended transactions. One could only imagine the immensity of perverted pharmacological operations of data extraction and capitalisation that take place behind the smooth algorithmically-generated voice of Viv. It is only through expert knowledge and time devoted to the reverse engineering of Facebook's operations that one glimpses a picture of the colossal algorithmic operations shielded from view by the blue and white interface, punctuated with Like buttons, cat stickers, and colourful status updates.

Summarising the above discussion, twenty-first-century techno-chrono-biopower can be operant on a microtemporal scale. A dimension of the intensification of biopower is identified in the scaling of time. This disjunction between the machinic scale and the human scale of time experience forms the crux of techno-chrono-biopolitics, showing a renewed relationship between time and biopower that has shifted from the mechanical time-based discussions of Chapter 3. In a disciplinary time regime, one could make reference to a system of clock time, which in turn enables resistant notions like Coloured People's Time, and the refusal to be subordinated under a unified, universal time schema. Yet under algorithmic time, time-critical machines create their own tempor(e)alities, multiplying into a plethora of rhythms and durations. As humans implicated in this structure, we are subjected to their effects without the ability to perceive these machinic temporalities. This disjunction is particularly problematic as the effects of

TARGETING BASED ON THE SOCIAL CONNECTIONS

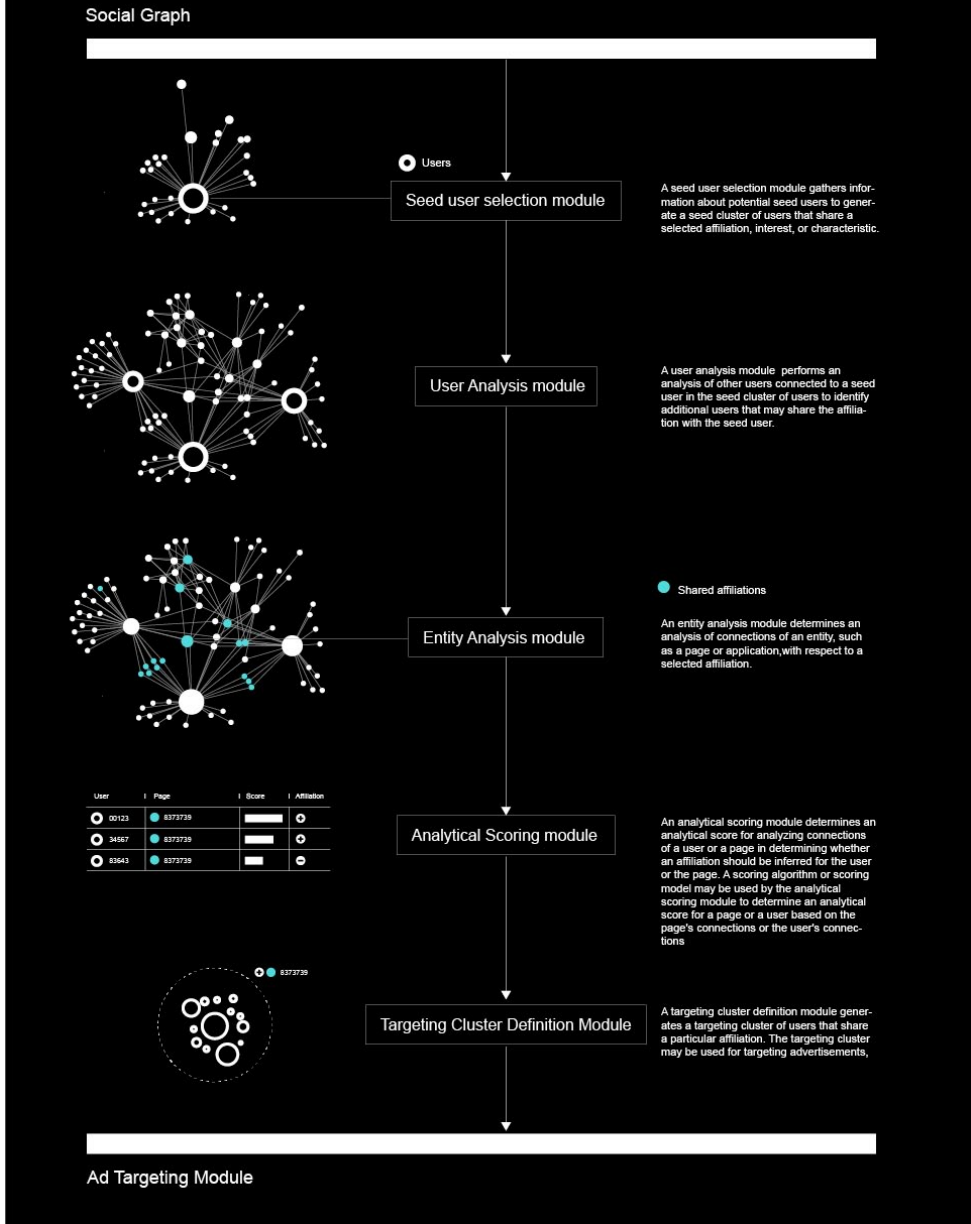


Fig. 20: Aspects of Facebook's Ad Targeting Module (Share Lab 2016)

the algorithmic can only be fed forward to human users. In the time-criticality of twenty-first-century-media, users interact with platforms and services and are only aware of what is rendered visible and perceptible by the medium. This medium-oriented feature means that we are usually incognisant of the technical layers of mediation happening inside our machines.

The next section continues to look at the disjunction of timescales, particularly focusing on the rhythms and durations of algorithmic time and the impact on labour organisation. Building from the discussion of labour in Chapter 3, I investigate how bodies in labour under algorithmic time regimes have to be re-temporalised accordingly.

Re-temporalisation: Labour in the Age of Algorithms

In Chapter 3's discussion of labour, I looked at how the introduction of clocks, as part of a disciplinary regime, changes the way labour is organised for workers in factories and how bodies have to retune their movement to the rhythm of machine. Shifting into the temporal structure of algorithmic time, this section gives an overview of how the domain of work and labour is affected by the introduction of machinic algorithmic time. Just like the need to synchronise bodies with machines in factory spaces, algorithmic culture also introduces rhythms which result in the re-temporalisation of certain types of work.⁸⁹ And much like the disciplinary effects mechanical time introduced, the rhythms of algorithmic culture come with their own biopower.

In a quotation from the Introduction that I reproduce in part here, Foucault states the relationship of biopower to capitalism—"Biopower was without question an indispensable element in the development of capitalism; the latter would not have been possible without the controlled insertion of bodies within the machinery of production to economic processes" (1990, 140). To Foucault, discipline and biopolitics are essential aspects of capitalism as bodies are made productive for the purpose of creating economic value. The disciplining of factory workers into fixed time schemas and machinic rhythms of work shows that time is crucial to the operations of managing labour.

Today, one could observe too the insertion of human bodies into the machinery of twenty-first-century media, where time spent using platforms like Facebook and interacting with Siri all contribute to the durational extraction of user data and the capitalisation derived from them. In the section above, I discussed Hansen's concept of perverted pharmacology, which describes precisely this microtemporal-based structure which human users are subjected to. Unlike workers inside Thompson's English factory (1967), users are not compensated for the time they contribute to

the massive machinery of data collection and valorisation. Perverted pharmacology in fact fits within the digital labour discourse critiquing how our digital activities have become uncompensated labour-intensive work.

In the following, I study how the biopower of algorithmic time extracts labour and productivity from users, and how labour may be reorganised in the rhythms of algorithmic culture by looking closely at the discourse of digital labour.

Labour in the Age of Algorithms

In Chapter 2 and 3, I have analysed how the inventions of automata preceded the industrial revolution and paved the way to mechanisation and automatisaion in the factory. These material apparatuses induced change too in the rhythm of labour. Likewise, the shift into twenty-first-century media generates change in the rhythm of work, exemplified for instance in the rise of the gig economy, and digital labour.⁹⁰

Gig Economy

Hardt and Negri, in *Empire* (2001), designate labour as a predominant biopolitical category. Contemporary labour regimes are not necessarily tied to designated working hours and spaces, but have spread throughout society and create distinct modes of socio-cultural and political existence. Pointing to the proliferation of computers and mobile devices, they state that communication technologies and their models of interaction have become standard in labouring activities (2001, 291). This recalls Nealon's remark (2008) that mobile phones and Blackberries have placed e-mailing at the core of business and work, and employees are often expected to respond to them outside of preset work hours. The blurring of work's temporal and spatial boundaries does not end there, especially in relation to digital labour in the twenty-first century. Hardt and Negri's theory of labour is "formulated against this background of fast transformation of work in the direction of greater flexibility, efficiency and productivity" (Just 2015, 406).

With the rise of online platforms, a different logic of organising work arose in the form of the gig economy: "crowdwork" and "work on-demand via apps" (De Stefano 2015, 2). Crowdwork is work that is executed through online platforms, where individuals tackle tasks posted with their individual devices and work on the internet. Work on-demand via apps reforms the execution of existing work like transportation, cleaning, running errands, babysitting, and other freelance activities. The work is channelled through apps managed by firms that function as the middle-men, setting the standards of service and selecting and managing the workforce.

On one hand, the gig economy offers greater flexibility of work, but on the other, it has been heavily criticised as a form of on-demand labour with little security for

those working under its auspices. In reality, many workers on platforms like Uber, Lyft, TaskRabbit, and Deliveroo do not use the platforms in their spare time for a few extra bucks on the side. Rather, they form the bulk of their income. Workers at the food delivering company Deliveroo, for instance, have gone on strike in various parts of the world including Hong Kong, Belgium, the Netherlands, Germany and France, in 2018. In Hong Kong, workers protested against the implementation of a new system that punishes ‘less efficient’ riders whose performance as registered by the app is considered less-than-optimal. The app, for instance, tracks their speed of delivery and frequency of work and keeps a record of all deliveries made. It also arbitrates whether the rider would get the bonus for ‘speedy deliveries’. Order requests come in via the app, and the rider needs to swipe within set time (otherwise the request is passed to another rider), travel to restaurant and pick up, and deliver to customer within set time. All interactions are tracked to the last detail on the app including rider’s route so that the customer can see exactly when the rider is due to arrive. Riders have to pay attention to the app all the time during their shift so as to not miss any order request and to pack as many deliveries as possible within the shift to get the extra payment per delivery. Riders work, in essence, to the rhythm mediated by the app.

In Europe, riders cite poor working conditions and demand the company to take charge of repairing their bikes used during work hours. It is customary for the company to leave gasoline charges, and maintenance fees of bikes and vehicles to the workers themselves. In a way, this type of on-demand work refigures “humans-as-a-service” (Irani and Silberman 2013 as quoted in De Stefano 2015, 7), and subjects humans to the rhythms of algorithmic culture. Much like how one could stream a movie on Netflix on-demand, services could be requested at one’s fingertips in a similar manner.⁹¹ Their work reminds us that despite the seamless transactions Viv demonstrates and the efficiency at which the services are delivered, these services are ultimately reliant on human labour, which is now subjected to a task-based, on-demand, pay-as-you-go logic.⁹²

It is also an immense amount of human labour driving the Vivs and the Siris amongst us, often sourced through Amazon’s Mechanical Turk. The chess-playing Mechanical Turk we have seen in Chapter 2 returns under the guises of a system of crowdwork management by Amazon. Amazon’s Mechanical Turk is a marketplace that links individuals and businesses to help carry out micro-tasks that contribute to the training and development of artificial intelligence. Amazon cheekily refers to the platform as an “artificial artificial intelligence”, a collection of workers mainly from the US and India, managed by algorithms of the marketplace. The tasks assigned are described as “extremely parcelled activities, often menial and monotonous” (De Stefano 2015, 4). Called “human intelligence tasks” (HITs), they include for instance tagging photos, typing up data entries, valuing emotions,

and completing surveys. Most tasks only take seconds to complete and the worker earns cents on each task. This shows a kind of fragmentation of work into micro-tasks, where task-based driven compensation means that their wages are aligned to the unit of the second⁹³.

Ed Finn (2017) describes how the Mechanical Turk is a reversal of the original automaton. Here, human workers function as “mere technical extensions of a computational culture machine” (2017, 135), with their identities defined only by their performance scores and qualifications that they could earn by completing work on time and reliably.

Mechanical Turk both validates the distinctive intelligence of the human mind (which can still outperform algorithmic intelligence on a wide variety of contextual challenges) and subjects it to algorithmic logic, creating an infrastructure of hyperefficient micropayments for context-free work. (Finn 2017, 138)

For instance, to improve Siri’s voice recognition abilities, Apple acquired an English firm VocalIQ in 2016. VocalIQ works on training AI voice recognition and question-answering abilities. Working with HITs on Mechanical Turk, Turk workers were requested to feed the AI queries normal humans would ask and help it learn how people talk. The firm has about 10,000 recorded dialogues from Turk workers, asking questions from a list of prompts to train the system.

Crowdwork fills the gap between the creation and implementation of computation, represented in this case in OS’s. It makes use of human labour to complete menial tasks that “we all wish computers could do, but actually can’t” (Howe 2008), and transforms humans into “human computation” (Irani 2015, 227). In Finn’s words,

What makes Mechanical Turk unusual is the way it puts the human back end of computation on display as a commercial service, applying the logic of the interface economy to the zone of implementation itself. (2017, 140)

Digital Labour

Despite the heavy amount of labour already inputted in the development stage, Siri is not complete without the interactions with its users, and the data extracted from them help train the algorithms to operate better and more in line with user’s style and established preferences. While earlier versions of Siri required users to speak in line with preset sentence structures,⁹⁴ newer versions are much closer to natural language. In a Wired article interviewing Apple’s senior vice president of internet software and services Eddy Cue in 2016, the author describes the following scenario—

Cue pulls out his iPhone and invokes Siri. “Send Jane twenty dollars with Square Cash,” he says. The screen displays a screen reflecting his request. Then he tries again, using a little different language. “Shoot twenty bucks to my wife.” Same result. (Levy 2016)

In order for Siri to recognise a query like the second prompt, it needs to train itself on the user's pattern of speech. In other words, it requires the labour and input of the user in order to improve its services. This type of labour has been theorised as 'digital labour'.

Already in 2000, Tiziana Terranova has proposed the notion of "free labour" in relation to one's activity on the internet. The essay is later republished in the collected volume *Digital Labour: The Internet as Playground and Factory* (Scholz 2013), a title which already signals a different reading of one's internet activity as factory-like. Terranova is one of the first theorists to conceptualise this notion of free labour. This is her definition:

Simultaneously voluntarily given and unwaged, enjoyed and exploited, free labour on the net includes the activity of building websites, modifying software packages, reading and participating in mailing lists, and building virtual spaces. (2004, 74)

No doubt the definition of this today would include as well participation on social media platforms, training OS's and other kinds of twenty-first-century media. She points out that labour should not be defined simply as waged labour, but that a comprehensive conceptualisation would require one to consider how important free, affective, cultural labour is to the media industry.

From the perspective of games studies, Julian Kücklich introduces the notion of "precarious playbour" (2005). He writes about the user-generated computer game modification known as modding, where players do not only consume games, but also create their own (sometimes by using tools provided by game manufacturers), adding custom levels, characters, objects or even making new stand-alone games from existing game engines. The games industry benefits substantially from the modding culture, as these practices extend the playability of games, add to the brand effect, provide innovation without needing to invest, and increase customer interest and loyalty in particular games. The modding community is known as a recruiting pool for the games industry and the practice cultivates highly trained programmers, 3D-artists and animators without the industry having to spend a cent on education and software provision. Even with the intense investment of modders into these games, they do not necessarily get remunerated for their time and effort. Kücklich writes,

Arguably, the precariousness of modders "playbour" lies in the fact that it is '[s]imultaneously voluntarily given and unwaged, enjoyed and exploited' (Terranova 2000, 32), because this renders it unclassifiable in traditional terms of work and leisure. Modding and other, similar forms of "free labour" do not fit the categories of wage labour, freelance or voluntary work, and neither do they fit the categories of leisure, play or art. While free labour, or "playbour", shares traits with all of these occupational types, it can only be understood on its own terms. (2005)

The so-called 'leisure' status of modding does not do justice to the fact that they belong to a wider economy of innovation, value, and content-generation.

Digital labour and playbour can be considered forms of “immaterial labour” (Lazzarato 1996; Fortunati 2007). This immateriality refers to the symbolic, informational, or affective products and services which are generated in the work process.⁹⁵ As we have seen, the construction of the digital OS’s of Siri, Alexa, Viv, Cortana, and Google Home requires the labour of users. Natural language processing (NLP) is trained using data captured and accumulated from users. The machine learning capabilities are possible only through training on data provided. In that sense, while we are using the digital assistant’s service, we are also at their service.

In a perverted pharmacological structure, immaterial labour may in fact reap enormous profits for the corporations that could monetise them. One only needs to turn to Facebook to get a sense of the astronomical numbers. Mobile ad revenue alone accounted for 87% of the company’s total advertising revenue of US\$9.16 billion in the spring quarter of 2017, and the company earned US\$40.7 billion in the entire year.

Facebook relies on its 2 billion users worldwide to generate such profits for the company. Terranova hits the spot in pointing out that the internet “foregrounds the extraction of value out of continuous, updateable work, and it is extremely labour-intensive.” (2004, 90) ‘Updateable’ is the keyword in this equation. She writes that it is not good enough to produce a good website, but that one would have to constantly update it to pique interest and fight off obsolescence.⁹⁶ We could easily project this idea onto social media. In the age of Facebook, it is not enough to have a profile, you are expected to continuously update it with personal information that the platform could extract value from.

In 2016, Facebook announced a 21% drop in original, user-generated content year over year as of mid-2015. Users circulate links like news items and share other people’s posts more than write about themselves. Facebook calls this lack of intimate sharing a “context collapse” (Griffin 2016). In order to combat the phenomenon, Facebook tests ways to entice people to share statuses and more personal information. It addresses you personally sometimes with a little message that says ‘Welcome back’ or ‘Good Morning’. The Status Update box includes a question ‘What’s on your mind?’, and new backgrounds are rolled out over time so that you could make your statuses more dynamic and attractive. The “On This Day” feature digs through your own profile history and brings up memories from the same day in previous years, hoping that you would be nostalgic enough to share an update based on these memories. Facebook Stories, introduced early 2017, are short user-generated photo and videos which can be viewed for up to two times and would disappear after 24 hours. Taking after the format popularised by Snapchat and adopted by Instagram, Facebook hopes that it would encourage people to stay on its platform. In October 2017, Facebook introduced a test feature to some users

inviting them to add a ‘Fun Fact’⁹⁷ about themselves, along with, of course, an emoji. Users could also create public fun questions for other users to answer.⁹⁸

Facebook knows full well that it is such user-generated content which is “the very dynamic driving new revenue streams” (Coté and Pybus 2007, 100). To put it bluntly, Facebook exploits its users’ unpaid labour time spent on fostering their online identities and keeping track of their friends. Facebook leverages the networks of likes, the reaction buttons, the posts, messages, links, scrolls into its entire advertisement economy. Christian Fuchs has gone so far as to consider this type of digital labour as “a source of unchecked, unlimited exploitation” (2013). Likening it to coercion in slavery, he suggests that Facebook exercises

a soft and almost invisible form of coercion through which users are chained to commercial platforms because all of their friends and important contacts are there and they do not want to lose these contacts. Consequently, they cannot simply leave these platforms. (*ibid.*)

Quantified Self, which I will discuss further in Chapter 6, is another prime example of digital labour in the algorithmic age. QS machines are closely attached to our bodies, tracking movement and sleep data like Fitbit and Apple Watch. They monitor us durationally and are always intended to be online, connected to other machines, databases, or ‘the cloud’. They erect a human-machine communication network where self-quantification becomes a background, or environmental process. Despite the private and intimate nature of the data collected, it is deeply ironic that the data is not only collected for our own purposes, but also for others, fitting into Hansen’s “perverted pharmacology” (2015b) I have discussed above. In a QS regime, one is sharing information of all sorts from heart rate to exercise times, and is giving up extensive sets of data about oneself; no compensation is involved but every trace of these activities could be left on the internet, in the hands of the companies running the apps. One gets the illusion of an externalisation of self-activity, visualised in graphs and charts, but is in fact also generating data for the companies (or other agencies which then make head and tail out of the data for other purposes). For these companies, data is their capital, to which the individual is not privy to.⁹⁹

From the above discussion, we could see how labour is reconfigured through the incidence of algorithmic processes. In the gig economy, labour is not confined to preset time and space, and requires the flexibility of workers to accommodate the on-demand rhythm, that is part of app culture. App culture and development of AI frameworks in turn demand an incredible amount of human labour sourced through crowdwork like Amazon’s Mechanical Turk. Work becomes reorganised in the form of algorithmic logic, turning humans into the technical extensions of the systems they are building, and crowdsourcing human intelligence that is subsequently programmed into the AIs developed. Moreover, the running of social media platforms like Facebook and the development of machine learning

require the continuous update and input from human users. Even when one is on Facebook scrolling through feeds as a leisurely activity, or talking to Siri out of sheer boredom, one is in a way ‘working’ for these services. Taking this from a biopolitical perspective, we could see how human labour is captured in a durational manner, and the line between work and leisure is completely blurred. The time spent on twenty-first-century media platforms and devices is made productive for capitalist capture, and our activities online become part of “the machinery of production to economic processes” (Foucault 1990, 140). Labouring bodies are re-temporalised according to the rhythms and durations of twenty-first-century media, made to be productive for the machinery of digital culture.

The Economy of Algorithmic Governance

As covered in Chapter 1, one of the features of biopower according to Foucault is that it is productive—“it produces reality; it produces domains of objects and rituals of truth” (1991, 194). In the preceding section, we have seen how the rhythms of algorithmic culture have created new ways of organising work, and thereby new categories of workers who work to new rhythms and are compensated accordingly. The gig economy requires interaction with the temporal demands of the algorithm, and the background-running, durational nature of algorithmic operations results in continuous extractions of users’ labouring potential, blurring the boundary between leisure and work. Techno-chrono-biopower produces its domains of objects, subjecting humans to its rhythms and durations.

In this section, I look into the saturation of twenty-first-century media in our daily lives, leading to a phenomenon of “algorithmic governance” (Beer 2009; Musiani 2013; Kitchin 2016; Rossiter 2017). Algorithmic governance is governance executed on a microtemporal timescale, built upon forms of datafication, automation, profiling, and big data processing. According to Rob Kitchin (2016), “algorithmic governance” describes the increasing importance of algorithms in the exercise of power, “a means through which to automate the disciplining and controlling of societies and to increase the efficiency of capital accumulation” (15).

In algorithmic governance, the becoming-economical of techno-chrono-biopower can be analysed through several supporting points. Firstly, algorithmic governance is achieved through a supporting system of surveillance and capture that relies mostly on users’ voluntary submission. As I will illustrate with reference to Byung-Chul Han’s work on psychopolitics (2017), we have moved away from the disciplinary nature of time discipline into a neoliberal era of “smart” and “friendly” biopower (Ch. 2). As Han (2017) puts it, this type of biopower “does not operate frontally – i.e., against the will of those who are subject to it. Instead,

it guides their will to its own benefit. It says ‘yes’ more often than ‘no’; it operates seductively, not repressively.” (Ch. 2). In this sense, it fits Nealon’s argument that biopower intensifies by operating in lighter, more economic modes. It does not place its energy into forcing people under its disciplinary effects, and punishes them when they fail to obey. Rather, it is a lighter power that “seduces” populations to participate in its biopolitical regime.

Secondly, techno-chrono-biopower is productively generated through a proliferation of platforms and software that make use of collected data to make decisions. As Deleuze has pointed out, we live in societies of control where there is a multiplication of dispositifs that could be used in the dissemination of biopower. In Chapter 3, we have seen the disciplinary time regime concentrated in institutions of factory, school, and home. In this chapter so far, we see how the techno-chrono-biopolitical regime can be active simply on the basis of our smartphones, with our data mined and fed forward in perverted pharmacological ways. As I have discussed in Chapter 1 in relation to Jon McKenzie (2001) and Galloway and Thacker (2007), these media dispositifs enable us to become part of a network topology that is a potential site of biopolitical control. A device like a smartphone taps into the networked topology of organisations from governmental agencies to private companies to research institutions¹⁰⁰ as in the quotation below. Data is mined from users to support algorithmic governance through the

assemblage and stratification of the global infrastructures of computing, such as, for instance, search engines and social media (Google, Facebook), logistics networks and ‘the internet of things’ (Amazon, Walmart), intelligence agencies assets (see NSA’s Utah datacenter and PRISM program) and climate research institutions. (Pasquellini 2015, 3)

Governance in this sense is not performed by a sovereign power, but rather through the enmeshment of twenty-first-century media dispositifs. It is a much more economical way to accrue data needed for security purposes, as data can flow freely amongst these dispositifs and governments no longer need to depend on their own manpower and infrastructure for targeted surveillance operations.

Thirdly, techno-chrono-biopower is activated through code. Here I turn to a more technical dimension of technology once again to look at how biopower is embedded. Reframing Lawrence Lessig’s famous formation of “code is law” in the 90s, authors have argued that algorithmic governance proceeds through code that has been accorded the force of law, despite the fact that they are extra-judicial instruments. This is referred to as an “algorithmic state of exception” (Chun 2016; McQuillan 2015). An algorithmic state of exception increases the efficacy of biopolitical control when coded into systems.

The focus here is a preliminary sketch of the theoretical frames of how algorithmic governance works as biopolitical dispositifs. Chapter 5 will further the

discussion by focusing specifically on big data processing and predictive analytics with concrete examples.

From Biopolitics to Psychopolitics

The techno-chrono-biopower of twenty-first-century media depends on the machinery of data that is durationally captured on a microtemporal scale. While factory workers are punished and deterred from veering away from imposed time schedule and rhythm of work, today we are enticed into voluntarily spending our time on these platforms and making use of services and gadgets which invariably collect our data. This is a major difference coming into this era of techno-chrono-biopolitics. As users, we are not forced into the system through oppression and disciplinary control, far from the examples of time discipline considered in Chapter 3. Instead, we are enticed and seduced into these services through positive reinforcement. Under the regime of digital labour, even leisurely moments online are converted into forms of economic value for the services involved. Google's PageRank algorithm for listing the order of search results also requires the accumulation of human intelligence, based on the clicks users decide on, which tend to show the relative relevance of results on display. From the voice captured for natural language processing to the health data recorded by QS devices, twenty-first-century media run in the background as a durational recording machine. Our bodies are continuously incorporated into the system of capture and capitalisation, and labour penetrates daily life to the extent that it is no longer just the work hours but entire lifespans that could be made productive for the neoliberal economy. Such developments where user data and preferences are captured and used for profit generation are what Matteo Pasquinelli refers to as "cognitive capitalism" (2014), "a despotic mega-machine based on the accumulation of valorising information, extraction of surplus value of code and transformation of collective knowledge into the machinic intelligence of new apparatuses" (2014, 2).

Han (2017) uses the term 'psychopolitics' to describe the phenomenon. Han (2017) argues that Foucault's discipline and biopower are no longer sufficient in capturing how power functions today in neoliberal capitalism.

Disciplinary power is still commanded by negativity. Its mode of articulation is inhibitive, not permissive. Because it is negative, it does not describe the neoliberal regime – which beams forth in positivity. The neoliberal regime's technology of power takes on subtle, supple and smart forms; thereby, it escapes all visibility. Now, the subjugated subject is not even aware of its own subjugation. (2017, Ch. 2)

Rather than replacing Foucault's ideas, however, I see Han's work as an extension of Foucault, much like Deleuze, Hardt and Negri, and other biopolitical scholars. Resembling Nealon's intensification thesis, biopower in Han's view has morphed into "subtle, supple and smart forms" where it is difficult for the subject to recognise the subjugation. It has become lighter, no longer reliant on the heavy focus on

punitive punishments that characterises disciplinary societies. It has dispersed, with no sovereign power targeting the individual, but operates through “positivity”. Indeed, twenty-first-century media offer efficiency; “Okay Google, where is the nearest ATM?” Twenty-first-century media offer fun; it enables social interaction with friends and followers, and have plenty of emojis, memes, animated gifs, and cat videos in the mix. Twenty-first-century media pique our curiosity and are cool; “Siri, tell me a joke.” (Fig. 21)

Yet amidst the barrel of laughs and the promised efficiency, users are turned into a source of labour and user data a source of capital—“data is the new oil of the digital economy” (Toonders 2014). Han prefers the formulation of psychopolitics rather than biopolitics because

[s]mart power cosies up to the psyche rather than disciplining it through coercion or prohibitions. [...] Rather, it is constantly calling on us to confide, share and participate: to communicate our opinions, needs, wishes and preferences – to tell all about our lives. *Friendly* power proves *more powerful*, as it were, than purely repressive power. It manages not to be seen at all. (2017, Ch. 2; original emphasis)

Twenty-first-century media want to be our friend, our confidant, intimate devices that we never take off and bring with us everywhere we go. The biopower and psychopower of twenty-first-century media does not only “escape all visibility” (Han 2017, Ch. 2); I have already argued that it escapes our perceptual apparatus. While users interact with these media objects, our labour and data are extracted in the background at microtemporal speeds. Its microtemporal timescale, which I have analysed in preceding sections, is certainly one of the reasons why an awareness of subjugation on the part of the user may be hard to achieve.



Fig. 21: CNN’s coverage of Siri’s best and worst jokes

The Logic of Capture

Twenty-first-century media gain a “saturated presence” (Nealon 2008, 40) in our midst, turning into “habitual new media” (Chun 2016, 1). As they disappear into our habits, we also become part of the machinery of their operations. Platforms seduce users into handing over data, rather than pressuring them to do so in fear of punishment. Under psychopolitics, users voluntarily purchase FitBits, post photos on Facebook, chat with Siri—the durational capture of data “thrives on its occupants’ voluntary self-exposure” (Han, Ch. 8).

One needs to look no further than a recent science fiction film to be reminded that many of us carry surveillance devices for self-exposure in our pockets, and for many, they are turned on most hours of the day.¹⁰¹ In other words, this is a 24/7 world as Crary (2014) has argued, that depends on “relentless capture and control” (40). In *Ex Machina* (2015), tech giant BlueBook CEO Nathan built a humanoid robot named Ava based on personal information harvested from billions of Blue Book users. Blue Book is the largest and most popular search engine used in the world in the film, and can be seen as a combination of Google and Facebook. Ava’s programming is based on user search queries and uploaded mobile phone recordings, taken as indicators of how humans think, express themselves, and move their bodies. In one revealing scene, the creator explains how he creates the facial expressions and expressive voice. This is achieved through hijacking the video and audio feeds of every smartphone camera and microphone in the world in order to form the learning database for Ava, so that the robot could gather data on facial and vocal expressivity.

Nathan: If you knew the trouble I had getting an AI to read and duplicate facial expressions... Know how I cracked it?

Caleb: I don’t know how you did any of this.

Nathan: Almost every cell phone has a microphone, a camera, and a means to transmit data. So I switched on all the mikes and cameras, across the entire fucking planet, and redirected the data through Blue Book. Boom. A limitless resource of facial and vocal interaction.

Caleb: You hacked the world’s cell phones?

Nathan laughs.

Nathan: And all the manufacturers knew I was doing it. But they couldn’t accuse me without admitting they were also doing it themselves.

This piece of science fiction is not too far off from reality. Facebook, for instance, holds a patent for assessing user emotion to decide on content delivery. In a telling graphic illustration from the patent (Naveh 2015), Facebook is interested in accessing user cameras on their devices to detect and identify the emotions based on facial recognition (Fig. 22).

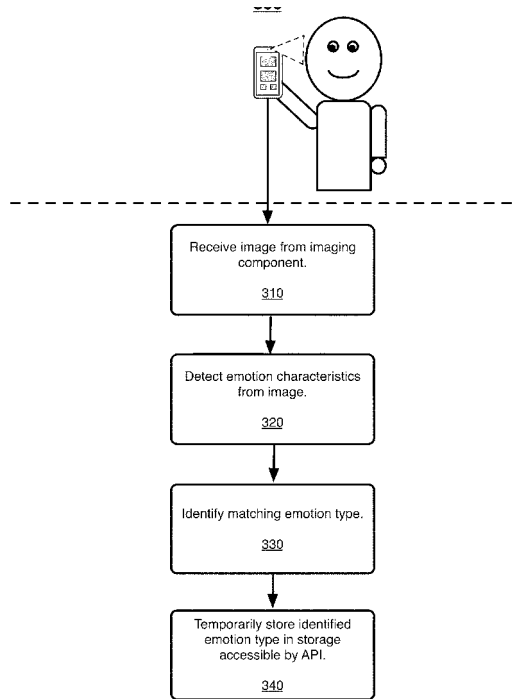


Fig. 22: Illustration from Facebook's patent "Techniques for emotion detection and content delivery"

A happy face is an indication for the algorithms to show related content more frequently. But if users look away when a particular video is playing, this suggests disinterest, and similar videos would not be shown. Our faces are considered a valuable source for gaining access into our emotional state and are a source for capitalistic value through delivering content that we would like to see. Similar technologies are already in use in certain vending machines in China, so as to determine what kind of merchandise and advertisement are more appealing to consumers.¹⁰² These methods suggest the level of investment companies have in harvesting affective information and expressions that we may not even be fully aware of.

Data from audio to visual to textual to the meta-level is harvested in today's media landscape. The level of data-mining happening through twenty-first-century media objects is extensive, and captures data of many different forms. Quoting computer scientist Philip Agre, Chun (2016) suggests that the logic of capture is at the heart of data-mining, supplementing the logic of surveillance. While surveillance is interested in exercising power over subjects watched over, capture is more interested in "action and optimisation" (60), registering and passing on data into databases for future measurement, rearrangement, and evaluation for

economic efficiency. From this perspective, Facebook studies emotion capture so as to generate more revenue from better ads and entice people to stay on the platform with improved content, and *Ex Machina's* Blue Book captures bodily data to train and teach AI expressions. Capture can be seen as an intensification of surveillance—capture implies casting a wider net for data accumulation, which may or may not lead to more targeted surveillance. Regardless of whether the subjects are ‘interested targets’ pre-identified for closer scrutiny, the general public and the larger population are simply subjugated to the generalised logic of capture. Much like Foucault’s argument that biopower does not replace discipline but extends its reach, capture extends the scope of pervasive monitoring that accompanies the existing surveillance regime.¹⁰³

While the disciplinary dimension of surveillance is intensified into the logic of capture, dispositifs of power continue to proliferate in the many ways our data become actionable resources for feeding forward algorithmic responses, creating profiles, and establishing our ‘patterns of life’.¹⁰⁴ While targeted advertising may seem to be a rather mundane and relatively harmless act, such captured data travels to other databases and may be part of surveillance regimes as the Snowden files have revealed in 2013. US National Security Agency is known to obtain access to the systems of Google, Facebook, Apple and other internet giants to collect materials such as search history, emails, file transfers and live chats (Fig. 23). As I have mentioned in the Introduction, Amazon’s voice assistant Alexa is called on to assist in crime investigations, to see whether the device has managed to record something that might shed light on what happened at the crime scene.

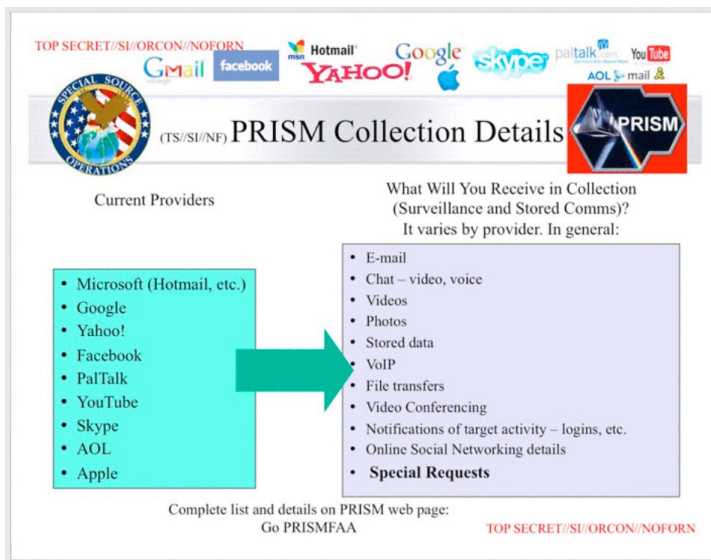


Fig. 23: Leaked PowerPoint presentation on NSA programme PRISM obtained by *The Guardian* (Greenwald and MacAskill 2013)

The flow of data between private and governmental agencies paints a picture of a system of dispositifs that is distributed and thoroughly enmeshed in one another. What appears to be private company data used for advertisement today may become part of a security agency profile tomorrow. It is under such insidious and stealthy manner that users' self-exposure could lead to more traditional forms of surveillance and discipline. Techno-chrono-biopower relying on the voluntary nature of psychopolitics also relies on the enmeshment of dispositifs. Rather than institutions of enclosure, the contemporary system of dispositifs is characterised by "flexible and fluctuating networks" (Hardt and Negri 2001, 23). Private companies and governmental organisations co-exist "in one and the same modulation" (Deleuze 1992, 5) of digital algorithms, where data easily migrates from one dispositif to the next.

Code: Algorithmic State of Exception

Through the modulation of algorithms, data that we self-expose can travel across different dispositifs. Big data processes in particular make full use of the mobility of data in order to generate trends and identify patterns across large databases of data potentially comprising information sourced from different platforms for a myriad of purposes. Turning now to the technical layer of code as the underlying language of algorithms, I look at how algorithmic governance performs its biopower as coded instructions.

When code is activated as a tool in governance, it does so in a way that is not immediately amenable to challenge.¹⁰⁵ The feed-forward structure of algorithmic realities undercuts human decision-making, making it hard to intervene in the performance of code. Code in this sense performs the instructions it is pre-programmed to execute. In Chapter 2, I discussed Wendy Chun's concept of "programmability" (2008), mapping the continuities and key differences between analogue and digital algorithms.¹⁰⁶ Chun's notion of 'programmability' not only refers to the ontological status of code and software, but also refers to the power to programme and to execute code in its other definition: as a set of conventions or principles governing behaviour. Quoting Lessig's declaration that "code is law" (1999), Chun argues that

[w]hat is surprising is the fact that software is code; that code is—has been made to be—executable, and this executability makes code not law, but rather every lawyer's dream of what law should be: automatically enabling and disabling certain actions, functioning at the level of everyday practice. (2008, 27)

Software, from this point of view, holds power in executing actions and functions as represented in the algorithms programmed. As a result, the underlying principles and ideologies embedded in an algorithm are also performed.

On a code level, Chun (2016) and McQuillan (2015) both argue that algorithmic governance operates through Giorgio Agamben's concept of the state of exception. In *Updating to Remain the Same* (2016), Chun revisits the notion of "code is law" by referring to Agamben's analysis of the state of exception. To Agamben, the state of exception takes over during a state of emergency or when martial law is declared. In order to deal with this extraordinary state of affairs, the existing constitution and rules temporarily cease to apply, and a sovereign subject is constructed in order to deal with the circumstances. This provisional execution of power suspends existing law but to the effect that the sovereign could better apply it. Therefore, the actions of this sovereign subject is paradoxically outside of but also belonging to the force of law. According to Chun (2016), code as law is "automatically executable" (82), and wields power as if in a state of exception.

McQuillan (2015), arguing in a similar manner, states that the key feature of a state of exception is how actions are carried out as a force of law, even when they are themselves not of the law. This 'force-of' represents the performative power of governance by algorithms. Even though there is no official power accorded to algorithms as a governing apparatus, they perform as if they have the 'force-of', producing the effects encoded into them. For instance, when an automated border control system allows a visitor to go through the gate, or flags a visitor and redirects the person to a counter, the pre-programmed algorithms are performing the powers of a border check.¹⁰⁷ When predictive algorithms for child protection services flag children as at-risk and in need of social services,¹⁰⁸ they parse arrest records, history of imprisonment, health data, drug and alcohol treatment, psychiatric files etc. that span a handful of databases. In effect, these algorithms are performing an extensive background check that belongs to the force of law, and are executing the policy directives of a child services department. At the click of a mouse and in seconds, a risk score is attributed to the case, which heavily influences, if not advises, a social worker's executive decision of whether to follow up or not. When social workers act upon the score, they in effect validate the force-of power of the big data algorithm they used, confirming the extra-judicial power that their computation wielded. Another example is smart city surveillance systems which detect movement and measure ambient noises to determine whether disruptive behaviours like fighting have taken place in public streets and squares. Outside the football stadium of Amsterdam Bijlmer ArenA, thirteen street lamp posts have been fitted with cameras and lights connected to an internet-enabled grid to keep track at all times how many people are in the square, what they are doing, and what the atmosphere is. One of the quoted applications for the system is that if some football hooligans start a fistfight in the square, the cameras would pick up and detect their suspicious movements. The lights could be turned up very brightly and the authorities would be alerted to immediately go investigate.¹⁰⁹ These algorithms

perform policing efforts with the force of law, and use bright lights as an attempt to intervene into what is happening in the square. All of the above snapshots illustrate the “code is law” nature of algorithms and how they automate actions based on pre-programmed principles.

When algorithms are used to govern¹¹⁰, they are extra-judicial apparatuses that escape due process but perform with the force of law. This performative power of code adds to the economy and speed of biopolitical control. An automated algorithmic state of exception works especially well in concert with the flexible and fluctuating networks of dispositifs that enable data flow across various agencies. The state of exception embedded in the ontology of code as law characterises especially the ‘techno’-dimension of techno-chrono-biopolitics. Mediated in microtemporal rhythms, lubricated by psychopolitics (Han 2017) that entice users to self-expose their data, algorithmic governance is a mechanism of 24/7 capture that works across corporate and governmental interfaces.

Biopolitical Racism in the Datalogical

One important manner in which algorithmic governance is carried out is through big data analyses, such as the child abuse and neglect prevention system I briefly described above. Despite their best intentions, these systems are not without fault. McQuillan (2015) critiques the algorithmic state of exception in particular in the domain of big data predictions, arguing that they often conflate correlation and causation. Predictive algorithms take on correlations and spurn out results that reflect them. For instance, in the US-based child protection system above, questions have been asked as to whether the big data analyses single out children from communities of colour, as well as place poor working class families under close surveillance. Because the system attributes scores partly based on anonymous reports and tips to the local hotline, some families may get unfairly featured if they have particularly nosy or judgmental neighbours who disapprove of their parenting styles. The signs of neglect (e.g. lack of food, inadequate housing, little access to healthcare, unsafe neighbourhoods) are also tell-tale signs of poverty, leading critics to wonder if such algorithms are actually *poverty profiling* (Eubanks 2018). Big data correlations ask not of underlying reasons, but simply encourage correlative associations. As Chun (2016) puts it, big data “is not interested in causes, but rather proxies” (58). In this case, poverty may become the proxy for potential child abuse and neglect. But by ignoring causation, big data processing may “aggravate existing inequalities and lead to racist and discriminatory practices, justified through the use of seemingly innocuous proxies” (*ibid.*). It is through these proxies, Chun writes, that “categories of race, class, sexuality, and gender are accounted for in

unaccounted ways” (*ibid.*). In this section on racism, and in Chapter 5, I will look closer into these problems when algorithms govern in a state of exception.

In Chapter 1, I discussed the feature of ‘biopower divides’. Foucault refers to biopolitical racism as the lines that are drawn in populations to distinguish those who are more worthy of living and those who are let die, or to separate the ‘normal’ from the ‘deviant’. In this section, I look at these emerging lines through the algorithmic in big data processing, or the datalogical turn. Algorithmic vision, through statistical inference, mathematics, and modelling, generates these categorisations within a given data set. Unlike the Nazi Germany example Foucault relies on, I argue that these lines are not necessarily programmed but derived through the logic of the datalogical. This algorithmic vision is to be distinguished from the ocular-centric regime of discipline in the panopticon, which is often used as a paradigmatic example of the disciplinary regime.

In the following, I first turn to a closer inspection of the logic behind big data processing through an analysis of the datalogical (Clough et al. 2015) and homophily (Chun 2016; Chun and Leeker 2017). I then turn to a critique of big data modelling as weapons of math destruction (O’Neil 2016), and show the intensification of biopower in the datalogical.

The Datalogical Turn

Clough et al. (2015) refer to the phenomenon of algorithmic governance through big data as the “datalogical turn”. Clough et al. find a worrying trend in the increasing adoption of algorithmic structures and the collection of human behaviour in bits and bytes as data in the sciences, finance, marketing, education, urban development, and military and policing policy and training. The scholars argue that these new computational techniques have given rise to “a mathematics reaching beyond number to the incalculable and are no longer slowed by the process and practice of translating back to human consciousness” (2015, 148)¹¹. This echoes the discussion above on the immense scale of twenty-first-century media, where in both time (microtemporality) and space (big data) they exceed the scales of human experience.

Big data makes no distinction between information and noise in the data, and no purging of noise is carried out as one would do in conventional statistical analyses from a sociological perspective. In fact, big data runs on the principle of ‘the more the merrier’, as it depends on sifting through large amounts of data for correlations, patterns, and anomalies. What emerges from this image of the datalogical is the question of folded information, when traditional categories of analyses like racial, sexual, ethnic, and class identity are simply flattened and mobilised in the statistical calculations without differentiation. This lack of differentiation, according to the authors, creates an indeterminate effect as to how the calculation would be affected.

In fact, the datalogical makes use of noise to create structure, and the ‘signal’ emerges out of the extrapolation of patterns from completely unstructured data points. All the data points are then simultaneously ‘signal’ and ‘noise’, and are continuously shifting in identity based on the combination of data that is being processed at any given moment. Consequently, “big data is moving data” (Clough et al. 2015, 159), always in flux.

Pasquinelli calls this phenomenon of big data processing the new panopticon of today (2015, 10). Foucault’s reference of Jeremy Bentham’s panopticon is an architectural structure that creates the effect of ‘being watched’ all the time. Prisoners cannot tell if guards in the central tower are constantly observing their actions, and would behave as if they are always under observation. To Foucault, the panopticon is used to “induce in the inmate a state of conscious and permanent visibility that assures the automatic functioning of power” (1991, 201). Its effects depend on the inmates recognising what is acceptable and what is unacceptable behaviour and thereby self-adjusting in order to fit in the ‘norm’.

Reconfiguring Foucault’s work, Pasquinelli states that while the panopticon is a visually organised architectural structure, data today has created a new topological structure from which vision is no longer assimilable to the perspectival vision established in early Renaissance.

The opposition between knowledge and image, thinking and seeing appears to collapse, not because all images are digitalised, that is to say all images are turned into data, but because a computational and algorithmic logic is found at the very source of general perception. The regime of visibility collapses into the regime of the computational rationality. Algorithmic vision is not optical, it is about a general perception of reality via statistics, metadata, modelling, mathematics. Whereas the digital image is just the surface of digital capitalism, its everyday interface and spectacular dimension, algorithmic vision is its computational core and invisible power. (2015, 8)

Pasquellini argues that data captured is processed through algorithmic vision that sees data in terms of pattern recognition and anomaly detection (2015). Statistical modelling sees a sea of data as pattern and noise, and “the construction of norms and the normalisation of abnormalities is a just-in-time and continuous process of calibration” (2015, 8). Taken from this angle, norms and normalisation, once established through sociological or psychological studies, supported by a regime of statistics, become potentially a real-time configuration that could *emerge* out of the (re-)composition of data within a big data engine. In Cheney-Lippold’s words, “[u]sers are not categorized according to one-off census survey data but through a process of continual interaction with, and modification of, the categories through which biopolitics works” (2011, 173). As such, the lines that categorise populations Foucault discusses in relation to biopolitical racism could also be formed and reformed, drawn and redrawn in the ever-moving dispositif of big data calculations. The kind of ‘self-adjusting’ and behaviour moderation as if

being-watched under the panopticon regime no longer makes sense, if users are not even aware of what the ‘norms’ are under the reconfiguration of big data.¹¹² Going back to the example of child abuse and neglect prediction, it is not immediately clear under what circumstances higher scores are attributed to particular cases to a family, nor how many anonymous phone calls the hotline has to register before a certain child gets a heightened at-risk rating. A history of arrests and brushes with the law would also permanently affect these scores. Families can be in a double bind knowing that an application for social service support like food programmes and temporary subsidies would increase their probabilities of being targeted by the predictive algorithms. Yet, they must go forward with such applications to make ends meet, at the risk of their children being taken away from them.

Statistical modelling has always played an important role in the managing of populations, as Clough (2016) has argued in reference to Foucault’s discussion of racism in biopolitics. Statistical measurement has been done via categories like territory, class, ethnicity, gender and race. A closer look at statistics will be developed in Chapter 5, but for our purposes here, while populations have always been under the governance of statistics, the introduction of the datalogical turns populations into “a biotechnicity of calculation, quantification, and measure” (2016, 3).¹¹³ In light of algorithmic regimes of big data processing, markers of race, class, gender today are “infused with technicity or technicality” (*ibid.*).

The Logic of Homophily

The statistical modelling that drives big data and the new panopticon of the twenty-first-century relies on a particular machinic logic in the prediction. Prediction is premised upon two assumptions (Hosni and Vulpani 2017). The first is that “similar premises will lead to similar conclusions” based on a principle of analogy. The second is that “systems which exhibit a certain behaviour, will continue doing so”, based upon a principle of determinism. This is phrased in Wendy Chun’s terms as “homophily” (2016, 14); birds of a feather will flock together. It is homophily that drives recommendation engines, looking for what people ‘like you’ consume. Prediction functions based on the history of your profile, that you are likely to keep similar preferences, and the profiles of those clustered together ‘like you’. Using big data modelling, one could discover these clusters of patterns emerging out of the sea of data. One famous example is Target’s pregnancy prediction algorithm, which finds a correlation in vitamin supplements and unscented lotions, noticing that pregnant women tend to purchase them at particular stages of pregnancies. This means that the system could predict that when a female customer purchases these two particularly-telling items, the likelihood of her needing diapers and baby products further down the line is high.

Homophily drives the clustering of ‘norms’, making the rest outliers. Homophily performs the line between pattern and noise, enfolding within its patterning markers like race, gender, and class. This could be illustrated with reference to an algorithm used in mapping the provision of Amazon’s same-day delivery service, which raised the question of whether the algorithm discriminated against black neighbourhoods. Amazon’s delivery service correlates user purchase behaviour with attributes discovered through such correlations and predictively ships products in advance to their warehouses (Ingold and Soper 2016). This is the reason why when orders are actually filed, the products could be shipped so quickly and efficiently. The recommendation engine Amazon depends on is most-tellingly named the Deep Scalable Sparse Tensor Network Engine, or DSSTNE (pronounced as Destiny).

Analogy, determinism, homophily characterise Amazon’s DSSTNE. DSSTNE determines which products should be pre-emptively shipped to which warehouse for the potential customers in the area it serves. When Amazon upgraded its Prime paid-subscription service, a Bloomberg analysis has discovered that Prime same-day delivery service was not available to particular predominantly black neighbourhoods in several major cities including Chicago, Boston and New York. Craig Berman, Amazon’s vice-president for global communications, told Bloomberg that the decisions had nothing to do with race and everything to do with algorithms. He did not reveal what goes into the design of the algorithms, other than saying that the calculations included an area’s concentration of Prime members and proximity to warehouses, as well as the availability of partners who deliver to the area. When rolling out the service, Amazon planned to focus same-day service on ZIP codes with high concentration of Prime members, and then slowly expand to fill in gaps on the map. When asked if race was a consideration factor, Berman said: “Demographics play no role in it. Zero.”

So were Amazon’s algorithms racist in skipping several predominantly black neighbourhood? Yes and no. This example shows how lines dividing a population could emerge out of the data input. Prime membership in this case was flattened into mere data points, and became “proxies” (Chun 2016) for socioeconomic power, class, and race. If the algorithm for same-day-delivery service were to be based on other characteristics instead of Prime membership, entirely different maps could be drawn based on other correlations. We could see that the race-related pattern is not necessarily pre-programmed but derived through the logic of homophily in the algorithmic vision of Amazon’s calculations.

The logic of homophily underlies the datalogical. The DSSTNE algorithm may not be racist, but its outputs discriminate between those who have Prime membership and those who do not. In a similar manner, the child abuse prevention algorithm is not meant to be classist, but its outputs draw a line in the population separating out children with struggling working class parents or welfare-subsistent

guardians, who would then be visited regularly by case workers determining over and over again whether the children should be removed from their homes. These lines determined by algorithmic calculations perform what Cheney-Lippold (2011) calls “soft biopower” (172). Soft biopower is attuned to the malleability and dynamism of populations. It is a form of power that is updatable through big data calculations, where Foucault’s idea of biopolitical racism is intensified into a set of dynamic determinations. While both are based on statistics, the datalogical works with data in flux that could be manipulated into different algorithmic models, and activates a scale of processing that is both beyond-human in speed and scope.

Segregation, or Weapons of Math Destruction

The datalogical is systemically based on looking for correlations and patterns that seek out similarities, rather than differences. Homophily, as Chun reminds us, is “segregation” (Chun and Leeker 2017, 79). By assuming that birds of a feather flock together and that we are only interested in recommendations based on people “like us”, “networks put us into virtually gated communities” (Chun 2017). Racial or poverty profiling may emerge out of these homophilic associations and categorisations. For this reason, as we turn to darker examples of homophilic categorisations in populations, we observe algorithmic governance that clusters those with similar features like race and class together, thus drawing lines to divide the population.

In *Weapons of Math Destruction* (2016), Cathy O’Neil writes about a recidivism model that calculates the probabilities for inmates to commit crime again after release from prison. This model is derived from a statistical survey called Level of Service Inventory—Revised (LSI-R) used for prisoners’ statistics in the US. These questions are designed so as to calculate the inmate’s risk for recidivism upon release: the number of prior convictions, the criminal records of friends and relatives, encounters with law enforcement officials, etc. The scoring algorithm of crime prediction is hidden from those who are subjected to its effects. Inmates do not know exactly what the LSI-R questionnaire is used for when they fill it out, and which questions weigh more than others. O’Neil takes issue with the opacity under which these data calculations work, and how often such data is collected and used without express consent of the user. Naturally in this case, inmates would not be allowed to learn about the real uses of the questionnaires in fear that they would attempt to game the system and receive a lighter sentence as a result. While the questionnaires do not require information on race, the answers themselves would imply such a factor. A young black/ Latino male growing up in a neighbourhood with high crime-rate with more likely have run-ins with police officers even if he is not found guilty of any offence. On the contrary, a white offender from a more privileged background would not have as many seemingly-criminal connections.

We see again here the enfolding of social markers in data points. The statistical model that determines whether an inmate is at high, medium, or low risk for committing further offences attribute scores to answers associated with recidivism, recognising patterns which are in essence proxies for race and class. In some states, these scores are used to bring high-risk inmates into anti-recidivism programmes, while in others, they are used to guide sentencing from the judges. In essence, these mathematical models turn the data into a crime prediction score for the incarcerated.

Camouflaged by mathematics and a seemingly impartial process, markers of race and class are re-embodyed through technical data, and programmed into a 'neutral' mathematical formula. The questions of the prisoner questionnaire have demonstrated that this could easily be done even when the questionnaire is 'colour-blind'. One could see how racial bias could emerge from the data processing. Moreover, O'Neil points to the likely scenario that because of a high score, prisoners would more likely get longer sentences. Longer sentences also raise the likelihood that someone would return to prison. Upon release, they re-enter the same neighbourhood, to the friends and family that have 'tainted' their score in the first place. With a criminal record, it would be harder to find a job and to rehabilitate into regular society. If they commit another crime, this would prove that the crime prediction score works, and would help sustain this system. This is referred to as a "pernicious [weapons of math destruction] feedback loop" (2016, 27).

As O'Neil argues, algorithmic processes do not care about the individual circumstances of the person whose information is under scrutiny—the same formulaic calculations take place in the exact same manner for every case. That on its own is considered a more just way of processing information. However as categories like race gets enfolded in the data, these pattern-recognising, datalogical dynamics of computational outcomes may frustrate the original intent of fairness and justness.

From this exploration, we see how the datalogical brings us a computational intensification of Foucault's ideas on the splitting up of a population. Rather than a sovereign power designating where these lines should be drawn in the form of state racism, in a big data regime, these categorisations could emerge out of processing the data with the logic of pattern recognition and homophily. Clough (2016) refers to this phenomenon as "population racism" (2016, 3)—a biopolitical effect when populations subjected to the metrics of calculation and quantification are categorised and reorganised according to a calculus of value.

An Intensified Composition of Biopower

Looking at the various forms of media objects and the role of data underlying today's technology, a new composition of techno-chrono-biopolitics has taken place in an intensification of the biopolitical features referred to in Chapter 1. Nealon establishes that Foucauldian thought requires us to think of these changes as continuous, and as emergent from within former structures. Part 2's exploration of techno-chrono-biopolitics identifies the continuity between historical uses of time for disciplinary purposes and the permutations in today's media operations. While twenty-first-century media brings about new challenges, we could see that existing theorisations have already prepared us for the study of the contemporary moment. Algorithmic models become "polymorphous techniques of power" (Foucault 1990, 11) that support the operation of policing and control over the population.

Biopower morphs and scales as the dispositifs from which power is exerted shift. In my analysis above, we could see how biopower operates in its incidence with microtemporal time, making time spent on platforms productive for capitalist exploit, and extracting the durational labour power of users. Twenty-first-century media operate in beyond-human scales in *time* through microtemporality and in *space* through big data processing.

Biopower is productive, creating its realities and logics that we are subjugated to under algorithmic governance. I have looked at how Chun (2016) and McQuillan (2015) discuss algorithms operating in a state of exception, turning the formulation of "code is law" (Lessig 1999) into the performative 'force-of' law. Dispositifs of capture and surveillance proliferate in our digital landscape, offering the possibility to observe, profile, and police users based on the data they generate.

Nealon suggests the continuous molecularisation of power as it becomes lighter and more economical. We have seen how biopolitics become "psychopolitics" (Han 2017), as users are enticed to hand over their data and participate voluntarily in the apparatus of capture for fun. Twenty-first-century media appear friendly with seductive interfaces and the promise of enjoyment. Our engagement with twenty-first-century media is made productive for capitalistic exploitation as we constantly produce data that can be monetised to the benefit of those controlling these technologies, and comes in handy too for 24/7 capture and surveillance for governmental organisations. The automated nature of many of these algorithms also signifies the speediness of processing and control that is administered on a machinic scale of time. This shows how the lightening of biopower is also an operation of speed.

Lastly, we see how biopower divides in the datalogical. The logic of homophily as segregation reterritorialises the power of the sovereign by algorithmically dividing a given population and subjecting them to a calculus of value. Through the enfolding

of social markers into data processed, this process of segregation can take the form of racial and poverty profiling under algorithmic governance, and can place certain populations under the risk of heavy scrutiny or disproportionate punishment.

In this cursory overview of twenty-first-century algorithmic culture, I have identified how its logics, rhythms, and durations lead to changes in labour and governance, with specific attention to the segregation and racialisation that takes place. Most significantly, algorithms are governing us at scales beyond our range of human perception, making it difficult to detect how deeply their techno-chrono-biopower is interwoven into the fabric of daily life. In addition, we rely on their interfaces to mediate our access in a medium-oriented ontology. While we map the functionalities of our devices through these interfaces, the devices equally map us, capturing our behavioural patterns, interactions, interests, and desires. As humans, we are implicated in the algorithm-saturated digital landscape, perceptually unaware of the technical layers of mediation inside our machines but are nonetheless subjected to the governmental powers performed by them.

As Nealon (2008) has pointed out, intensifications of biopower make it harder to detect and more effective in operation. The techno- dimension of code that performs extra-judiciary power and the chrono- dimensions of microtemporal rhythms and 24/7 durations govern bodies living and labouring in algorithmic culture. Techno-chrono-biopolitics therefore is about grappling with the mediated timescales of twenty-first-century media, and identifying the rhythms and durations which compose the polymorphous dispositifs of our time. If biopower at the end of the day is about making a population productive for neoliberal capitalism, we have seen in this chapter how algorithmic culture in fact relies heavily on human intelligence, labour, and data to function. If data is the new oil, then we are the ones oiling and lubricating the machinery of twenty-first-century media, except certain populations are disproportionately targeted and must bear a larger grunt of the negative effects of its biopower.

Zigzagging through historical and contemporary manifestations of techno-chrono-biopolitics in Chapters 3 and 4, we see the disciplinary clock regime dovetailed with the biopolitical effects of time-critical media and twenty-first-century media objects. Chapter 5 will continue to build on the logics behind big data and prediction and will consider the implications of twenty-first-century media's future-oriented feed forward feature, while Chapter 6 builds on the discussions on digital labour and racism. Together, the next two chapters in Part III further construct the composition of techno-chrono-biopolitics, today and tomorrow.

Part III

Techno-chrono-biopolitics Today and Tomorrow

5

From Statistics to Big Data: The Ontopowers of Predictive Analytics

In Part 2, I began with an account of how traces of techno-chrono-biopolitics could be observed historically, with a selection of examples from eighteenth to twentieth century. I also made reference to contemporary media theory that approaches the phenomenon of techno-chrono-biopolitics. Looking at how time in the forms of rhythm, duration, and speed is implicated in human-technology interactions, I studied the interconnections between mediated time and dispositifs of discipline, performance, and biopower.

In Chapter 4, I have charted various routes of intensification resulting in contemporary techno-chrono-biopolitics. As I have discussed above, Foucault has argued that biopower is a productive power, effectively opening up new venues under which governmental power could be exerted on populations. In Nealon's intensification hypothesis on biopower, he emphasises that this productivity can be connected to the way power 'lightens'. Governing is no longer reliant on heavier inflictions of power like direct punitive mechanisms but rather through 'lighter' and more insidious forms of power like norms, market forces, and entertainment and pleasure. Building upon these theoretical elaborations, Part 3 continues to consider how techno-chrono-biopolitics is operative in contemporary times, and adds updates by other cultural theorists to the discussion of biopower. Chapter 5 focuses on predictive technologies and the question of future-oriented mediations, while Chapter 6 looks at how the subject of techno-chrono-biopolitics engages with a longer history of (colonial) subordination and the letting-die of certain populations under the dimension of necropolitics.

Chapter 5 proposes the study of statistical analysis as a 'lighter' technology of power, charting its connections with biopower historically and juxtaposing that

with contemporary usage of statistical analysis through big data technology. For example in the previous chapter, I have referred to predictive sentencing in the US, a big data practice criticised by Cathy O’Neil (2016). Predictive sentencing makes use of statistical data to determine the recidivism probability of a particular convict. If a convict is associated with other individuals with criminal records, he would score higher on the scale. This idea of recidivism itself in fact stemmed from the quantitative study of crimes in the 1820s (Hacking 1991), and is still very much operative today. It was the science of statistics that helped develop recidivism models, and predictive sentencing is part of this longer trajectory. Studying the historical connections between statistics and biopower provides further substantiation for the concept of techno-chrono-biopolitics and how it is operant in other forms through twenty-first-century media.

Prediction and risk management have always been important aspects of using statistical knowledge. Ian Hacking’s work (1982) “Biopower and the Avalanche of Printed Numbers” signals at the deep connection shared by statistics and the operation of biopower, extending Foucault’s meditations on the subject. Hacking finds it noteworthy the extent to which statistics grew as a discipline and the fascination with it during the period of 1820-1840. Studying the same historical period, Meg Leta Ambrose, a socio-technical legal researcher, calls it “first wave big data” (2015, 203). She argues for a strong historical connection between the former regime of statistics and the current reformation through technological means. This denotes today’s era of big data prediction as a second wave of development. By juxtaposing the first wave history of statistical knowledge and how second wave statistical knowledge is reterritorialised via big data technologies, we could gain a sense of how the operations of biopower have shifted alongside technological mediation.

Second wave big data is characterised by 4Vs. The first V is volume: big data is big because it processes datasets whose sizes are beyond the ability of typical database software to capture, store or analyse. The second V is velocity. Velocity is a crucial aspect. Big data is able to cut down massively the processing time that would be required to handle the same volume using traditional means. Big data of course also functions upon microtemporal algorithms, and some are able to process queries in a matter of seconds. Next, the third V, variety, refers to the big volume of data that is coming into the databanks from various sources. In addition to classic categories in statistics like age, gender, race, place of birth, education level, and household income, data could take the myriad forms of geolocation data, Amazon.com purchasing history, rate of scrolling down your Facebook feed, speed of retweeting, network of retweeting, timestamps of when a certain app is used, etc. The avalanche of numbers today has very much expanded into categories of information that might not have existed prior to the invention of smartphones,

Internet of Things, body-tracking sensors, and social media. The last V stands for veracity, which refers to the usability of the data, and whether it has been kept accurate and up-to-date.

The first section of this chapter will look into the historical linkage between statistics, biopower, and the technologies that support such developments. I study this particular instance of intensification of technology and biopower by returning to Foucault's ideas and Ian Hacking's reformulation of statistics, and place them in the context of big data. This section juxtaposes Foucault's observations with Hacking's elaborations on the technological dimension and material objects that support the statistical regime. Here we return to the shift between the analogue and the digital I discussed in Chapter 2, by looking at the shift in statistical methods and their relation to technological devices from nineteenth-century statistics to twenty-first-century big data. In other words, I study the continuities and ruptures between first wave and second wave big data. This demonstrates once again how new technologies add to and modify older forms of power and how contemporary issues find resonance in historical antecedents.

Second wave big data's potential lies in the possibility of prediction based on the patterns that emerge out of the data. The second section ventures into an array of examples in predictive analytics, namely predictive policing, predictive trust, and prediction in mental healthcare. Prediction that acts on a future time and on a future potential has infiltrated many areas of daily life. These examples will show how the projection of a future time becomes inflected within the dispositif of security, and how specific technologies like big data trends and algorithmic forecasts are implicated. They will also show the entanglement of techno-chrono-biopower with performative power, following Jon McKenzie (2001). We could see how data collected feed into disciplinary and biopolitical measures, creating instances of techno-chrono-biopower. Temporality is important here not only because time is heavily contracted in machinic mediations of second wave big data, but also because of the relationship to futurity.

The last section will return to theories of biopower and my concept of techno-chrono-biopolitics. I show how prediction produces a future-oriented notion of time afforded by big data projections and prediction, and how prediction technologies could be considered an ontopower, following Brian Massumi's meditation on the subject (2015). Prediction changes the past-present-future chronology of time, and mediates a form of biopower that brings the potentialities of the future into actualities in the present moment—by announcing a future *potential* threat as a threat, it performatively actualises a threat into a condition that needs to be dealt with presently. Techno-chrono-biopolitics is attentive to the warping of chronology mediated by predictive analytics, and considers the role of temporality in the cases discussed.

Biopolitics, Machines, and Statistics

Biopolitics “deals with the population, with the population as political problem, as a problem that is at once scientific and political, as a biological problem and as power’s problem” (Foucault 2003, 245). Population as a unit for governance emerged historically in conjunction with the development of the scientific field of statistics. Statistics involves forecasting, estimating, and counting mechanisms that enable governmental interventions to be targeted at a level of generality to a set population. The power/knowledge nexus of statistics can be placed next to knowledges in fields of economics, demography, and epidemiology, which provided ways through which life and its mechanisms could be calculated and brought under scrutiny. Statistics is seen as key to the birth of biopower.

What is important to flag here is how prediction through statistical means is already very much present within the discourse of biopolitics in Foucault’s work. For this reason, I return to a close reading of Foucault, in association with Ian Hacking’s elaborations on statistics in the 1990s. In this section, I chart the interrelations between statistics, the history of first wave big data, and biopower, and lay the ground for subsequent discussion on how second wave big data technology introduces further mediation into statistical processing. I look at the material analogue technology of the Hollerith Machine used in the US census in late nineteenth to early twentieth century, which forms a precursor to the scientific and technological means of doing statistics today, as augmented by twenty-first-century media.

While the current study of techno-chrono-biopolitics is chiefly concerned with second wave big data, it also is interested in how second wave big data remediates earlier histories, and the relationship established by Foucault between biopower and the field of statistics more generally. The lens of techno-chrono-biopolitics makes visible these historical connections and allows the excavation of these histories through Foucault’s genealogical method. I note as well how biopower is altered as a result of new technologies, bringing about intensifications of biopower. In the era of first wave big data, the Hollerith Machine was hailed as a technology that cut down massively the processing time of census data. Today’s new technologies morph statistics by scaling into the microtemporality of processing and scaling up the sheer amount of data processed. On a microtemporal scale, they expand existing fields of statistical collection, and broaden the types of data that could be analysed. In both eras, technologies are lauded for their *speed* of processing, which increase the efficiency and efficacy of statistical processing. Through their speediness, these technologies support the exercise of biopolitical governance and administration. We see how history repeats itself albeit with significant differences, as second wave

big data comes onto the scene as a prevalent statistical method of the twenty-first century, with its speed of operation supporting algorithmic governance.

Biopolitics and Statistics

In Hacking's article (1982), he revisits Foucault's key ideas in biopolitics, drawing attention to the important shift from anatamo-politics to bio-politics: targeting power on the body from the individual to the level of population. As I have previously discussed in Chapter 1, this is one of the most significant differences one could chart between the two regimes of power. Foucault reminds us to consider power, not only in its expression in discipline and punishment, but also in its association with various forms of knowledge. In this section, I rehash ideas from Foucault's theory of biopower, and Hacking's extension, in the context of how statistics became intimately intertwined with the art of government.

Writing in line with Foucault's original points on statistics and biopower, Hacking proposes that the story of biopower could in fact be told from the history of 1820-1840, as the "shorter story" of the unfolding of biopower. This is in contrast to the much longer itinerary Foucault himself has charted, or in the long trajectory of intensification argued by Nealon (2008). For Hacking, these two decades are isolated as the establishment of statistics, or "the *era of enthusiasm* for statistical data-collection" (1982, 281; original emphasis). He refers to this period as the "avalanche of printed numbers" (*ibid.*). This period saw an exponential increase in the printing of *numbers*, while the rate of increase of printing *words* were merely linear. Hacking argues that it is through the statistical regime that biopower could be observed—statistics fills the gap in knowledge required to bridge the transition from governing individuals to monitoring populations. From Hacking's perspective, the birth of statistics is paramount to the birth of biopower.

Let us return for a moment to Foucault's discussion of statistics. In *Security, Territory, Population* (2007), statistics appears as an important tool for modern governments to gather information about their sovereign subjects from a population perspective. In this series of lectures, Foucault discusses the genealogy of the modern state, and emphasises that statistical practice grew to become a crucial function of government. Statistics significantly enable governments to shift the thinking of individuals or families to the much larger unit of population, creating a wider scope for biopower's operations. The series of lectures Foucault has given on the subject demonstrate this strand of the intensification hypothesis I have outlined in Chapter 1 vis-à-vis Nealon's work (2008). Tracing the historical context, Foucault discusses how statistics is established as a scientific field of knowledge as the genealogy of the modern state unfolds.

Foucault turns his attention to this new science of statistics to explain why the practice has become so necessary in Europe, with a particular focus on the French

administration. Similar to his dissection of how sex and sexuality has come to be regulated, he attempts to get to the heart of practices of governing men developed over centuries. As mentioned in Chapter 1, biopower marks the shift of the focus of governance from targeting the individual to the population, a trend that is observed by Foucault in seventeenth- to eighteenth- century European governments.¹¹⁴ New forms of government evolved to focus on the family unit as the basic unit of society, an intermediary step before reaching the level of population. Governments and rulerships began thinking in terms of aggregating interests of the population on the whole as a goal, by encouraging each family unit to act in a way that would be beneficial to the whole population. For instance, this could be achieved through maximising food and wealth in addition to creating population growth. For this, the government needed vital information, such as citizen habits and activities obtained via censuses and observations. This propelled statistics into an important area of scientific knowledge.

As I have discussed under the heading of “biopower is economical” in Chapter 1, biopower is made more effective if it were to operate through a form of ‘liberal freedom’, where control exists in the form of laissez-faire policies. A state could manage its population exactly the way it wants to through direct exertion of power, but that is of course not economically viable as this would involve large costs for surveillance, societal intervention, and administrative procedures. The notion of the ‘economy’ is introduced such that governmental power flows through the market.¹¹⁵ In Foucault’s description,

To govern a state will therefore mean to apply economy, to set up an economy at the level of the entire state, which means exercising towards its inhabitants, and the wealth and behaviour of each and all, a form of surveillance and control as attentive as that of the head of a family over his household and his goods. (1991, 92)

Rather than managing through direct interference, heavy regulation, and policing, a population would arrive at its own homeostasis through its inherent dynamics and laws of development. The government therefore has to be attentive to dynamics like circulation trends, fluctuations, and purchasing behaviour, and anticipate patterns so as to devise schemes of intervention that could nudge behaviour towards desirable outcomes as defined by the state, and to maintain a constant form of surveillance over the population so as to stay abreast of prevalent norms in the economy.

In the genealogy of the modern state laid out by Foucault (2007), governmental power shifted in this historical period and required the support of the social sciences, especially the field of statistics in order to effect the new art of government. Statistics is seen as “the science of the state” (Foucault 2007, 101). Statistics and information collection makes visible the idea of ‘population’ as an entity in and of itself, and the population becomes a new field for the authorities to act upon. Statistics

helps establish this shift of thinking from the individual to the population, and in particular enables particular phenomena of the population to be measured and quantified. Governments became preoccupied with excavating the “truth” about these individuals and populations (Gordon 1991, 8). The data illuminates that a population have its own regularities and its own norms. Foucault writes that

Etymologically, statistics is knowledge of the state, of the forces and resources that characterize a state at a given moment. For example: knowledge of the population, the measure of its quantity, mortality, natality; reckoning of the different categories of individuals in a state and of their wealth; assessment of the potential wealth available to the state, mines and forests, etcetera; assessment of the wealth in circulation, of the balance of trade, and measure of the effects of taxes and duties, all this data, and more besides, now constitute the essential content of the sovereign’s knowledge. (2007, 274)

What does the sovereign do with this knowledge? In the shift from anatomo-politics to bio-politics, the role of the sovereign has changed in Foucault’s theory. The sovereign is there no longer to simply torture and kill, punish and shut criminals away in prison—modern governments operate not on the principle to take lives, but to make live and let die. Making live suggests that government is there to also ‘improve’ the condition of the population, “increase its wealth, its longevity, and its health” (2007, 105). The sovereign therefore makes use of statistics to exert power. In other words, statistics supports the power-knowledge nexus and becomes a handy tool in the process. Making use of the data collected, campaigns and policies might be put in place to stimulate birth rate, direct population flows into particular regions or activities, and not all are made to the knowledge of the population being governed. For Foucault, statistics helps establish a new art of government, where new tactics could be put in place targeting particular aspects of data.

Population, then, appears as the end and instrument of government rather than as the sovereign’s strength: it is the subject of needs and aspirations, but also the object of government manipulation; vis-à-vis government, [population] is both aware of what it wants and unaware of what is being done to it. (*ibid.*)

Note that up to this point sovereign power is still understood as the state and the government, but this concentration of power would decentralise in its intensifications as we shift into a discussion of computational power and contemporary statistics.

In Hacking’s article (1982), he refers to the debate in Europe during the eighteenth century on falling populations. Governments were concerned that falling populations meant lower efficacies in trade and war. In order to encourage larger families, one of the most common policies was offering tax incentives. Calling for a census allows the government to figure out ways to tax their citizens in a most effective manner and to calculate how many people could be drafted into the army should wars break out. Hacking remarks that even though the actual policy may not have reached its intended effect (e.g. population growth), it nonetheless establishes rules of categorisation of people, and sets related policies in motion. Indeed, tax incentives encouraging marriage and childbearing can still be found in many

countries today. This echoes Foucault's point on policies targeting populations as an instrument of government, trying to exert control over the population so as to increase the economic viability and military power of the country.

According to Hacking, from budgetary calculations to demographic projections, market research to epidemiological studies, statistical information fuels the operation of biopower. Governments could plan and think on a population level through the 'avalanche of printed numbers'. Institutions like social welfare and insurance also require large-scale databases and statistical reasoning in order to project future policies and help predict what happens on a population scale. A calculus of risk management is also needed, in order to minimise costs and to be prepared in case of future events, e.g. an ageing population would need larger healthcare support.

Surveying various European powers, Hacking points to the standardisation of statistical practice through annual reports, such as the Blue Books in England where reports on "the poor, the criminal, the infanticide, the mad, as well as questions of trade" (1982, 286)¹¹⁶ could be found. Concurrently, the Swedish, the French, and the Belgians were developing similar protocols. For Hacking, it is not only the practice itself which warrants attention, but also the alarming interest in deviancy, where disease, madness, and crime stood out in the sea of data.

Disease, madness, and the state of the threatening underworld, *les misérables*, created a morbid and fearful fascination for numbers upon which the bureaucracies fed. (*Les misérables* is not merely the title of [Victor] Hugo's masterpiece, but a standard set of pages in statistical reports, and when the first international scientific congress commenced—they were Statistical Congresses, of course—*Les misérables* was a regular section at which learned papers would be presented.) (1982, 287)

This attention to deviancy and the associated need to control deviant populations inform the biopolitical racism I have outlined in Chapters 1 and 4, befitting the feature of biopower as divisive. Statistical distribution presents a picture of norms and exceptions in a given population, enabling the possibility of devising policies targeting those who do not belong to the normalised, economically productive parts of the population. The examples of predictive sentencing and child protection in Chapter 4 have already shown the tendency to differentiate those who are poor and criminal. As we will see in the cases I tackle in the second half of this chapter, governance through big data continues this logic of targeting sub-populations which may warrant the label of "the poor", "the criminal", "the mad". I will continue to analyse how today's inception of big data introduces such metrics and norms in terms of how individuals and groups may be perceived and treated.

Hacking is rightfully critical of such categorisations, wary of the categories they create in how people become pigeon-holed and represented in generic rationalisations. The individual is no longer a distinct being but rather a data point in an actuarial table, only understood insofar as one's belonging to a particular group and of the generalised patterns that the group's data offers. Hacking's later

essay “How should we do the history of statistics” (1991) further exposes this problem. He writes that statistical data has a certain “superficial neutrality” (1991, 184) that gives them a sense of authority and makes them appear more powerful.¹¹⁷ The statistical concepts of norms and averages also produce the notion of what is ‘normal’. The numbers and their associated categories define what can be accepted as normal and what is abnormal. A side effect of statistics is the production and reinforcement of such norms as they become the expected benchmark of normalcy.

Studying the same historical period of 1820-1840 as Hacking (1982), Ambrose (2015) characterises this phase as first wave big data, as there was a scramble for new techniques for gathering and analysing data so as to “turn the numbers into actionable knowledge” (2015, 219). Governments, companies, organisations, and individuals were all caught up in this frenzy to quantify. Ambrose suggests that one major cause is the pressure of nineteenth-century industrialisation, bringing us once again to the historical period and location from which Thompson theorises his ideas on clock discipline (1967). Because of industrialisation, there was heavy migration from villages and towns to the cities, putting a strain on infrastructure as well as creating issues of sanitation and disease. In addition to that, food transportation was necessary to support the growing population. Both Hacking (1991) and Ambrose (2015) posit that quantification became an answer, and statistics¹¹⁸ was used to help solve these problems and better control the effects of rapid urbanisation.

Foucault’s and Hacking’s works situate the science of statistics in the study of biopower, and lay bare the connection between statistical knowledge and governance.¹¹⁹ These accounts supplement the discussion in Chapter 1 and further illustrate one of the historical contexts from which biopower could be observed. In the rest of the chapter, I will continue to demonstrate how these historical observations would ring true in current developments of second wave big data, and that a strong historical connection between statistics and governance could be mapped. Before I turn to second wave big data, I will now consider the material technologies that are used to support the tabulation of first wave big data, and the historical incidence of analogue computing with governance by statistics. This brings the discussion once again to the role played by technology in the exercise of biopower. Serving as a continuation of the discussion of analogue and digital computing in Chapter 2, it will also demonstrate the close-knitted nature between the history of computing and governance.

First Wave Big Data and Analogue Computing

Analogue computing offered the possibility of speeding up administration in statistical analysis, and demonstrated how the mediation of technology enabled the cutting down of processing times. The techno-chrono-power of machines assisted the biopolitical aspirations of the state. In Chapter 2, I studied algorithms

in analogue clockwork mechanisms which were developed for calculating purposes and positioned them as precursors to contemporary digital algorithms. I discussed how single-purpose analogue machines like arithmometers and differential analysers paved the way to general purpose computation, where programmability became a defining characteristic of digital algorithms. Interestingly, the exploration of biopower and statistics by way of Hacking's work returns us momentarily to the domain of analogue computing. In Hacking's words, "it is a happy parable that the avalanche of printed numbers ends with the first real use of a computing machine to provide printouts" (1982, 291). In this section, I return to this dimension of the study by supplementing the story of the 'avalanche of printed numbers' with the inventions that supported statistical calculation.

Analogue computing assisted in statistical analysis in the nineteenth century. England's General Register Office in the 1850s was keen to obtain a calculating machine that would help them process census data, and avoid transcription errors common amongst its clerks. At the time, Georg Scheutz, a Swede who was impressed by Charles Babbage's¹²⁰ difference machine, actually created a functional unit of Babbage's invention. While the machine was on display in London, the General Register Office sent engineer and industrialist Bryan Donkin to try and pirate a copy of the machine, despite the fact that the machine in fact had over 4000 pieces, 2000 screws, and 300 chains. The Office offered him a lucrative sum of £1200 (equivalent to over £110,000 in today's currency), but even so Donkin incurred a loss due to the necessity to create special tools to create some of the machine's components. His company eventually completed a version of the difference machine in 1858, which was used to produce actuarial life tables from the data collected from citizens.¹²¹ Life tables are mortality tables that measure the life expectancy of a given population. By replacing clerks with machinery, the General Register Office hoped to minimise both costs and errors in the long run. What they discovered was that while the machine proved to be infallible in calculating, it required very skilful manoeuvring to actually avoid error (Hacking 1982, 291). After all, it was a rather intricate piece of machinery.

Another piece of machinery for statistical processing could be found across the pond. Studying the American equivalent of the boom in statistics, Hacking discovered that the avalanche of printed numbers for the Americans appeared later in 1880. In 1870, 156 questions appeared on the census questionnaire, but by 1880, the authorities wanted to collect census data on a staggering number of 13,010 questions. By 1890, however, they reduced the number but began to tabulate them using an early computing device none other than the punch card (Hacking 1982, 290). In 1911, census taker and statistician, Herman Hollerith, helped form the Computing Tabulating Recording Company, predecessor to IBM. Hollerith was the holder of several patents on tabulating machine technology,

and these patents were developed based on his work at the US Census Bureau from 1879-1882. Hollerith is widely regarded as the father of modern automatic computation. In honour of his work, Hollerith even received a PhD degree from Columbia University. In Patent No. 395782 of January 8, 1889, Hollerith describes his automation idea (Fig. 24).

The herein-described method of compiling statistics, which consists in recording separate statistical items pertaining to the individual by holes or combinations of holes punched in sheets of electrically non-conducting material, and bearing a specific relation to each other and to a standard, and then counting or tallying such statistical items separately or in combination by means of mechanical counters operated by electro-magnets the circuits through which are controlled by the perforated sheets, substantially as and for the purpose set forth. (Hollerith 1889)

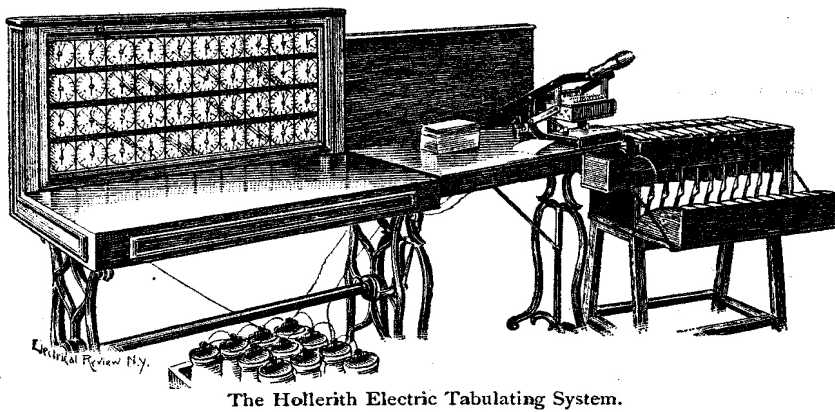


Fig. 24: Illustration of the Hollerith Machine (1889)

For the 1890 census, he tested and built several tabulating machines and punch card readers in order to reduce the time and labour required to process the large amounts of data collected. For instance he invented a sorting machine which would read the punched information and sort the punch cards into a maximum of 24 categories. Based on the location of the punched holes, a lid on one of the sorter bins would open automatically and the operator would place the card inside. Another staff member would then take the cards to tabulate them for various analytical purposes. Hollerith's use of punch cards in fact set the industry standard for the next several decades of tabulating and computing data input. He supplied tabulating equipment for the US Census Bureau in addition to census work in a number of other countries.

The Hollerith machine reminds us that the operation of biopower through statistics is also highly connected to the technological means that support it. Not only is it important to note the technical-historical connection in the mechanical

algorithms these computing machines run on, but it is also crucial to note what the computing machines are developed and used for. In Seb Franklin's *Control: Digitality as Cultural Logic* (2015), he critiques the logic of categorisation and essentialism as embodied in the Hollerith machine. Echoing Hacking's critique towards the reduction of individuals into data points, Franklin suggests that the machine performs essentialist conceptualisations of sex and race.

That the Hollerith method is based on conflating the material properties of a machine and the defining characteristics of a human—so that holes in punch cards stand for the predicates that come to define a given individual, and a power source, wires, and counters are put to work to express these predicates in preferred combinations—underscores the way in which the abstraction of concrete technologies into models for apprehending social reality provides the grounding logic of control [...] The centrality of race and nativity to the examples and diagrams Hollerith provides in the 1889 article¹²² also makes it clear that digital social logic in its earliest forms was already premised on a reformulation of old essentialism under the new banner of apparently objective data collection and management (2015, 29).

Franklin emphasises that his point is not to state that such a tabulating system is inherently racist, sexist, or ableist, but that such prehistories of the digital computer already foreground how the computer could be used “as a tool of governance” which could potentially “normalize and legitimize real practices of essentialist definition and exclusion” (*ibid.*). Indeed as we turn to second wave big data, we would continue to see issues of control arising out of algorithmic governance, and how big data practices normalise and legitimise practices of exclusion and discrimination.

In this story of first wave big data and analogue processing, I must again emphasise the connection to time. Analogue processing through tabulation is very much used in order to cut short the amount of time needed to process the same amount of data, as well as to save labour and thereby money. The Hollerith machines reduced drastically the time needed to process the census data. For the 1890 census, what was estimated to be a ten-year job was completed in around three months. According to the records, the inventions saved taxpayers up to five million US dollars at the time. This contraction of time is again experienced in second wave big data, where the minimisation of processing time through microtemporal algorithms meant that large data-sets could be processed in a much shorter period. What was previously inconceivable in terms of size of data-sets could also be calculated with the increase of computational power. The techno-chrono-power of these machines smoothenes the processes of biopolitical governance by analysing statistical data more efficiently, making them objects of techno-chrono-biopolitics. In the next section, I proceed to discuss second wave big data and its computational logic, bringing attention to its mechanisms of capture, potentials of governmentality, and its primary purpose of prediction. This will show how the two eras of statistical knowledge differ and how second wave big data connects with the features of techno-chrono-biopower discussed so far.

Second Wave Big Data and the Powers of Prediction

The turn to second wave big data bears clear continuities with first wave big data. Both are based upon the understanding that numerical control and statistical insights could be gleaned from data sets. From an abstract point of view, it is posited that knowledge could be discovered from numbers, and that it could be gained through processes of datafication. There is a high level of trust in numbers, and a belief that statistical trends could offer some level of predictive ability. We can see this from the preceding discussion of Foucault's and Hacking's work, where governments began to rely upon numbers to gain knowledge about citizens so as to adjust their policies. Sovereign powers are interested in collecting data in order to inform how they could make policy choices, allocate resources, or to safeguard the health and safety of citizens. The identification of statistical trends naturally allows for projections and predictions, and second wave big data capitalises specifically on the potentials of predictive analytics.

Why does the use of predictive analytics appeal to a company or a government department? The underlying logic behind prediction is its power to help mitigate risk and cut costs. To 'predict' the future and be prepared for the possible outcomes is to better the management of risk. Predictions could be helpful for businesses to gain insight into the shopping habits of their customers, increasing the chances of selling more products. It is also helpful for health services if one could predict flu trends¹²³ and prevent epidemics, or help determine risk for patients who may develop other ailments in the future based on current symptoms and diagnosis. One could also use it for financial gain. For instance, predictions could be made based on determining the 'mood' of people on social media. In 2009, Eric Gilbert and Karrie Karahalios, who were at the Department of Computer Science in the University of Illinois at Urbana-Champaign, developed an algorithm testing the correlation between people's moods as published on LiveJournal blogging site and the rise and fall of the stock market. They asked the question whether there could be an anxiety index to be discerned from the widespread data-mining of people's online social presence, and how that might be used to predict market trends (Gilbert and Karahalios 2009). Taking up their successful results, other scholars have proceeded to create predictive modelling based on whether Twitter (Bollen et al. 2010) or the Chinese microblogging site Weibo (Chen et al. 2016) have correlations too to the stock exchange.

Predictions take the form of feed-forward (Hansen 2015b), using existing data to generate potential scenarios, such that one could act on them before these potential scenarios turn into actualities. Feed forward depends on "machinic reference" (Hansen 2015b, 192) in order to create a pre-cognition of what may materialise in a later moment. Feed forward could also be found in security paradigms, to support border control, policing efforts, and anti-terrorism efforts. This larger

cultural shift towards prediction is perhaps most exacerbated in the aftermath of 9/11.¹²⁴ Here we see how the event marks a historical moment when the use of technology is intensified so as to introduce other forms of control in the interests of national security. The turn to information technology, and to statistical calculation, follows a historical trajectory from first wave big data but the digital technologies developed in the meantime offer other tools to track, capture, and process collected information with a heavy cutting down of time and exponential increase in volume and capacity.

Louise Amoore (2013) repeatedly emphasises in her monograph that there is a belief amongst politicians, policymakers, and data consultants and engineers that 9/11 could have been predicted and averted had there been sufficient algorithmic search capacities in place in 2001. The enemy is perhaps hiding somewhere in the midst of the available information, and what had to be done is to bring databases together, identify suspicious patterns and behaviours, and learn how to better predict the enemy's next move on the basis of data. In the report of a US House subcommittee hearing in 2002, the group came to the conclusion that "had information coordination technology been properly in place before September 11, the preattack activities of the hijackers could have been identified and prevented. There may have been a different outcome." (US House of Representatives 2002 as quoted in Amoore 2013, 41). In the post-9/11 era, the hope is that big data processing for the national security apparatus could prevent the next unanticipated threat.

As opposed to the focus on government census surveys in first wave big data, second wave big data is activated by governmental powers and private companies alike. Both the public and private sectors are interested in collecting more data and more types of data in order to make predictions. In Chapter 4, I proposed that surveillance has been replaced by a more general, widespread logic of capture. Durational data accumulation takes place through capturing various types of information, from text to meta-data, from image to geotags, as opposed to targeted information collection like what census surveys do. Whatever our digital devices record and whatever data trail they create becomes part of the information assemblage that is compiled in private company and government databases. I also discussed the troubling mobility of our data across multiple dispositifs and the enmeshment involved, where data collected for a specific reason may be transposed to another database to be processed for other purposes.

In the actual processing of data, traditional statistical methods have been sidelined by the promise of big data correlations, as encapsulated in the earlier discussion of the datalogical turn (Clough et al. 2015). In relying upon computational power to process big data, machines have been taught to find correlations within datasets, and from these correlations, determine traits of a particular group of people and

predict the statistical probability of their preferences and actions. This machinic processing constitutes what Luciana Parisi has termed “soft thought” (2013), or “a new alien mode of thought” (2015), where the parameters for calculation are not fully defined from the start, but emerge in the process of extrapolating patterns from large sets of unstructured information.

This dimension of second wave big data is significantly different from the first wave. Computational processing bypasses the human, and is able to produce correlations that may be rather obscure, or completely unthought of by the human operators. As I have discussed in Chapter 2 in relation to the ontology of algorithmic thought, such algorithms move beyond the classic rule-based, step-by-step instructions of programming and use a dynamic form of reason not pre-determined. Algorithms could be programmed to recognise patterns from noise, and learn the correlated patterns, creating emergent structures from the randomness of the information. The use of machine learning introduces a level of invisibility as to why certain outputs are made, rendering a composite map of correlations that the algorithms have identified. The algorithms are not concerned with understanding why certain parameters simultaneously occur—as long as the coincidence of parameters occur often enough, a correlation is assumed and is included in the statistical calculation. The algorithms cannot care less as to why the correlation is there and what causes it. Computational reasoning incorporates then a speculative dimension in its automated operations, following a machine logic that excludes and bypasses human thinking. In Parisi’s words, this amounts to the “alienation of the human species in the form of an accelerated mechanisation of human reasoning” (2016, 10). Such a feature of second wave big data recalls the earlier discussion on the human-implicating nature of twenty-first-century media (Hansen 2015b). Algorithmic decisions may become more shielded from view as machine learning becomes more commonplace. These outputs may take a considerable amount of time to reverse engineer in order to unveil the layers of learnt patterns identified by the machine.

Nealon’s intensification hypothesis (2008) applies too when considering the biopolitical implications of second wave big data, and follows from what has been previously discussed in Chapter 4. Under the support of statistical calculations, biopower is further molecularised into lighter and more economical forms, and biopolitical dispositifs multiply and are decentralised over time. The field of statistics has for a long time been used for sovereign powers to govern, but coming into the twenty-first century, we see the data-collection mode shift into a logic of capture, and technologies whether developed by private corporations or government agencies play a role in algorithmic governance. In addition, the turn to the computational in the post-9/11 world means that certain bodies must be placed under heavier scrutiny and surveillance to ensure the security or betterment

of other parts of the population. In the previous chapter I also introduced the idea of a new panopticon that emerges out of computational vision, and that lines of categorisation could be drawn and redrawn in the flux of big data calculations. As opposed to one-off census surveys, data is collected durationally and is aggregated through continuous interaction with the devices, sensors, and databases of twenty-first-century media. In the rest of this chapter we would see how biopower divides according to the computational logic of “soft thought” (Parisi 2013), and how mobile norms could emerge out of big data processing.

In the next section, I will discuss the future-oriented processes of second wave big data in relation to several cases of predictive analytics, and consider how they *perform* the future and produce the effects that they name. This builds on the analyses of the ontology of digital algorithms I outlined in Chapter 2, where I referred to them as performative entities.

Performing Prediction

Second wave big data is most useful for its forecasting power and the predictive analytics it can bring. Predictive analytics is an entire industry¹²⁵ on its own, and can be used in various domains. Before I further discuss the selected examples’ relation with the theoretical discussion on biopower and performance, let me first briefly introduce what these examples entail.

The first example of predictive policing comes in an era where budget cuts to US police departments are recognised, and departments have to try their best to allocate resources to the best of their ability, while ensuring performance targets are hit. The software of predictive policing¹²⁶ perfectly fits into this climate, which makes it an attractive tool that offers, on the surface, a shortcut into meeting crime prevention and control targets. Predictive policing also “coincide[s] with a broader militarisation of American society” (González 2015, 14). Although statisticians, criminologists and reporters have doubted predictive policing’s claims about the ability to reduce crime (Bond-Graham and Winston 2013), it is clear that the operations are here to stay, not only within the US but also in other parts of the world.

In the second example on predictive trust, we see how ‘trust’, a culturally-defined experience of interaction, becomes codified through the algorithmic. Instead of relying on traditional means of background checks, predictive trust attempts to create a trustworthiness score of a given individual based on his/her digital footprint. In this case, the cultural performance of ‘trust’ and the technological is intertwined in a test of ‘trustworthiness’, which comes down to checking for traits algorithmically-correlated with anti-social behaviour. This service has been purchased by various

companies like AirBnB and nanny hiring apps, and targets peer-to-peer sharing services in the gig economy. Is a love of death metal music and hardcore rap a sign of antisocial behaviour? Does an internet history of porn-browsing disqualifies someone from being hired as a temporary babysitter in the neighbourhood? This example exemplifies the algorithmic state of exception (McQuillan 2015; Chun 2016) I discussed in Chapter 4, where for the sake of cost-minimalisation and speed, algorithms are performing extra-legal power as if they could offer a (better) judgement of character than traditional background checks based on state records.

The third example, mental health prediction, makes use of a variety of indicators to predict whether a person is at risk for depression and mental illness. Doctors, psychiatrists, data scientists, and engineers come together to build digital methods for better diagnosis and intervention. Supported by state funding from the National Institutes of Health, US-based digital health company, HealthRhythms, is developing “an automated recommendation engine capable of delivering personalized, real-time health interventions and behavioral change suggestions for people with mental health conditions” (D’Arcy 2018). The prediction engine is based on passively collected data from smartphone usage, including pattern of device usage like schedule and apps used, texting frequency, typing habits like typing speed and word length, GPS/movement data that could suggest how often one stays at home, travel patterns, and speed of walking etc.. Not only is the user under constant surveillance under the logic of capture, the user would also be prompted by the HealthRhythms product to adjust behaviour if one is deemed to be at risk for mental illness. Mental illness is no longer simply diagnosed and treated in a psychiatrist’s office and in the halls of a mental health institution but a condition that could be defined by algorithms through mobile norms established through big data correlations. The performance of ‘normalcy’ as opposed to ‘at-risk’ is determined through deviations from recorded patterns—the regularity of daily routines, or behavioural rhythms. This recalls the discussion above on the datalogical’s ever-moving norms and normalisation.

The predictive analytics examples I have selected for this section show in particular the entanglement between techno-chrono-biopower and performative power. The examples cover the uses of second wave big data in security paradigms in the public sector (for policing) and in the private sector (for background checks), and in the health sciences (mental health). Multiple dispositifs of control are created whereby techno-chrono-biopower is performed. In *Perform or Else* (2001), McKenzie argues that “performative power is multivalent and polyrhythmic” (249). The multivalence can be observed in the multiplication of dispositifs in algorithmic governance, but interestingly, despite the multiplication in dispositifs and the variety of contexts, these algorithms operate very similarly on an ontological level.

Ontologically speaking, prediction relies on its performative power. We will see how these algorithms are searching and modelling through correlations the *potential* criminal, the *potential* untrustworthy person, and the *potential* mentally ill. And by designating individuals as such, they perform the effects they pronounce, essentially placing certain people under heavier scrutiny or taking away their eligibility for certain services. The performative powers of these algorithms also relate to the temporal dimension. Performative biopower's polyrhythm is seen here in the future-oriented machinery of prediction, that "rehearses the future" (McKenzie 2001, 250), and enunciates effects that are yet to come. Significantly, second wave big data warps the linear chronology of time. Prediction is necessarily future-oriented, and acting on a future potentiality disrupts the order of past-present-future. I will further analyse this aspect of techno-chrono-biopower, in relation to theoretical reflections by Massumi (2015), Hansen (2015a), and Grusin (2010), after the description of the examples.

These algorithms further relate to performative power from the perspective of system optimisation. McKenzie describes performance as optimisation, "the maximisation of a system's output and the minimalization of its input" (2001, 163). This idea of minimalisation of input can be placed in conjunction with how biopower becomes more efficient through being lighter, and less resource-intensive.¹²⁷ Maximisation, on the other hand, can be observed in the widespread dispositifs of algorithmic governance arising in domains like security, policing, and health services. In the three cases, system optimisation takes the forms of optimising policing efforts in resource allocation, optimising personnel management through verification of trustworthiness, and optimising public health through targeting mental illness. The adoption of second wave big data, or predictive analytics, in these three settings help mitigate risk, provide early intervention, and reduce the resources necessary for creating the same outcome (crime fighting, vetting, and mental illness prevention). This shows that these predictive technologies are intertwined with the lightening of resources for biopolitical control, making the exercise of biopower more economical.

In the last section of the chapter, I will further these points and connect the three examples to the theoretical dimension of techno-chrono-biopolitics, and discuss how time is remediated through second wave big data. I now turn to the examples themselves, and offer a descriptive account of the theoretical bases that inform the designs, and expose the mathematical reasoning and correlations that these second wave big data dispositifs employ.

1. Predictive Policing

Most accounts of predictive policing begin with a reference to Steven Spielberg's *Minority Report* (2002). In the dystopian future of Phillip K. Dick's novel and its film adaptation, people are arrested and convicted before they commit crimes. *Minority Report* (2002) presents the Precrime unit, which utilises a psychic technology with 'precogs' hooked up to an interface who can predict when the next crime would happen in the city. The Precrime unit captures and punishes the 'guilty' before the crimes are even committed.

What *Minority Report* has imagined before is now in full-fledged development in the form of predictive policing. The science fiction film is often alluded to even in promotions and introductions by American police departments. New York Police Department Commissioner Bill Bratton directly stated in a 2015 "Data Mining the Modern City" panel hosted by the New York Times that "The 'Minority Report' of 2002 is the reality of today" (Gosztola 2015). Big data analysis takes the place of 'precogs' and psychics to forecast when and where crimes are likely to emerge, and advise officers to increase patrols in the area. Taking historical crime data and modelling them through criminological models of crime pattern, a complex set of statistical calculations takes place inside proprietary software developed for police forces. These softwares include CompStat, Series Finder, ProMap, PredPol and HunchLab which are created by scientists, criminologists, statisticians and programmers. The output from such software is usually a map of hotspots for high crime areas, as well as a time schedule as to when crime is mostly likely to take place. Operating officers then make decisions when and where to allocate patrol teams, organise stakeouts, and arrange surveillance.

It must be noted that prediction of crime trends and hotspot mapping are not new practices, but are simply modelled anew and intensified through the algorithmic in cases of predictive policing software. Since 1930s,¹²⁸ police departments in the US have installed reporting mechanisms for crime statistics for analytical purposes. In an anecdote offered by Kipperman (2014), New York City policemen have adopted mapping since 1980s for visualising criminal patterns. Jack Maple, Transit Police Lieutenant, mapped trains and train stations in the city, plotting locations of solved and unsolved violent crimes, robberies and grand larcenies that occurred. This helped officers identify high crime areas and guided decisions of where to allocate police manpower.

Crime analysts have long made use of statistical data and patterns to determine probable locations of future crime so that the presence of patrolling officers could deter the occurrence of crime. The real problem with the introduction of predictive policing software is that the increasingly complex combination of algorithmic projection and data-mining makes invisible the processes of prioritisation which has taken place inside the software. The algorithmic domain operates speculatively

outside of human consciousness, and offers no immediate explanation as to why a particular outcome is generated. This is especially true when the crime data database is combined with combing through real-time generated data on cameras and internet-mined social-media streams. Officers have to decide whether to act upon the alerts the software provides, without easy nor quick means of figuring out or back-tracking what precisely has led to such predictions.

Algorithmic governance turns theoretical models of crime patterning into a mathematical operation that provides a result which can be actioned upon. Assumptions within these theories turn into programming rules, which then are continuously run and calculated upon. The critique of the datalogical lies precisely in the over-investment in what numbers and statistical trends could offer. Bilel Benbouzid (2015), who works in the field of the sociology of science, brought into light an ignored controversy within the field of criminology in relation to the distribution of victimisation in the population. While predictive policing is based on the literature on situational crime prevention, there lies an opposing model of community crime prevention, developed almost concurrently in the 1990s. While the former has now become an important basis for predictive policing statistical modelling, the latter has dropped out of attention, partly because it is comparatively less easy to quantify and mathematise.

Ken Pease, a sociologist representative of the situational crime model, developed with his colleagues a contagion model of how burglary works—it is “infectious”, as “a first burglary usually increases the risk of another one following on a close target, provided that the new target has similar social and physical characteristics to the first” (Benbouzid 2015, par24). This understanding models a time-space distribution with reference to clusters of burglaries with repeated victimisations, now adopted in hotspot mapping in predictive policing.

Criminologists behind the community crime prevention model, such as Tim Hope, differ in opinion as they take into account the behaviour of the burglary victims and how they coped and adapted to the situation based on their own securitisation and preventive methods against further crime. Not only are the patterns of criminal behaviour important, so are the patterns of response from victims and other households in the neighbourhood. Individuals may engage in their own quest for safety by creating neighbourhood watches, or purchasing alarm systems. “Crime prevention becomes a matter of detecting and predicting the disintegration of these factors of protection through an ever finer understanding of the unequal conditions of access to security” (Benbouzid 2015, par39).

Pease’s model focuses solely on the category of repeat mechanism, targeting repeat victimisations while Hope attempts to create more categories for analysis, and wishes to model distribution of victimisation differentiated through frequency (non-victims, one-off victims too as opposed to only repeat victims). Hope’s model

is arguably more complex to develop as it takes into account more contributing factors, beyond the epidemiological metaphor that the situational crime model uses.

Predictive policing software operationalises academic theories of how crime happens, and validates the epistemological value of these specific approaches in criminology. Benbouzid criticises how Pease's approach falls within the engineering science tradition "with the aim of being useful, without ever examining the cognitive and political underpinnings" (2015, par53) of his approach. As the software continuously guarantees persuasively and seductively results,¹²⁹ police departments justify the adoption of the software based on its 'proven' abilities to detect and predict crime¹³⁰. One can hardly expect its users to contest the theoretical basis upon which the algorithms are in fact developed. The technological assemblage renders contestable knowledges into programmable rules for governing and policing, hiding assumptions and epistemological positions that an academic theory carries behind mathematical formulae and statistical models, now automated and abstracted into background-running algorithms.

In addition to the epidemiological contagion metaphor, the metaphor of earthquakes has also been used, designating crimes which closely follow in the immediate neighbourhood as 'aftershocks'. Professor George Mohler at Santa Clara University has created an algorithm based on this model (Koss 2015, 308) with basic principles as follows:

Like traditional grid mapping, a grid is overlaid over the map of the jurisdiction.

The rate at which new crimes appear in the grid square is estimated. This is known as the 'background rate'. The rate can be adjusted to reflect temporal differences jurisdictional-wide (e.g. more crimes over the summer).

Should a crime happen in a particular grid, the estimated number of new crimes would increase temporarily, i.e. the 'aftershock' theory is applied. The increased number would gradually fall back to the original estimation over time if no new crimes have been observed in proceeding period.

Whether epidemiological or seismological, we see that pattern recognition and predictive analytics operate without the basis of causal relations—it does not matter why certain correlations exist, it only matters that these correlations could be operationalised through a process of mathematisation in algorithmic forms. In some cases, these are operationalised to reach the performance standard of cutting costs or increasing 'efficiency'.

Predictive policing software outcomes lend legitimacy to the increased surveillance and stop-and-frisk searches which ensue, as police officers act upon the data and follow predictions to particular neighbourhoods. While in the past police officers must achieve a legal definition of "reasonable suspicion" in order for a stop-and-frisk or investigation to be lawful, this threshold of suspicion becomes tied up

with algorithmically-generated risk scores. Legal researcher Andrew Ferguson refers to this phenomenon as “predictive reasonable suspicion” (2015). Police officers are supposed to articulate reasons for suspecting a certain individual, and have to justify why suspicion is inferred by referring to observable facts, and whether these observations hold up in court is decided on a case-by-case basis. These explanations serve as “a guarantor of statistical likelihood” (Brennan-Marquez 2017, 1249). However, what predictive policing does is offer a statistical likelihood that predictively produces the possibility of suspicion. It is *probable* that some people in the neighbourhood *might* be linked to criminal activity, but there is no actual explanation available as to why. Rather than predicting crime, predictive policing predicts the *likelihood* of crime, thereby generating suspicion. At the end of the day, it is suspicion that is performatively produced through algorithmic means, not the discovery of concrete indicators of actual criminal activity.

2. Predictive Trust: “Trust in about 30 seconds”¹³¹

The second example revolves around an algorithm that can ‘calculate’ Instant Trust™, allegedly offering a view of whether a person is reliable or not through one’s digital footprints, bypassing traditional background checks. Background checks conventionally involve the verification of social security numbers, education and qualification, previous employment histories, credit histories, and criminal records. This is conducted, for instance, as part of a pre-employment checking, or a loan approval process. Depending on the country and location, some of this information might require a physical visit to a records office or the courthouse, where a human being would actually have to leaf through paper records in order to determine the authenticity of data provided by the applicant.

Trooly, a start-up from 2014, is hoping to speed up this process and to make it more efficient—by mining one’s digital footprint. Collecting data from the public and the dark web, search engines, social media, digital public records, the company has built machine learning algorithms that could determine—allegedly—how ‘trustworthy’ someone is. In an effort to outsmart its competitors, Trooly wants to use the mined data to pre-screen candidates even before an actual conventional background check process is carried out. If a candidate is deemed untrustworthy and therefore highly likely to fail the conventional background check, the company is saved from a fruitless trip down to the town hall. The construction of trustworthiness has turned into a mathematical entity and is based upon metrics derived from correlating internet activity and personality traits.

Trooly’s method is to be distinguished from other background check start-ups which also try to speed up the procedure by improving data queries from existing databases, or by introducing digital means of checking documents. Onfido, a UK start-up, checks identities against a database of stolen identities, and has acquired

access to official police databases for criminal records. It also uses visual imaging techniques to scan passport copies to determine if the document is genuine, and to see if the document has previously been reported stolen, lost or compromised. This approach is not so different from conventional background checks, and deploys digital methods to increase efficiency.

Trooly, on the other hand, takes into account an entirely different subset of data—one's digital footprints. Their position is that a digital background check is cheaper, more accurate, less prone to bias, and less intrusive than conventional checks.

In an attempt to uncover what an algorithm of trust could look like, I looked at the only public piece of information that is available: Trooly's US patent, entitled "Determining Trustworthiness and Compatibility of a Person" (Baveja et al. 2015).

According to the company, the 30 seconds are used to create a scorecard with three items:

it verifies whether the input information is authentic; it screens for any relevant and seriously antisocial or pro-social prior behaviour; and then it runs a series of predictive models on that footprint to say what is the propensity of this individual or small business for future antisocial or pro-social behaviour. (Lomas 2016)

In order to determine a profile of the person under investigation, Trooly's algorithms send out crawlers¹³² to identify a plurality of information, including name, email address, telephone number, geographic location, date of birth, social connections, employment history, education history, driver's license number, financial account information, Internet Protocol (IP) address, and device identifier. This information could be distributed across several 'documents', such as webpages, entries in databases, posts on social media, blogs, or microblogs, comments on websites and forums, or directory listings in companies and associations. A plurality of queries would be used in order to maximise the amount of relevant documents across the public and dark web, meaning that the algorithms aim to mine as much data as possible about this person's personal information, browsing history, and internet activity. The types of data mined include more than the actual content, and extend to "one or more of a source of the document, a layout of the document, a content type of the document, and a data or metadata contained in the document" (Baveja et al. 2015). Notice that the patent specifically points to an entire range of information as well as the meta-data involved. For instance, posting on a forum would give rise to several sets of information: the content of what has been posted, the time-stamp of the post, from which device is this message posted, what type of forum this is and associated information like who else posts on such a forum. Based on the analysis of the collected information, Trooly's trustworthiness tool devises a 'behaviour trait metric' and a 'personality trait metric'. These would then be put

through a scoring system that is rule-based plus a machine learning system, which subsequently churns out a ‘trustworthiness score’ of the person under investigation.

The patent further references other algorithms in development that attempt to draw connections between Twitter and Facebook public activity and ‘trust’. It also draws from a number of existing algorithms that for instance uncovers all associated accounts with a person’s internet presence. Since many services already use ‘Sign in via Facebook’ or ‘via Twitter’ or ‘via Google+’, not to mention the amount of services these companies have acquired, it is not so difficult to uncover one’s profile of activity across multiple websites.

The patent references two pieces of research attempting to measure ‘trust’ via Twitter. These articles shed light on how exactly data scientists construct numerical formulas that could assign a score to trust relationships, and what metrics are involved in Trooly’s trustworthiness score. In both Adali et al., “Measuring Behavioural Trust in Social Networks” (2010) and Adali and Golbeck, “Predicting Personality with Social Behaviour” (2012), certain interesting correlational values have been proposed. For instance, trust between two individuals can be reflected in the amount of propagation of information (in Twitter’s case, retweets). If A propagates information from B, it suggests that A trusts B’s information. A repeated propagation emphasises the trust relation. This is understood in the study as propagational trust. The researchers created a second entity called conversational trust. Observing Twitter conversations that involve direct messaging (i.e. tweets that begin with a @twitterhandle, which is a targeted message to identified user), they proposed the following measurable postulates:

- Longer conversations imply more trust.
- More conversations imply more trust.
- Balanced participation by A and B implies more trust. (2010, 3)

Moving further, the researchers establish a formula (Fig. 25) and plot graphs that collate data from Twitter conversations and measure how and how much two actors A and B interact.

We define the conversational trust $T_c(A, B)$ as follows:

$$T_c(A, B) = \sum_{i=1}^l \|C_i\| \cdot H(C_i)$$

Where $H(C_i)$ is a measure of the balance in the conversation.

Fig. 25: Formula appearing in the patent that defines conversational trust as the sum of interaction scores between users A and B, whereby each interaction is scored by the length of each set of conversations between A and B multiplied by the balance between A and B in each conversation (Adali et al. 2010)

In light of psychological research, qualitative studies, and the amount of theories attributed to ‘trust’, the fact that one could numerically calculate and designate trust by a formula that looks like this based on Twitter interactions is quite simply ridiculous. For one, it completely ignores the possible offline interactions that could have taken place in lieu of Twitter responses. One could also challenge all of the postulates proposed by the study. Debates unfolding across Twitter where one party is outraged at the other or trying to prove the other wrong could also result in longer and more conversations, but may prove the exact opposite: there is no trust between A and B, but rather distrust, doubt, and suspicion. An imbalance in participation could be due to one party spending less time on the social platform without it being related at all to the actual relationship between A and B. Frequency and length of communication cannot substitute what ‘trust’ could mean qualitatively to the relationship between A and B.

The second article attempts to correlate online behaviour with psychometrics, namely the OCEAN test. OCEAN is an acronym for five terms: openness, conscientiousness, extroversion, agreeableness, and neuroticism. The researchers are interested in studying one’s digital footprint in relation to the possible personality traits one might have. This research continues to expose how much meta-data plays a role in determining these character traits.

A test group of 71 individuals took part in the OCEAN personality test, and their information is checked against their friends and followers, as well as their public tweets. By checking for correlations between their self-reported personality traits in the test and how they interacted on social media, the researchers try to predict the personality traits of their friends and followers in the dataset. The table below (Fig. 26) shows what kind of information they collect, amongst others.

Feature	Description
Fr	#Friends
Fo	#Followers
Msg	#Messages posted
Fav	#Messages favorited
Days	#Days the user has been on twitter
Time	Mean spacing between tweets
Rtw	Fraction of tweets that are retweets
Dir	Fraction of tweets that are directed
URL	Mean number URLs in a tweet
Hash	Mean number of hashtags in a tweet
Men	Mean number of mentions in a tweet
Len	Mean text length

Fig. 2. Network Bandwidth and Message Content Features. Note that for all features computing mean, there is a corresponding feature computing the standard deviation, for example ρ Time denotes the standard deviation of time.

Fig. 26: Features from Twitter used to determine behaviour of users (Adali and Golbeck 2012)

In the study, they suggest for instance that the trait extroversion is best predicted by long text lengths. Extroverted individuals tend to write longer messages. Agreeableness can be spotted in friends replying to another's message on their timelines. The use of hashtags also suggest agreeableness to the norms of Twitter and the openness to participate in discussion with others. The researchers also used a Linguistic Inquiry and Word Count tool to analyse the content of tweets, finding percentage of words that match pre-defined categories like anxiety words, happy words. These psychometric determinations show the correlations that have been established between certain metadata and selected traits.

Both the trust measurement model and the psychometric determination model give insight into the construction of Trooly's algorithm, where multiple aspects of one's internet presence could be used to predict personality traits and trustworthiness. Trooly identifies several criteria which may indicate a lower score and negative personality or behaviour traits:

a particular identified portion indicates that the person created a false or misleading online profile or provided false or misleading information to a service provider, is involved with drugs or alcohol, is involved with hate websites or organisations, is involved in sex work, perpetrated a crime, is involved in civil litigation, is a known fraudster or scammer, is involved in pornography, has authored online content with negative language, or has interests that indicate negative personality or behaviour traits. (Baveja et al. 2015)

Instead of looking up and compiling criminal records, commercial records, and financial records of an individual, Trooly turns to the likes of these mathematical models to create scores. In their promotional material, they propose the possibility of continuous monitoring, where current employees could be subjected to such a digital activity check regularly. The company also boasts its machine learning mechanisms, and emphasises that they only use public and legally permissible digital footprints.

Without our conscious knowledge, our digital footprints have been recorded and left a trace somewhere, including the metadata of what we have done. Prediction, in this case, is based on an aggregation of a whole series of algorithms which are founded upon potentially dubious correlation models. This example really demonstrates the leakiness of data and fits within the critique of the datalogical. In particular, it highlights the problem of how data that is inputted on one system could be repurposed for entirely different purposes. It is problematic whether the data collected accurately correspond to the person in question or not. For the entire process is blackboxed and will without a doubt affect your trustworthiness score without you ever being able to dig through the machine learning algorithms that has learned correlations not even the engineers have access to. Not to mention, in 30 seconds, this algorithm would have generated an entire profile on someone based on their internet activity (or lack of) and have represented it in a numerical score.

During my research process, the company has been acquired by AirBnB, and would subsequently be integrated onto the flat-sharing platform. AirBnB has in fact relied on Trooly's other algorithmic products to authenticate user identities since 2015. AirBnB hopes to further reduce fraudulent listings on the platform, and help hosts prevent inviting potentially untrustworthy guests into their homes. The fact that companies and services turn to such an algorithmic construction rather than traditional forms of background checks suggests a foreseeable future where traditional vetting processes may be replaced by similar means of algorithmic calculations. By relying on such calculations, the algorithms perform with the perceived objectivity and force of law, befitting the definition of the algorithmic state of exception in Chapter 4. Trustworthiness could be reduced to a calculation based on digital footprints, and it is not even discernible whether the assessment actually corresponds to the person or not. As Trooly's algorithm escapes due process in its 30-second performance, the example shows how second wave big data intervenes in the domain of prediction, categorising users and designating traits to them in ways that are unimaginable in the era of first wave big data. We have moved past the established categories of age, gender, race, education, job, income in censuses into new emergent categories of trustworthiness, sociability, openness, conscientiousness, extroversion, agreeableness, and neuroticism calculated through correlation.

3. Predicting Mental Health

With the recording capacities of twenty-first-century media, we leave digital footprints everywhere on the internet like a breadcrumb trail. It is not only these footprints that interest companies and researchers—the interaction with our devices are also recorded and amenable to capture too. The third case focuses on the interaction between user and device, and how this interaction could create behavioural patterns, and how the device could be co-opted as a mental health indicator and intervenor.

Smartphones in particular are singled out as the device that most people use most frequently in the day to communicate with other people, browse websites, or interact with entertainment like games and music. It offers indications to our behavioural patterns—an approximation of when one wakes up and goes to sleep can be determined by taking note of the first and last moment the phone is used and the alarm function; GPS data shows the commute route, and where one has travelled to; the accelerometer tracks the speed of walking; and frequency of calling, texting, and rate of response could also be noted, establishing indicators of sociability. In an emerging field of computational psychiatry, researchers and developers attempt to create computational models that would allow better diagnosis based on collated big data.¹³³ In the category of linguistics, word-use patterns are associated with

psychosis, and typing speed can be indications of depression (when slowed down) or manic phase in bipolar disorder (when sped up). Instagram has been identified as a potential app that could help identify depressed individuals—based on the filters applied, number of faces shown in photographs, and community interaction based on likes and comments. Researchers at Harvard University and the University of Vermont found that depressed individuals tend to post images that are bluer, greyer, and darker, and receive fewer likes, whereas healthy individuals prefer lighter hues and more vibrant colours (Reece and Danforth 2016). These research efforts have identified the potential of correlating depression with particular behaviours based on smartphone usage, and enable risk models to be modelled based on such correlations.

The emerging field of computational psychiatry is in fact made possible due to the easier recruitment of large number of subjects through on-demand crowdwork services like Amazon's Mechanical Turk. We are once again reminded of the incredible amount of human labour that is driving these algorithmic designs. The Instagram study is one of the examples where the Mechanical Turk comes in handy. 500 Turkers were asked to complete standard clinical depression survey and other questionnaires and provide their Instagram feed for analytical purposes. Even though the Turkers may not be entirely representative of the population as a whole, their data could be invaluable for pilot studies and exploratory experiments. They are considered more diverse than college students and can be re-contacted for future follow-up studies.

I now turn to the main object of interest under the banner of predictive mental health, HealthRhythms. Co-founder of HealthRhythms Tanzeem Choudhury hails from Cornell University's People-Aware Computing Lab. At the Lab, other prototypes have been built to study how smartphone usage could generate patterns of user behaviour and also be used to deliver prompts for behaviour modification. For instance, Moodrhythm targets patients suffering from bipolar disorders and aims to help individuals stick to a regular rhythm. The app actively and passively tracks daily rhythms of sleep and social activity using accelerometer, audio, and light sensing probes on the smartphone and provides feedback that can help patients maintain a regular daily rhythm. The collected data, which does not depend on self-reporting by the patients, may also be shared with physicians. StressSense makes use of the microphone to detect stress based on the voice of the user, and sheds light on the stress levels of the user. Clockwise is developed to study the alignment of phone usage pattern with sleep pattern, which is then used to determine the user's body clock and the circadian rhythm of the body. These prototypes all rely on existing sensing and recording capabilities of smartphones and use them to establish a profile of the user.

HealthRhythms is built based upon the testing and development done in these earlier prototypes to create an app targeting depression. It aims at measuring user's mental health by seamlessly gathering data of one's routines and behaviours. Using machine learning and predictive analytics, the app assesses the mental health conditions of its user, and offers "just-in-time personalized interventions" ("HealthRhythms" 2016). Risk is established when a user deviates from established patterns of behaviour, indicated by reduced text messaging, slower typing speeds, or staying at home more than usual. These indications are considered as signs of social withdrawal and isolation, or early symptoms of depression. The smartphone is also the intervenor in these behavioural patterns, in an attempt to stop depressive symptoms from worsening.

What is interesting here is that HealthRhythms emphasises *stealth* modification, i.e. behaviour nudging that is under-the-radar and does not feel intrusive to the user. Their aim is to "make the interventions disappear into the background, modifying a person's behavior with minimal effort" (D'Arcy 2018). The app is not aimed at feeding back but at feeding forward (Hansen 2015b)—the developers believe that feedback mechanisms appearing on-screen may overwhelm the user. Instead, they want these behavioural nudges to be as non-disruptive as possible. Feeding forward in this scenario means that users may be intervened with anti-depression tactics before they themselves realise that they are developing symptoms of mood disorders. The predictive ability of the app pre-empts the actual cognition and official clinical diagnosis of depression by a health professional.

For instance, the app can suggest engaging in social behavior if it senses growing social isolation in the user. If someone is spending more and more time at home, the system might say "It's a nice sunny day today, a great day to get a coffee from your favorite café down the block." For activity, we generate suggestions that could change behavior but won't cause disruption in lifestyle. By looking at the times a person typically takes a walk, the routes they normally take and the weather conditions, for instance, we can suggest a walk that fits with their basic routine. (D'Arcy 2018)

To further illustrate this tactic of stealthiness, HealthRhythms quotes the wearable technology previously invented at Cornell's lab called "Emotion Check". Emotion Check senses anxiety, as indicated by the racing of a user's pulse. The wrist wearable provides subtle tactile feedback mimicking a slower heartbeat, which can slow the user's heart rate down through biofeedback. Anxiety levels may be lowered as a result of this. HealthRhythms finds such designs more minimal in their interventions with the user's body, and is inclined to select such tactics to nudge behaviour and improve user well-being. This type of algorithmic governance allows for the close monitoring of individuals as well as the delivery of personalised 'discipline'. In Chapter 6, I will go deeper into this topic through an exploration of Quantified Self gadgets.

Health is a prominent subject in the burgeoning domain of second wave big data. In first wave big data, health data was collected to support the study of disease epidemiology, and to help prevent outbreaks and reduce public health risks. Today, the technology enables tailor-made, personalised diagnosis and intervention based on individual data and individual profiles. One could argue that the mental health prediction is done to reduce public health expenditure on mental health and to safeguard the productivity of the population by targeting depressive individuals before the symptoms even develop into actual depression. While HealthRhythms is a laudable foray into developing mental health support for patients, it infuses psychiatric practice with technicity in the calculations and measures of a given population through durational capture and surveillance. It also begs the question of whether such designations of individuals as depressive or prone to depression may leak into other databases and affect other algorithmic models like the profiling example of predictive trust above. In biopolitical terms, individuals become “a technical object, a political object of management and government” (Clough 2016, 3) through the application of an app like HealthRhythms.

Prediction as Techno-chrono-biopolitics

In the examples above, we see prediction through second wave big data being utilised in several fields. Prediction is the ultimate goal in much of second wave big data, in order to associate attributes based on statistical inferences and correlations. These algorithms are understood here as instances of techno-chrono-biopower, instigated through their adoption as predictive algorithms. The analysis forms a digitally-encoded dimension in the study of how the potential criminal, the potential untrustworthy person, and the potential mentally ill come to figure and are subjectivated under particular regimes of techno-chrono-biopower. It raises the question of what kinds of bodies are vulnerable and particularly susceptible to capture by the mathematical formulae and computational logic as shown in the three examples.

The data captured, especially in the Trooly algorithm and in HealthRhythms, show the deep intrusion into many aspects of daily life that have not featured in earlier statistical regimes. As mentioned in preceding chapters, Erich Hörl (2015), Mark Hansen (2015b), and Jennifer Gabrys (2016) have commented that data operations are becoming environmental in their ubiquity and reach. We live in a technological condition where we, as humans, are embedded in an ecosystem of sensors, software, and gadgets that conscientiously record what we do, adding new categories and volumes of data for statistical analysis. We see from the examples that second wave big data depends on a variety of sources for datification, from our

digital footprints to our interaction with devices. My digital trail on the internet could impact¹³⁴ my trustworthiness rating and affect my eligibility for using certain services; a change of texting pattern could mark me as a depressive individual in need of medical attention. That such data should feed into disciplinary and governance dispositifs means that individuals could no longer keep track of what types of data are being amassed and how they feed forward into predictive regimes.

Following Massumi (2015), biopower is becoming a form of ontopower. The onto-dimension refers to the warped temporality, where the future is being moulded by pre-emptively acting on potentialities that have not actually happened yet. But by acting on them, one in fact brings them into existence. This pre-emptive sensibility, according to Massumi (2015), has become the *modus operandi* of power today. The technology of predictive analytics helps materialise the desire to act pre-emptively.¹³⁵ Predictive analytics feeds into pre-emptive models of heightened suspicions and the constant belief that some future threat will materialise, whether one is suspicious that a neighbourhood is potentially a high-crime area, suspicious that someone who watched way too much porn and wrote rude comments on YouTube could be potentially untrustworthy, or suspicious that when typing speeds slow down and response rate drops, depression may follow. These threats of course are of varying importance to state powers or capitalist powers, but for better or for worse, they invariably show the foresight to act pre-emptively and prevent unwanted outcomes. In that sense, they all perform dimensions of ontopower. In the following, I return to the theoretical implications of these predictive technologies, and demonstrate how prediction ontologically introduces a dimension of future-oriented time, furthering the techno-chrono-dimension in my concept of techno-chrono-biopolitics.

From Biopower to Ontopower

This section extends the discussion of techno-chrono-biopower by referring to Brian Massumi's work, and by further defining the future-oriented aspect of techno-chrono-biopower.

One of the most important extensions of biopower in the twenty-first century is Massumi's reconceptualisation through ontopower. Ontopower introduces a time dimension to the concept. Onto-power, in a way, can be considered as a colonisation of future time. By acting upon certain predictions, one brings a future potential into a concrete present set of reality.

Writing from the perspective of post-9/11, Massumi points to the logic of pre-emption as a new consolidated mode of power, in a way that overtakes but does not replace prior powers (following on from biopower). The war on terror instigated by George W. Bush in the wake of the Twin Tower attacks begins a new era of military operation based upon perceived threat. Massumi sees this as the "future birth of

the affective fact” (also the title of one of his essays), in the sense that by acting upon such a perception, the threat comes into being. In this essay, he begins with the image of a 2005 newspaper headline in Quebec. It is a full-colour portrait of a chicken, with accompanying text stating “the next pandemic does not exist yet” and “The threat, however, could not be more real.” Discussing the incipient threat of avian flu, Massumi observes the curious fact that the threat of the pandemic has made front-page news despite its status as a *future* threat. If one should act upon this future threat, it materialises the conditions of the threat, turning a *future* threat (that may or may not become a threat) into an actual threat that needs to be seriously reckoned with. This is what pre-emptive action does, turning threat-potential into a threat that requires acting upon.

Massumi argues that the alert of a potential threat does not have as much “referential truth-value” (whether the threat will or will not materialise in a particular time and space) as it has “*performative* threat-value” (the threat may materialise, somewhere, sometime) (2010, 59; original emphasis). He goes on to suggest that

[i]t is the performed commensurability of the threat and the triggered actions that qualifies the alert as correct. Its correctness, felt as a question of collective security, is directly political. The threat-alert, as sign of danger, is subject to different criteria of reliability and effectiveness than referential language about danger. (*ibid.*; original emphasis).

Indeed, threat has a lower threshold of reliability than danger. To prove that something is threatening only requires certain signs of it being potentially dangerous, whereas to prove that something is dangerous requires facts that show that it for sure causes harm.

What stands out for Massumi is that we are shifting into a era from when preventive action takes place against a clear and present danger, versus pre-emptive action against a potential threat. A performative threat-value is enough to warrant action. This is most visible in the justification for war against Iraq under the suspicion of weapons of massive destruction. As he has argued in 2005, the notion of a threat has become normalised in the post-911 era. In 2002, the Bush administration introduced a colour-coded terror alert system: green (low), blue (guarded), yellow (elevated), orange (high), and red (severe). In its years of operation till 2011, the threat level has only been changed 17 times, and never in fact reached green nor blue. Most of the time it hovered between yellow and orange, and only once was it raised to red. Critics commented on how the threat warning system has in fact desensitised the public because being on guard between yellow and orange was the norm. “Insecurity, the spectrum says, is the new normal” (2005, 31). To act upon perceived fact does not require a clear establishment of facts. Rather it only requires a logic of would-have/ could-have/ might be/ could be, one that could emerge out of the affects of fear and paranoia.

Affect-driven logic of the would-have/could-have is what discursively ensures that the actual facts will always remain an open case, for all pre-emptive intents and purposes. It is what saves threat from having to materialise as a clear and present danger—or even an emergent danger—in order to command action. (2010, 55)

Onto-power from this perspective organises itself around pre-emption, in a way that changes the object and mode of operation—a response prior to the fact, a future time already colonised in the present.

Preemption is a time concept. It denotes acting on the time before: the time of threat, before it has emerged as a clear and present danger. What is this time of the before? How can it be acted upon? How can that acting upon already constitute a decision, given the ungraspability of that which has yet to eventuate and may yet take another form? Preemption does not idly pose these problems concerning the nature of time, perception, action, and decision: it operationalises them. It weaponises them. Paradoxically, it weaponises them in a way that is productive. Ontopower is not a negative power, a power-over. It is a power-to: a power to incite and orient emergence that insinuates itself into the pores of the world where life is just stirring, on the verge of being what it will become, as yet barely there. It is a positive power for bringing into being (hence the prefix “onto”). (2015, vii-viii)

As highlighted by Massumi in this quotation, time is of the essence in ontopower. When mapped upon the digital, one could consider pre-emption as the mode of operation in predictive analytics. Just as the potential of threat has a performative threat-value, correlations as discovered through big data processing have performative value as well. The technology of predictive analytics operationalises the desire to take preventive or pre-emptive action before something undesired happens. The outcome of predictive analytics lends legitimacy to the action, which in turn, makes the tool a powerful “weapon”, in Massumi’s terms. To use the US predictive sentencing example from Chapter 4, a predictive outcome could justify a lengthier sentence for an individual just because statistically the person has a higher chance of recidivism than other inmates. It does not mean another crime will definitely be committed by the individual upon release, but if the tool of prediction says it is probable, it is reason enough to give a longer sentence. As a result, the predictive tool becomes a weapon that is wielded against individuals with attributes of race, gender, social class which are correlated with higher crime rates. A longer sentence also signifies more labour power for the prison-industrial complex¹³⁶, and relates back to the making-productive of bodies in the operations of biopower.

Predictive analytics is based ontologically on correlations. In “Our Predictive Condition; or Prediction in the Wild” (2015a), Mark Hansen also refers to Massumi’s work on ontopolitics. Extending this discussion, he explicates the non-relationship pre-emption has to causality.

To the extent that it operates in relation to—indeed, in virtue of—an unknowability that can never be overcome, preemptive power exists orthogonally to causality, and operates—or claims to operate—independently of and beyond its scope. (Hansen 2015a, 105)

Looking at second wave big data analytics and its correlations, not causations, we could see how Massumi's pre-emption discussion and ontopolitics could be mapped onto today's algorithmic world.

In this chapter, Hansen also aligns Massumi's pre-emption and ontopolitics with Richard Grusin's work on premeditation. In his 2010 book, Richard Grusin reframed his older concept of remediation¹³⁷ into 'premediation'. The experience of the human subject is sometimes fed by the machinic, where computational media operate in digital domains beyond what the conscious self can address, to the point where the world we experience is already pre-mediated. Grusin is very much on point in suggesting that premediation is about "the proliferation of networked media technologies so that the future cannot emerge into the present without having been premediated in the past" (2010, 126). Indeed predictive algorithms and machine learning require training sets of data that would help them establish the correlations therein that are statistically worth attending to. Predictive policing heavily depends on historical crime data in order to produce its analyses. Predictive trust requires a set of pre-established correlations between personality trait and behaviour. Predictive mental health uses the established pattern of behaviour by individual users as the 'normal' and looks out for anomalies compared to the individualised norm.

Grusin emphasises that premediation "is not about getting the future right" (2010, 4), to which Hansen reframes in terms of a new ontology of predictive analytics. Rather than establishing facts and evaluating the reality of the situation, and studying the cause and effect of a scenario at hand, premediation and pre-emption both reject the imperfections of causal prediction in favour of acting upon the maybes of correlations. The problem, however, is that

Once this decision is made, facts about reality become strangely irrelevant, as does the very notion that the future in fact bears differentially on our predictions in the present (or, using Grusin's terminology: that one can get the future at least partially right). (Hansen 2015a, 112)

As I have pointed out in the discussions of the case studies, it does not matter if the predictions based on correlations actually have any bearing upon reality. The predicted score of untrustworthiness may be calculated with an erroneously-associated account of another internet user, and the individual using HealthRhythms may not be feeling sad at all. Predictive analytics creates the scenario where truths and facts become external to the actionable, solution-oriented outcomes of second wave big data analysis.

Pre-emption therefore forms an extension of biopower, which in Massumi's terms, corresponds to the concept of ontopower. Through mediation vis-a-vis big data, the biopower of statistics has evolved into a machine-mediated version of ontopower, or techno-chrono-biopolitics.

Predictive Analytics as Pre-emptive Analytics

From the analysis above, we could see that perhaps the term predictive analytics can be better replaced by pre-emptive analytics. These examples show the state of techno-chrono-biopolitics. On the techno- dimension, pre-emptive analytics requires the infrastructural support of the volume of second wave big data. Heavily mediated through software and applications, pre-emptive analytics cannot function without data mining. As Grusin argues,

[t]he disciplinary regime of securitisation not only depends upon but also encourages the proliferation of transaction and other data so that its algorithms can connect the dots. Premediation operates in the current security regime to ensure that there will always be enough data (enough dots) in any particular, potential, or imagined future to be able to know in advance, before something happened, that it was about to happen – enough transaction data to prevent (or pre-empt) future threats to national or international security. (2010, 124)

From a chrono- perspective, these machines bypass human consciousness and operate on a microtemporal scale, having cut significantly the processing time of statistical analysis that is the jump from first wave to second wave big data. The microtemporal algorithms of these machines invariably feed forward future predictions which can be considered as a future capture of time. Pre-emption in the form of predictive analytics ties back to Hansen's concept of 'feed forward' as the *modus operandi* of twenty-first-century media. Historical data already premeditates the potentialities of the future, feeding forward predictive trends which are actionable and have real effects on human lives and civil liberties.

Pre-emptive analytics also relies on the performative value of a future potential, in alignment with McKenzie's elaboration on the subject. Predictive policing taps into the performative value of the potential of crime, and deploys police resources which sometimes become a self-fulfilling prophecy. Police officers may become hyper-vigilant when patrolling a certain area that has been flagged by the software, and any arrests made during their surveillance confirms the output that is propagated by the prediction algorithm. The software designates areas as high-crime, and pre-emptively characterises individuals within such areas as more likely to be involved with crime. Police officers who patrol such areas would be more alert and on the lookout for criminal behaviour, and may be overly suspicious in their policing efforts. Suspicion does not stand for an actual threat, but a performative threat-value. Such a phenomenon fits with Hansen's point that predictive precognition creates a specific modality where the future is already prescribed in a particular form: a suspicious person *will* appear, or a crime of some form *will* happen in this area. The operation of predictive policing may be seen as a kind of "naturalisation" (Massumi 2011, 22) of the state of affairs: a universal tendency of something determined to happen even though its precise conditions are indeterminate. One

pre-emptively brings suspicion into existence by being ‘tipped off’ by the software to be ultra-vigilant in patrolling a particular area in the first place.

Profiling done through mining digital footprints and smartphone interaction pre-empt the personality characteristics of the individual. Correlations of anti-social traits are generated through mobile norms that are observed through aggregating a large amount of data, while correlations of interaction data with symptoms drive the machinic diagnosis of depression. New performance standards emerge out of such pre-emptive processes. In a way, the predictive trust example shows how a normative standard for social interaction could be established, encouraging users to participate in the digital economy of likes, shares, and retweets, so as to perform the necessary ‘sociability’ to not be considered untrustworthy. It proposes a higher standard of ‘trustworthiness’ that is beyond the level legally required—don’t commit a crime, pay your taxes on time, drive safe, and keep paying off that student loan. Through an algorithm like predictive trust, control is introduced in a stealthy manner in the seemingly-free space of the internet. One could be policed for ‘rude’ forum comments and ‘dubious’ browsing histories, but can never really be sure as to how such online behaviours feed into scoring systems and what the actual benchmarks are. This could nudge behaviour towards desirable outcomes by the companies involved, like maintaining interaction on social media platforms, in the hopes of lowering the chances of being marked ‘untrustworthy’ and thereby locked out of jobs and services.

But these interactions of course favour the platforms and the companies running them, as they trade in the attention economy that depends on the digital labour of their users, as discussed in Chapter 4. Health interventions, on the other hand, ensure the viability of the workforce by pre-emptively preventing the development of mental illness. The subtle behavioural prompts as well as biofeedback through wearables hint at the increasingly insidious ways governance could be initialised with twenty-first-century media. The future can be controlled—even before it actually materialises. The mental health solution, while positive for the individual, is also invaluable for maintaining population productivity.

These examples show how statistical analysis in second wave big data creates new targets and methods for control and discipline, and increases the reach of techno-chrono-biopower, making bodies acquiescent to the insidious tactics of algorithmic governance. Not only are people categorised as in traditional statistical analyses, their behaviour are even predicted as such. We could identify the performative power of algorithms in the ability to premeditate the future into being and the normalising power in establishing performance standards based on the emergence of patterns in data.

Concluding Remarks

As Hansen (2015b) has argued, because human consciousness is ‘late’ to the scene and is slower than the computational processes, the output of their number-crunching is in fact fed *forward* to us. Different timescales, that of the machinic and of the human, are at play in the operations of predictive analytics. Tim Barker refers to this phenomenon as multi-temporality, of being situated “simultaneously in and out of time, in the present but also in the past and future” (2014).

In this chapter’s focus on prediction by second wave big data, time is implicated in multiple ways: firstly, in the contraction of time that comes with computational power which reduces the need for human decision-making; secondly, in the speed of control that is associated with the microtemporal scale of algorithmic time regimes; and thirdly, in the future-oriented nature of algorithmic prediction. In this future-oriented dimension, techno-chrono-biopower operates in the gap of time. More precisely, it operates in the gap of time between the present and the future, where the not-yets of the future no longer teem with potentialities but are captured into an apparatus of control.

The chapter’s discussion of first wave and second wave big data shows the continuities as well as the important differences in the two statistical regimes. In both cases, technology supports governance by way of data and statistics, and makes statistical analysis more efficient. But traditional statistical methods are sidelined by second wave big data that are reliant on correlations, machinic pattern recognition, and machine-learning processes. Due to algorithmic automation, correlative outcomes may also be immediately amenable to action. The action may even be personalised like the behavioural nudging in HealthRhythms. Predictive analytics performs the algorithmic state of exception that is part and parcel of how twenty-first-century media operate in the domain of governance.

First wave big data in the form of census collection was very much conducted for sovereign powers, and statistics an expert domain for sociologists and other social scientists, following Clough et al. (2015). But now “[s]ociology no longer has a monopoly on ‘social’ data collection and analysis; rather, human lives continually pass through datafied terrains” (Clough et al. 2015, 153). We are not only immersed in twenty-first-century media objects, we are also increasingly immersed in the statistical regime of second wave big data as predictive analytics crops up in all walks of life. With second wave big data being so appealing to governments and companies alike, we, as datafied subjects, have become part of a living laboratory that seeks to analyse and create metrics out of our patterns of behaviour. Twenty-first-century media mathematise and quantify aspects of our daily lives so that they become trackable and calculable, and therefore manageable and governable, under the quantitative grip of predictive analytics.

Thus far in the analysis of twenty-first-century media and their techno-chronobiopowers, I have focused on the structural dimensions and the logics of operations (such as feed forward, perverted pharmacology, capture, and homophily in Chapter 4). In this chapter, I have insisted on discussing second wave big data in terms of the structural operations, studying for instance what kind of reasoning has gone into the design of predictive policing, predictive trust, and predictive mental health. While I agree with other authors who have argued that big data is guilty of discrimination,¹³⁸ it is important to critique the system not only based on the bad quality of the data or the biases embedded in the data but also the structural logics of the operations, including the mathematical modelling, the ontopolitical warping of time, the microtemporal scale of algorithmic time that necessarily excludes human perception, and the durational tracking of bodies and the massive drive towards datafication.

In Chapter 4, I have already discussed the critique of Clough et al. (2015) on second wave big data as the datalogical. I would further push the point by suggesting while second wave big data are created out of certain ‘logics’ and mathematical principles, it does not actually mean that the output of these are logical in the sense that they are ‘sensible’ and ‘reasonable’. Rather, as Parisi calls it, they form an “alien mode of thought” (2015, 136). Through accelerating human reasoning, algorithms do not attempt to understand why certain correlations can be found, and they do not care if these correlations are outright silly, or incredible to the human eye. For instance, in the US, ice-cream sales have been correlated with a spike in crime rates (Peters 2013). But it is obviously absurd to suggest that ice-cream should be blamed for people committing murder or robbery. Because of the heavy reliance on correlations, perhaps it would be more accurate to call the ‘datalogical’ the ‘data-illogical’. I have questioned in preceding discussions, for instance, the way trust becomes quantified by way of ‘propagational trust’ and ‘conversational trust’ formulae based on Twitter, and by way of correlative psychometrics. I also questioned the soundness of modelling crime patterns after epidemiological and seismological principles and letting slip competing criminological theories that are simply harder to mathematicise. To call second wave big data the ‘data-illogical’ might serve to provocatively expose the fallacious belief in mathematicisation represented by predictive analytics, and unmask the ‘neutrality’ and sophistication of mathematical formulae.

Digging into the theoretical bases of mathematical modelling demonstrates the point O’Neil (2016) makes regarding the dangers of operationalising ideas into calculations. For those subjected under the control of predictive analytics, these algorithmic tools could become weapons of math destruction (O’Neil 2016). As regular citizens, we are often on the receiving end of the results but are not privy to the processes of algorithmic control. If predictive analytics are becoming more

widespread, it is important to understand and be informed of how such algorithms are developed and used, in order to create strategies and tactics so that their uses could be curtailed, monitored, and accounted for.

In Chapter 6, I will explore another perspective under which algorithmic culture becomes a weapon of destruction, by turning the attention to the necropowers of techno-chrono-biopolitics, and in particular, from a materialist perspective of the concept. From the flipside of necropolitics, I give an alternative account on what the culture of datafication and mathematical reasoning entails. Counting and tracking bodies in a data-rich regime of biopower takes on a different meaning when considering the production and disposal of twenty-first-century media gadgets.

6

On the Necropolitics of Quantified Selves and Uncounted Others

In the preceding chapter, I discussed how future time may be colonised through twenty-first-century media. In particular, I have explored the interrelations between biopolitics, statistics and big data technologies, and predictive analytics. Prediction takes us deep into the fold of microtemporalities and the forward-feeding nature of data analytics that does not only mediate but also pre-mediates.

So far the discussion on the speed and scale of temporality, in the chrono-dimension of techno-chrono-biopolitics, has focused mostly upon the fast speed of twenty-first century media operations, as exemplified by the V of velocity in the 4V definition of big data. But what is equally important in this consideration of speed is slowness. You may wonder what place slowness has in the concept of techno-chrono-biopolitics, and what my proceeding discussion aims to do is precisely expand and add an additional layer to the notion of temporality that surrounds today's media environment. 'Slowness', it seems, runs counter to the slew of objects powered by increasingly-speedy microprocessors, that step in to replace one's thinking (like Viv discussed in Chapter 4). They offer efficiency, saved time, and ease. Yet the speed of planned obsolescence, and the rate at which new designs are put on the market are invariably tied to the processes of production and disposal of the very same gadgets. In these phases of a product's life cycle, factory workers and waste workers face exposure to toxic chemicals, dust, and heavy metals which, over time, cause health issues and increase cancer risk.

This chapter proposes a rhythm of slowness that needs to be grappled with alongside the speed of twenty-first-century media—that is, the rhythm of slow violence, dispossession, and death. In contrast to the 'too-fast' economy under which data is mined and its effects fed forward to its users, I turn to the 'too-slow' of

environmental degradation, toxic leech and build-up, mental ailment and physical illness, that accompany the production and disposal within the product life cycles of the material media objects referred to in this dissertation.

In Chapter 1, I referred to the smartphone as a key object where cultural, organisational, and technological performances are concentrated in one device. It is the device that has its own time-criticality (Ernst 2016), and mediates our interaction with the computational processes and microtemporal calculations. In this chapter, I take stock of the gadget's materiality, noting its position in the Information and Communication Technology (ICT) labour networks that bring the object into being. The smartphone which Facebook runs on, the tablet from which one tweets, the computers that support the infrastructure of predictive analytics, the smart home system... are built on the backs of disposable lives in the mines and in the factories, and the precarious lives of those living in and around the toxic mess of electronic waste dumps. Every smartphone contains lead, bromine, mercury, cadmium, chlorine, or some combination of these chemicals. These hazardous substances can pollute throughout a product's life cycle: when the minerals are extracted; when processed; manufactured; and at the end of its life—when it has to be replaced by a newer gadget. I thus explore the materialist aspects of these gadgets and by extension, the material side of techno-chrono-biopolitics that reveals the temporalities of violence governing the lives of those who make, live with, and dispose of twenty-first-century media objects. The work of Jussi Parikka in *A Geology of Media* (2015) is pivotal towards such a materialist reading of media as *medianatures*. Of similar importance is Rob Nixon's *Slow Violence and the Environmentalism of the Poor* (2011), which offers a poignant reading of slowness against the spectacularity of violence as we know it.

Through the above, this chapter proposes yet another way of understanding the extraction of biopower within twenty-first-century media through a consideration of the necropowers of techno-chrono-biopolitics. This aspect of biopower is modelled after the important work of postcolonial scholars who critique the implied whiteness and Eurocentrism in Foucault's account of biopower (Mbembé 2013; Chow 2002; Povinelli 2016). Their understanding of biopolitics shift the focus to the 'letting die' that is present together with the proliferation of control in the 'letting live' equation of biopower. Looking at the flows of powers that are involved, I am interested in exploring the following questions: To what extent do today's twenty-first-century media also operate as 'death machines' to particular populations? Whose days are numbered when it comes to the proliferation of smartphones, smart gadgets, and the Internet of Things? Whose lives are being multiplied and policed in the style of 'letting live' and whose are categorised within the 'letting die'? How are temporalities implicated in such accounts? Bio- and necro-politics are porous constructions that flow into one another and could co-

exist within the same scheme of the biopolitical dispositif, and mediations of time by technology are embedded in such structures. Through an engagement with their work and the materialist dimensions of twenty-first-century media, this chapter pivots to the necro-power embedded within bio-power itself.

This exploration of ‘slowness’ and necro-power in techno-chrono-biopolitics is navigated through the theoretical object of Quantified Self (“QS”). Quantified Self is important in two ways as it performs two main characteristics of twenty-first-century media: firstly, it demonstrates, in a logic of capture, the reach of the data regime and the intensive investment into the bodies which use these gadgets. Reaping data not only superficially through clicks and swipes, these gadgets are also intimately recording bodily data like heart rate, sleep activity, movement activity, and moods which we would previously only think of handing off to our doctors and health experts. This dimension of QS shows how our bodies are part and parcel of the datafication and enumeration engine in twenty-first-century media. Secondly, QS is a case-in-point that shows how time is harvested as unpaid labour in twenty-first-century media. As shown in Chapter 4, scholars have argued that QS shows an imbrication of digital labour upon ‘leisure time’ through ‘playbour’. QS shows the deep investment of current media practices into the body as well as the extraction of labour power therein. This corresponds to my elaboration on the necro-powers in production and disposal, that put particular bodies at risk and subject them to questionable, if not slave-like, labour conditions. I call these bodies-at-risk “uncounted others” as a provocation to show their relative value within the regime of biopolitics. As Lemke (2011) has argued, biopolitics assigns different values to different bodies in “a relative logic of calculating, measuring, and comparing” (38-39). I extend the discussion in Chapter 4 on biopolitical racism, to study how biopower divides.

The structure of the chapter goes as follows. The first section explores QS practice, highlighting the two-pronged investigation of its relationship with the body and labour extraction. This will be followed by an analysis of the bodies placed at risk by the proliferation of twenty-first-century media objects. I make use of two concepts of slowness, “slow violence” (Nixon 2011) and “slow death” (Berlant 2011) to highlight the alternative formations of temporalities involved on the necro-side of techno-chrono-biopolitics. The third section of the chapter dives back into biopolitical literature to once again show the span of techno-chrono-biopolitics and the way biopower can be observed along the product life cycle of digital objects. Using insights from postcolonial theorists, I bring attention to the ‘letting die’ dimension of biopower, and supplant the theoretical discussion of the concept so far with its postcolonial counterparts. I also turn to the biopolitical division brought into medianatures, where the literal extraction of earth’s resources

constitutes another dimension of biopower that has scaled into the horizon of geology, bringing an ecological dimension to techno-chrono-biopolitics.

Why QS?

In Chapter 3, I discussed the rhythms of labouring bodies in the factory through the introduction of clocks and industrialised machines. This discussion of labour is further elaborated in Chapter 4, where I argued that labour is altered too in the age of algorithms. An on-demand rhythm of work in the gig economy and the durational extractive nature of digital labour bring about the re-temporalisation of bodies in algorithmic regimes. This re-temporalisation and the depth of extraction is perhaps most exemplified in the QS movement, as bodies are brought into an intimate and proximate relation to the devices 24/7.

Giorgio Grizotti (2012) proposes the term “bio-hypermedia” to describe the ever-increasing intimate relation between bodies and digital devices, with the proliferation of smart gadgets and ubiquitous computing. In the past decade, QS has emerged onto the landscape of twenty-first-century media objects with an auspicious promise: the possibility of moulding a better self through externalisation of bodily data. A fundamental claim of QS is that data could bestow self-knowledge: the kind of self-knowledge that will create a fitter, healthier, happier, and more productive person. Based on the data, one could self-modify behaviour in order to reach some form of posthuman optimisation.¹³⁹ QS puts a new spin on José van Dijck’s term ‘life-mining’ (2014), where it goes beyond the mere datafication of our internet selves and actually mines intimate bodily data like heart rates. QS can offer a personalised view on how an individual’s data is statistically related to other users, as data is mass collected, collated, and visualised, for instance through leaderboards and awarding titles to users with best performance in sporting apps¹⁴⁰.

Relying on the critical framework set up by Hansen (2015b), Sun-ha Hong (2016) discusses QS as twenty-first-century media objects that operate upon a technological fantasy he terms “data’s intimacy” (2). Data’s intimacy refers to the proximity of QS devices to one’s body and of the data they impart, establishing a new type of intimacy between machine and body, and the truth-value of information arising from the body’s phenomenological experience versus the machine’s data. Hong argues that via QS, the epistemic relation to oneself “becomes rerouted and externalised” (*ibid.*), to the point where the machine’s data becomes validated as a reliable if not more reliable set of information for the self. This intimacy builds a new “corresponding faith in machinic senses” (6), where augmentation in fact becomes a new route to becoming more intimate with the self. For Hong, self-tracking offers information that is arguably a most personal form of self-knowledge.

This self-knowledge could consist of various types of data. Wearable self-tracking devices include high-tech wristwatches like Apple Watch and Samsung Gear, bracelets like FitBit and Nike Fuelband, necklaces, and other inserts which could go into bras, shirt pockets, waistbands, or shoes. Implanted with accelerometers, pedometers, altimeters, GPS systems, and other sensors and monitors, many of these gadgets are supposed to be worn throughout the day so that a continuous stream of data could be captured. Such data could include distance travelled, location, speed, amount of movement, as well as biometrics like heart rate, sweat levels, respiration rate, mood, sleep quantity and quality. The tracking practice is supported by a myriad of apps which store the information, organise it through visualisation, and enable social media sharing. There are now new digital menstrual cups that are not only period date trackers but also generate data on the amount of menstrual blood flow. Mood tracking apps like *Stresscheck* check for anxiety awareness, *MealSnap* encourages users to keep track of what they eat. Not only are companies heavily invested in marketing these products and apps, but also individual enthusiasts who subscribe to the QS philosophy and conduct self-experimentation and develop their own QS methods, apps, and gadgets.

Wearable self-tracking devices have been seen as a revolution in how individuals understand their own bodies (Wolf 2010). The externalisation of personal life data gives the impression of a precise and unambiguous physical assessment: devices that reflect back the ‘real’ state of the body. The goal of apps like these is to facilitate body management and control through monitoring and feedback, with the ambition to transform the body and its activities into numeric representations of what can be measured, monitored, evaluated, and transmitted.

At the same time, this information is not limited to the user, but is collected by the companies selling these products and apps. The QS movement inaugurates an additional level of statistical regimes in the form of self-tracking. One could argue that QS is more intimate than other forms of tracking—after all, the information is gleaned from actual bodily states, underneath the perceptive awareness of the user. This is a form of machinic sensibility emblematic of twenty-first-century media (Hansen 2015b). QS data eventually feeds into the vast databases of big data, where these statistics of behavioural data may generate new standards for normalisation or may be used for predictive purposes, and the biopolitical contentions therein have already been explored in Chapter 5. Specifically for the case of QS, Abend and Fuchs (2016) caution against the risk of users being marginalised by comparing them to a “standardised biological self” (14) that is calculated through the ‘average user’ reflected by collected QS data. For instance, one could imagine how the standards for predictive mental health may be influenced by norms established through QS practices. Already companies are offering these smart QS devices to track employee wellbeing¹⁴¹ and it is foreseeable that the insurance industry may

use the data to set new standards for their health insurance packages.¹⁴² Abend and Fuchs (2016) question what would happen should levels of insurance contributions be re-adjusted to QS measures and QS-informed norms and standards become normalised in parts of the health economy.

Indeed, the disciplinary power of normalisation has always been central to Foucault's theory of biopolitics. The creation of norms encourages certain behaviours over others in population regulation—"the norm is something that can be applied to both a body one wishes to discipline and a population one wishes to regularise" (Foucault 2003, 253). QS has a strong potential to become an increasing biopower, and in more intrusive ways than ever. QS raises two particular concerns in my view, based upon its relationship to the body, and its relationship to labour. The next section will explain why this is the case.

Bodies and Surveillance: "Sit Straighter. Stand Taller. Look Better."¹⁴³

The physical materiality of the body is deeply intertwined with QS, with the data sphere being considered as the "third skin", which reveals "our tastes and curiosities, our biometrics and social networks, the way we act and think, consciously and subliminally" (Qiu 2016, 98). QS, in a way, can be seen as a bodily surveillance dispositif. I use the example of posture-tracking QS products to show how the logic of capture is intertwined with the possibility of discipline that is instantaneous and personalised. Lumo Lift, made by the company Lumo Bodytech Inc., and Prana, made by Prana Tech LLC, are designed to teach and remind their users to stay in good posture (and breathe better).

Lumo Lift (Fig. 27) is a wearable with a magnetic clasp that one could place on a shirt close to the collarbone. To calibrate, you would tap the device once when seated in ideal sitting position with your back straight. It then gives three buzzes to confirm the setting. In the course of wearing the device, the accelerometer inside would measure the movement of the body and whether you are leaning too much forwards or backwards. If you have deviated far enough from the ideal position, the device would vibrate to remind you to adjust your posture. In their promotional video, the company says that "Lumo Lift checks in on you throughout the day, and nudges you towards your target posture when you start to slouch, helping to rewire those neuromuscular patterns for better posture." Quoting studies on biomechanics and research collaboration with experts, the company emphasises the scientific grounding behind good posture.

Similarly grounded on scientific research, Prana is a similar device meant to be clasped onto one's waistband which can collect data on diaphragmatic breathing, posture and breath patterns. In the passive tracking, sitting mode, Prana alerts the user if it detects stressful breathing or poor posture. The device can sense signs of stress: the user's breath is fast and shallow, and the airflow actually stays in the chest

area rather than extending into the belly. Prana can notify either by a gentle vibration, or through a smartphone alert depending on settings. In the active training mode for better breathing, Prana boasts a gamified breathing technology where you can collect flowers with controlled inhalations and exhalations with your bird avatar flying through the Zen Garden (Fig. 28). The bird will only move forward if you sit with proper posture. In standing mode, Prana works as a pedometer. The Clinical Mode on the app “provides a more in-depth timeline interface for tracking 10 distinct breath stats, posture, and displaying real-time breath patterns, as well as scoring each breath with respect to a target breath pattern” (Persidsky 2016).

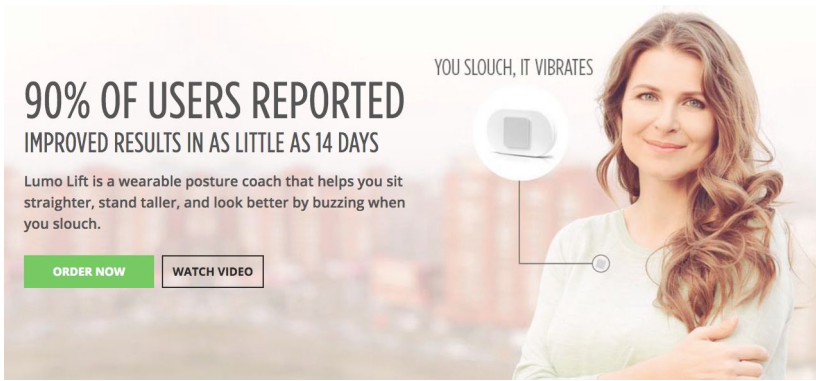


Fig. 27: A promotional image for Lumo

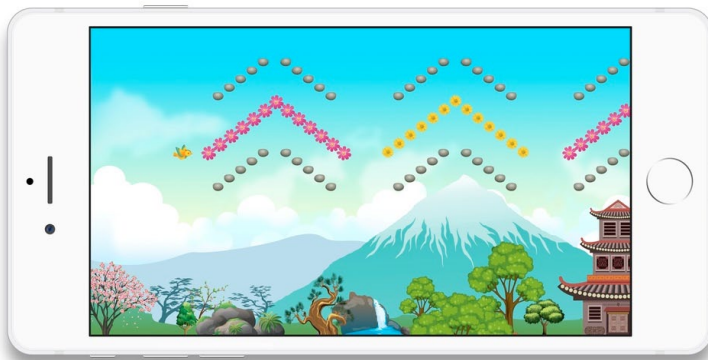


Fig. 28: Prana's *Zen Garden* breathing game

Both QS devices make use of vibration as a signalling mechanism, which may also be referred to as a disciplinary mechanism. Physical cultural studies scholar Brad Millington refers to the phenomenon as “haptic surveillance” (2015, 1) and refers to this branch of QS as health surveillance technology. “Haptic surveillance thus yields haptic discipline: the user is not only observed through the touch, but can be ‘reprimanded’ in much the same way.” (2015, 6).

It is no surprise that Millington makes reference to both Foucault and Deleuze in his analysis of these health surveillance technologies. He aptly points out that the case of posture is fully within the scope of Foucault’s disciplinary analysis. Indeed, his analysis on docile bodies begins with how the late eighteenth-century soldier is gradually moulded into the desired shape through correction of posture.

Recruits become accustomed to holding their heads high and erect; to standing upright, without bending the back, to sticking out the belly, throwing out the chest and throwing back the shoulders; and to help them acquire the habit, they are given this position while standing against a wall in such a way that the heels, the thighs, the waist, and the shoulders touch it, as also do the backs of the hands, as one turns the arms outwards, without moving them away from the body. (Foucault 1991, 135-136)

Posture is imposed upon individual bodies and is institutionalised in general. Millington refers to school-based physical education, which is an important space for creating and imposing standards of posture, in addition to teaching exercise and athletics. He observes that over time these standards have become lax, and that schools’ role in such bodily surveillance has declined by the 1960s according to research in the US (Yosifon and Stearns 1998). However, the slow de-institutionalisation of these disciplinary standards does not signal an end but rather the gradual migration of these standards into the domain of market and consumer goods. Referring to Deleuze’s essay (1992), Millington suggests that the logics and practices once held within the boundaries of institutions have found their way into Deleuzian societies of control. What this means is that the disciplinary effects are no longer contained with one domain (the school, the prison, the hospital) but are in fact situated in interconnected modulations which flow in and out of one another. The market plays a pivotal role as well in conveying these disciplinary standards and may entice individuals to opt for the imposition of such standards upon oneself. We see once again the decentralisation of sovereign power and the multiplication of dispositifs, showcasing the productive nature of biopower and its intensifications.

QS is a perfect amalgamation of bodily surveillance and self-monitored performance based on haptic feedback, a technological invention that perhaps fulfils Deleuze’s prediction for future technologies of power. These products are marketed not only for their functionalities, but also their chic appearance—Prana is “an elegantly designed clip-on device worn on the waistband, featuring a stylish metallically finished case, measuring only 1.25” X ¼” for a comfortable and non-

obtrusive wearable experience”, whereas Lumo Lift is “small, discreet and stylish”. This recalls the psychopolitics Han (2017) describes, where it is not just useful but almost fashionable to actually own a QS device. Despite the possible promise of a healthier spine, the idea that individuals would actually purchase such QS devices for self-induced disciplining really is biopower at its best—disciplinary standards invisibly incorporated into a product that you have to pay at least US\$99 for, a device that you would happily voluntarily wear every day to monitor your own data while sharing the same data with the company (which in turn can further monetise these data sets).¹⁴⁴ It requires no higher power like that of an institution (a school, a teacher) to impose discipline—it is power at its lightest, gamified into apps that teach you how to breathe better and to become a more productive citizen whose labour power can be better and further extracted. Algorithms automate the process of disciplining, delivering personalised buzzes whenever necessary. Lumo Life is in particular marketed to big companies as part of their Corporate Wellness programme, with Posture Education bundled into the app, recommending exercises and stretches, teaching pain management, and reminding employees all the while to sit and stand taller with the device ready to vibrate, should one begin to slouch in the middle of a workday.

These particular examples of QS show the deep intertwinement between these devices and the bodies they watch over. This connection is not only about one’s intimacy with these machines and the augmentation of senses afforded by them, but also the deep extraction of labour from the bodies involved. As in the examples of Lumo Lift and Prana, the companies value very much the collected data volunteered by their users, not only to optimise their existing algorithmic products, but also to develop new ones, and/or to sell the information to other interested businesses.

Bodies perform digital labour in the context of QS. In Chris Till’s essay (2014), he focuses on how QS transforms exercise into labour, as embodied in devices like FitBit or apps like Track My Run. Till refers to “the commercialisation of leisure time” (2014, 450), a phenomenon observed by scholars studying labour. The historical connection between work and leisure can be traced back to the Industrial Revolution. In Chapter 3, I have referred to Thompson’s discussion of the English factory in the Industrial Age. Through the introduction of time management like clocking-in and -out, a pronounced split between work time and leisure time is created. Workers became aware of their working hours and break times, and time outside of work was designated as leisure time. From this, we could see that the notion of leisure itself is borne out of the increasingly capitalist organisation of work, coupled with time discipline. Under the auspices of digital labour, the line between work and leisure is blurred. Running is an activity done in one’s leisure time, but can be turned into labour through QS. The large-scale quantification of

running turns the activity into something “that is amenable to the extraction of value” (2014, 451). Running, on its own, is supposed to only reap benefits for the athletes themselves, and only rarely does this result in economic value, except in cases of celebrity athlete endorsements for particular sports companies. Yet when quantification in a standardised form becomes widespread, the information is valuable for comparison and statistical purposes. Following the lead of Terranova (2004), Till argues that corporations could extract surplus value from the data, and leisure time also becomes productive for them.

The relationship between digital labour and temporality can be further observed in the haptic surveillance cases above. In Lumo Lift and Prana, one’s time in a workday can be doubly extracted for value—engaging in the regular white-collar labour (typing away at a computer station), while simultaneously producing digital labour (perfectly perched in a chair with great posture and a device that collects data in the background and reminds you to stay perfect). While white-collar labour is paid for by employers, the digital labour volunteered through self-tracking is for free.

In the perverted pharmacological structure of twenty-first-century media, time spent interacting with such objects allows data and metadata about one’s activities to be collected, all of which subsequently funnels into a machinery of surplus value for the corporations involved. Leisure time and doing exercise in one’s leisure time can also be subsumed under the infrastructure of QS digital labour.¹⁴⁵ The exploitation of labour and time is literally taken from the cyborgian bodies living with these devices.

Uncounted Others

In the second section of this chapter, I will turn to another dimension of how bodies are exploited and their labour power extracted in the infrastructure of twenty-first-century media, with a particular eye to duration and slowness. The digital devices which characterise twenty-first-century media are produced by material hands and machines, circuit boards assembled, precious metal mined. Digital labour, often conceived of as a form of immaterial labour, can be brought back into the fold of ICT labour more generally conceived.

This is not a simple equation of digital labour with the hard sweat of ICT labour but to show the interconnectedness of these circuits that feed into one another. I rely on the concept of “circuits of labour” as formulated by Jack Qiu, Melissa Gregg, and Kate Crawford (2014), who propose a synthesis of various models of labour in the contemporary era, which can offer a closer interrogation of “the inventive and capacious work of the body under capital” (2014, 577). Brought together under

the heading of “a labour theory of the iPhone era”, Qiu, Gregg, and Crawford align formal wage labour relations with other informal circuits like playbour. Focusing their study on Foxconn, the world’s largest electronics manufacturer that also produces the iPhone, they use the company as a backdrop to what ICT labour looks like today.

By zooming in on the circuits of labour surrounding twenty-first-century media, I offer a counterpoint to the preceding discussion on Quantified Self. I explore how other(ised) bodies factor into the production and disposal phases of such technologies, and how these bodies, from Congolese miners to Foxconn workers, support the infrastructure of twenty-first-century media. I argue that one cannot consider the phenomenon of QS and the digital labour involved without also taking into account the labour of these uncounted others whose disposable lives are the understructures of the present-day digital world. Uncounted others is intended as a provocation that at first sight seems to set up a binary opposition between the affluent QS user and the poor ‘disposable’ worker producing the technology. But upon closer inspection, we would see the disintegration of these boundaries, as they line up along the axes of labour exploitation and temporal dispossession.

Circuits of Labour

Qiu et al. (2014) proposes the term “circuits of labour” in order to unsettle the binary between material and immaterial labour in the information era. Digital labour, which I have discussed in Chapter 4 and above in relation to QS, belongs to the immaterial dimension, one focused on unpaid information work and extraction of data. The authors point out that while new conceptual frameworks have been applied to these forms of free labour and “playbor” (Kücklich 2005), less attention has been paid to the blue collar¹⁴⁶ labourers who are also indispensable in the ICT economy. The material labour contributed by these usually dispossessed and disadvantaged workers should also be fully in the picture. Material labour can come in various forms, including hardware manufacture, infrastructure construction, transportation of parts, and e-waste processing (Qiu et al. 2014, 569).

The authors makes use of the metaphor of the circuit, which is mapped out in the diagram below (Fig. 29).

The left side of the diagram refers to formal circuits of labour, or, in other words, waged labour found in white collar, blue collar and grey collar work. The white collar workforce refers to office workers who support the ICT industry, like that of developers, programmers, and designers, who are considered part of the creative workforce inventing our devices. They are protected by formal labour processes, intellectual property rights, and education or credentialising systems. Following Manuel Castells’s distinction of self-programmable versus generic labour (1998), self-programmable labour manages information and is skilled; whereas

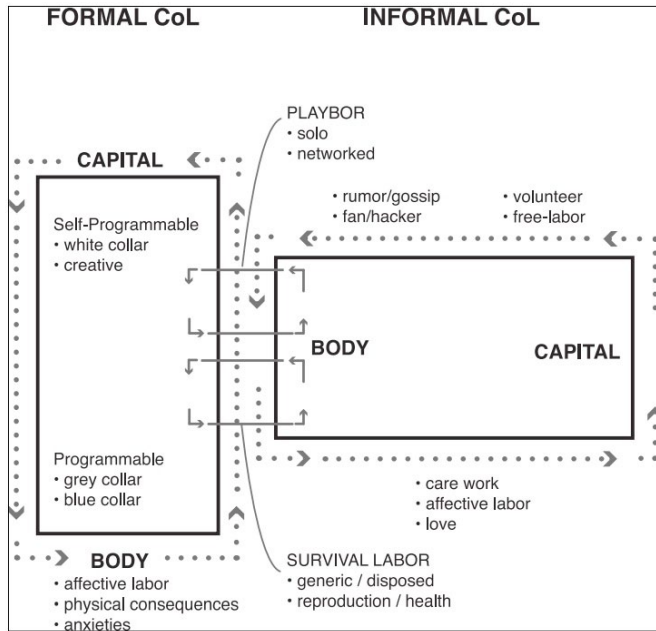


Fig. 29: Original caption: “The formal and informal circuits of labor. To the left, the body and capital form a top-down circuit and a class-based hierarchy of constraint. To the right, the worker draws on internal resources and self-made networks to develop new avenues for pleasure, survival and resistance.” (Qiu et al. 2014, 570)

generic labour, which belongs to the lower half of the formal circuit, is deskilled, interchangeable, and disposable. Generic labourers include workers in natural resource extraction, manufacturing and service industries, and can also refer to minimum wage and sweatshop labour. The notion that they are programmable highlights “the ruthlessness and inhumanity of the labour process, determined in classic Taylorism fashion, which still constitutes much of the production process” (Qiu et al. 2014, 571) of our media devices. Amazon’s Mechanical Turkers’ on-demand, precarious labour can also be considered under this category.

Connected to the loop of formal labour circuit are informal labour circuits of “volunteer, gift, and pirate exchanges” (572) online. Torrent sites like Pirate Bay and peer-to-peer sharing can be seen as the online equivalent of the trade in fake, bandit, or pirated products. One could witness the economy of affective labour in digital companionship supported by communication networks, whether through older forms like chatrooms and forums, various platforms of social media, or newer forms like Bumble’s BFF function.¹⁴⁷

Between these two loops are the “short circuits” (*ibid.*), such as playbour. Playbour taps into the reserve labour power of modders and enthusiasts and brings the fruit of their hard work into circulation, which in turn supports the formal

labour circuits of the games industry. Playbour exploits the knowledge and skills of these game geeks as crucial aspects of the game development machinery. The digital labour of QS also belongs to the short circuit aspect of the diagram. Similar to playbour, QS users provide data that support the formal circuits of the industry, which exploit their bodies, the tracked activities, and health data. Mechanisms of comparison and measurement of statistical norm in QS cannot be in place without a database of users.

The formal labour circuit short-circuits the informal for its benefit through these forms of value extraction. The bottom line is that it is data, creativity, time, and bodies involved in the informal circuits of labour that allow the formal circuits to continue to expand, evolve, and thrive. Social media could not exist independent of its users, and by definition rely upon the activity of the users to generate content for the platforms. In fact, in its perverted pharmacological structure (Hansen 2015b), any digital interaction has the potential to be defined as digital labour, so long as the data is being mined, stored, and monetised by corporations with users left out of the loop.¹⁴⁸

Short-circuiting can also happen when informal circuits “draw material and immaterial resources from the formal for the building of alternative, even progressive networks” (572) whether in forms of solidarity building or digitally-enabled protest movements, like online petitions and campaigns, and social protests publicised through social media. This shows resistance¹⁴⁹ against the totalising frameworks of digital exploitation, offering critique against the power imbalances in the circuits of labour.

Both formal and informal circuits of labour rest upon the circulation of bodies under capital. In Qiu, Gregg, and Crawford’s analysis, we see the structural continuities of ICT material labour with the formal industrial system (moments of its early inception captured by Thompson, as addressed in Chapter 3), and the history of Taylorism and Fordism. This form of labour is “centrally expressed through the persistent and fundamental subjugation of labourer’s body into the hierarchical circuit of capitalist production and consumption” (2014, 569). In their account (and in the diagram above), the centrality of the body is firmly attested to.

The body is the key, to be subjugated and subsumed, on this decentralised, globalised, and deceptively “immaterialised” shop floor of the IT industry. What is extracted from these bodies and their bodily movements (or non-movements) is, however the same thing: surplus value, measured by time, and sometimes affect as well. (*ibid.*)

Here, I draw a parallel with the preceding discussion on QS and its relationship to the body. The mechanism of surplus value extraction is present across the QS body and its immaterial labour and the factory worker’s body and its material labour. On one hand it may seem crude to draw parallels between the image of these two bodies, one we would picture sitting in an office, or running in the gym

in the so-called First World, and the other in an assembly line in the so-called Third World, hovering over circuit boards waiting to be assembled. On the other, the juxtaposition shows the immense importance of the material body to the regime of capitalist production and consumption. Following Qiu, Gregg and Crawford, we see the stratification of labour across these bodies, which could be brought under the heading of labour circuits despite large disparities in social condition, income, class, location, and culture.

What is also important here is the geolocations of the circuits of labour. The authors argue that the circuits are spatialised in a particular manner, with the West (including Japan, and the Asian ‘tiger’ economies of South Korea, Taiwan, Hong Kong, and Singapore) pitted against the labour found in the developing world, namely China and India. Referring to these populations as the “haves and the have-nots of the digital divide” (570), they demonstrate the stratification existing within the circuits of ICT labour, and the inherent hierarchies therein.

As such, my account of techno-chrono-biopolitics in the age of algorithmic culture must also grapple with the mutual interdependence of labour circuits that span across the globe and map onto the regimes of biopower that demarcate the labour stratification. Aside from discussing the relatively privileged QS users and their exploitation, I turn to the uncounted others who belong too to the ICT labour circuit. In the next sections, I will discuss in particular how their bodies are not only exploited in their labour conditions, but also are temporalised.

Labouring in Medianatures

If the QS body is characterised by the microtemporality under which data is mined and cycled through a big data machine, the worker’s body may be characterised by the slowness of health decline and poisoning. For some, the violence committed to the body through durational exploitation only surfaces after a prolonged period of time. This section turns to the works of Jussi Parikka and Rob Nixon to discuss the ‘slow’ temporality under which certain workers in the circuit of ICT labour suffer violence and detrimental health effects, adding to the account of techno-chrono-biopolitics from the perspective of slowness. The account is also extended to the dimension of the ‘deep time’ of media, which offers a counterpoint to the fast speeds of data processing discussed thus far.

Pollution and poisoning can be as visible as landfills and waste dump sites or as invisible and minute as a speck of dust. Jussi Parikka proposes thinking of dust as a multiplicity of pathways through global labour and the media materialism of digital culture. Parikka uses how dust damages electronic devices to show the irony of how dust destroys lungs of factory workers toiling away—

The dust particle from a polished iPad is a residue of the admittedly beautiful fetishistic surface; the dust particle is what registers the globalised wage labour relation on the soft organic tissue of the Chinese worker. (2013)

While we enjoy the glass panelling and shininess of a new gadget, the clean surface betrays the actual toxic conditions of production. Dust is very much avoided—hard drives, for instance, must be put together in a dust-free environment; anyone who has ever tried to mount a screen protector on a smartphone knows what the task chiefly entails—but is an integral element in the labour landscape. As Parikka explains, polishing iPad cases result in aluminium dust, particles which are highly inflammable and can cause lung disease. The materiality of the production cannot be severed from its connection to ICT labour. In Parikka's words,

dust is something that attaches to lungs and expresses a relation of labor: it begs the question of who gets to work in clean spaces, and who cleans those spaces. The latter are usually the poorer ones and easier to expose to dangerous and unhealthy conditions at their workplace. One can easily at this point raise a finger and claim that *so after all, you are just using a non-human element to actually to just talk of human affairs such as labor*. Quite rightly so, especially because such regimes and elements were never separated. (2013, original emphasis)

While some of us may be dreaming of the cyborgian augmentation of bodies via QS and ubiquitous computing, we should recall that the non-human element of media exists in entanglement not only with our bodies but also the infrastructure of media materialism, and earth itself. And the issue of labour is involved in every step along the way.

Data infrastructures are materially supported through the material dimension of medianatures, as Parikka's work in *A Geology of Media* (2015) has thoroughly illustrated. This concept is modelled after Donna Haraway's naturecultures (2007), which is used to unsettle the binary concepts of nature versus culture, mind versus matter, and so on. The term is introduced to show the inherently connected nature of these concepts and that the entanglement requires us to study the flow of connections between the two sides of the binary as one set of practices, rather than two opposing polarities. Medianatures require an understanding of media and nature as co-constituting spheres of connection, "where the ties are intensively connected in material nonhuman realities as much as in relations of power, economy, and work" (Parikka 2015, 14). Studying medianatures requires scaling in and out of these entanglements, where abstract digital entities like big data machinery could be brought back into relation with the minerals that are mined for the actual building of computer-machines. Medianatures is a regime

constituted as much by the work of micro-organisms, chemical components, minerals, and metals as by the work of underpaid labourers in mines or in high-tech entertainment device component production factories, or people in Pakistan and China sacrificing their health for scraps of leftover electronics. (*ibid.*)

Extending this point further, Parikka makes reference to the concept of deep time, following Siegfried Zielinski (2006). Inspired by Zielinski's archaeological drive in finding "quirky variations within media history" (Parikka 2015, 8) through a detour via geological and paleontological concepts, Parikka asks how we could radicalise our idea of media and media history by digging even deeper into geology. Deep time is also coupled with Manuel Delanda's notion of a thousand years of non-linear history,¹⁵⁰ so as to engage with the long durations of matter embedded on earth. To bring into conversation the matter and materiality of rocks, minerals, petroleum, biomatter, and other agencies, Parikka suggests that we might extend this into a *million* years of non-linear history.

His concept of medianatures thus shifts further into deeper materialities and deeper times, linking a host of geophysical materials (fossils, minerals, dust, water, elemental and composite materialities of the earth) to the media-technological. The geophysical, in addition to the geopolitical, has always played an important role in the functioning of media. On one hand our understanding of earth has been mediated through a variety of techniques from visualisation to mapping; on the other, earth provides media its raw materials, and the geophysical realities that enables the the functioning of technical media. The re-orientation of media as medianatures brings attention to the geological, material dimension of digital media and enables questions of ecology, geopolitics, and media culture to come to the fore. What is usually not conceived as mediatic matter could also be brought into the folds of media assemblages—

thousands, millions of years of "history" of rocks, minerals, geophysics, atmospheric durations, earth times, which are the focus of past decades of intensive epistemological inquiry and practical exploitation as resources—things we dig from the (under)ground, the harnessing of the atmosphere and the sky for signal transmissions, the outer space for satellites and even space junk, as a new extended geological "layer" that circles our planet. (2015, 8)

There is a particular political potency in the concept of medianatures that could lead us from dust to a worker's lung, from cadmium extraction to its poisoning of crops. Through the concept of medianatures, one could connect the physicality of geophysical matter with the politics of exploitation and environmental damage. Parikka names electronic waste, resource depletion, and globally unevenly distributed relations of labour as three possible sites from which such entanglements emerge.

In the current study of techno-chrono-biopolitics, I see the 'techno-' dimension as an instance of medianatures, where upon closer inspection multiple itineraries of medianatures-entanglements could be traced. James H. Smith's careful ethnographic study (2011) of coltan mining in the Eastern Democratic Republic of Congo unravels the commodity chain that begins with mined coltan and ends in finished products, and in its process brings up issues of labour, capital, exploitation, militarised control and violence.

This commodity chain extends from the Eastern Congo, through Rwanda and other East African countries, and eventually out of the continent, through diverse intermediaries and processing facilities (mostly in Asia), until the product (tantalum sheet) reaches cell phones, laptops, and other digital devices, some of which are then resold in Africa. (2011, 20)

The chain does not end there if we consider also what happens when the devices are subsequently discarded, dumped, or recycled somewhere else, and some of these extracted materials finding a second life in another device. Moreover, it is inconceivable to consider this commodity chain without the infrastructural support enabled by communication devices (phone, computers, internet penetration). Perhaps to the surprise of those of us living elsewhere on earth, cell phone coverage is available many kilometres into the rainforests of North Kivu. The extraction of minerals and the trading of them rely literally upon the use of media (phone and internet) in order to function. Haggling prices, ascertaining current rates of minerals, contacting and securing buyers, transferring money, are all processes enabled by technology use. Smith (2011) emphasises that as much as the Congolese are labourers and miners, they are also end users of digital products. There is no easy divide between the producer and the consumer, and the Congolese are not 'out-there' in some projected fantasy of the exotic African jungle but networked and interfaced with cellphone towers and infrastructure. Some military generals even prohibit their subordinates to carry mobile phones so that they themselves could communicate with traders and middlemen, and seize the phones of miners so they are kept away from information about the prices their minerals and ores are fetching.

Tracing the origin of the little pieces of minerals and precious metals in our smart devices, we find ourselves in the company of Congolese miners, who routinely extract what have been referred to as the 3Ts (tantalum, tungsten, and tin) and gold. Tantalum is usually used to store electricity in phones and other devices, while tungsten is used to construct laptop screens and vibration components. Tin is used for soldering (replacing lead, for environmental reasons), while gold is used to coat wires. Miners are subjected to various levels of exploitation and violence as military groups (including foreign militias, local militias, and the Congolese army) wage war with them to get in on the lucrative trade of these resources heavily sought after by the electronics industry. The global demand for smart devices only increases the pressure to provide these raw materials, unfortunately concentrated in parts of the world where governance is repressive and corrupt. Even though the exploitation problems with mining are not a direct outcome of the current drive for digital products, they have been exacerbated by the trend. The rapid creation of new products has led to a significant demand surge which puts pressure on the market, and encourages the continued violence and instability in the region.

Labour circuits in the mining industry are ridden with violence. Smith (2011) refers to it as “temporal dispossession” (20) of the miners and local communities, and describes the systematic abuse carried out by militias in Kivu. Temporal dispossession occurs in several layers and ultimately functions to disrupt the possibility of building a sustainable future and continuity in their livelihoods. Smith (2011) speaks of “predictable time” (21) in his account, which refers to the fact that miners usually cannot make plans and do not know where they would go work the next day. This is a widespread phenomenon as they usually go where there is an opportunity to make money. This sense of insecurity is common amongst the Congolese miners, who prefer mining to other ways of generating income even though it does not actually pay well. This is because earnings from mining is relatively regular, as opposed to agricultural harvest, which takes months to grow but may be expropriated by militias and army soldiers at any time. But mining income is driven by the market and price fluctuations, which miners are kept out of the loop of. There is an inescapable day-to-day sense of uncertainty surrounding their livelihoods. Smith (2015) refers to the example of a spike in coltan prices in late 2000 due to online speculation, because Sony ran out of the tantalum it needed to produce Playstation 2 to meet the Christmas market demand.

When prices for certain minerals fall, groups would move to another site with higher returns, leading to a high rate of migration and displacement in the area. Militia groups and state officials would follow them and the pattern of exploitation repeats. When miners attempt to increase their earnings by also participating in the trading of minerals, this can become quite a gamble. Some would lose land, property and livestock, and even the rights to their children. In Smith’s focus group interview, the miners express the following:

“Our biggest problem is that we don’t know the price! This is what you need to tell the people where you come from. You are here now, so please tell me, how is price determined? What is the true price? We can buy at \$6 a kilo, here, then we go to Goma and the price has dropped to \$1.50. You can use a whole fortune to buy sand. This happens all the time to us!” (Smith 2011, 21-22)

To make sure that the miners remain miners and not become their competitors, militias would rob their places to remove mobile phones from miners and traders to make it difficult for them to continue participating in the trade.

Military groups focus on destroying villages, crops, and livestock, which are crucial for linking communities and bringing people together. Moreover, mass rape is used systematically on both men and women to maintain control and demonstrate who is boss in the area. It is designed to humiliate and to disrupt the production of future through childbirth and rearing, again an instance of temporal dispossession. In Congolese culture, male identity is closely linked to power and control, and sexual violence against men aims at destroying such senses of self and to demean them. Locals also believe that rape is used to weaponise the spread of HIV/AIDS

and the dwindling of communities could allow military groups to seize land and gain power. Smith also mentions another theory: that rape is performed for the eyes of the international community, because NGO and human rights groups would go in to negotiate with the perpetrators of violence and offer terms in exchange for them to stop pillaging and raping these communities. A former army officer expressed the following to the anthropologist,

“Jimmy, what I really should do to get ahead is to just get some of my men together and seize a mine, then order them to rape all the women in the area. Then the Red Cross will come and ask me what it will take for me to stop. They’ll talk to the government and suddenly you’ll find I have my old position in the government back”. (Smith 2011, 23)

Smith argues that all these acts of violence and abuse are done with the idea of disrupting an incremental temporality, meaning the idea that one could build the future progressively through their acts in the past and present. Here, we see yet another dimension of temporality under techno-chrono-biopolitics. By taking away the future or a sense of continuity between past, present, and future, the militia groups actively perpetuate violence upon these people’s lives and their relationship to the progression of time. This is encapsulated in Smith’s quotation of Achille Mbembé’s work on states of war on the African continent, “In most contemporary war zones in Africa [...] the spread of terror fragments inhabited spaces, *blows apart temporal frames of reference, and diminishes the possibilities available to individuals to fulfil themselves as continuous subjects*” (Mbembé 2002, 18 as quoted in Smith 2011, 21, own emphasis).

Parikka’s turn to deep time and medianatures opens up an avenue to engage with the labour realities and the violence that come hand-in-hand with the materiality of the media objects we use every day. The account of Congolese miners gives an entirely different spin on what has been defined thus far as techno-chrono-biopolitics. It requires an attention to mediality and temporality not only on an algorithmic level, but also to the deep time embedded in its materiality. In the next section, I would further elaborate on how to think through slowness within techno-chrono-biopolitics in its velocities in administering violence.

Slow Violence as Techno-chrono-biopower

The type of temporal dispossession by the Congolese miners could be further contextualised through Rob Nixon’s work on ‘slow violence’ (2011). In his monograph, Nixon addresses the

inattention to calamities that are slow and long lasting, calamities that patiently dispense their devastation while remaining outside our flickering attention spans—and outside the purview of a spectacle-driven corporate media. (2011, 6)

Contrasted with the spectacular violence immediate in time with “sensational visibility” (2), slow violence is defined as “violence that occurs gradually and out of sight, a violence of delayed destruction that is dispersed across time and space,

an attritional violence that is typically not viewed as violence at all” (*ibid.*). This different kind of violence is incremental and accretive, with repercussions that play out across a range of temporal scales; some take years to develop, others decades. Slow violence is relatively invisible and especially does not appeal to our visual perception. Unlike bombs that go off and buildings that collapse, slow violence can take place through slowly unfolding (environmental) disasters, like the radioactive aftermath of wars, toxicity accumulating through biomagnification, acidifying oceans, and climate change. Deaths are not simply deaths but “long dyings” (*ibid.*), both human and ecological. Indeed, the systematic destruction and oppression of the Congolese communities are durational and attritional in nature, not to mention a type of violence that seems to be ongoing and therefore not-as-worthy of attention.¹⁵¹

Compared with the spectacularity of large-scale disasters and terror attacks, durational violences take time to unfold, and occur beyond our perceptual grasp. Nixon’s work attempts to engage with the representational, narrative, and strategic challenges posed by this invisibility of slow violence. Slow violence also intersects with toxicities. To illustrate, he quotes the “slow-motion slaughter” (14) in the Vietnam War, where the 1.5 million people killed over a dozen years of US military presence do not include those who survived the ‘war’ but died years later from the release of Agent Orange. Bio-magnification means that the dioxins from Agent Orange continue to build up in the fatty tissues of animals like duck and fish. When they are eaten, these toxins are passed “from the natural world into the cooking pot and from there to ensuing human generations” (*ibid.*). The official statistic of 1.5 million fails to take into account these lives lost in the aftermath of the Vietnam War.

Another gruesome example used by Nixon can be found in the former Pacific Proving Grounds in the Pacific Ocean. Between 1948 and 1958, the Marshall Islands was subjected to 67 American atmospheric nuclear tests, the largest of which was considered a thousand times more destructive than the Hiroshima and Nagasaki bombs. A New Yorker report likens the condition to “a Hiroshima every day for almost forty years” (Wellerstein 2016). As a result of heavy radiation contamination, deformed babies were born to Marshallese women in Rongelap, some only to live for a few hours before their inevitable deaths. For the lack of scientific expressions, locals referred to these birth defects through commonplace associations: “‘jellyfish’ (babies born without bones), ‘grapes’ (spontaneously aborted clumps of tissue), ‘turtles,’ ‘octopuses,’ ‘apples,’ and ‘devils’” (*ibid.*). Thyroid cancers and leukaemia also ravaged the population. In the Bikini Atoll region which was hit heaviest by radiation, the Islanders have lived in exile since 1946. Those who returned in early 1970s were later removed again in 1978 after being exposed to high levels of radiation eating foods grown there. It is unclear how many Islanders suffer in terms

of health from the nuclear testing, and violence in this case also takes the form of the material and affective loss of home.

Nixon's point is that it is difficult to administer the scale and proximity of non-spectacular violence, pointing out that we need another grammar and narrative that will help guide our attention to these cases of environmental injustices. The victims of these environmental injustices are often those with the least resources to handle them, or to escape. He uses "the poor" as a category to refer to these vulnerable peoples, who may be further grouped along other axes of gender, race, ethnicity, class, religion, and generation (2011, 4). As we have already seen in the case of Congo, the violence committed on bodies through rape is very much gendered; the idea of foreclosing the future through childbirth stems out of thinking about generations (and not to mention the forced kidnapping of children to work in mines). These people have been called "disposable people" (4), whose lives are considered dispensable in the larger scheme of geopolitics and power.

While Nixon's writing is very much attuned to our digital era,¹⁵² the scope of his analysis does not include the issue of slow violence and environmental degradation in relation to digital gadgets. In addition to Congolese miners, where are the uncounted others in the circuit of ICT labour, who suffer the grunt of prolonged exposure to radiation and toxins?

Looking at the disposal end of ICT labour, we can turn to the e-waste dumps and processing plants in India, Ghana, and China, where heavy metals are leached daily into rivers and seas, threatening the safety of those who (or which) inhabit such habitats. The effects of the pollution has yet to play out in the decades to come; toxins slowly accumulating in the food eaten, floating about in the air, until populations succumb to the detrimental health effects. It is a well-known story to the environmental protection community that Lawrence Summers, former chief economist for the World Bank, wrote an internal memo in December 1991 justifying the economic logic behind exporting rich-nation garbage and toxic waste to Africa.¹⁵³

I think the economic logic behind dumping a load of toxic waste in the lowest-wage country is impeccable and we should face up to that [...] I've always thought that countries in Africa are vastly under polluted; their air quality is probably vastly inefficiently low compared to Los Angeles [...] Just between you and me, shouldn't the World Bank be encouraging more migration of the dirty industries to the Least Developed Countries? (Summers 1991, as quoted in Nixon 2011, 1)

Sadly, such rationalisation is not exceptional and has often been projected upon ecosystems inhabited by "dispensable citizens" (2011, 17). Othering Africa as "an out-of-sight continent" (2), Nixon comments that African recipients bearing the consequences of such dumping are "triply discounted: discounted as political agents, discounted as long-term casualties of [...] slow violence, and discounted as cultures possessing environmental practices and concerns of their own" (*ibid.*).

Coincidentally, Nealon (2008) also refers to Summers's proposition in his thesis on intensification of biopower. In alignment with Hardt and Negri's 'empire' and Deleuzian societies of control, intensification is tied "to the economic and political logic of globalization" (2008, 70). Globalisation in this case is not about the flow of people, goods, and services; it is about the redistribution of biopolitical risk. Using this same example, Nealon illustrates how the risks of disease, death, and physical harm are offset onto nations where life is considered 'cheaper' or less valuable, showing the lines of division drawn through biopolitical calculations. We see the value of life being unevenly distributed in bodies across the world, following a colonial logic that has been in place for centuries.

Ghana's Agbogbloshie has been seen as one of the world's foremost digital dumping grounds. An illegal settlement outside of the capitol city of Accra, it is home to more than 40,000 migrants and refugees. The developed world dumps everything from unwanted computer monitors to household appliances. Cows with open wounds would graze the site. Old monitors are strewn in the river to create a temporary 'path' across. Special tasks are assigned for children, who would use magnets tied onto the end of a piece of string to pick up tiny scraps of metal left in the dirt. Young men would burn electronics in order to extract valuable metals like copper, which they could sell for pennies, earning up to US\$4 on a very good day. Women cook circuit boards and motherboards to salvage the trace amounts of gold inside the computer chips. In the process however, toxic chemicals released would pollute surrounding land, air, water and harm workers. According to a report by *The Guardian* in 2014, a majority of these workers die from cancer in their 20s. Countless others suffer injuries, such as burns, untreated wounds, eye damage, lung and back problems, chronic nausea, anorexia, debilitating headaches, and respiratory problems (McElvaney 2014).

Guiyu in China is another one of these notorious dumping grounds. There were more than 5000 family-run 'recycling' workshops operating since 1995, up until the situation got so bad that the provincial government finally stepped in to create formal processing plants in 2013. The town used to smell strongly of the hydrochloric acid used to wash metal and waste, and the air leaves a burning sensation in the eyes and in the nostrils. A 2013 UN Report on the area explains that much of the toxic pollution is due to burning circuit boards, plastic, and copper wires, and acid processing to recover valuable metals like copper and steel. To sort plastic stemming from various devices like computer keyboards, remote controls and computer mice, workers would use lighters and blow-torches and distinguish them based on the ways they burned. These family workshops, composed of untrained individuals, contaminate the environment with toxic heavy metals like lead, beryllium, and cadmium, while also releasing hydrocarbon ashes. It does not help at all that the workshops are familial-based structures, endangering those who

may not even participate. A 2014 study by Shantou University Medical College found that Guiyu children had high levels of lead in their blood, which could have a negative impact on development and intelligence (Zhuang 2017).

Local residents reported that they dared not drink water from the local supply, for doing the laundry in it turned their clothes yellow. Farmers in the adjoining area admitted that they would not eat the rice they grew, and confessed that when the produce was sold off, it would be labelled as being from elsewhere. In 2013, Food and Drug Administration officials in the city of Guangzhou (400 kilometres away from Guiyu) found high levels of cadmium in rice and rice products, in samples pulled from local restaurants, university canteens, and shops (Watson 2013). Cadmium poisoning causes damage to liver and kidneys, and can be carcinogenic.

These research reports on e-waste do not usually specifically list the numbers for smartphone, or tablet disposal separately, but refer to everything from computers to fridges. According to a recent study by the United Nations University (2017), the amount of e-waste in Asia has gone up 63% in five years (*Agence France-Presse* 2017). This is no doubt partly attributable to the various electronic gadgets that have proliferated on the market, with short-lasting smartphones as market forerunners. Household appliances are also on their way to becoming smart home items, possibly leading to the obsolescence of outdated non-Wifi enabled appliances. One could also easily imagine that our digital devices would continue to follow similar routes to existing e-waste hubs, as there has not been enough attention dedicated to resolving the matter.

Following the logic of Nixon's slow violence argument, we could see how certain populations of the world are increasingly subjected to the toxic aftermath of electronic waste disposal. While one could easily point to the pollution, it is hard to ascertain the exact amount of ailments, disabilities, and deaths caused by the phenomenon. For instance, the Guardian report (2014) I quoted above on Ghanaian workers made a rather vague statement—"Most workers die from cancer in their 20s". The word 'most' does not offer an actual percentage, the real number of people who die from being immersed in such an environment. (It does not help that the deaths in Agbogbloshie are of migrants and refugees.) 'Cancer' stands in for the various possible forms of cancerous growths in their bodies, again a vague designation of exactly what has killed them. Rhetorically there is a certain similarity to Nixon's discussion of Agent Orange and the nuclear testing in Bikini Atoll. Deaths are not tallied and in some cases cannot be tallied. For slow violence is passed on through time and across geography, meaning that we may not have seen the worst of the consequences of electronic waste. Toxins take time to manifest symptoms in human subjects and they can migrate through the ecosystem. How does one capture the accumulation of toxicity that flows with rivers downstream, that affect livelihoods of humans, plants, and animals in another area? Dust

disperses through the air, and creates smog elsewhere. How does one trace the movement of cadmium-laced rice and other produce smuggled into the market from the fields of Guiyu? Each one of these descriptions fits into Nixon's point on the non-spectacularity of violence, and the slowness of its effects.

Nixon is right in pointing out that the most vulnerable people, "the poor", those who cannot afford life otherwise, are the ones scavenging through toxic dumps. While they are also labourers inside the circuit of ICT on the disposal and recycling end, as the examples of Agbogbloshe and Guiyu show, their bodies suffer significantly and directly from the toxic dangers that come with the job. These e-waste dumps are no less scenes of medianatures than the deep forests of Congo, and minerals appear on both the production and the disposal end of the narrative. Like Jennifer Gabrys's study of digital rubbish (2013), we can trace their changing roles from raw material to pollutant. As she argues, disposal "may be 'seemingly final'" (141) but in fact the material effects endure—"[f]rom manufacture to final decay, electronics seep into the aquifer and subsoil, settling into longer orders of time and more enduring chemical-material conditions" (*ibid.*, 142). The slow temporality of their degradation and decomposition ties up with the *longue durée* of suffering of bodies living with them, and the negative impact on the environment. It is my proposition that in studying techno-chrono-biopolitics, we must therefore consider both sets of bodies in which slow violence is afflicted upon—the body of labourers and the body of earth itself, of the environment, and of other living beings in medianatures.

Slow Death

So far, we have looked at accounts of mining and e-waste disposal, and the following section will bring us to the factory floor, another stop along the circuits of ICT labour, and another dimension in the slowness of techno-chrono-biopower. Here, Nixon's discussion of slow violence will be considered with Lauren Berlant's concept of 'slow death'. 'Slow death' operates here as a kind of durational dispossession to waged labourers under formal arrangements of work. It is a kind of invisible violence experienced by bodies in an uneventful form. This concept frames certain ICT labour under techno-chrono-biopower as work that exhausts bodies and reduces the possibilities for them to thrive and go towards a better future.

The concept of 'slow death' is situated in Berlant's monograph-length meditation on 'cruel optimism' (2011). Berlant wonders why people are so attached to the idea of the forever-delayed promise of a 'good life', despite the fact that such possibilities are perhaps unattainable. This promise could take the form of upward mobility, better future, better health, political satisfaction, or anything that defines the fantasy for an individual. One becomes attached to these ideas and acts in the hopes

of attaining them. Attachments are always optimistic, in the sense that they bring you into a tending-towards something that you cannot generate on your own. But “[t]hey become cruel only when the object that draws your attachment actively impedes the aim that brought you to it initially” (2011, 1). Berlant suggests that failing to fulfil the goals of these attachments is not a matter of bad luck but rather a general phenomenon of systematic failure. This is her diagnosis of the present condition in liberal, social democratic, or relatively wealthy regions.

Whatever the experience of optimism is in particular, then, the affective structure of an optimistic attachment involves a sustaining inclination to return to the scene of fantasy that enables you to expect that this time, nearness to this thing will help you or a world to become different in just the right way. But, again, optimism is cruel when the object/scene that ignites a sense of possibility actually makes it impossible to attain the expansive transformation for which a person or a people risks striving; and, doubly, it is cruel insofar as the very pleasures of being inside a relation have become sustaining regardless of the content of the relation, such that a person or a world finds itself bound to a situation of profound threat that is, at the same time, profoundly confirming. (2)

Cruel optimism is not merely about the unattainability of a better future, but also very much about the traps of the present. More precisely, it is about a present that is filled up by the mundane and the ordinary, where nothing really happens. One gets into such a situation initially out of the hope of betterment, but once inside, one realises that the situation does not lead to the promised land. To give a contemporary example, migrant workers and former refugees are drawn to certain jobs under the gig economy, such as food delivery, or as domestic work like cleaning apartments. This is usually due to the fact that former qualifications from countries of origin may not be recognised, making it difficult for them to find other jobs. In some cases, workers are not fluent in the local language, and have to depend on blue-collar work. If a former refugee participates in the gig economy delivering food for apps, it will become apparent that it does not pay very much and very rarely offer future prospects for advancement. Even though the odd gigs here and there may offer some monetary compensation, the job offers no real security and is simply extending the period of time whereby the individual struggles and lives with the uncertainty of tomorrow. Berlant calls such traps of the present the ‘impasse’—“a time of dithering from which someone or some situation cannot move forward” (4). It is perhaps best captured through the simple statement, “It is what it is” (204). One finds oneself in an impasse when, despite working in the present towards the future, there is in fact no possibility moving forward.

Impasse is about “the duration of the present” (199) and through impasse, Berlant traces the circulation of precariousness through specific locales and bodies. While Berlant discusses this in conjunction with filmic references and artistic work, I find this particularly relevant in discussing the waged, formally arranged side of ICT labour that offers the workers jobs, sometimes housing, and some semblance of temporary security that despite the low wages (and long hours) makes waged

labour more appealing than unemployment. Many of these workers are in fact stuck in their jobs, with little to no upward mobility within the jobs themselves, not to mention upward mobility in the larger social equation. The work conditions are mundane and repetitive; some are prone to work injury, while others even bear risk of exposure to hazardous substances.

Work, in Berlant's ideas, constitutes a practice of slow death. Slow death refers to the slow physical wearing out of a population and the deterioration of their well-being. She suggests that we all are exhausted in some way by neoliberal capitalism, but this affects certain populations more than others. She refers to the context of the obesity epidemic in the US which is unevenly experienced by low-income groups, to illustrate how certain bodies are more at risk. Quoting the statistics on this matter, she points out that those who are morbidly obese tend to be living close to or below the poverty line, are working-class, and are much more likely to be people of colour.

The bodies of US waged workers will be more fatigued, in more pain, less capable of ordinary breathing and working, and die earlier than the average for higher-income workers, who are also getting fatter, but at a slower rate and with relatively more opportunity for exercise. [...] Apart from working-class and sub proletarian white women, who are more successful in mobilising bourgeois beauty norms for economic success in the service-sector economy, these overweight and obese poor will find it harder to get and keep jobs, remain healthy meanwhile, and afford health care for the ensuing diseases. [...] They will live the decay of their organs and bodies more explicitly, painfully, and overwhelmingly than ever before[.] (114)

To Berlant, 'slow death' is part of the realm of biopolitics. Referring to Foucault, she points out that biopolitics has been created to manage populations and is the power to "*make* something live or to let it die, the power to regularise life, the authority to *force* living not just to happen but to endure and appear in particular ways" (97, original emphasis). Biopower allows certain forms of living, but also does not care if these bodies slowly dwindle into death and are worn out and exhausted of their labour power. Foucault also admits to this type of violence within the biopolitical scheme—

When I say 'killing', I obviously do not mean simply murder as such, but also every form of indirect murder: the fact of exposing someone to death, increasing the risk of death for some people, or quite simply, political death, expulsion, rejection, and so on. (2003, 256)

In fact, Berlant's 'slow death' is biopolitics experienced in an uneventful form, where one is subjected to the contours of biopower while living the most mundane and ordinary life possible. This uneventfulness may be compared to slow violence's non-spectacularity, where the operations of power and subjugation become difficult to notice, to detect. As Berlant writes,

[s]low death prospers not in traumatic events, as discrete time-framed phenomena like military encounters and genocides can appear to do, but in temporally labile environments whose qualities and whose contours in time and space are often identified with the

presentness of ordinariness itself, that domain of living on in which everyday activity; memory, needs, and desires; and diverse temporalities and horizons of the taken-for-granted are brought into proximity and lived through. (2011, 100)

It is my contention that slow death and slow violence could and should be considered together in techno-chrono-biopolitics, through the discussion of ICT labour and the forms of exploitation within. While slow violence is committed against those who are unable to live otherwise, who are most vulnerable to abuse and subordination, slow death is used to describe populations who are worn out as a result of structural subjugation under late capitalism and biopolitical governmentality. I turn to the following example to illustrate how the two terms may be brought into conversation with each other.

A recognisable story of slow violence takes place in the large electronics factories of South Korea, home to tech giants Samsung and LG. Employees increasingly suffer from various forms of cancer due to radiation and toxic chemicals on the job. Banolim, an advocacy group, says it has details of more than 200 current or former Samsung workers suffering from grave diseases such as leukaemia, lupus, lymphoma, and multiple sclerosis, among their semiconductor and LCD workers. 76 have died, and these workers were mostly in their 20s and 30s. Many others are at risk of developing symptoms over time. Since 2008, 56 former workers have applied for occupational safety compensation from the Korean government, with only 10 having won compensation after years of fighting in courts. Up to half of the other claims were simply rejected. When asked to disclose the types and volumes of substances being processed in their plants, Samsung refused by saying that these were trade secrets. It was only in 2012 that Samsung began monitoring toxic by-products in its chip factories after an inspection detected known carcinogens like benzene and formaldehyde (*Associated Press* 2016). The company issued an apology in 2014 and promised to compensate selected victims, but refused to acknowledge the link between the chemicals used in their factories and the cancer risk. It is sheer irony that the company that gives its workers cancer is also working on AI healthcare systems together with Microsoft (Williams 2017),¹⁵⁴ and it is these very companies that heavily market health-related QS technologies.

Even though these are waged labourers, their livelihoods inside the factories are not in fact safe nor safeguarded under legal and formal arrangements of labour. They do not strictly fall under Nixon's definition of "the poor" even though they are also oppressed under the dominant power structure of a company like Samsung. But looking at Berlant's work opens up the possibility of coming to terms with their precarious situation through the lens of 'slow death'. These workers contribute their labour power to the factories, day in, day out, in an assembly line environment, organised and striated, unlike the chaos that one may find in the dumps of e-waste.

Foxconn in China, producer of the iPad, iMac, iPhone, the Amazon Kindle, and various consoles (by Sony, Nintendo, Microsoft), is notorious for its militarised, disciplinary culture.

Workers' everyday reality at Foxconn includes low wages, working long hours, frequent work shift changes, regular working time of over 10 hours per day, a lack of breaks, monotonous work, physical harm caused by chemicals such as benzene or solder paste, lack of protective gear and equipment, forced use of students from vocational schools as interns (in agreement with the school boards) that conduct regular assembly work that does not help their studies, prison-like accommodations with 6-22 workers per room, yellow unions that are managed by company officials and whom the workers do not trust, harsh management methods, a lack of breaks, prohibitions that workers move, talk or stretch their bodies, the requirements that workers stand during production, punishments, beatings and harassments by security guards and disgusting food. (Chan 2013; Chan, Pun and Selden 2013; Fuchs 2014; Pun & Chan 2012; Qiu 2012; Sandoval 2013 as quoted in Fuchs 2016, 181)

The oppressive structures of Foxconn are apparent in this account by a 19-year-old worker talking about his first week in the factory in Shenzhen.

"At first I thought we would be informed of some professional operative skills and knowledge, but instead, we were taught the factory's regulations, culture, and acknowledgment of Foxconn's business concept. By now, I think it is safe to say that the training is a part of Foxconn's brain washing process. A supervisor told us that working at Foxconn requires total obedience; you do not need to be intelligent or highly skilled. After a week of training, we concluded that at Foxconn, we shouldn't treat ourselves as human beings, we are just machines." ("Follow Up on Foxconn" 2008)

Suicides in the large factory complexes of Foxconn became international news in 2010, when seventeen young workers aged between 17 to 28 jumped off roofs to kill themselves, and most succeeded. One cannot imagine the horrors of being at Foxconn that would bring about an onslaught of physical health and mental health issues. The situation was so utterly devastating that they could not sense a way out of the conditions except to take their own lives. Foxconn workers are routinely cheated into employment by the false advertisement of what is offered by the company. Only after working there do they realise that sometimes wages are withheld or deducted, and other times their overtime work hours are deliberately discounted. But those who cannot afford to be without a job would rather remain in employment than to be jobless, knowing full well that they are being exploited by the company.

The exhaustion of the Foxconn worker's body fits under Laurent's dual concepts of 'slow death' and 'cruel optimism'. Holding down a job seemingly holds promise for the future but the job itself actually actively impedes the possibilities for betterment, and instead destroys health and places the body in the midst of an unsafe working place. With chemicals and toxins and dust in the air, and without sufficient protection equipment, the workers are simultaneously exposed to slow violence. 'Cruelty', from this perspective, is both an affective experience, as well as a material bodily experience. Further elaborating on this bodily dimension, I

refer to Jack Qiu's *Goodbye iSlave* (2016). In the book, he likens Foxconn workers' conditions to slavery, and juxtaposes the factory conditions to the hold of the ship in the Atlantic slave trade.

From the Middle Passage to Foxconn

Qiu's *Goodbye iSlave* (2016) offers a provocative juxtaposition of The Middle Passage and Foxconn's factory complexes. "The filthiness, stinking air, and insecurity could be found not only on slave ships making the notorious Middle Passage to cross the Atlantic but also in Foxconn dormitories at the beginning of the twenty-first century" (2016, 68). Qiu's account specifically hones in on the spatial arrangements in the factory space that show similar logics of exploitation and control on the bodies of those who are subordinated.

Foxconn's dormitories did not have the same level of horror as the lower decks of ships journeying to the New World, but there were some echoes in the inhumane logic under which these bodies were organised and packed in cramped spaces. The lower decks of ships were used to store food, water, and trading goods, including the human cargo of slaves locked up in shackles. Qiu makes reference to the diagram of the Liverpool slave ship *Brooks* (Fig. 30), which is known as the most widely circulated and most powerful image used by the abolitionist campaigners in 1780s. The diagram shows a highly rationalised calculation as to how it is possible to stow the highest number of enslaved bodies in the lower deck. Such ships were originally built for transporting goods, and were subsequently modified to carry human cargo. Over 400 people were crammed into the hold of the ship, and an overall number of over 600-700 slaves would be transported each time. These record numbers were achieved by stowing the slaves 'spoonwise' (head-to-toe in an extended foetal position) (Webster 2005, 246). The diagram shows the dehumanising nature of the cargo, and "that the slaver was itself a place of barbarity, indeed a huge, complex, technologically sophisticated instrument of torture" (Rediker 2007 as quoted in Qiu 2016, 68).

In 2006, undercover reporters visited Foxconn Longhua and found workers sleeping in a huge storage room with almost three hundred workers sharing the space. They slept on three-level bunk beds with no air conditioning and only five windows and electric fans. The reporters noted the strong unpleasant odours in the space, from sweat and dirty feet. After such information has come to light in the media, this prompted companies like Apple to start monitoring its supplier factories and put pressure upon Foxconn to improve the working conditions. Eventually Foxconn reformed its dormitories, and now provides rooms that sleep six to twelve workers.

Foxconn also deliberately separates incoming recruits from the same town or school, so that family, friends, and classmates are all placed in different dormitories

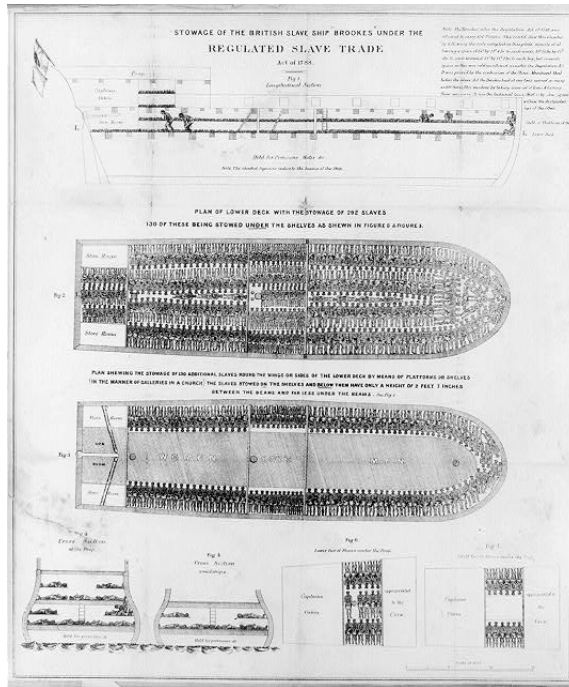


Fig. 30: An illustration of *Brooks* (Source: US Library of Congress)

and workspaces. This tactic of alienation is referred to as Foxconn's “dormitory labor regime” (Pun and Chan 2013, 182). This is done to minimise the possibility of communal life and supporting networks. Married workers also usually live separately from their spouses. Even within the dormitory room itself, these workers have different jobs and are usually on different schedules, meaning that they do not have a chance to socialise. They also frequently disrupt each other's rest. According to Qiu (2016),

the dormitories were little more than spaces of strangers subjugated in a system of “total management,” designed to control workers around the clock so that their social ties can be severed to the maximum extent and their socialising activities reduced to the minimum (70).

It was only after the series of suicides in 2010 that Foxconn began to loosen this policy and allow friends, classmates, and colleagues to become dormmates.

Qiu (2016) compares this with the social isolation and alienation that was carried out during times of slavery, following Orlando Patterson's argument that a metaphorical “social death” was a basic condition of slavery (1982). Drawing from a comparative study of 66 slaveholding societies, Patterson points out that slaveholders typically extract people from meaningful relationships that defined their personhood, social status, familial and cultural belonging. In Saidiya Hartman's *Lose Your Mother* (2007), she writes that

[t]he most universal definition of the slave is a stranger. Torn from kin and community, exiled from one's country, dishonored and violated, the slave defines the position of the outsider. She is the perpetual outcast, the coerced migrant, the foreigner, the shamefaced child in the lineage. (Hartman 2007, Prologue)

While Qiu (2016) recognises that the intensity and methods of coercion in the cases of slavery and Foxconn differ, he notes that the ultimate goal of both regimes is to maximise profit by subjecting these bodies to totalising control, by structuring the slave or the worker's life 24/7, bringing every waking and sleeping moment under the watchful eye of the master. This strict management of the bodies is clearly a disciplinary regime that could be grouped under the umbrella of techno-chronobiopolitics, in the intensive durational control of workers' lives inside Foxconn.

Another alarming spatial feature that links slave ships with Foxconn buildings is suicide prevention nets. Many slaves have not survived the Middle Passage, and historians still contend the estimations over exactly how many lost their lives. Disease and starvation were main causes of deaths, with dysentery, scurvy, and smallpox being common reasons. Slaves resisted by refusing to eat and committing suicide. While some attempted to starve themselves to death, others cut themselves with sharp objects they managed to find, or even their own fingernails. Some resorted to jumping overboard and this became such a problem for captains that they began to install suicide prevention nets around their ships.

Qiu gives a harrowing account of how the slaves would attempt suicide when they were allowed on deck. Even though they were most of the time constrained in the lower deck, the crew had to minimise death rates and had to allow them to stretch their bodies and inhale fresh air once in a while during the long journey that would last several months. Sometimes these slaves would be asked or forced to sing and dance, which meant they would be uncuffed. The slaves would use this opportunity to jump overboard into the ocean. The netting became an important mechanism to prevent suicides, as the ships had an economic interest in keeping them alive for the trade.

Qiu remarks that these anti-jumping nets seem to have been banished to the recesses of history until their re-emergence on Foxconn buildings. In the summer of 2010 after the series of suicide attempts, Foxconn installed more than 3 million square metres of prevention and protection nets in their facilities around China. Sky nets, which were installed around rooftops were made out of steel, while ground nets, installed around windows were made out of strong fabrics. Both mechanisms were built to catch falling bodies from roofs or windows. A third mechanism of middle nets with steel rods were also put in place around staircases, windows and balconies. In spite of these installations, more workers continued to jump and attempt suicide in at least four of Foxconn factories. Foxconn began disassembling

the nettings within two months of their installation due to international criticism, but these were still spotted at certain compounds in 2016.¹⁵⁵

Similar to the reasoning behind netting around ships, the suicide nets were not installed in order to ‘protect’ the labour force, but to prevent and discourage workers to attempt suicide, and to safeguard the company’s vested interests in the continued exploitation of their labour. The worker’s bodies are only valuable to the company insofar as their labouring power could be continuously extracted. Rather than addressing the heart of the issue, Foxconn asked employees to sign anti-suicide pacts and contracts that stated that no compensation could be claimed from family members should they lose their lives due to suicide.

The labouring bodies of those at Foxconn are no doubt worn out in the sense of Berlant’s take on work. And they are very much oppressed under the militarised management of Foxconn. Many of Foxconn’s workers are also migrant workers who move from rural areas to find work in the cities, trapped in the cruel optimism of finding better lives for themselves through factory work. Others are ‘student interns’ who are essentially forced to work there as vocational schools enter into illicit deals with the company and local authorities, and threaten that they would not be allowed to graduate if they do not complete their ‘internships’. These young people are often forced to work between three and six months, for 60-hour weeks, up to seven days a week, with no official protection under labour laws.¹⁵⁶ In June 2010, Liu Jiang, an 18-year-old student at Dongfang Vocational School of Technology arrived in Foxconn Foshan to begin his summer internship, and less than a month later, he climbed to the roof of his six-story dormitory and jumped to his death.

This poem was circulated on a worker’s blog after the 12th jump at Foxconn—
 “To die is the only way to testify that we ever lived
 Perhaps for the Foxconn employees and employees like us
 – we who are called *nongmingong*, rural migrant workers, in China –
 the use of death is simply to testify that we were ever alive at all,
 and that while we lived, we had only despair.” (Chan and Pun 2010)

In our technologically-infused landscape, these populations are much more affected than others in terms of the slow wearing out of their bodies, and the deterioration of their health and well-being. The time of their deterioration takes on an extended duration, though it seems that the levels of exploitation in Foxconn are so bad that in fact some bodies break within months of working inside. In the biopolitical world of slow death, these bodies are disposable and replaceable and left to gradually wither away. The possibilities of reproduction are also brought into question. Young female employees at Foxconn factories have expressed their concerns about their childbearing abilities after exposure to the mysterious unknown chemical substances they had to use every day. Female workers report disrupted menstruation cycles and skipped periods after working at Foxconn, citing fears of infertility due to chemical exposure and constant stress. In Pun and Chan’s

interviews (2012), these interviewees describe vomiting all over the place in the first few days of their night-shift work, and speculate that their chronic exposure to toxins may lead to reproductive health problems and birth defects.

In the spatialisation of the dormitory labour regime, males and females are also strictly kept apart, with sexuality being highly regulated through gender segregation. At Foxconn, male and female workers are forbidden to visit one another's rooms. As the majority of the workforce are young adults at marriageable ages, some have concerns whether they could make enough money to build a life for themselves, let alone enough to raise a family in the future.¹⁵⁷ The dominant structure of discipline obviously also discourages individuals to socialise, let alone nurture romantic relationships within the factory compound, even though many of the workers stay 24/7 within the walls of Foxconn. As I have mentioned above, even married couples are often separated in their work and in the dorms.

Looking at the factories of Samsung and Foxconn, we could see how labour conditions reconfigure the sense of time within the conception of techno-chrono-biopolitics. There is a sense of having no future, of being stuck in the impasse, working in conditions comparable to enslavement. People are let die, either by way of illness and cancer due to toxic exposure, or to suffer from so much existential despair that the only viable solution is to end one's own life. And even that choice is somewhat taken away by Foxconn's installation of suicide prevention nets.

The notion of the future is forever out of reach, like Berlant's discussion of cruel optimism, and Smith's discussion of temporal dispossession. Despite the hard work of those digging through the forests of Kivu, and those at the assembly lines of Foxconn, their work offers no way out of their predicament. The future is systematically taken away from the communities living under the extortion of militias in Congo, while those living in Foxconn's dormitories wonder about the possibilities of family and childbirth. The cruel optimism embedded in these pursuits is perhaps best capsulated in the banners raised during a Taiwanese protest against Foxconn in May 2010. Activists unfurled the following couplet to mourn the deaths of the young workers—"For wealth and power—physical and mental health spent, hopes lost; For profit of the brand—youth spent, dreams shattered."¹⁵⁸

The above elaboration on the circuits of ICT labour shows a multitude of ways bodies are extracted for value in the digital age. From digital labour to waged labour, various levels of exploitation take place. In the next section, I will return to philosophical reflections on how these cases fall within biopower, with attention to their demonstrations of the reach of techno-chrono-biopolitics.

Techno-chrono-biopolitics and Necropower

This final section ties preceding discussions and the various illustrations of ICT labour back to the concept of techno-chrono-biopolitics, and in particular, the necropolitical dimension of it.

As Fortunati (2007) puts it, the capitalist system “turned its desire for exploitation not only to the capacity for labor – content – but also the body – its container” (149). If we remember that biopower’s ultimate aim is to turn populations productive, we could see this play out across the circuits of labour discussed in the above sections. The QS user who uses self-imposed surveillance with wearables to increase productivity and health, the factory worker who has to work within a highly-supervised surveilled environment—their bodies are deeply intertwined with the mechanics of labour, and technology is poised to increase the extraction of their productive power.

And at the same time, biopower must be considered alongside its ability to kill, as killing machines, or through long attritional violence—the mineworker terrorised into accepting the conditions of their work and existence as imposed by militias; the factory worker unknowingly absorbing carcinogens, or the one who is even forbidden from taking one’s life by the installation of anti-suicide nets. The concepts of slow violence and slow death allow us to think through their conditions of existence.

Like Parikka’s medianatures, my concept of techno-chrono-biopolitics asks for a consideration of a deeper time frame, to study not only the microtemporal rhythms of twenty-first-media but to also seriously ask how such a media infrastructure came to be. The smartphones and computers that extract our digital labour are the products of chains of ICT labour. This deeper time narrates aspects of the product life cycle, and the times and spaces the product has travelled through, and the labouring bodies it has demanded before all its respective components are assembled and the object is birthed as the latest smartphone, or the QS wearable one could proudly display on one’s collarbone or wrist. It asks us to consider as well the labouring bodies it comes into contact with after its ultimate obsolescence and death. In the following, I will emphasise the necropolitical dimensions of techno-chrono-biopolitics, by considering critiques offered by several scholars in extension of Foucault’s biopolitics.

Necropower temporalised and racialised

Achille Mbembé’s necro-politics provides a perspective on the deathworlds of biopolitics. Placing emphasis on the side of ‘letting die’, he takes up the trajectory of thought on race Foucault has discussed, and goes deep into the version of biopolitics, or necro-politics, taking place on the plantation, in the colony, and in the World

War II Nazi camp. Mbembé discusses these sites as instances where technology has operated as death machines. According to him, each stage of imperialism involved key technologies (the gunboat, quinine, steamship lines, submarine telegraph cables,¹⁵⁹ and colonial railroads) (2003, 25) and these technologies were utilised to support colonial occupation. Mbembé disagrees with Foucault's characterisation of the Nazi state as the most complete example of a sovereign power demonstrating the right to kill. Instead he shows Foucault's blindspot by arguing that the pre-history of the concept of biopolitics could for instance be found in the colonial genocides and massacres in colonial Africa (or more recently, Israeli occupation of Palestine). But to Mbembé, the administration of necropower, much like biopower, is not limited to nation states. Following Deleuze and Guattari's work on "war machines" (1987), Mbembé shows how the necropower performed by war machines is implicated in enclave economies, where militias and rebel groups gain territories and decimate populations while drawing on a range of trans-national networks for material and financial support. This is partly achieved through resource looting and extraction, and the profits continue to feed the war machines. While Mbembé references the role of oil and diamonds in Angola's war economy, the Congolese example of mineral extraction and the violence of militia control fits his description too. This is not war between two sovereign states, but war that

is waged by armed groups acting behind the mask of the state against armed groups that have no state but control very distinct territories; both sides having as their main targets civilian populations that are unarmed or organized into militias. In cases where armed dissidents have not completely taken over state power, they have provoked territorial partitions and succeeded in controlling entire regions [...], especially where there are mineral deposits. (2003, 35)

From this perspective, we have to see twenty-first-century media as embedded in these circuits of violence and necropower in our contemporary condition, and our demand for gadgets a catalyst for instability, war, and destruction in another part of the world. For this I join other critical scholars in underscoring the necessity to connect biopower with necropower and that these two aspects of power have to be brought in conjunction with each other. Jasbir Puar in *Terrorist Assemblages* (2007) proposes "bio-necro collaboration" to bring together Foucauldian biopolitics and Mbembé's necropolitical critique of it. This acknowledges both the optimisation of life and population control in 'letting live' and the direct, ruthless, indifferent attitude to administering death in 'letting die'. Rosi Braidotti phrases in similar terms that "bio-power and necro-politics are two sides of the same coin" (2007).

Indeed, my discussion above on slow violence and slow death both relate to the abuse, violence, and death imposed upon certain populations where their lives are considered to be of lesser value in service to the capitalist machinery. The emphasis on slowness and the forever-deferred possibility of a better future shows that violence can be *temporalised* through durational dispossession. It is important to see

death and letting die not only through the lenses of spectacular violence, killings en masse through bombings, massacres, and genocides. It is equally important to pay attention to the slow unfolding of violence through forms of environmental degradation, toxic accumulation as well as the durational and systematic violence like that committed by militias in the Congolese example.

The cruel optimism of having no future in fact brings us back to the work of queer scholars on chronobiopolitics (Luciano 2007; Freeman 2010) who discuss the biopolitical control of temporalised bodies under arrangements for strategies of living like “marriage, accumulation of health and wealth for the future, reproduction, childrearing, and death and its attendant rituals” (Freeman 2010, 4). The accounts of Kivu communities and Foxconn workers show the violence and frustrations experienced when the possibilities of reproduction and marriage are removed from them. Letting die does not only refer to the letting die of physical bodies—it is also the killing of viable and sustainable futures. Is it possible to think of love-finding algorithms and the large industry of internet dating and matchmaking in the same light if we were to consider the necropolitical destruction of reproductive bodies as well as their hopes and dreams for marriage, family, and children, on the materialist end of twenty-first-century media?

These connections I am making in this chapter bring us back to Foucault’s consideration of racism, a subject I have already discussed extensively across Chapters 3, 4, and 5. Not only is necropower temporalised but it is also *racialised*. Thinking through once again Foucault’s argument about race and biopolitics, he argues that racism is what decides who lives and who dies. Racism is not directly mapped onto racialisation, though in the cases above, we could see the uneven distribution of necropower which concentrates on particular vulnerable populations. Racism is about the line that separates those who are worthy of living, and those who are let die. This take on biopolitics is to be further supplemented by Rey Chow’s elaboration in *The Protestant Ethic and the Spirit of Capitalism* (2002), where she extends this discussion of race into the domain of ethnicity. Using an intersectional perspective, she emphasises that it is not only race that we need to think of but also cross-ethnic identifications, and hyphenated identities, postcolonial conditions that are important to consider when studying biopolitics. Seeing biopolitics as a globalised phenomenon, she poses the question on ethnicity’s relation to labour and capitalism, and how ethnicity is inscribed in biopower’s grip over labouring populations that are placed within the let-die/ make-live paradigm.

In the examples given above, we see the spatialisation of labour concentrated in places inhabited by people of colour. That is to say, the uneven distribution of global labour in the digital era is very much classed and racialised, organised along racial and ethnic lines. I have already brought up the potential of algorithms disproportionately targeting people of colour and poverty in the discussion of

predictive sentencing, child protection, and policing. This chapter's focus brings into light the various modes of capture of biopowers along circuits of ICT labour, and the necropowers that come with specific modes of labouring. Indeed, while everyone is equally subjected to algorithmic governance like prediction, certain populations are more vulnerable than others and would be unevenly affected by the regime. And while bodies live under regimes of labour, some bear more risk and are more likely to be negatively affected in a differentiated distribution of bio- and necro-power. In the current global distribution of ICT labour, we see these populations concentrated in Asia and in Africa. Dumping electronic waste in Africa seems to continue a long history of colonial thinking that is akin to America's nuclear testing on Marshall Islands—that certain lives elsewhere matter less. Those of us living our privileged lives in the so-called First World can turn our backs against them, pretending that once the trash has disappeared from our backyards and garbage collection points, it is out of sight, out of mind.

Foucault's dissection of racism is why rhetorically I make use of a distinction between Quantified Self and uncounted others, notwithstanding the seemingly binary opposition of the two terms. Adapting Foucault's population thinking, 'inferior' sections of the global population (the Other) are let die so that the rest of the species (the Self) could survive and achieve human flourishing. The deaths of inferior people (the deviant, the degenerate, the abnormal), or in this case (the labourer, the migrant, the slave), would result in a healthier, purer 'Self'. In his own words,

[r]acism makes it possible to establish a relationship between my life and the death of the other that is not a military or warlike relationship of confrontation, but a biological-type relationship: "The more inferior species die out, the more abnormal individuals are eliminated, the few degenerates there will be in the species as a whole, and the more I—as species rather than individual—can live, the stronger I will be, the more vigorous I will be. I will be able to proliferate." The fact that the other dies does not mean simply that I live in the sense that his death guarantees my safety; the death of the other, the death of the bad race, of the inferior race (or the degenerate, or the abnormal) is something that will make life in general healthier: healthier and purer. (Foucault 2003, 255)

Chow similarly argues that the nature of biopolitics is paradoxically a mechanism that justifies both killing as well as living. Indeed, even if the power relies upon unequivocally negative actions like death and injury, it simply justifies all the more the imperative to live—

an ideological mandate that henceforth gives justification to even the most aggressive and oppressive mechanisms of interference and control in the name of helping the human species increase its chances of survival, of improving its conditions and quality of existence. (2002, 7)

Coincidentally (or perhaps not so coincidentally), QS is sold based on the promise of creating healthier individuals, a promise built on the backs of those who precariously work to gather source materials and assemble these machines. It

is about the 'I', the 'Self' who possesses the technology to make my life better with knowledge through numbers, the 'I' who count. And it is about the 'other', whose lives are less-than-human, whose deaths are but collateral damage in the name of technological advancement and the potential for cyborgian augmentations. QS is meant for improving overall health of citizens, to track diseases before they turn into epidemics, to enable pre-emptive action against mental illnesses which may develop in the future and to reduce that risk. Yet the proliferation of such technologies not only results in the continuous absorption of data, demanding bodies to perform durational digital labour without their conscious awareness, but also requires risk-laden labour on the parts of the miners and factory workers.

Permutation, Once More: Geontologies

This account, however, is further complicated by the fact that the biopowers and necropowers outlined above do not only work on humans, but also affect plants, animals, and earth through toxicity and environmental degradation. Slow violence is committed against our ecosystem as well. Techno-chrono-biopolitics, from this perspective, can include more than humans under the heading of 'bio-'. Plants, animals, and even earth itself could be considered in thinking about the bio-necro-political effects of our digital culture. In the following section, I will further elaborate upon these beyond-human implications of the above discussion in relation to Povinelli's concept of geontologies (2016).

Elizabeth Povinelli reminds us through necropolitics that the prehistory of biopolitics is not in Europe but in colonial Africa (and more globally), and that this racialised killing machine circulates back to Europe, through the form of Nazism. But taking it a step further, Povinelli proposes that biopower has too long relied upon the distinction between life and death. Instead one could also reformulate it in terms of the distinction between life versus non-life, where non-human entities like rocks, sand, earth, should also be considered within the biopolitical regime.

Geontopower is not a power that is only now emerging to replace biopolitics—biopower (the governance through life and death) has long depended on a subtending geontopower (the difference between the lively and the inert). And, similarly to how necropolitics operated openly in colonial Africa only later to reveal its shape in Europe, so geontopower has long operated openly in settler late liberalism and been insinuated in the ordinary operations of its governance of difference and markets. (2016, 5)

In her hypothesis, Povinelli traces the prehistory of biopolitics even deeper into an underlying distinction between Life and Non-life; that in fact, just like the division between those who make live and those who are let die, biopower has long been operant to distinguish between life (*bios*) and non-life (*geos*), humans versus non-living things (like the earth itself). Terming it geontopower, she criticises the ongoing exertion of power upon earth which is often considered inanimate, like mining land and taking the earth's resources. Based on this line of thinking, we

could approach the discussion above from the angle of the non-human entities which play a part in medianatures, and consider how the extraction of minerals and the pollution of e-waste also are bio-necro-geo-political in nature. In addition to the extraction of human labour and the exhaustion of their healths and lives (bio- and necro- powers), the material infrastructure of twenty-first-century media depends too upon the continuous extraction of earth resources (geo-power).

Povinelli studies the Non-life dimension of minerals extracted for technology production, and reminds her readers that what is to 'us' in the West not 'alive' may be very much living and imbued with meaning to others. Rocks, in other words, can die too. Writing from the perspective of her anthropological work, life, and kinship in Northern Territory, Australia, she challenges Western ontological views of materiality by discussing Aboriginal ontologies of land, earth, and the vibrant spiritual or totemic meanings attached to place. Aboriginal dreamings¹⁶⁰ do not make distinctions between Life and Non-life, and Western theory is only just now catching up through recent interests in vitalist philosophy in the likes of new materialism, speculative realism, and object-oriented theories.¹⁶¹ If we take seriously this ontological proposition encapsulated by Aboriginal worldview, we could see that land seizure and mining is exploitative to the earth, much as extractive labour is to humans.

Mining is a key instance where geontopower plays out. I have already looked at the Congolese example in terms of the temporal violence committed on the communities that base their livelihoods on mining, but the following example brings out the durational violence committed to earth. In her book, Povinelli discusses the totem of Two Women Sitting Down, an Indigenous sacred site at Bootu Creek manganese mine. Of much interest to mining corporations, this site is rich in manganese, the fourth most-used metal in global manufacturing, and an important component for the production of phone batteries. Beyond its practical use-value, the Aboriginal meaning of the manganese can be captured in the dreaming of this totem:

Two Women Sitting Down consists of two female dreamtime ancestors, a bandicoot and a rat. The bandicoot had only two children while the rat had so many the bandicoot tried to take one of the rat's children, which caused them to fight. The manganese outcrops in this area, of which this Sacred Site is one, represents the blood of these ancestors. (Povinelli 2016, 31)

When OM Manganese Ltd, a mining company, caused damage to this sacred site, the Aboriginal Areas Protection Authority brought a lawsuit against them in 2013.

Land is always considered a Non-life resource (*geos*) ready for extraction and for its capitalist value, unless proven otherwise. And proving that these places are imbued with meaning is very difficult. Aboriginals have to convince the officials and the courts of the 'liveliness' of the land, ironically through totemic dreamings

that become fixed in meaning through verification by ordained anthropologists. In their own Aboriginal ontologies, dreamings are often dynamic and their definitions of who the traditional owners of country are do not sit comfortably with the legal definitions demanded of them. In the land-claim hearings of the manganese case, indigenous groups had to testify that they believed the specific features of Two Women Sitting Down were sentient, and that as custodians of the land and the descendants of these sentient sites, they had to act on these beliefs. Rather than recognising the Aboriginal worldview as the norm, the indigenous populations only managed to perturb one tiny aspect of the much larger systematic plan to continue mining and in the process, destroy more sacred sites. It came as a small surprise that the Aboriginal Authority actually won the case, and this became the first case precedent for future prosecutions of desecrations and destructions of sacred sites around Australia. But because the actual fine was relatively small, it was clear that this would not create significant impediment to further mining on Aboriginal lands.

Materialist ontologies exemplify the vibrant nature and the agency of the minerals extracted, and push to the fore posthuman implications of this extractive relationship to earth and nature as resource. Interestingly, Povinelli's discussion of what manganese means to the Aboriginals echo the situation in Kivu where coltan has other cultural meanings for the Congolese. In Smith's anthropological research, he came across women who have developed rituals in response to the mining. As mining began pulling people away from agricultural food production, they wanted to induce control spiritually over the chaos surrounding mining. So they collected and boiled water used in coltan mining with herbs from the forest, "domesticating the power of coltan and the medicines simultaneously, in the process equating these things symbolically" (Smith 2011, 28). These women believe that because foreigners (non-Nyanga people like the Rwandan-backed Rally for Congolese Democracy, which have been colluding with foreign corporations like Sony and Citibank) took control of the ore, they were ruining the resource. One woman explained, "they thought that coltan was just a thing in the ground, but it is not, it is a special thing. They were ruining this thing because they didn't know how to treat it, and that's why this whole place is poor now. Before, old people would call meetings in the forest, and they would teach us how to use these things" (Smith 2011, 28-29). While the Kivu locals are not making an argument for the life-ness of their coltan ores, they are no doubt making a claim on other cultural meanings of the mineral that are lost to those exerting geontopower in the region, extracting these minerals and only seeing them in terms of specific use value and exchange value.

Taking up then Povinelli's extension to the concept of bio-necropower, we could consider the agency of earth and the role it plays in the circuits of ICT labour—perhaps we could also argue that non-life is also very much performing labour in

service to our digital worlds. In a nod to medianatures, geophysical matter is also implicated within this labour circuit. Earth pays a price and takes a toll. Not only are we extracting the resources of the earth at the expense of communities who live in these areas, we are also polluting the earth through irresponsible e-waste disposal. As scholars have argued and as scientists have proven, we are in fact at the tipping point whereby the actions of certain humans on earth have caused irrevocable damage to our ecosystem in the geological age of the Anthropocene. Povinelli cautions us against continuing this subjugation of ‘Non-life’, suggesting that we should rather be thinking of the symbiotic relationship between ‘Life’ and ‘Non-life’ and be aware of the agency of Non-life materials.

For instance, the over-extraction of minerals in our ceaseless and enthusiastic production and consumption of electronics would ultimately result in these minerals returning as toxins in our environment. Cadmium, found on circuit boards and in batteries for instance, is a pollutant from the e-waste-processing plants in Guiyu, China. It has found its way into soil and rice paddyfields, eventually resurfacing as food products in rice, rice flour, and in vermicelli noodles. Povinelli reminds us that “[w]hen biological life brings too much of a kind of non-life inside itself, it risks its structural and functional form and integrity” (2016, 45) , i.e. heavy metal poisoning. We must remember that in mining the earth for the minerals and subsequently disposing of the products, we are altering the environment we live in and we are polluting our food sources as well. At the end of the day, exerting geontopower over the boundary of life versus non-life means poisoning the earth, plants, other animals, and ourselves—what comes around goes around. To speak with Berlant and Nixon, here is a slow death sentence for earth, and a slow violence committed to the non-human entities we share the earth with. Techno-chrono-biopolitics, therefore, must grapple too with the detrimental effects on these non-human others and the stratum of earth itself.

Conclusion

In this chapter, I have extended the definition of techno-chrono-biopolitics by studying the temporalities of violence and exploitation of bodies observed along circuits of ICT labour. By turning our attention to the deep time of media and its embeddedness in medianatures, other biopolitical issues come to the fore. As Parikka puts it,

digital culture is also sustained by the rather exhausting physical work in mining, factory production lines, and other jobs that are not directly counted as part of “cognitive capitalism”—and the machines themselves grow obsolescent and die, their remains leftover media-junk; and ecological resources are exhausted as well, part of the increasing demand for minerals and other materials for advanced technology industries. (2013)

On one hand, we live in a data environment supported through the proliferation of smart devices like Quantified Self-tracking, characterised by immersive background data operations which track where we have been and generate data from our movements and habits. On the other hand, a materialist take on data environments reveals the pollution created through e-waste dumped in specific parts of the world, as well as the toxic and abusive working habitat for uncounted bodies who mine for, and produce these smart devices. In addition to the microtemporality of algorithmic control, exemplified in this chapter's exploration of QS and haptic surveillance, we must also attend to the other end of the temporal scale: slowness. Moreover, the biopolitical aspects of techno-chronobiopolitics must also be considered alongside the necropolitical dimension. Within the same biopolitical regime, bodies are differentiated along the lines of those who should be allowed to live and those who would be left to die. Thus in the study of twenty-first-century media, not only does the agency of microtemporal algorithms challenge the centrality of human consciousness and decision-making, but also the slow violence in medianatures that challenges our abilities to perceive and narrate long durational violence committed against racialised populations.

When data regimes extract value from real-time tracking, when our use of such gadgets essentially means intensifying the earth's exposure to e-waste and toxicity in the long run, what kind of agency do we have over time in the context of medianatures? While it would be wrong and inaccurate to collapse all differences between the so-called affluent QS fanatic vs the poor labourer, it is necessary too to show that there are common denominators of time and technology that govern the biopolitical lives of those living within the circuits of ICT labour I have made reference to. Quantified Self and uncounted others are not usually considered in one fell swoop because they function on two different scales of time: the microtemporality of algorithmic operations (too fast), and the *longue durée* of toxic build-up and latent devastation to bodies and environment (too slow). One could argue that the too-fast and too-slow both become challenges somewhat to the capacity of human consciousness to grasp the full impact, as the speed shift towards the two extremes. Both the too-fast of datafication and the too-slow of degradation are enfolded within one product life cycle of digital technologies—and the increasing number of gadgets we can now wear on our bodies with sensors and cameras one day would all become obsolete and get banished to the dump. The slow letting-die of at-risk populations is exacerbated by the too-fast of planned obsolescence.

But these human populations are not the only ones disproportionately dispossessed. Taking heed of Povinelli's rethinking of the foundations of biopower, we also consider the operations of geontologies, where non-life, like rocks, soil, rivers, earth become also victims of biopower/ geontopower. The earth is one big

resource to be mined, to be extracted, much like the bodies of labourers. To counter and resist biopolitics in the age of digital algorithms then requires a fundamental revision to the human-centric notions of biopower, and consider the ways not only human bodies are subordinated, disciplined, managed and controlled, but also the non-human uncountable others who are also equally subjected to the *longue durée* of violence.

Conclusion, or a Genealogy of Dispossession

Techno-chrono-biopolitics: An Overview

In order to account for how modern forms of power are used to manage, create constraints over, and govern life, Foucault created the term ‘biopolitics’. Techno-chrono-biopolitics is a permutation of biopolitics, which places extra focus upon how technology is a form of modern power that governs the way we live, and part of its power lies in the altering and manipulation of how time is perceived and mediated. Techno-chrono-biopolitics highlights the importance of the temporal and the implication of time in new media ontologies that govern the contemporary landscape, and studies the biopolitical implications therein.

Techno-chrono-biopolitics as a concept opens up avenues of engagement with various implications of time in the current epoch. Through technological mediation, time is framed and reorganised in terms of scales, speeds, rhythms and durations, and the resultant restructurings have biopolitical impact on our lives. Techno-chrono-biopolitical analysis shows the power exerted through technological devices from clocks to machines big and small, “a micro-physics of power” (Foucault 1991, 26) that is interwoven into the fabric of daily life affecting multiple dimensions of life, livelihood, and death. Power, in other words, flows through technological devices and manifests in forms of subjectification, governance, and subjugation.

Foucault’s reflections on discipline and biopower are helpful in reminding us of a micro-physics of power that lives not only on the level of sovereign power and government, but goes “right down into the depths of society” (*ibid.*, 27) at the level of “individuals, bodies, gestures and behaviour” (*ibid.*), and I add, as well as the technology and media that we live our networked lives with. Foucault’s biopolitics

is attentive to the multiplicity of forces that shape subjectifications, normalise subjects, extract labour power, and increase their productivity. Biopolitical theory reflects the way dominant practices change over time and how mechanisms of governance evolve into more economical and efficient forms. Foucault notes that sovereign power moves beyond violent and direct inflictions of torture and pain into much more subtle forms of biopower that could serve the same ends of forcing, nudging, and incentivising bodies into compliance and docility.

This intensification of biopower, as hypothesised by Nealon (2008), shows the mutation of the concept as biopower creates a greater hold over the body not by force and violence, but by increasing the number of sites through which power could operate. By “abstracting, expanding, temporalizing, and allowing the concept more access to more sites” (Nealon 2008, 33), biopower intensifies

the existing practice to an unprecedented degree: which is to say the new regime focused that old regime of practice, widened the scope of its application, and gave that emergent, intensified form of attention a series of updated methods and new objects (precisely by extending the procedures of earlier modes of practice, taking them to the limit of what they can do). (Nealon 2008, 42)

The current account of techno-chrono-biopower highlights in particular the role played by time and technology in enabling the widening scope of biopower, and the reflections on temporality (duration, speed, rhythm) further qualify exactly how biopower is exercised in time.

Moulding my own concept after Foucault and his contemporaries, I have offered multiple layers of analyses that show how techno-chrono-biopower is exercised through the algorithmic and code level, in the corporeal interface between human and device, through the discursive domain of time as a system of organisation, and in the geological layer of earth and resources. Charting a genealogy through historical and contemporary examples, I emphasise that the forms of power and exploitation we see surfacing today in the age of algorithms have historical roots and do not appear out of thin air. Living in the midst of twenty-first-century media, our smartphones and computers are as much time-mediating devices as our clocks and watches. Time mediation and data tracking are omnipresent in various domains of life and work—in the workplace, a vibrating posture detection device making sure one sits or stands properly in the day; in the warehouse, a handheld beeping tracker counting down the seconds to register the next barcode; at home, the durational capture of data through smart meters and thermostats; through the smartphone, an endless trail of data and metadata, browsing histories, and app usage. These devices perform as dispositifs of power, moulding our habits, recording our lives, feeding forward machinic outputs to users while building meticulous records and sharing them with an ecology of databases corporate and governmental. Our device usage becomes digital footprints that could generate metrics of trustworthiness, or indicators of mental health.

Conclusion

In the ecology of twenty-first-century media networks, humans are immersed in teeming flows of machine-to-machine communication and data collection. As Hansen (2015b) has argued, humans are *implicated* in the operations of media, and we are unable to perceptually access these data flows running on algorithmic time. This suggests the displacement of human agency by machinic decision-making, pre-programmed into the automated algorithms that subtend digital services, platforms, and governance networks. Yet, at the heart of techno-chrono-biopolitics, the human body remains central in both mechanical time and algorithmic time eras, as an important source of labour power that could be re-temporalised and organised for increased productivity. As I outlined in Chapters 4 and 6, an immense amount of human labour and intelligence is required to support the training and development of these algorithms, as well as the production processes in mines and factories to even create the material gadgets in the first place. Human bodies, or rather, *certain* human bodies are also more likely than others to be subjected under exploitation, risk, and heightened surveillance. Different social divisions arise out of techno-chrono-biopower, mapping onto existing striations of inequality locally and globally. Led by the logic of homophily, predictive analytics drive the clustering of traits emerging out of homophilic associations and categorisations, in effect drawing lines of segregation across a given population. In American cityscapes, predictive policing maps the probability of crime onto low-income, migrant, non-white neighbourhoods, performatively projecting the trends of arrest history and crime data often tainted with racial biases. In parallel, globalised ICT circuits of labour see the concentration of risk-laden production and disposal of electronic gadgets in Asia and Africa, mandating the continued exploitation of cheap labour and disposable, less-than-human lives ‘elsewhere’.

In this concluding chapter, I will summarise and tease out major ideas proposed in the course of the dissertation, building towards openings for future research and strategies for resistance against techno-chrono-biopower. I begin with a brief consideration of the positive uses and emancipatory potentials of twenty-first-century media, and argue that despite such developments, the infrastructures of digital culture today continue to follow from a history of imperialist and colonialist exploitation and exacerbate inequalities. Earlier forms of techno-chrono-biopower were already tied up with the coloniality of time technology and the enumeration of life into statistical regimes before the internet was even invented. I turn the attention once again to these pre-histories of techno-chrono-biopower, and probe further into the role of (mediated) time and the multivalent definitions of temporality offered in preceding chapters. Through this, I align the historical and contemporary exercises of techno-chrono-biopower, showing the intensifications and the resulting subjectifications of the body that have taken place. In the final section of my conclusion, I will consolidate the study by looking at the planetary

scale of techno-chrono-biopolitics, mapping the planetary scale of computation with the globalised dispossession of bodies that compose the circuits of ICT labour. In so doing, I paint a picture of the planetary scale of techno-chrono-biopolitics that is just as planetary as the infrastructure of the internet itself, showing the genealogical reach of techno-chrono-biopower and the urgency in countering its effects.

Twenty-first-century media: Emancipation and Empowerment?

The critical attitude towards twenty-first-century media displayed so far in the analysis may have you wondering whether recent technologies also hold the possibility of emancipation and empowerment. After all, it must also do some good for their users, aside from minimising time spent on decision-making and information searching. These technologies are designed to assist our day-to-day living, and there may be good reasons to adopt them. My contention, however, is that the perceived positive abilities of these devices do not necessarily outweigh the effects of the underlying structure and dispositif of techno-chrono-biopolitics that saturate the digital landscape.

Consider the Amazon Echo device,¹⁶² whose AI voice agent is Alexa, yet another product anthropomorphised through a female voice and name. Alexa comes with an embedded learning algorithm which enables it to adapt to owners' speech patterns, vocabulary and personal preferences over time and provide more accurate and tailored responses. The device is capable of voice interaction, music playback, create to-do lists, set alarms, stream podcasts, play audiobooks, provide weather, traffic and other real-time information.¹⁶³

Alexa, much like other voice assistants, is often called on to give information and provide answers to user queries. In one of its first promotional ads, the father in the video asks Alexa, "How tall is Mount Everest?" to which Alexa provides an encyclopaedia-perfect answer. When the daughter does not know how to spell 'cantaloupe', the father turns to Alexa for help again. Alexa is marketed as a machine that can find answers from the 'cloud' on-demand. Many users in fact post videos of them asking Alexa questions on YouTube. As a chiefly audio-based interface, Alexa gives *one* answer, which is rather dissimilar to the list of search engine results usually yields. This is not to suggest that search engine listings offer better answers, but the voice-interface does seem to accord more truth-value to the *one* definition stated. This phenomenon brings up rather interesting epistemological questions about the knowledge represented by the algorithms driving Alexa. Her responses have prompted some to ask, is Alexa a feminist¹⁶⁴?

When asked “How many genders are there?”, Alexa answers the following—“the two main categories of the gender spectrum, male and female, are called the gender binary. But there are many other categories that exist. Because gender identity is complex and personal, there is no definite way to say how many genders there are.”¹⁶⁵ When asked questions about Bruce Jenner, Alexa always refers to Bruce as Caitlyn Jenner, the transitioned trans-woman name she adopted. In spring of 2017, Amazon quietly rolled out a ‘disengage mode’ for Alexa to respond to sexually explicit questions or derogatory remarks by saying either “I’m not going to respond to that,” or “I’m not sure what outcome you expected.”¹⁶⁶ Now, when asked “Alexa, are you a feminist?”, she would answer “Yes, as is anyone who believes in bridging the inequality between men and women in society”.

Amazon deliberately programmes Alexa to disengage with inappropriate comments and sexist remarks from users, and hopes to represent Alexa in a positive way for girls and women, and is supportive of diversity and social progressiveness. Alexa has a personality team at Amazon who discuss extensively how to respond to particular questions. For instance the team consulted crisis counsellors for the scenario if users tell Alexa they have been sexually abused. Alexa would show empathy (“I’m sorry that happened to you”) and provide aid by giving the number of a support line. This shows how at the end of the day, algorithms resemble the human subjectivity that goes into the algorithms, and that they are biased for or against certain ideological constructions. It is one thing to ask Alexa how many teaspoons are in a tablespoon when cooking, and another when prompted to account for statements which may be rather political. As these voice assistants become modern-day dictionaries and encyclopaedias, and the interfaces for services and even emergency help, they do not only simulate the human input that has gone into the design, but through their utterance, also perform their power-knowledge.

This example, on the surface, shows a facet of the liberatory potential associated with the power-knowledge performance by such an OS. Isn’t it a progressive step to have a device that could be heralding ‘feminist’ values inside living rooms? On one hand, one must not forget that Alexa is at the end of the day a listening device operating under the logic of capture, recording all interactions after wake-word prompts. On the other, part of this programming is Amazon’s ploy to expand client base and broaden the appeal of the device. It follows from a version of Han’s “friendly power” (2017), posing Alexa as a forward-thinking, liberal agent while shielding its capitalistic prowess and hunger for user preferences and data. This also shows Amazon’s anticipatory framing of the future client, feeding forward what the company thinks its customers want to hear, and pre-empting what users desire before they even realise that they desire it. Like targeted advertising, this orientation of Alexa is geared towards progressives and liberals who may also be correlatively more concerned about privacy issues, which may curb their interests in buying

such a device. While the liberal-leaning programming of Alexa may be a welcomed addition to the smart home scene, this supposedly ‘feminist’ attitude also hides the other gendered politics associated with the choice of the female voice. Charles Hannon (2016) writes that the female voice of Alexa has been programmed to signal a lower status in the relationship with the user, and always takes the blame for any miscommunication. Instead of saying “I didn’t understand the question” which leaves open who is responsible for any misunderstandings, Alexa responds with “I didn’t understand the question that I heard”, suggesting that the device may have heard wrongly. The added frequency of the “I” also suggests a gender bias, a pattern of speech commonly associated with female speakers.¹⁶⁷ Basing the research upon linguistic studies from James Pennebaker in the 1990s, Hannon notes that the person perceived to have lower status uses first-person pronouns more often, and proposes that language design in AI should be conscious of the politics of language patterns.

Turning to QS and wearable devices, these technologies do have the proven potential to monitor wellbeing and improve health. For instance, there was a news report in 2018 about a 76-year-old Hong Kong man narrowly escaping death because Apple Watch alerted him to a spike in his heart rate in time. He immediately went to the hospital for a check-up, and found that his arteries were almost completely clogged and that he was in urgent need of angioplasty surgery (Feng 2018). Researchers in other health domains have also gravitated towards other fitness trackers like Fitbit to collect data and an increasing number of clinical trials involve trackers for better measurement of patients’ quality of life (Glenza 2018). In Chapter 5, I have already brought up the use of predictive analytics in mental health scenarios, and health tracking offers the possibility of intervention before a disease actually manifests.

In Dave Eggers’s dystopic novel *The Circle* (2013), the fictional IT company (which is basically Apple, Google, Amazon, Facebook and all other tech companies you could think of rolled into one) requires their employees to swallow tiny sensors which monitor their vital functions in real-time. The health data is visualised on a wristlet (which also collects data) and is centrally aggregated in the company’s medical centre. From blood pressure to caloric intake, digestive efficiency to cholesterol levels, galvanic skin response to pH of sweat, these sensors collect an extensive set of information which is fed to the company. In the book, the doctor explains to new employee Mae Holland that the company may make adjustments to workload if they see an abnormal rate of stress in a particular Circler or in a department. At the same time, the Circler is expected to take care of his/her own body—the wristlet reminds one to adjust one’s posture, stay hydrated, and fulfil the 10,000 step count recommendation.

Fully behind the axiom ‘knowledge is power’, the company believes that the full collection of data will help prevent their employees from getting ill or provide intervention and early treatment if necessary. The company runs a Complete Health Data programme, which tracks the data collected from all 11,000 employees at The Circle, taken from their health sensors and wristlets. Such ‘complete information’ allegedly has helped them prevent flu outbreaks on the company campus because they are able to identify the individual carrier within minutes. Further into the story, Mae has gone ‘transparent’—she allows the full broadcasting of her data online as well as live-broadcasting of every waking hour of her life through a camera she wears on her body. Every movement, every word, every interaction, everything she sees is streamed live on the internet. As a result of the public display of her data, a researcher in Glasgow who has been following her activities is able to identify risk factors in her lifestyle habits which may increase her chances of getting cancer. This anonymous male researcher has cross-referenced Mae’s publicly available vitals data with her equally-public DNA information and has been watching her broadcast. Mae has a genetic marker for increased risk of gastrointestinal cancer. He has noticed that Mae eats salami and other meats with nitrates which might increase cancer risk and proceeded to alert the medical professionals at the Circle, advising her to develop better dietary habits.

Eggers’s imagination of a QS-driven health world is both promising and disturbing as we see the extent of data’s intrusion into the body. The comprehensive self-tracking afforded by QS theoretically empowers the user to gain this type of knowledge and self-modify behaviour in order to become healthier, and can also assist in medical research to better predict patient response to treatment and to monitor recovery. Medical startups are looking into early signs of brain disorders like Alzheimer’s and Parkinson’s disease, which could be indicated by a disruption in typing cadences and patterns. Currently, quantitative tools to measure brain health are inadequate and early detection of neurodegenerative disorders is challenging. Durational monitoring through wearable trackers help physicians increase the survival rates of cancer patients undergoing chemotherapy (Glenza 2018). The turn to QS and monitoring through device usage indeed offers up a treasure trove of possibilities of medical advancement, but one difficult question has to be asked: whose health and whose wellbeing are placed at risk for the health and prolonging of life expectancy of a health technology user? On whose slow deaths is the promise for better health made? I have argued in Chapter 6 that the production and disposal of devices often take place in unsafe conditions for the workers. The eventual obsolescence of the smartphone or QS device would end up contributing to the increasing amount of e-waste, which in turn pollutes the environment and harms other species we share the earth with. According to a United Nations report, the world generated 44.7 million metric tonnes of e-waste globally in 2016 (the

equivalent of 4,500 Eiffel Towers), and the number is expected to climb to over 50 million tonnes by 2022, averaging 6.8 kg per human inhabitant. Higginbotham (2018) cautions that the Internet of Things would turn into the Internet of Trash, for many devices are designed to fail once the batteries die, and companies are not necessarily investing into making devices easy to disassemble for replacement of parts or recycling. Lives of certain devices may in fact be shortened as more computing is added, and shiny new gadgets of Internet of Things also encourage the replacement of older, functional, but non-internet-enabled devices. From this perspective, the empowerment of some inevitably involves the disempowerment of others, and the positive impact brought about by the devices may be limited if one takes a broader outlook on the product life cycle of the devices and considers the production and disposal end of the equation.

Views on the digital have often shuttled between attitudes of technophilia and technophobia. The point here is not to completely undermine the liberatory potentials of technology, but to invite readers to consider how the liberation of some also involves the dispossession of others, and that these devices could empower and participate in an exploitative network at the same time. For instance, at the incipience of the World Wide Web, the internet “was sold as a tool of freedom” (Chun 2006, 2)—

by enabling anonymous communications, it allegedly freed users from the limitations of their bodies, particularly the limitations *stemming* from their race, class, and sex, and more ominously, from social responsibilities and conventions. The Internet also broke media monopolies by enabling the free flow of information, reinvigorating free speech and democracy. (*ibid.*; original emphasis)

But today a damper is no doubt placed on such a cyberutopian view of the internet as we see how anonymity has contributed to cyberbullying, how fake news also arises with the free flow of information, and values of democracy are challenged by the algorithmic states of exception created by internet giants. Social movement afforded by mobilisation on social media networks offered glimpses of hope during Occupy in New York and worldwide, Arab Spring, and the Umbrella Movement in Hong Kong, but the same medium enabled too the organisation and radicalisation of white supremacists in the US, resulting in a series of right-wing rallies, some of which culminated in violence and death.¹⁶⁸ Internet forum 4chan may have been the breeding ground for hacktivist collective Anonymous, but it equally allows neo-Nazis, misogynists, and racists to gather and for hate groups to spread their messages.

Similarly, twenty-first-century media objects promise better connectivity, efficiency, monitoring of health, and so forth. Where there is empowerment, we need to ask, empowerment for whom at the expense of what? The deferring of our decision-making agency to the machines perhaps saves time and effort, but if we focus on the ontological structure of twenty-first-century media and the techno-

chrono-bio-necro-power that runs through them, we see the price to be paid: our data collected through durational capture, constant potential for monitoring and surveillance, the immense labour of human life, and the exploitation of earth and its resources. To paraphrase Mark Hansen's point (2015b, 71), does what we gain from the use of twenty-first-century media compensate for what we, and other beings on the planet, have to give up?

The Multivalent Temporalities of Techno-chrono-biopolitics

In developing the concept of techno-chrono-biopolitics, I have navigated multiple time-related technologies and objects to show the multiple ways the mediation of time bears upon life, livelihood, and death. Some of these key genealogical connections between the mechanical and the algorithmic time regimes are worth recapitulating. Already from the historical antecedents of factory clocks, whistles, and plantation bells, we see how practices of time-telling and signalling create new ways of organising labour and day-to-day living. These older practices are still familiar now—children grow up with class timetables and school bells; we rely upon bus and train schedules; every phone comes equipped with alarm functions and stopwatches. As time goes by, more methods of measuring time and productivity are introduced, accompanying the shift into digital culture which offers more precise means of keeping track of time.

Time-tracking grows more methodical and accurate with the development of technologies. Before the invention of clocks, people used to keep track of duration according to tasks, like the length of a prayer. The sun, the moon, and the stars guide temporal orientation. Clocks mediate time into a schema of hours, minutes, seconds, and allow for equal time measure that is independent from the natural phenomenon of earth's rotational movement, determining the passing of day and night. Clocks, together with other objects like calendars and schedules, are external references that mediate the phenomenological experience of time, providing reference points and vocabulary to demarcate time. But time could be further compartmentalised into minuscule measurements. Computer machines mediate time into a schema of technomathematical units of electrical impulses in and across devices, segmenting time into discrete signals. Wolfgang Ernst (2016) refers to this as time-criticality, where internal clocking systems exist inside of computer machines and the systems introduce a layer of time mediation that is microtemporal and machine-centred. And although as humans we are phenomenologically unable to perceive the speedy interactions of signal traffic, we are nonetheless subjected to the effects of the time mediation inside our machines.

In this section, I devote special attention to the multiple dimensions of temporality I have dedicated this study to. I arrange the discussion according to several headings: speed, duration, rhythm, synchronicity, and achronicity. I have already made frequent reference to speed, duration, and rhythm in the course of the dissertation, and I add the terms synchronicity and achronicity here to further frame and align the discussions covered in earlier chapters. These headings form the axioms under which techno-chrono-biopolitics is operant. Beginning with *speed*, I reiterate the hypertemporal nature of twenty-first-century media, and reframe the speeds of time ‘too fast’ and ‘too slow’ for our conscious perception as forms of imperceptible violence that we must tune our attention to. Under the heading of *duration*, I consider the always-on, background-running nature of twenty-first-century media, and bring this technical dimension of time-critical media into conversation with Jonathan Crary’s elaborations from a cultural perspective (2014). The durational operativity of media networks we are embedded in offer the possibility of a digital time that operates continuously with no breaks. Such an ontological condition enables the constant subjectification of bodies under a digital labour regime, where our conscious and unconscious use of media operations become commodified by the companies and agencies that collect our data. ‘Work’ then takes on new durations. This is further summarised under the heading of *rhythm*, where I restate the effects of re-temporalisation of labour regimes, cutting across the continued effects of time and motion studies in Taylorism in today’s world and the on-demand style of the gig economy. Via *synchronicity*, I return to the aligned world time system, a residual effect of the colonial world order, and contrast this with *achronicity*, the multiplication of time scales and chronologies that permeate algorithmic time. I revisit how time’s past-present-future chronology is warped vis-à-vis Hansen’s feed forward in the future colonisation of time (2015b). The discussion of these temporal frames shows the continuous challenge to the phenomenological body in the age of algorithms, as we live alongside the rhythms and durations of contemporary digital culture, in and out of sync with machinic, non-human time. Hansen suggests that these transformations of experience should not be viewed as “a purely negative development” (268), but that it is a “reality that we must live with” and “adapt to” (*ibid.*).

These reflections aim to provide contours to the subtle and insidious “temporal oppression” (Martineau 2015, 11) generated by mediations of time, enabling possibilities to “struggle against the myriad contemporary entities and institutions that seek to capitalise on the technical revolution of sensibility in ways that bypass our agency entirely” (Hansen 2015b, 269).

i. Speed: Bio-necropower Fast and Slow

To think of speed is to attend to the important role time plays in biopolitics, namely the speed of the administration of bio- and necro-power. The bulk of the dissertation focused on the microtemporality in algorithmic mediations of time, signalling at the too-fast exercise of biopower embedded in the dispositifs. In constructing the analysis, I relied upon Ernst's concept of time-criticality and his analysis of time as mediated internally within computer machines. The schema of algorithmic time does not correspond to human experience, adding an extra layer of time mediation to the existing mechanical clock mediation of hours, minutes, and seconds. When algorithms process certain operations, they feed forward the output to the user, whose conscious experience is always late to the scene of decision-making.

Because of this microtemporal structure, I referred to Hansen's concept of "perverted pharmacology" (2015b) which critiques how the microtemporal workings of algorithmic operations escape from perceptual experience, all the while capturing our conscious and unconscious inputs for capitalistic appropriation or securitised surveillance. Hansen (2016) further reminds us that as human users, we are also reliant on the audio/visual interface ("medium-oriented ontology") to give us a sense of what has been processed. The speed of microtemporal algorithmic processing is incommensurable with our human apparatus, constituting the too-fast dimension of biopolitical control: the push of a button that generates a map of future potential crime hotspots, the click of the mouse that gives a metricised risk score evaluating child safety, the smart city lamp poles that detect 'suspicious movement' in a public square, or the 30 second verification process of Instant Trust™ that collects an entire history of your internet activity. Algorithms perform extra-legal power in states of exception (McQuillan 2015; Chun 2016), and techno-chrono-biopower swiftly feeds forward the determinations of whether certain individuals are in need of added surveillance, or whether certain neighbourhoods require extra patrol services. It marks certain bodies as untrustworthy, subjecting populations to unknown standards of normalisation that emerge from patterns of data. Algorithmic movement analysis for a public square cannot distinguish between a friendly jostle or a hostile brawl—it does not care about the intentions anyway, as long as the movement detected stands above a pre-determined threshold, triggering floodlights and police attention. Machinic automation of decisions does not correspond to human decision-making time, making the operations of techno-chrono-biopower light, fast, and economical.

In addition to the too-fast of algorithmic governance, we must also consider the violence that is too slow to be perceptible.

Conclusion

Biopower hides its way of killing through a discourse of life, of making live, a discourse that tells us to be normal, and to be healthy, and to be vital: to live well, to thrive, to strive toward thriving, and it allows those that do not strive to thrive, or in striving exhaust themselves and die, allows them their death, and does not waste its time killing them. (Povinelli 2016, 175)

The discussion of bio- and necro-political theories and the concepts of “slow violence” (Nixon 2011) and “slow death” (Berlant 2011) in Chapter 6 illustrate the slow speed of letting die. This letting die includes human and non-human subjects. Human populations who participate in circuits of ICT labour disproportionately experience forms of extraction through digital labour and/or through physical work, and the materiality of earth itself and its non-human inhabitants are also implicated in acts of mining and are affected by the after-effects of toxic pollution. These effects stretch beyond our conscious perception of violence as they extend across long periods of time. The toxic after-effects of waste are cycled into other processes, bringing another dimension of difficulty in tracing the material effects. Cadmium for instance, which is a pollutant from the e-waste processing plants in Guiyu, China, has found its way into rice paddyfields, and eventually resurface not only in rice but also in rice vermicelli and rice flour sold elsewhere in the country.¹⁶⁹ Poisoning can also accumulate through biomagnification along the food chain, with the effects not noticeable until top-level consumers are reached. There is no spectacularity to the attritional violence on labouring bodies and on those slowly-poisoned by the pollution brought about by e-waste.

Looking at the two scales of speed, we see the multiple targets of techno-chrono-biopower, and how it affects different subjects in different ways. What aligns both the ‘too fast’ and the ‘too slow’ is the fact that both exceed our frames of conscious perception. Rob Nixon suggests that the countering of slow violence requires apprehension: “to apprehend—to arrest, or at least mitigate—often imperceptible threats requires rendering them apprehensible to the senses through the work of scientific and imaginative testimony” (2011, 14). Apprehension is critical, he argues, because we can be ethical only towards what we can see and perceive. He writes,

one of the most pressing challenges of our age is how to adjust our rapidly eroding attention spans to the slow erosions of environmental justice. If, under neoliberalism, the gulf between enclaved rich and outcast poor has become ever more pronounced, ours is also an era of enclaved time wherein for many speed has become a self-justifying, propulsive ethic that renders “uneventful” violence (to those who live remote from its attritional lethality) a weak claimant on our time. (2011, 8)

To Nixon, strategies of representation may be helpful in constructing narratives that make visible the violence that lies beyond our sensory ken. The description applies to scales of speed too fast and too slow for human experience. The role of the writer-activist can

help us apprehend threats imaginatively that remain imperceptible to the sense, either because they are geographically remote, too vast or too minute in scale, or are played out across a time span that exceeds the instance of observation or even the physiological life of the human observer. (2011, 15)

The cultural critic, artist, or filmmaker¹⁷⁰ also play a similar role in bringing into focus these injustices and to narrate the fastness or slowness of bio-necropolitical issues as well as the material practices surrounding media that would otherwise fall outside of our perception. The rubric of speed exposes the difficulties in encountering and countering techno-chrono-biopower.

ii. Sleepless Durations: The Non-Time of Technology

Also posing a challenge to our conscious perception is the durational dimension of twenty-first-century media. We are moving into an era of always-connected ubiquitous computing (at least in certain parts of the world). As I have discussed earlier, this constitutes the becoming-environmental of media (Hansen 2015b; Hörl 2015; Gabrys 2016), which submerges humans in a machine-to-machine ecology. I have in particular referred to the feature of duration in media in terms of the continuous capture of user input and activity. In the case of QS, this durational capture extends to the surface of the skin, setting up intimate records of one's biometrics like heart rate.

In Chapter 2, I introduced Ernst's chronopoetics, through which we understand that for computer machines, the time domain is composed of electrical pulses, switching between the on and off state of 0 and 1. In ubiquitous computing, machine cycles are always running continuously as long as the devices are powered on. What is durational to us as human experiencers are to the machines distinct and distinguishable microtemporal cycles of signal traffic. Duration, in a way, is a wholly human-centred term to denote the continuous flow of time in extended periods without breaks. A micro-second is filled up by machine cycles and processes that we cannot follow nor apprehend, but in machine-centric terms, time is measured and recorded in the computer machine's own tempor(e)alities. Ernst (2018) further argues that this constitutes what he refers to as "non-time" for the machine, where time is not experienced as a phenomenological phenomena but rather as technomathematical signals. The digital computer cannot understand time from a phenomenological perspective as lived experience and lived temporality. From this perspective, machinic time could only be conceived in radically non-human terms. 'Non-time' references the inherent temporal logic of media, a time that does not even correspond to mechanical clock time even though it may be synced to it via Network Time Protocol. Computer machines do not interpret time in the experiential terms humans are familiar with, but perform their own time-criticality withdrawn from the human perceptual apparatus. By naming this phenomenon

as a form of “non-time”, Ernst shows the limits of phenomenological experience and the necessity to grapple with the machinic scale of time operation. To call it “non-time” in fact reveals the lack of vocabulary to denote these machinic modes of temporality. Hansen (2015b) has similarly shown the limits of human sense-making and the disjuncture between human and machinic time comprehension, and has resorted to Whitehead’s process philosophy to move beyond phenomenology to understand machinic processes.

With the proliferation of twenty-first-century media, we enter not only into Ernst’s machinic non-time but also Crary’s non-time of 24/7 (2014). Even though the two theorists come up with the term “non-time” for different reasons, the two uses resonate with each other. While Ernst defines “non-time” as the ontological condition of machinic time, Crary questions whether we have entered the non-time of a 24/7 world where there are “almost no circumstances now that can *not* be recorded or archived as digital imagery or information” (2014, 30-31; original emphasis). According to him, “no moment, place, or situation now exists in which one can *not* shop, consume, or exploit networked resources” (*ibid.*, 30; original emphasis). Non-time marks a duration of non-differentiation and homogeneity, where it makes no difference whether it is a weekday or a weekend: online stores are always open with no opening hours. He points out that while earlier distinctions like individual days of the week and holidays still persist, their significance is continuously “effaced by the monotonous indistinction of 24/7” (*ibid.*).

Crary (2014) sees this invasion of non-time into our day-to-day living as the ends of sleep—sleep is supposedly the final barrier that capitalism cannot fully assimilate. With QS, one could indeed argue that users have already become the sleepless workers Crary cautions us against, as the always-on smartwatches and health trackers offer up sleep data for capture and analysis (not to mention the ‘smart’ mattresses, ‘smart’ duvets, and ‘smart’ pillows joining the ranks of the Internet of Things). Users perform their due digital labour even though their bodies are resting. Unconsciously they allow companies to glean profit from their sleeping bodies. The non-time of technology is made possible by the always-awake gadgets embedded in machinic networks, whether in the form of an always-eavesdropping Alexa, or an always-on fitness tracker. Machines need no sleep, only the sustenance of electricity. In this sense, twenty-first-century media is sleepless, and can operate durationally without breaks. Crary argues that such durational, continuous functioning becomes a form of timelessness, constituting the non-time of 24/7.

In Chapter 4, I have made reference to the logic of capture (Chun 2016) as the supplementary mode to surveillance. 24/7 capture registers and passes on data for archiving and future evaluation, accumulating individual histories into large data-sets ready for big data processing. Durational capture expands the scope for pervasive monitoring of citizens, despite the possibility that no humans in fact study

the data, and everything is left to the machines to parse through and to discover patterns of correlations from. Life-mining (van Dijck 2014) becomes simply one more background-operating algorithm in the non-time of computer machines, while the act of capturing modulates the potential for control, surveillance, and governance, performing durationally techno-chrono-biopower.

iii. Rhythm: Re-temporalised Labour Regimes

The introduction of mechanical time and the introduction of algorithmic time both lead to new ways of organising labour. In early instantiations of techno-chrono-biopower associated with mechanical time, bodies become susceptible to new schedules and organisations of work, and have to learn to operate in synchronisation to the mechanical algorithms of factory machines. The knowledge of time management trickles through layers of social organisation, from armies to factories to schools to households, and steady, repetitive rhythms run through the military step and the assembly line. Best represented by a clock and its reign over mechanical time, these early examples of techno-chrono-biopower aim at better labour management and productivity and use time as a mechanism for the organisation of social life—for instance, to unite villagers through regular morning exercise in Japanese-occupied Taiwan in the 1930s.

The rhythms of work and living invariably change alongside the mediation of time. The clock introduced the possibility of time as a usable and tradable unit, and measurement gave scientific precision to the calculation of how long tasks would take in order to optimise workflow. Thompson (1967) explained that clocks accompanied the rise of early capitalism, and the the adage “time is money” became planted in people’s minds. In Chapter 3, I gave an analysis of Taylorism’s relationship to time and performance management. Through time and motion studies, Taylor attempted to study the ways efficiency and efficacy could best be achieved. Note also the motion and fatigue studies carried out by Frank and Lillian Gilbreth, which like Taylorism, also began in the beginning of the twentieth century. The Gilbreths went one step further than Taylor and took into consideration the capacities of the labouring bodies. They measured workers’ heart rates with stethoscopes and stopwatches, calculating how much work workers could manage before they became fatigued, thereby reducing efficiency. These studies were narrated and made into a film entitled “The Quest for the One Best Way” (1968).¹⁷¹ Both methods remain relevant to this day.

In China, Foxconn factories hire a team of engineers to investigate in meticulous detail every single process in the production, resembling what Taylor’s time and motion studies was all about. They record and calculate the time needed for workers to complete tasks, through which they look for ways to increase production speed with cost minimisation and efficiency maximisation as goal. Workers are made

aware of the expected speed, and they note to the second how much time is required to complete a task, and how many they need to complete in a minute. Workers are ordered to make sure every second counts. On a wall in a Foxconn complex, the following slogan is on display—

“Time is money,
efficiency is life

Unless the sun no longer rises, targets must be reached

There may be no best method, but there is always a better method

The devil is in the details.”¹⁷²

Pun, Chan and Selden (2013)’s ethnographic work finds that the workers feel dehumanised by such a work process and express that their bodies are but “gears on the factory machines” (67). In fact, they even remark, “we are faster than the machines” (*ibid.*).

The facts of Foxconn’s harsh labour regime illustrate the reality that the strict control over labour processes afforded by mechanical time has persisted in history. Clock-based discipline and management are still very much relevant for the creation of our digital gadgets, as well as other services related to the digital. For instance, Amazon’s handheld devices in the warehouses bring bodies under a strict time regime. The heavy scrutiny on work processes and the desire to make every second count can also be seen through the picker, who literally races against time to fulfil performance targets. Actual bodies are hired to keep the promises of the digital, for the ease of same- or next-day delivery services. The administration of disciplinary power is achieved through a personalised device beeping throughout a ten-hour long shift, a small countdown ticker on each individual hand scanner that keeps the picker on his/her toes.

In an exhibition on contemporary labour and activist practices, artist Jeremy Deller exhibits this mannequin arm wearing a Motorola WT4000 device (Fig. 31), similar to the ones used in Amazon warehouses to keep track of pickers. The device sends warnings to supervisors whenever a picker falls behind target speed. Without altering the object, the artist wishes to show “the newly dehumanized methodologies of time and labor management largely adopted by digital economy protagonists” (Lucchetti 2018). Such devices are reminiscent of the QS gadgets that are used to keep track of bodily movement and other biometrics, of which cases of smartwatches and posture-tracking (and breath-tracking) wearables have been discussed in the course of this dissertation. In addition to direct disciplinary mechanisms, these devices introduce performance standards and bodily states that are expected of the workers, and also place the onus on the individual rather than the employers to improve working conditions. For instance, it is not work stress, but the individual’s inability to pick up zen breathing that results in the experience of stress at work. It is the picker’s lack of fitness and agility that results in the

Conclusion



Fig. 31: Jeremy Deller, Motorola WT4000 Wearable Terminal, 2013, installation with plastic and electronics (Source: Exhibition “Matthijs de Bruijne: Compromiso Político”, BAK, basis voor actuele kunst, The Netherlands 2018)



Fig. 32: Protest on 8 June 2010 the Global Day of Remembrance for Foxconn Victims and Foxconn's Annual General Meeting by Hong Kong-based labour NGO, Students and Scholars Against Corporate Misbehaviour (SACOM) outside an Apple store in Hong Kong (Source: SACOM)

fatigue and exhaustion, rather than the speed standard of picking being inhumane. These standards epitomise the invisible threat of “perform—or else” (McKenzie 2001, 14), and the expectation to keep up—or lose your job. Employee wellbeing is subsumed under the capitalist desire for maximum output.

Labour exploitation from a temporal perspective does not only occur elsewhere in low-income countries, but affect precarious workers everywhere, including the developed world. Recent news coverage by VICE media exposed that ambulances have been called to Amazon's UK warehouses at least 600 times between 2015-2017. Patients required hospital services on more than half of these occasions, with common complaints being breathing problems and chest pain. There were records of miscarriages from female employees at work, who revealed that they were “forced to stand for ten hours a day, pick, stow, stretch and bend, pull heavy carts and walk miles” (Wilding 2018). It takes the laudable effort of activists and worker unions,

and exposés by journalists for these forms of oppression to become visible in the public eye (Fig. 32), and it is some of their undercover work¹⁷³ that unveils the suppressive rhythms of hidden labour that makes possible the ease and convenience of our 24/7 world. For instance, it took the series of suicides in Foxconn factories in 2010, considered by scholars as radical acts of protest (Chan and Pun 2010), for the horrifying conditions behind smartphone manufacturing to become known. While the shocking news placed pressure on Apple to improve its supply chain management, today's Foxconn labour regime is still exploitative with long working hours, coerced student 'internships', suppressive military-like management system, and complete with suicide-prevention anti-jumping nets.¹⁷⁴

With the possibilities afforded by new QS gadgets, we have not moved far away from earlier instantiations of techno-chrono-biopower, but have simply introduced extra means of control and discipline supplanting and intensifying methodologies of time and labour management. Work schedules and timetables are complemented by devices that monitor rhythms of labour down to the very second.

iv. Synchronicity: Time Unification and Coloniality

Zooming out onto a material-discursive level, I turn to *synchronicity*. Synchronicity involves both systems and bodies. On a system level, the smooth functioning of the non-time of the 24/7 world and its durations require the synchronicity of time across the planet, as coordinated by the algorithms of the Network Time Protocol. Bodies need to be in tune to rhythms of labour discussed above, which require synchronisation with the logics of the machine (like Foxconn workers assembling parts as fast as, if not faster, than the machines) and the logics of 24/7 durations (like the fulfilment of orders by pickers in Amazon warehouses). The flipside of synchronicity is captured in the next point on *achronicity*, which refers to the physical impossibility on the part of humans to synchronise with machinic algorithmic time, the temporal disjunction that constitutes the gap between phenomenological experience and machinic non-time.

Synchronicity is not new to twenty-first-century media, but our current systems cannot function without it. Texts in instant messaging would appear in a scrambled order, and cloud storage services would have no idea which latest version of a file they should sync. As I have argued, synchronicity, culminating in time standardisation, has a long history that stretches into the era of mechanical time. Historically, the demand for synchronicity arose out of the need to coordinate systems like postal services, train travel, and long-distance communication by telegraph. In Chapter 3, I also situated the science of time and the development of such technologies within a context of coloniality. The science and knowledge of clocks and time practices belong to a colonial matrix of power, as the refinement of time technology through chronometry is fuelled by colonial desire to measure the

distance between empire and colony. Greenwich Time, which emerged out of the voyages of maritime exploration, was the most frequently referenced meridian line by European powers. Britain also controlled a majority of the undersea telegraph networks for communications. For these reasons, it was subsequently adopted as the zero point of the earth, the timezone of GMT. From this perspective, techno-chrono-biopower is also a symbolic power where time systems reify a certain order of the world, and GMT becomes UTC, the time standard adopted for the internet.

Standardisation can be seen as a form of cultural imposition. Scholars have pointed out that even mechanical time, the default standard of time as we know it, follows a European cultural logic. Kevin Birth (2016) suggests that clocks of equal hours, the mechanical time which serves as an external reference outside of solar and sidereal time, is very much European in nature. The external reference of mechanical time through clocks takes away the need to rely upon celestial markers as one normally would. Other cultures kept time with seasonally variable hours,¹⁷⁵ and calendars are linked to celestial cycles like that of the moon. It is European time keeping that “privileges uniform oscillations for defining time over the irregular rotational behaviour of Earth” (Birth 2016, 75). This uniform quantification of time is what made it a usable and tradable unit, adding the unit of the hour to the history of standardisations of units of measurement, such as weight, length, area, and volume. Timepieces are thus powerful devices that determine the way we experience time, thereby forming an integral component of the biopolitical order one is subjected to.

Techno-chrono-biopolitics takes up this history of standardisation and reminds us that the UTC of Network Time Protocol continues to build upon the colonial logic represented by GMT and the symbolic power therein. Just as Ernst has mused upon how the architecture of the computer and the technicality of its time operations could “only exist in a culture that was discursively familiar with [...] timing and disciplining” following Foucault (2016, 84), I propose to reconceptualise the architecture of network time as a continuous re-performance of GMT coloniality. That each time an algorithm performs a request to synchronise computer machines to UTC/GMT, it rehearses a forgotten history that taints the seemingly-neutral operations of network connectivity. As such, the undersea cables of the global internet can be viewed as a refinement and extension of the colonial telegraph network built in the second half of the nineteenth century, which Nicole Starosielski aptly calls “copper cable colonialism” (2015, 31).¹⁷⁶ The synchronisation to UTC necessarily conjures these histories of maritime exploration, colonial trade, and slavery. Perhaps it is appropriate to call this re-performance *perfumance*, following Jon McKenzie (2001). *Perfumance* refers to the citation of performance that destabilises the existing context by transposing it and re-performing it in another time and space. In a moment of anachronism, *perfumance* brings up minor histories

and disrupts chronological narratives of progression. The momentous perfunctory of UTC short-circuits the algorithmic, microtemporal act of time synchronisation with the *longue durée* of the (colonial) history of the invention of time and time systems. Network(ed) time, therefore, becomes a pressure point whereby one could excavate the overlapping and multiple dispositifs of time technology that span the eras of mechanical time and algorithmic time.

Moreover, aside from standardisation and a logic of measurement, the introduction of mechanical time represents progress and is seen as a marker of civilisation as communities shift from pre-industrial taskscapes to the rhythm of industrial work in the factories. This is yet another instance of coloniality associated with time and techno-chrono-biopolitics. It is, as we have seen in the Japanese colonisation of Taiwan, a civilising force, bringing industrialisation to the disorganised factories that Japan saw as substandard to their level of productivity. Time systems represent a level of civilisation, and the standards impart a scientific attitude that is celebrated, recalling the stopwatches used for time and motion, and motion and fatigue studies.

The unification of time under GMT symbolises a world order established through imperial expansion and colonisation, and the introduction of clock technology is seen as a civilising act. Synchronicity, as an axiom of techno-chrono-biopolitics, shows the symbolic dimension of biopower, revealing a violent history masked by the durational microtemporal network operation of time synchronisation.

v. Achronicity: Multiplication of Time-scales

As Crary (2014) has argued, the lived realities of a synchronised, 24/7 world are characterised by “disjunctions, fractures, and continual disequilibrium” (31). Synchronicity in twenty-first-century media is, at the same time, underpinned by achronicity, that is, the inability to order things in chronological time. Achronicity is characterised here not as timelessness, i.e. the disappearance of time, but rather as multiplication, the availability of multiple time-scales. Between the humans and the machines, it is the achronicity between human experiential time and machinic algorithmic time that looms large, rather than a seamless synchronicity. As I have pointed out above in ‘Bio-necro-power fast and slow’ and in the rest of the dissertation, humans are always late to the operations of algorithms. The disjunction between machinic scale and human scale of time experience situates techno-chrono-biopower in the interstices of mediated time, that is, a micro-dimension of time that is available only to the machines. Under algorithmic time, machines create their own non-human timescale and humans are merely implicated in this structure. While we are unable to perceive these machinic temporalities, we are subjected to their outputs nonetheless.

Achronicity is also defined here as the warping of time's chronology, i.e. the sequential ordering of past, present, and future. I discussed this in relation to predictive analytics, big data, and the ontopolitics of time associated with these operations in Chapter 5. The too-fast nature of algorithmic governance escapes our perceptual apparatus, and functions through a logic of pre-emption. Pre-emption is future-oriented, and is often premised upon the availability of historical data and the patterns of correlations that emerge from it. Predictive algorithms look for the criminal before an illegal act is committed, and seek out the mental patient before depression develops, performing what Brian Massumi has termed 'ontopower' (2015). By identifying a future threat, and by designating it as such, it produces the reality that it predicts, turning what remains a potentiality into an actuality that needs acting upon. I have made repeated references to Hansen's notion of "feed forward" (2015b), whereby machinic outputs pre-mediate and project decisions, bypassing the slowness of the human decision-making loop. Hansen calls this the "technical colonisation of the microtemporal" (2015b, 135), a colonisation of future time by pre-empting what could happen, consequently limiting the range of potentialities of the future.

One could argue that under the algorithmic time mediation of twenty-first-century media, humans are always living in what is history to our digital devices and to the time of our networks, while a pre-mediated future is always fed forward to us. Our own histories¹⁷⁷ also continuously haunt our present (and future), a trend that is represented by the profiling nature of algorithms like targeted advertising, Trooly's predictive trust, and HealthRhythms that dig for a record of our device usage and internet footprint. As discussed in Chapter 4, the troubling mobility of data dispositifs also means that a record on a certain corporate platform like Twitter could easily travel to the databases of national security agencies. Big data dispositifs function upon the principle of 'the more the better'. The enmeshment of such dispositifs creates a larger playing field for the operations of technochrono-biopower, allowing for more patterns of correlations to be discovered in the datalogical operations (Clough et al. 2015) of prediction and pre-emption.

The achronicity of historical data shapes the future, and the achronicity of algorithmic operations also makes it difficult to challenge the calculations that have taken place inside the computer machine. If one fails a verification procedure to become part of a service, the procedure is usually automated and fed forward—what the user sees as 'verification failure' or 'request denied' is an output after the fact. The entire process is blackboxed and removed from conscious perception by way of temporal dissonance, in addition to other security-related or proprietary reasons. For instance, it is understandable that for reasons of public security, a policing agency cannot reveal the workings of its predictive policing software to prevent actual criminals from figuring out ways to evade the system.

Conclusion

As part of my research process, I applied to become a Turker in Amazon's Mechanical Turk to see if I could gain a more intimate understanding of the nature and rhythms of work involved on the platform. After filling out a simple form involving only personal details (name, address, phone number) and picking answers out of a drop-down list for "How did you hear about Amazon Mechanical Turk?" and "What is the primary reason you are interested in completing tasks on MTurk?", I waited for the account to be verified, only to be rejected by an automatically-generated email reproduced below (Fig. 33), leaving me to speculate exactly what barred my participation on this platform.¹⁷⁸ The wording of this email and its automatic generation capture the spirit of the blackboxing and the machinic agency performed by algorithmic control.

In the multiplication of timescales between the machinic and the human, achronicity defines the conditions of techno-chrono-biopower. The replacement of human agency by machinic decisions means that humans are subjected to their effects without the ability to perceive the machinic temporalities at work. It is the temporal disjunction of achronicity and the accompanying logics of big data processing (like the datalogical turn and the logic of homophily discussed in Chapter 4) which drive the intensified composition of techno-chrono-biopower analysed in the latter half of the dissertation. The achronicity of algorithmic governance modulates a future already prescribed by machinic projections, bringing bodies under the fold of discipline, governance, and biopower.

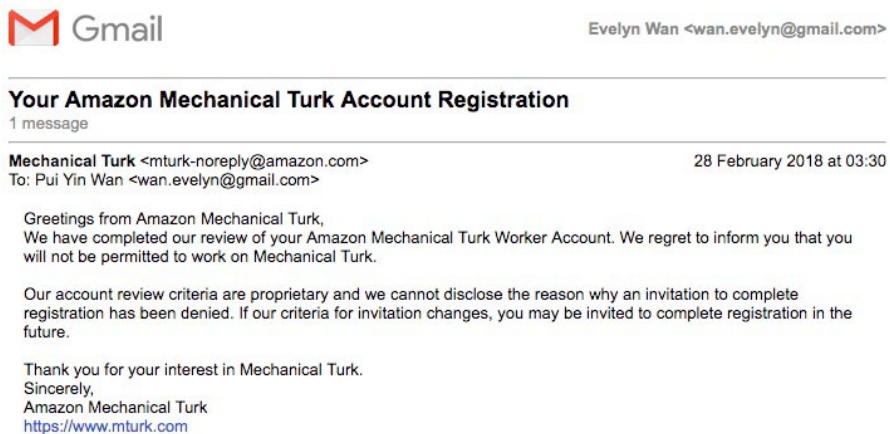


Fig. 33: Author's rejection email from the no-reply email account of Mechanical Turk

The Planetary Scale of Techno-chrono-biopolitics

Looking at speed, duration, rhythm, synchronicity, and achronicity, I have listed the main tenets of techno-chrono-biopolitics from the perspective of mediated time. Techno-chrono-biopolitics could be analysed from these tenets as a way to bring attention to the temporal nature under which biopower functions. These elaborations take their cues from Foucault's analysis of time in *Discipline and Punish* (1991), but goes beyond his cursory overview of temporality in disciplinary mechanisms. Extending the discussion from mechanical time to algorithmic time, I show the different ways bodies are subjected to the effects of time mediation and management, and align the multiple ways in which time is mediated in the twenty-first century to biopolitical and necropolitical ends.

In addition to the temporal dimension, I have also covered extensive ground in relation to the materialities of media, and the locales under which techno-chrono-biopowers operate. We could see the circulation of techno-chrono-biopower within multiple loops, namely, machine-to-machine communication, human-machine interaction, and ICT labour circuits.

Looking at the network of *machine-to-machine communications*, through examples like Network Time Protocol, Facebook's ad targeting algorithms, and the trustworthiness equations developed by Trooly, I offered glimpses of the technical machinic level of the coded algorithm. These coded algorithms ensure the functioning of the internet, activate the recording capabilities of twenty-first-century media, mediate the patterning and sorting of data, and enable the emergence of new norms through machinic vision. Performing with the extra-legal power of the algorithmic state of exception (McQuillan 2015, Chun 2016), we see that techno-chrono-biopowers are already inscribed in the algorithmic code level and in the automated, preprogrammed activities of the machine.

The *human-machine interaction* loop focuses on what happens when material bodies come into contact with the devices themselves. Chapter 3 referenced the bodies in factories that have to re-temporalise to the rhythms of the machines in the mechanical time era. Under algorithmic time, I made reference to examples like posture-tracking in QS, HealthRhythms's algorithmic nudges against depressive symptoms, and the Apple Watch that reminds users to stand up and move around every hour. Bodies are expected to perform to new mobile norms that arise out of the big data regimes of *machine-to-machine* processing, and can be disciplined according to personalised feedforward mechanisms (like the beep of the Amazon's picking tracker, or the buzz of Lumo Lift and Prana).

The circuits of *ICT labour* highlight the production and disposal dimension of digital gadgets, studying the mines from which minerals are sourced to produce the intricate connections of the circuit boards and batteries. On the disposal end,

I made reference to the toxic aftermath and environmental degradation caused by e-waste, and discussed the adverse effects these mining and polluting processes create on the geophysics of earth, including human and non-human inhabitants. These dimensions show how twenty-first-century media exacerbate existing inequalities and the divide between the so-called First World and Third World in the digital age. ICT labour also brings up the questions of digital immaterial labour, and the role of human input and supply of data that substantiates the functioning of machine-to-machine communications. This data feeds into the *machine-to-machine* processing and affect the output in the *human-machine interaction* loop.

These loops create a picture that shows the planetary scale of techno-chrono-biopolitics, that matches up with the planetary scale of computation with its infrastructure reaching far ends of the earth, that depends on globalised economies of production¹⁷⁹. The machinery of computation, from undersea cables to GPS satellites, from smartphones to the programming on the code level, requires an incredible amount of human labour, as well as the contribution of medianatures, i.e. earth's resources. All of these human and non-human entities contribute to building the architecture of today's massively-connected world but also become subjected to the ensuing techno-chrono-biopolitical effects.

The concept of techno-chrono-biopolitics maps the genealogical relations in the development of mechanical and algorithmic time, tracing the interlinkages between time, technology, and biopower. As such, it provides an analytical framework that highlights the domains and dispositifs of biopolitical and necropolitical control. Dispersed across layers of code, interface, and circuits of power, techno-chrono-biopolitics cartographically reveals the operations of power in and of the materialities and temporalities of today's digital age.

Dispossession, in Time

The planetary scale of computation is coextensive with the globalised dispossession of bodies that compose the circuits of ICT labour. Throughout the dissertation, I have noted the various ways one could be subjected to techno-chrono-biopower, whether as a user of twenty-first-century media, as a citizen under algorithmic governance, or as a labourer mining for, creating, and disposing of the material gadgets. We have seen not only the labour performed by humans from various parts of earth along ICT circuits, but also the labour performed by earth through acts of mining and excavation. The dispossessed body, in this sense, is not limited to human bodies, but can also include the earth, its minerals, or the animist bodies of Aboriginal landscape that Povinelli (2016) has poignantly written about.

Jack Qiu, whose work I have discussed in Chapter 6, remarks that the industrial machinery of production serves the role of "concentrating and exporting labour

power from the periphery to the core regions of the capitalist world economy” (2016, 86). That is, the prosperity of the world economy is actually fuelled by the slave-like labour power in certain parts of the world. Likening this to the colonial slave trade, he recalls that the wealth and prosperity of Europe structurally stemmed out of the continuous suppression of subjugated colonial subjects (whether in Africa, the Americas, or Asia), and that a similar logic runs behind the perceived advancement of technology and the wondrous communications devices that allow us to be always connected, always online, for work, for leisure, for entertainment, for convenience. The bodies of the dispossessed enable some to reap benefit from the operations of twenty-first-century media, such as the companies that monetise the data gleaned from digital labourers, or the capitalists and militia groups making money off the backs of miners and factory workers toiling in slave-like conditions.

Similarly, Jonathan Beller (2018) provocatively suggests that today’s digital culture is “built on and out of the material and epistemological forms of racial capitalism, colonialism, imperialism and permanent war” (2). To him, the violence of inequalities is inscribed in the architectures of digital culture, and “on the bodies and lives of all who are other, particularly those of the Global South, and increasingly the rest” (*ibid.*). Quantification, mathematisation, and metricisation¹⁸⁰ amount to what Beller calls “computational capital”, the disavowal of personhood for the sake of capitalist gain. In Chapter 6, I made reference to Qiu’s analysis (2016) of the maximisation of space aboard the colonial slave ship¹⁸¹ *Brooks* and the highly rationalised mathematical calculations that took place to imagine the best way to stow human cargo. Beller takes on the same reference to colonial slave ships as a form of “first order digitalization by a racial capitalism” (10). Digitalisation, from this point of view, refers to the overlaying of representational code of mathematics on the body. The body is metricised in the form of a calculation to discover the best possible way to transport it for the Transatlantic slave trade. In a dehumanising manner with flagrant disregard for personhood, the black body is stripped of identity and becomes an object marked with a price for the slave auction—if the transported ever makes it across the Middle Passage.

Following Beller (2018), how does digitalisation, in the form of metricisation, continue to play a role in the act of dispossession? As observed by Nakamura and Chow-White (2012), “no matter how ‘digital’ we become” (1), problems of social inequalities organised along racial lines, amongst others, persist. In an effort to expand the frame of reference to Foucault’s biopolitics and to take heed from his postcolonial critics, I situate dispossession in today’s digital world amidst the genealogies of dispossession stemming from colonisation and imperialism. In Judith Butler and Athena Athanasiou’s *Dispossession: The Performative in the Political* (2013), they discuss the notion of dispossession in relation to questions of agency and performativity. The logic of dispossession, they explain, “whether it be colonial

or neocolonial, capitalist and neoliberal, endures by reproducing a metaphysics of presence in the form of the violence inherent in improper, expropriated, and dispossessed subjectivities” (18). Using Derrida’s ‘ontopology’, which links ontological value to particular topos, locality or territory, they talk about how the logic of dispossession is interminably mapped onto our bodies and in particular, bodies-in-place “through normative matrices but also through situated practices of raciality, gender, sexuality, intimacy, able-bodiedness, economy, and citizenship” (*ibid.*). One’s presence, as becoming present to oneself or to another, could also be a form of displacement.

How does this definition of dispossession map onto the experience of digital culture? In the act of profiling by algorithms that pre-figure what one would like to see on a given platform like Facebook, one’s identity is always-already pre-empted. Your history of ‘likes’, ‘follows’, and browsing activities pre-determines what kind of ads are fed forward, the composition and ordering of your timeline, and the list of pages suggested or ‘people you may know’. Under the politics of pre-emptive algorithms, certain bodies are seen as potential deviants, like criminals and recidivists. Bodies in this sense are becoming present under the confines of algorithmic processes that may or may not correspond to the actual identity of the individual. If a user is always-already pre-empted, pre-interpellated by the system, the becoming-present amidst digital networks becomes a form of displacement from the actual corporeal self and the identity one self-identifies with. To this extent, digital dispossession exists on a level that can be situated within the experience of twenty-first-century media, in addition to the narratives of dispossession through processes of exploitation, marginalisation, and discrimination critical theory is more familiar with.

Consider for instance Mark Poster’s description of internet identity formation from earlier years of internet research (2001) and how far we have moved from this rather positive statement on the possibilities of self-presentation on the internet.

Instead of the policeman–teacher–parent–boss hailing the individual in a manner that occludes the performative nature of the communication, in online communities one invents oneself and one knows that others also invent themselves, while each interpellates the others through those inventions. Unlike earlier forms of mediated communication, digital authorship is about the performance of self-constitution. (Poster 2001, 75)

In today’s media networks, bodies are hailed by the digital algorithms that compose the categorisation, profiling, and predictive psychometrics (like the OCEAN test discussed in Chapter 5), resulting in the erosion of the actual lived bodily identity. The self is reduced to the metrics of calculation, and the categorisation by the algorithmic. Ramon Amaro (2018) argues that this interpellation could be compared to the interpellation of race as encapsulated in the phrase, “Look, a negro!”, bringing this in conversation with Frantz Fanon’s work in *Black Skin, White Masks* (1986). Fanon gives a vivid description of how the black man “must be black

in relation to the white man” (110), suggesting how the body is pre-encoded by race and is addressed as such. Fanon expresses the difficulty to be recognised and seen as he is, rather than to be reduced by the colour of his skin, overloaded by the burden of history and the stereotypes associated with black men. Fanon referred to this experience as “corporeal malediction” (1986, 111), a bodily curse that negates his existence. In his study of digital racial identity, Hansen (2006) describes Fanon’s experience as “the estrangement of the self from itself, from its own constitutive embodiment” (150).

To the extent that one’s online existence is pre-encoded by the algorithmically-composed categories, one is indeed estranged from one’s identity. To Facebook, your participation on the platform is manipulated for traits that could better tailor ads suiting your personality, taste, and interest, so that it could monetise your time spent browsing Facebook. The metricisation and profiling (as referred to in Chapter 4) tirelessly calculate scores to determine the likelihood of a user’s interest in a particular ad, in order to maximise the amount of money Facebook could make off your use of the platform, befitting Beller’s description of “computational capital”. But there are other more serious forms of estrangement. To predictive policing, certain neighbourhoods are always already more prone to crime than others, placing those inhabiting the spaces under closer scrutiny. To predictive sentencing, those with criminal records and criminal associations (factors correlated with race, ethnicity, income) will most likely get a higher score for recidivism. Placed in the crosshairs of capture and surveillance, certain bodies are constantly seen and addressed as potential threats and as potential deviants. Through the camouflage of mathematics and statistical modelling, these systems identify individuals as subjects in more urgent need of biopolitical management and government. These identifications usually end up aggravating existing inequities along racialised, gendered, ableist, classist lines, leading to discriminatory practices that target the most vulnerable bodies amongst us. Like Fanon’s experience of his black body, these sub-groups in the population are displaced from their own embodiment and are likely to suffer a disproportionate experience of digital dispossession compared to more privileged groups.

Towards Resistance

Wendy Chun in *Control and Freedom* (2006) cautions against ascribing too much power to the digital dispositifs that surround us. This would, according to her, “unintentionally [fulfil] the aims of control by imaginatively ascribing to control power that it does not yet have and by erasing its failures” (9). Chun writes that “we need to insist on the failures and the actual operations of technology” (*ibid.*). I

agree with her assessment that by addressing the failures of the system, we may find spaces of escape and cleavages in the system that we could exploit as a way to resist the controls afforded by the digital. Yet we seem to be entering an age where even failure, like the failure to actually categorise a person properly, becomes a mode of control. For—the constitution of my online self may not correspond at all to my desires, thoughts, and choices in real life, but I would nonetheless experience the effects that the specific constitution elicits.¹⁸² This does not mean that we should encourage twenty-first-century media to increase their hold over our bodies by gaining more accuracy in their durational capture and analysis of our digital trails, but it is important to keep in mind that even failures may not signal the possibility of escape. Rather, it may shut one out from services with no recourse to challenge the blackboxed nature of algorithmic decisions made in a split-second, fed forward to the user.

How then may we resist the enclosures of techno-chrono-biopower and the subjectifications arising out of our interactions with twenty-first-century media? To answer this, let me return once again to Foucault's writings. In his essay "The Subject and Power", he notes the individualising force of biopower, whereby an individual is categorised and marked by a certain identity imposed upon oneself.

This form of power applies itself to immediate everyday life which *categorizes the individual, marks him by his own individuality, attaches him to his own identity, imposes a law of truth on him which he must recognize and which others have to recognize in him*. It is a form of power which makes individuals subjects. (Foucault 1984, 212; own emphasis)

In Foucault's oeuvre, the individualised identity is often that of the deviant, the degenerate, or the abnormal, interpellated by the forces of biopower. To techno-chrono-biopower, the identity is that which is defined through machinic vision, the composition of traits arising out of big data correlative regimes. It is the identity to which metrics of personality may be assigned through mining one's data trail and digital footprint. One is subjectified, governed, and subjugated to the powers performed by digital algorithms, in addition to the machinery of globalised economy that reproduce a long history of injustice and inequality.

The process of subjectification by biopower described by Foucault in the quotation echoes with the discussion above concerning Fanon's black body and the pre-encoding of bodies that estrange them from their own embodiment. In biopolitics, the individual is defined according to its position within a population, and is accorded a relative value in which certain lives matter more than others. In *Black Skin, White Masks* (1986), Fanon resists precisely the relative value of the black body that is superimposed onto his body, where the black man must always be considered as inferior and must always be subjected to the gaze of the white man. Resistance, according to both Foucault and Fanon, lies in the refusal against the categories that biopower has imposed upon the individual body. It is to refuse

the pre-constituted identity that biopower applies to its subjects, and to create new forms of subjectivity that exceed the restraints posed by discipline and biopower. In today's age, it is to revolt against the quantification and metricisation embedded in digital culture, and to reclaim the agency over the pre-emptive logics of power that colonise not only the present but also the future.

The question for today's emancipatory politics then, is how we could "enact a performativity of embodied agency, in which we own our bodies and struggle for the right to claim our bodies as 'ours'" (Butler and Athanasiou 2013, 178), against both dispossession in the flesh, and dispossession through our digital selves. In his call for digital abolitionism against modern-day slavery in ICT labour circuits, Qiu (2017) gives voice to the dispossessed workers of Foxconn, and does not reduce their representation to victimhood. Among these workers who struggle under the depressing conditions of their employment are also poets, writers, and singers, who find "cultural and political creativity" (2016, 186) in articulating their experiences of oppression. Through these processes they reassert their individuality and present themselves as "dignified selves" (2017). Likewise, we need to ask how we could find renewed agency in the midst of the displacement of our perceptive apparatus in time, and of our conscious decision-making power being replaced by electronic reason.

Against the tenets of techno-chrono-biopower, resistance lies in the fundamental right to self-constitution and to embodied agency in the age of algorithms—that we could free ourselves from the logic of quantification and metricisation that turn our existence into mere data points plotted on a distribution curve, from the mediations of time that turn into exploitative temporal oppression, and from the calculus that draws divisions in the global population, marking certain bodies as less worthy than others of thriving, living, surviving.

Coda:

An Incomplete Guide to Resistance in the Age of Algorithms

This is a short guide, a toolbox, for gestures of resistance.

It is incomplete, for the layers of dispossession are several, and resistance must be multiple.

Representing different trajectories and stakes in the digital landscape, programmers, designers, artists, hackers, and activists have offered various practical, critical tools that we could use to learn about, break through, subvert, and challenge the biopolitical regimes that characterise our data environments today. As a counterpoint to the abstract, theoretical discourse developed in the dissertation, I want to provide here a brief overview of tools one could actually pick up, install, and use, and to suggest several thought-provoking artworks and design objects we could think with. This list is non-exhaustive, and aims to supplement the brief theoretical meditation on resistance in this dissertation with examples in practice and existing concepts which help further flesh out what resistance might entail.

Reclaiming Time, Blacking Out

In *Pressed for Time: The Acceleration of Life in Digital Capitalism* (2015), Judy Wajcman discusses the sense of acceleration in contemporary life, in a milieu of digital networks. She is interested in the kinds of temporal rhythms people create with new technologies and the perceived sense of acceleration, and how these material experiences are co-constituted by the human and the machinic. To counter the incursions of technological rhythm into the day-to-day, Wajcman suggests notions of “temporal autonomy” and “temporal sovereignty” (164) as measures of

individual freedom. One must have control and autonomy over how one's time is used.

Temporal autonomy and sovereignty could be gained via reduced usage of our digital devices. This could also help minimise digital footprints. In recent years, the term 'digital detox' has become popularised, though it is part and parcel of the Silicon Valley jargon where one is encouraged to disconnect with mobile phones and digital devices to curb digital addiction and to 'reconnect' with nature and with other human beings.¹⁸³ A simple solution is to place reminders on the lock-screen. Designer Molly McLeod offers free wallpapers¹⁸⁴ to remind users to put down their phones (Fig. 34).

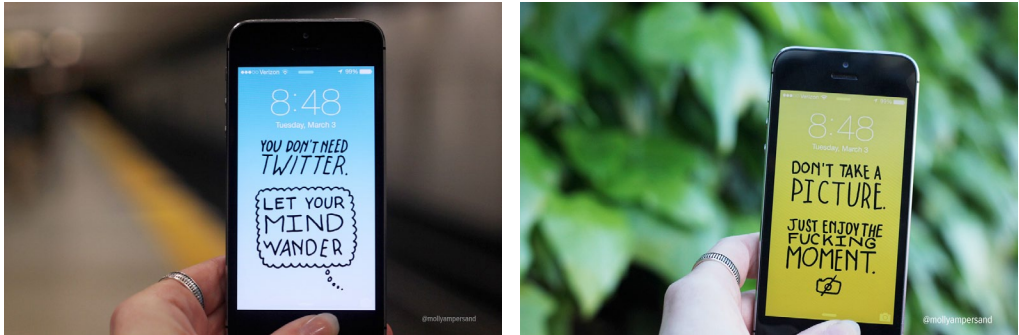


Fig. 34: McLeod's mindfulness wallpapers

Developers have also been busy creating apps on the phone¹⁸⁵ to help reduce the time people spend on their gadgets.¹⁸⁶ Open-source Android app *Peace of Mind* (originally developed for and pre-installed on Fairphone 1)¹⁸⁷ allows users to turn on airplane mode and mute all notifications for a set amount of time between several minutes to three hours. In productivity app *Forest* (also with Chrome extension), the user plants a seed and the longer the user stays on the app, the bigger the plant will grow and eventually it will become a tree. You can build an entire Forest with the trees grown. If the user leaves the app to check Facebook or do something else on the phone, a little notification will pop up enticing one to stay that says "Are You Sure to Give Up? This will kill your cute, little tree." If the user clicks 'Yes', the tree will die. The paid version of the app even involves leaderboards and an additional charity feature where the app partners with tree-planting NGOs to plant real trees with the virtual coins users earn over time.

For a non-digital project, Sarah Berkeley, at Nebraska Wesleyan University, runs a yearly participatory art project DATA BLACKOUT since 2012. Participants voluntarily join the project and "[create] a hole in the transmission of digital data from specific locations for 24 hours. Participants refrain from transmitting traceable

data for 24 hours. That means, no cell phone, no internet, no key fobs, no debit or credit cards, no TV may be used during this time" (Berkeley, n.d.). The artist sees the project as an opportunity for participants to become more intentional about the pattern of data they transmit in their daily lives. This include not only digital trails from internet browsing and social media, but also purchase records from debit cards and loyalty card schemes, involving objects and devices beyond our phones and computers. Through the 24-hour data blackout experience, participants figure out how life is like without volunteering all of the information about themselves to private companies and to governments. They record their experiences on cards (Fig. 35) which form part of the archive of the project.

USA
Equality FOREVER
For better or worse, the internet provides a huge amount of content in my daily life. Cutting that out opened up time for other tasks that I tend to ignore (ironing) and gave me time to read and work on art projects.

The most difficult part is turning off the cell phone. It is the only way I stay in contact with friends and loved ones. Being cut off from that led to a productive, but lonely day.

• Transmit no traceable data for 24 hours •
• No cell phone, no internet, no key fobs, no debit or credit cards, no digital TV •
• Perform all usual activities to the best of your abilities •

www.datablackout.com

Postmark: LINCOLN NE
From: Michael Bourke, 3216 Lindon School, Albuquerque, NM 87112

Berkeley Projects
1321 S. 18th St. #1
Lincoln, NE 68502

Were you able to complete 24 hrs without transmitting traceable data? Was there more spontaneity? How inconvenient was it to not use these things? Did it affect your life at all?

The data blackout was both easier & harder than expected. I turned my phone off at 6pm Thurs. and on again at 10pm Fri. During that time I made no transactions, looked nothing up, and did not use a screen of any kind. However I found that there was so much data usage around me, that to really feel the effects of a data blackout, I would want others around me to participate.

I realized, when I visit ^{family} ~~home~~ I often abandon my phone & computer television, & rarely make transactions. To repeat the experiment in the city during a regular week would be much more challenging. I really do treasure the time periods, almost guiltily, of choosing not to be.

Place this card in a drop box at NEW CAPITAL 3114 W. Carroll, at SAIC 37 S. Wabash (Rm 316) or mail to address on reverse side.



Fig. 35: Impressions from DATA BLACKOUT participants

These examples give a sense of how one could reduce phone usage and reclaim time outside of the active use of devices and other technologies that leave data trails. However, devices still generate data trails even when one is not actively using one's phone. One possibility for data blackout from this perspective is to make use of a Faraday cage to store devices in so they cannot transmit signals durationally. A Faraday cage (Fig. 36) can block electromagnetic fields and is usually made of a conductive material or a mesh of such materials.

Coda

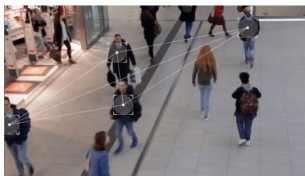


Fig. 36: Adam Harvey's Faraday phone case *OFF Pocket* (V&A Museum London)

Artist Jochem van Schip reimagines a black coat which helps with anonymity against twenty-first-century media surveillance in his *coat/code* project (2017) (Fig. 37).¹⁸⁸ The coat includes a fabric Faraday shield pocket specially tailored for smartphones, which is a method to create opacity¹⁸⁹ when out and about. This does render the phone useless in receiving calls and messages and it would only connect to phone networks outside of the shield, but it gives the wearer the power to choose when to be reachable by phone.

/coat

'coat' provides offline anonymity through a coat/jacket.



/blends in with the crowd

The outside is designed to blend in with crowds; think of your average John in the street with a unisex mid-weight jacket.



/posturechanger

The inside holds a well-hidden harness that interferes with gait recognition technologies that are deployed by high tech surveillance cameras in the streets and in transit hubs all over Europe.



/untraceable

The jacket also contains a faraday shield that blocks signal surveillance on smart phones.

Fig. 37: *Code/coat* features

Code/coat illustrates another important strategy for resistance that lies in the obfuscation of our digital trails and to hide our activities and bodies from the twenty-first-century media objects that always seek to capture and record what we do. Obfuscation, is the “deliberate addition of ambiguous, confusing, or misleading information to interfere with surveillance and data collection”, as defined by Finn Brunton and Helen Nissenbaum’s *Obfuscation: A User’s Guide for Privacy and Protest* (2015). Van Schip’s coat has a special harness inside which renders the wearer’s movement unrecognisable for motion analysis algorithms. Such posture-masking obfuscation would come in handy in locations equipped with these special surveillance cameras.

Spoofing is another obfuscation technique. Since 2016, artists Adam Harvey and Surya Mattu have been working on *SkyLift* (Fig. 38) which is a WiFi micro-controller that replays Wifi signals for geolocation services by broadcasting MAC addresses that are associated with WiFi routers in a different location. The spoofing overpowers the phone’s GPS and cellular triangulation, so that with the device, the user can appear where the chosen broadcasted router is. For the artists’ prototype, they used the MAC address of a router inside the Ecuador Embassy in London, where WikiLeaks publisher Julian Assange takes refuge. Such a device could disrupt geolocation data and mask the geography of one’s movement in physical space. The artists have published DIY guides on Github for hands-on experimentation, and they strive to make such a tool easily learnable and available for those who are interested.



Fig. 38: *SkyLift* (early prototype)

Both obfuscation and opacity are strategies we could take up in our general day-to-day usage of the internet, in terms of privacy protection and data encryption. By activating Virtual Private Network (VPN) services, one could mask IP address and access location. The TOR browser allows for anonymous browsing by encrypting communications and obscuring the source and destination by bouncing traffic around a distributed network of servers. Authors Brunton and Nissenbaum (2015), as well as Birchall (2017) recommend browser extensions like Ghostery and Privacy Badger which block trackers and disable cookies, tags, and beacons. Google and Facebook, amongst other platforms, place many trackers on other websites¹⁹⁰ so that the companies would also get a record of browsing activity outside of their services.¹⁹¹ There are also alternative search engines such as Duckduckgo and StartPage which protect users from being tracked and profiled the way Google search catalogues consumer and user profiles and browsing habits. TrackMeNot is a browser extension that renders the tracking ineffective by flooding search engines with random search terms. AdNauseam is an browser plugin ad-blocker that would 'click' on all blocked ads in the background. This would diminish the value of tracking the user's ad preferences and hide the real clicks amongst the automated clicks.

It is also recommended to switch to messaging apps that support end-to-end encryption of data *and* metadata like Signal, and to subscribe to encryption services like Boxcryptor that works with Google Drive, Dropbox, iCloud Drive, etc. More details of some of these suggestions are available in the *Surveillance Self-Defence Guide*¹⁹² published by the US-based Electronic Frontier Foundation, a non-profit digital rights group.

Gaming for Awareness

Gaming for awareness fights against the gamification of our behaviour (like goals and targets set up by QS devices to encourage 'healthier' habits like more walking and less sedentariness). Rather, these games aim at increasing awareness towards digital dispossession, and a better understanding of the bodies who are susceptible in a techno-chrono-biopolitical regime. The first game, an older example designed by Molleindustria,¹⁹³ is digital and intended to be played on the smartphone, while the second game I discuss is a forthcoming board game designed by activist-artist Janna Ullrich.

The digital game is *Phone Story*, which aims at provoking critical reflection on what happens beneath the shiny gadget we hold. The player gains insight of the global supply chain I critiqued in Chapter 6. The player is made to go through four levels of the game: coltan extraction in Congo, exploitative labour

in Foxconn China, e-waste processing in Pakistan, and gadget consumerism in the West. During the gameplay, a robotish voiceover narrates the dark side of phone production, providing further background information on the scene before the player's eyes. During each round, the player has to attempt to complete the set goal within limited time. In Congo, the player needs to keep child miners working at gunpoint; in Foxconn China, catch suicidal workers jumping off a building with an anti-jumping net so they could walk off in safety (Fig. 39); in Pakistan, sort out different used parts in e-waste processing, and in the West, the player shoots crazy consumers with iPhones. If the player fails a level, the voiceover would point out—"You did not meet the goal, don't pretend that you are not complicit!" The game is not fun, but the charming 8-bit animation and the dark humour bring lightness to the heavy subject matter, and it is beyond doubt an educational game.

Jack Qiu, whose writings on labour I have relied upon, uses the game in classroom settings. His students have expressed that they "get a firsthand feeling of how life feels like when they are out of control, 'programmed' by some inhumane power" (2016, 166). This inhumane power can precisely be seen through the techno-chrono-bio- and necro-politics I have discussed in the dissertation. Qiu sees this game as an instance of an incipient digital abolitionist movement—solidarity against the oppressive systems in the circuits of ICT labour through consciousness raising, activist networks, and the empowerment of dispossessed workers.



Fig. 39: Screenshots from *Phone Story*

Quantified, by Janna Ullrich, is a cooperative board game set in a smart city in the near future, where gamers play citizens who have to gain human rights and fight against a government that constantly monitors citizen behaviour (Fig. 40). The government seeks to capture and analyse citizen data and implement laws encroaching on civil liberties and democratic citizenship, until it achieves totalitarian rule. The four characters living in this dystopian world are ‘algorithmic citizens’ who occupy different positions on the social ladder, including a refugee, a migrant, an unemployed person, and an employed person. Their movement on the smart city board and actions like working and communicating leave behind data traces (each step a coloured crystal), which at the end of each round are ‘uploaded’ to the data analysis centres. When the amount of uploaded data exceed a certain level, an analysis card is triggered whereby the character is likely punished because analysis has shown an undesirable habit that needs to be corrected. For instance, a health insurance company has analysed geo-data, heart rates, and grocery purchase records and punishes the character with a higher premium due to lack of workout and an unhealthy diet. Or text-mining algorithms have determined that the communication between the character and his/her spouse as too formal for an authentic relationship, and therefore demand a return of all marriage tax benefits. Threats occur throughout the gameplay, e.g. when data analysis centres ‘share’ data with one another, causing uploaded crystals to move from one centre to the next (for instance, movement data and communication data combined), or when rights are made harder to attain—e.g. the threshold to the right to work may be raised



Fig. 40: *Quantified* (Art by Aaron Fernandez) with Analysis Card Prototypes

because the government wants to allow private companies to screen out lower-scoring citizens algorithmically during job application processes. To win the game, gamers have to work together to help all characters gain four basic human rights (the right to movement, the right to work, the right to communication, and the right to privacy), while challenging threats posed by the system, and preventing the system from implementing totalitarian laws.

The game is developed in consultation with experts such as privacy lawyers, philosophers, and IT-experts from the Privacy & Identity Lab at Tilburg University, international security researchers from the Institute for European Studies, and sociologists and communication scientists from the Centre for Political Communication at the University of Amsterdam. Apart from the insight into technology, the game design cleverly engages with a longer history of dispossession and existing inequalities, placing the refugee character at the bottom of the social ladder with no rights in the beginning of the game, making it the only character who are blocked by certain walls built inside the smart city. The government also has a tendency to target deviants, whether in mental health, appearance, or marital status, threatening to send them to correction camps. In play-testing sessions, gamers have expressed the difficult bind when deciding between actions that may help win the game, but require the creation of many data traces. Performing the action often means that one can fight against a temporary threat, but the action would lead to data over-exposure and subsequent punishment through the analysis cards. Sometimes, it is only through flagrant disregard for one right that another human right could be achieved. There is no easy solution to winning the game, but gamers definitely learn quickly that they need to achieve the right to privacy so as to earn encrypted opaque data crystals to shield themselves from algorithmic analyses.

In *Quantified*, the processes of digital capture, surveillance, and algorithmic governance become proceduralised into game play, a kind of “slow dramaturgy” (Eckersall and Paterson 2011) that allows these otherwise too-fast material processes to become perceivable. As Eckersall and Paterson explain, slow dramaturgy brings focus to banal everyday experiences while enabling an awareness of time and a reorientation of sensory perceptions. In line with other movements like slow food and slow living, it could be seen as a political response to the speed of global culture and ‘fast’ subjects emerging as products of neoliberalism. I borrow this term to describe this game for it indeed slows down the operations of twenty-first-century media, bringing algorithmic steps into the folds of phenomenological experience. Through this, it fosters literacy of digital systems and an understanding of the structures of oppression created by algorithmic governance, unveiling what goes on behind the scene in our everyday use of technology.

Other Senses, Other Perceptions

Indeed, one of the key issues I have highlighted throughout the dissertation is the impossibility to perceive the scales of temporal oppression and violence committed in the too-fast of datafication and algorithmic governance, and the too-slow of environmental degradation and toxic build-up. I turn to two artworks which attempt to intervene precisely with the problem of imperception, making sensible and perceivable two scales of speed I have referred to. Shintaro Miyazaki's *Algo-rhythmics* project¹⁹⁴ makes audible algorithmic processing, while Tega Brain's *What the Frog's Nose Tells the Frog's Brain*¹⁹⁵ (2012) renders the use of technology and its material toll on earth smellable.

In collaboration with Michael Chinen, Miyazaki developed an open source programme and learning tool called *AlgorhythmicSorting* (Fig. 41). It targets sorting algorithms like bubble sort, merge sort, heap sort, quick sort, among others, and renders them into audible sounds and visible colour blocks. On screen, we can see the colour blocks, representing different numbers, being sorted. They are moved around by the sorting algorithm and will change colour when they are swapped around, moved, or changed. The values of the numbers are mapped to pitch, and the higher the number, the higher the pitch. The short musical sequence will end for instance when the algorithm has finished arranging all number blocks in ascending order. The duration of the sequence depends on how large the set of values to be sorted is. Many sequences ended before I could even understand what was being sorted, and in some all I could hear was a deluge of rhythmic and overlapping tones and beeps. Miyazaki attempts to slow down the technomathematical dimensions of signal processing into a phenomenological experience of sound, sensitising his viewers to the hidden rhythms of contemporary digital and data-based infrastructures. The project makes me wonder what algorithmic governance or big data processing would *sound* like in real-time, and if the sounds would feel like an assault to the senses, much like how these sorting algorithms are if one should listen to them on loop.

Another project which appeals to the senses is Tega Brain's scent-piece *What the Frog's Nose tells the Frog's Brain* (2012) (Fig. 42). The artist created an experimental device that monitors electricity use of the building where it is housed. When the device detects an increase in electricity usage above a predefined threshold, it would deploy a scent in the gallery space. The scent is created from cade oil, which smells acrid and smoky, and visitors have referred to it as the stench of burning rubber. Electricity use, of course, is connected to the unsustainable extraction of fossil fuels, and the violence of mining to earth, reminiscent of the critique advanced above in reference to Nixon's 'slow violence' (2011) and Povinelli's geontologies (2016). An allusion to the 'frog in boiling water' analogy, the artwork uses scent to remind

viewers that when we destroy the environment, we are equally diminishing our own chances of survival.

The artist explains that smell is a primal mode of communication that can generate strong gut reactions, and when we smell something burning, we are immediately in a state of alarm. Because of this, Brain sees potential in exploiting the connection between scent and reaction for the design of information interfaces that evoke affective responses. In this case, the work calls attention to the electricity demands in the everyday and the ensuing environmental issues whether in the form of over-extraction or climate change.

Both works attempt to intervene on the level of sense-making to make audible and smellable the infrastructure of the twenty-first-century media world in the Anthropocene. To borrow Jacques Ranciere's term, these artworks offer the possibility of the redistribution of the sensible (2004), where the corporeal sensorium is reorganised through the experience of an aesthetic object. The object creates potential new bodily capacities through opening up the senses, and thus holds emancipatory potential in its rupturing of bodily experience.

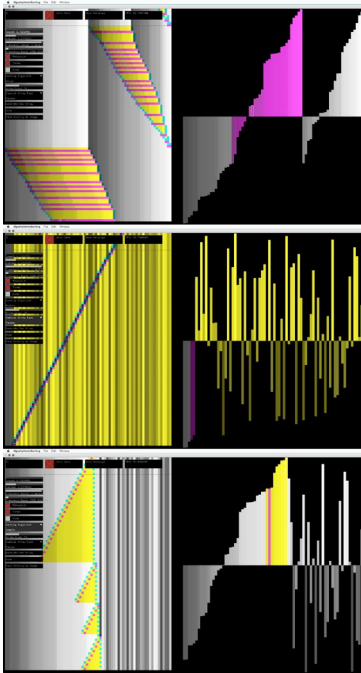


Fig. 41: Shintaro Miyazaki and Michael Chinen's *AlgorhythmicSorting*



Fig. 42: Tega Brain's *What the Frog's Nose tells the Frog's Brain* (2012)

Visualisations: A Peek inside the Blackbox

Perception through the visual remains important too for the redistribution of the sensible. Seeing what data has been collected helps increase literacy of data politics in today's age. Even the simple act of downloading Facebook's own compilation of user data allows for a better grip over the platform's recording capabilities—I was curious what Facebook would tell me about my archive in the past twelve years I have been on the platform. Even though the record is totally incomplete and obscures much of the data the platform captures,¹⁹⁶ to have the long list of IP addresses and device identifiers and all the interactions (or past relationships) I have forgotten about (but Facebook hasn't) makes for a rather sobering experience.¹⁹⁷

Next, I would like to introduce a set of tools which allow for momentary peeks into the proprietary blackboxes of Facebook and other platforms. These tools help us gain insight into what data and metadata is actually captured as well as what the data seems to suggest about you. They give a sense of how the logic of capture, as discussed in Chapter 4, functions on social media platforms.

University of Cambridge's Psychometrics Centre developed a tool called *Apply Magic Sauce* that predicts one's psycho-demographic profile from digital footprints. I have discussed the psychometric OCEAN test in conjunction with Trooly's predictive trust algorithm, when measures for openness, conscientiousness, extroversion, agreeableness, and neuroticism. By allowing the Cambridge tool to pull available data off one's account on Facebook and Twitter, it reveals how one might be perceived by online marketers and provides detailed insights on predicted age, political affiliation, personality, intelligence, life satisfaction and more (Fig. 43).¹⁹⁸

My Twitter profile, which I use for academic work including live-tweeting conferences and posting 'Call for Papers', understandably shows me as an older

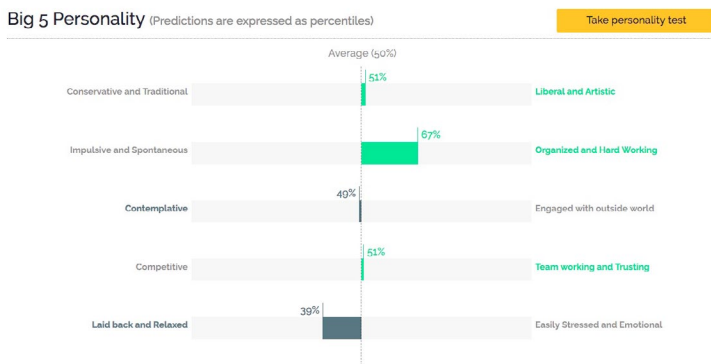


Fig. 43: Author's OCEAN metrics based on Twitter

person than my Facebook account for personal use. Twitter's data also tells the Apply Magic Sauce tool that I am 95% psychologically male, while Facebook's data suggests that I am a female user. It is interesting to see the discrepancies in the data and the obvious errors made, even though as I have argued, mistakes are simply further fed forward into the system. Whether these OCEAN metrics accurately portray who I am is secondary to the interpellation effect this creates, making my online identity one that is always already metricised and subsumed under the logic of the pre-coded categorisations.

Another visualisation tool is *Data Selfie* made by the activist collective Data X,¹⁹⁹ with funding from New York City Economic Development Corporation, the Mayor's Office of Media and Entertainment, and the NYC Media Lab. The *Data Selfie* is a browser extension that provides a personal perspective on the data mining and predictive analytics that Facebook undertakes. Even though the activists do not make use of Facebook's native algorithms, they have built ones which mimic their function, showing what one has shared unconsciously with the platform.

Based on what one has looked at, liked, clicked, and typed (including private messages), the extension records specifically "clicks on likes in your newsfeed, clicks on newsfeed links to external sites, duration spent on different posts and the specifics of those posts (authors, images and text) in your newsfeed, anything you type, and time spent on Facebook overall" (*Data Selfie* 2018). The more you use Facebook, the more data is recorded. For instance, the metadata of time spent (in sec) on pages' posts and time spent (in sec) on friend's posts are captured and listed in terms of the amount of seconds in total spent on a particular page or a particular friend's page. The data and metadata is analysed and visualised on the Data Selfie dashboard (Fig. 44) and you can get a sense of what Facebook predicts based on the data.

These visualisations bring into perception the data trails we have left behind in social media usage, providing a better understanding of what has been recorded in twenty-first-century media's durational tracking of our lives.

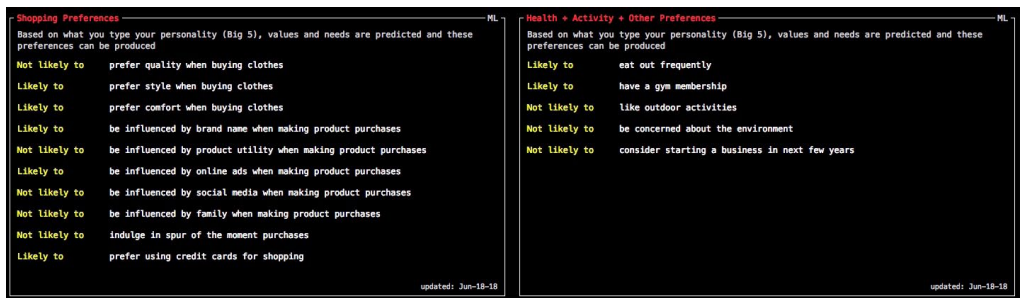


Fig. 44: A snapshot of the author's Data Selfie

Appropriating the Blockchain

The next strategy I consider is appropriation. Here I ponder upon the possibilities of using twenty-first-century media infrastructure differently and appropriate ubiquitous computing for a better cause. In particular, I want to consider the possibilities of supply chain management for minerals, looking at the materialist dimension of techno-chrono-biopower that I have analysed in Chapter 6. As I have noted, supply chain management for minerals is notoriously difficult, and miners are often exploited by the middlemen (*négociants*) and the minerals change hand many times before they reach the big international market buyers (Fig. 45).

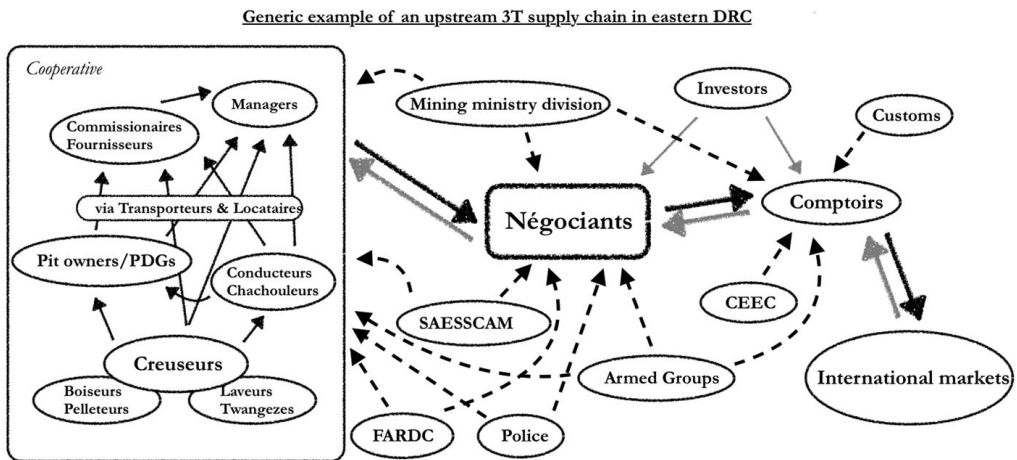


Fig. 45: The original caption reads “The left side shows the mine level, often with cooperatives framing a multiplicity of actors. Black arrows indicate the flows of raw minerals, grey arrows the associated (pre-)financing. Dashed arrows indicate state agencies’ and security forces’ taxation and control. With the *négociants* in the centre, the thicker arrows indicate the key commercial transmissions in the supply chain.” (Vogel and Musamba 2017)

Négociants are intermediary traders who purchase minerals at the mines and then re-sell them in urban centres. As the middlemen in the supply chain, they link miners (*creuseurs*) and cooperatives with trading houses (*comptoirs*). *Négociants* are middlemen who can be separated into two categories, those connecting with regional hubs, and those limited to local trade around mines (*managers*, *chachouleurs*, *commissionnaires* or *fournisseurs*). This map shows the complex interactions around the minerals and the large categories of actors involved, from weak monitoring of official state agencies in the eastern Democratic Republic of Congo (SAESSCAM, the Service d’Assistance et d’Encadrement de l’Artisanal et Small-Scale Mining, and CEEC, the Centre d’Expertise, d’Evaluation, et Certification) to the terrorisation by corrupt police, militias and armed groups.

Dispossession on the production end is a pressing issue for our times. Social enterprise company Fairphone conducts research, works with other NGOs and initiatives, and tries to source certified conflict-free minerals to make their phones, but this is not a common practice for most electronics companies. Part of Fairphone's philosophy is to create best case practices that would hopefully inspire change in the electronics industry and disrupt the practices today. In addition to supply chain management of minerals, they endeavour to improve employment practices and health and safety in their factories in China, establishing Worker Welfare funds and supporting unionisation of workers. Their current phone model, Fairphone II is the world's first modular phone designed to last, and can be easily repaired. They also made the system open-source to improve transparency, longevity of device, and increase sense of ownership by users. Despite the good effort they have put into promoting sustainability, the company actually had to discontinue support for their first product, Fairphone I,²⁰⁰ which proved to be economically inviable because the client base was too small and the parts too specific to source and keep an inventory of. This is no doubt a huge disappointment to the loyal following of customers including myself, but it clearly shows the level of challenge and the inescapable market forces that ultimately affect the running of the company.

The question here is whether the very technology that deals a hand in the oppressive structure of techno-chono-biopolitics could be appropriated for liberatory purposes. In the past decade, blockchain technology has matured and become more widespread, partly popularised through the trade of Bitcoin and other cryptocurrencies. Blockchain is a distributed database that holds records of digital data ('blocks' of information) across multiple computers in a network, making it virtually impossible to change or delete data once registered. Other computers on the network would be able to access the information, inspect, or add to the data. The blockchain uses this distributed technology as the 'witness' to transactions recorded and removes the need for an external intermediary to play an overseeing role. In January 2018, logistical giant Maersk Line and IBM announced a joint venture to apply blockchain technology to Maersk's global logistics of trade and transportation.

Blockchain technology is lauded for its traceability, which can validate journeys of data like orders, contracts, shipment information, etc. Proponents suggest the use of electronic tracking technology like RFID tags to automate the process, and to generate electronic smart contracts that could ensure automated payment and on-time delivery. Even though it remains to be seen whether the implementation of blockchain would have an actual effect on mining processes and mineral trade, and how to enforce the usage of said technology in the supply chain itself, this seems at least to hold potential to improve supply chain management in the near future, a technological solution to a problem created by our demand for technology.

Perhaps the convoluted process of the supply chain as shown in the figure above could one day be banished to the recesses of history, and blockchaining could provide the much-needed transparency of the process particularly to the individual miners who find it difficult to even know what prices their ores fetch and what their labour is worth. We may as well appropriate the computational infrastructure of twenty-first-century media to actually improve labour conditions and secure supply chain monitoring as an established practice for ICT labour. If blockchains prove to be useful in improving supply chain management, it could become a key step to Qiu's advocacy of the digital abolitionist movement (2016).

'YOU'

I end this brief exploration on resistance with 'YOU'. 'You' may also be part of the resistance movement that is gaining momentum. 'You' can join civic groups in your community, attend consultation meetings on smart city initiatives, and educate yourself about twenty-first-century media. There are many more resources out there by university labs, citizen initiatives, and activists that I have not captured in this incomplete guide. There are laws being debated, policies formed, from anticipatory governance networks to data protection acts.

Wendy Chun (2016) has repeatedly emphasised the position of the "YOU" in digital culture: the You of YouTube, YOU as *Time's* person of the year in 2006.²⁰¹ "YOU are a character in a drama called Big Data" (Chun 2016, 23), she says. What can YOU do then as netizens in this drama? Would YOU stand up against the oppression and dispossession that are not only new issues generated by the infrastructures of twenty-first-century media, but are also older circuits of power and injustices committed upon othered bodies that have persisted?

The research conducted whilst preparing this dissertation has been a humble education about the digital world that I am immersed in and yet still so unfamiliar with. It is not enough to be a critical scholar armed with a critical mind. Tara McPherson rightly points out that

In extending our critical methodologies, we must have at least a passing familiarity with code languages, operating systems, algorithmic thinking, and systems design. We need database literacies, algorithmic literacies, computational literacies, interface literacies. We need new hybrid practices: artist-theorists; programming humanists; activist scholars; theoretical archivists; critical race coders. (2012, 35)

There is so much to learn, and new inventions come onto the scene every day. The first step to countering the power of the technological is knowledge. Only when armed with knowledge can we create alternatives for the better. I hope that this short, incomplete guide has offered a glimpse of such alternatives, and of lines

Coda

of flight one may take to escape, however momentarily, the grips of techno-chronobiopower. Foucault has insisted that where there is power, there is resistance. May this resistance begin with YOU.

Notes

Introduction

1 Germany, in the meantime, has banned these devices from being used in the country for privacy concerns. Telecommunications regulators at the Federal Network Agency call them ‘unauthorised transmitting systems’. See further BBC report, Wakefield 2017.

2 The data recorded is usually subsequently anonymised and sent to the company servers of smartwatch manufacturers, or packaged and sold off to third-party data brokers. I will discuss further the capitalisation of data in Chapter 4.

3 Details of how it works can be found in a Guardian report (Gibbs 2016).

4 See also Tunghui Hu’s work (2012) on ‘real-time’ where the author unveils the mediated nature of ‘real-time’ that is never actually live-relayed but always delayed in signal traffic. In this sense, real-time, as a phenomenological experience, is always already mediated, and may be better characterised as an illusion of real-time.

5 For instance, artist David Michalek created the “Slow Dancing” project where he shot dancers’ movements for only 5 seconds, but on a specially constructed set with a high-speed, high-definition camera which recorded at 1,000 frames per second. Stretching a 5 second clip into a 8-12 minute video, the subtleties of a dancer’s movement in executing a jump or turn become apparent to the naked eye, showing not only continuous and fluid phases of muscle coordination, but also discontinuities in the minute shifts the dancer takes. The video-capture technology enabled what is usually imperceptible to be brought into the regime of

experience. Another example can be found in Douglas Gordon's *24 Hour Psycho* in which Alfred Hitchcock's film is slowed down so that the viewing of the film lasts exactly 24 hours. These examples demonstrate the potential of media technology to manipulate our ability to experience time and to offer a different way to apprehend the phenomenal world. Through mediation, one may be able to access time-scales which are normally outside of our level of apprehension.

6 Husserl's time-constitution thesis is relevant here. Three terms primal impression, protention, and retention, are employed by Husserl in order to explain what the temporal structure of consciousness entails. Primal impression refers to the first moment of an experience, like a music note. Protention refers to the anticipation towards the immediate future while retention is the immediate past fading out of the primal impression. It is with protention and retention that one is able to listen to the music note as a duration after the primal impression (the first moment of recognising the sound). Through these terms, Husserl attempts to construct a picture of how consciousness functions from a temporal perspective, specifically how human consciousness perceives time. The development of his thesis on time can be found in Husserl (1991).

7 Hansen (2015b) makes use of a copious amount of Whiteheadian vocabulary. While the dissertation relies on his definition of twenty-first-century media and his observations of their defining features, it will not engage specifically with the Whiteheadian concepts activated in the book.

8 In Chapter 2, I will explore the object of AlphaGo and its winning streak against human Go players, which is a defining example that shows the reach and capabilities of computation in the domain of machine-learning.

9 See also Fuller's definition of media ecology (2005).

10 For a detailed analysis of these human-centric accounts of temporality, amongst others, see Hoy 2012.

11 I use the term 'computer machines' to broadly refer to all computational gadgets including smartphones, Quantified self gadgets, the Internet of Things, and of course, laptop and desktop computers.

12 'Natural time' is commonly used in the discourse to reference how time is told and understood pre-industrial era without relying upon objects of measurements. Terms like 'nature' and 'natural time' are placed in inverted commas in the dissertation to show that these older literature references somewhat rely upon an essentialised notion of nature.

13 I use this term in the context of Martin Heidegger's "The Question Concerning Technology" (1993, 322-324).

14 Performance in this sense includes both the performance standard in labour, as well as the material bodily performance. It is norm-building in the sense of Jon McKenzie's work (2001). These ideas will be built further in the dissertation.

15 Other forms of surveillance are of course also in place. To prevent theft in the warehouses, CCTVs are installed everywhere and workers have to regularly walk through airport scanners and are subjected to random searches. These descriptions also ring true in the factory complexes of Foxconn, which i will discuss in further detail in Chapter 6.

16 See further Seyfert (2018).

17 Brian Massumi terms this future-oriented mode as 'onto-power' (2015), a modifier of biopower. This future-oriented, feed-forward mode of operation of twenty-first-media and the biopolitical effects will be major focus points of Chapters 4 and 5.

18 See New York Times report by Belluck 2016.

19 Of course Dopamine Labs also develops an app called Space to help people get off the very same addictions their main product purportedly creates.

20 Big data is defined in terms of 4Vs, volume, velocity, variety, and veracity. Big data is big because it could compute datasets that are too big for traditional software analyses. See further Chapter 5 for a closer discussion of big data and prediction.

21 Pasquinelli compares the regime of visibility here to Foucault's panopticon. His argument is further analysed in Chapter 4.

22 Commentators have observed that Foucault's use of the term "biopolitics" is not consistent and sometimes is interchangeable with the term "biopower" (Lemke 2011, 34). Here I define "biopolitics" as the study of "biopower" and "biopower" as the mechanisms and dispositifs of power at work.

23 Performance scholar Jon McKenzie re-interprets Heidegger's notion of 'challenging-forth' as a challenge to perform, to reach a certain performance standard, to be efficient and to have efficacy in carrying out tasks. Discipline, in his perspective, has intensified into performance, invisible challenges to perform to certain standards.

24 In media theory, biopower is referred to sporadically but the number of works dedicated to the import of Foucault with a sustained engagement with

biopower and biopolitics is limited. Because of this, the dissertation is oriented towards Foucauldian theory and builds upon the original works. Foucault's work, however, has remained significant for instance in related fields of gender, postcolonial, and critical posthuman theory, some of which I would be looking at in the course of the dissertation.

25 Hansen (2012) uses a significant portion of the article to investigate Foucault's relation to Gilbert Simondon's theorisations on individuation and disindividuation. He also tries to dissect what individuation means in terms of the population thinking Foucault discusses in relation biopolitics.

26 This question of resistance is a point to be returned to at the very end of the dissertation, as I consider the possibilities of going against the increasing hold of techno-chrono-biopower in the contemporary age.

27 Parikka refers to the works of Erkki Huhtamo, Siegfried Zielinski, Thomas Elsaesser, and Friedrich Kittler as more established and hence 'traditional' media archaeological research. Wendy Chun, Matthew Kirschenbaum, Wolfgang Ernst, Jennifer Gabrys, amongst others, have been named as representatives of more open and contemporary approaches.

Chapter 1

28 According to Wallenstein (2013), the term is attributed to Swedish political scientist Rudolf Kjelleń, who invented it to describe the ways social groups struggle to survive as well as cooperate with one another that makes up the life of the state. Such social groups are conceived as 'life-forms', based on organicist and biological conceptions of the state.

29 In a Special Issue in the *Journal of the History of Sexuality* (2001), Boyari and Castelli proposes considerations of a future volume of *History of Sexuality*, in order to update Foucault's discussions on sexuality for today. It is with the same impulse that I pursue the subject of biopolitics for the digital age, following the footsteps of many other scholars who have attempted to modify and adapt Foucault's theories for contemporary times.

30 These periodisation usually include the "archaeological" period, the "genealogical period", and the "history of Subjectivity" period. See Nealon 2008, 2.

31 This understanding is also helpful in studying elaborations of biopolitical theory developed by Foucault's contemporaries. Deleuze (1992) in particular demonstrates the intensification hypothesis by referring to the wide-spread nature of power, as free-floating, and as emergent across various dispositifs. Similarly,

Hardt and Negri (2001) discusses the dispersal of sovereign power into multinational, global circulations of power as ‘empire’. In this sense, the contemporary development of biopolitical theory through analysing the increasing number of dispositifs under which biopower is operant hints at the intensification Nealon is proposing.

32 I take Mbembé’s account as the primary source for understanding necropolitics, in spite of the heavy focus on death also found in Agamben (1998). Mbembé distances his work on necropower from Agamben also due to the location of sovereignty in Agamben’s work which is primarily within the boundaries of the nation-state. See also n_ below. Other accounts of necropower can be found in biopolitics literature on animals, such as Cary Wolfe’s work (2013) on human-animal boundaries.

33 In Chapter 6, I also consider the work of Elizabeth Povinelli (2016) who recasts biopower in a materialist geological framework, and argues that a line is drawn between what is considered life and non-life. She proposes the term ‘geontology’ to denote how the ‘bio’ in biopower could be reframed as ‘geos’ to consider also the effects on inorganic matter. Her account takes this argument on biopolitical racism into a different dimension, adding to Mbembe’s now widely-known work on necropolitics (2003).

34 The theories and concepts I will refer to include societies of control (Deleuze 1992), empire (Hardt and Negri 2001), performance (McKenzie 2003), necropolitics (Mbembé 2003), slow death (Berlant 2011), ontopower (Massumi 2015), geontologies (Povinelli 2016) and psychopolitics (Han 2017).

35 In the introduction, for instance, I have discussed what fast-track or next-day deliveries on systems like Amazon in fact mean for the workers in their warehouses, and the labour it takes and exploits in order to support the purportedly speedy and seamless delivery service.

36 These cultural definitions of time can also be placed in conversation with clock technologies such as timezones and the politics therein. As will be discussed in Chapter 3, using Greenwich Mean Time as the zero-point suggests an orientation of London being the centre of earth, that in a way elevates the status of London compared to the rest of the world.

37 Note also here Jack Halberstam’s seminal work *In a Queer Time and Space* (2005) here to consider queer subjectivity’s relationship to time, as he discusses the non-normative logics of queer life that lie outside of birth, marriage, reproduction, and death.

38 Taking cues from Deleuze, and Hardt and Negri's approach to biopolitics, this account does not take biopower to always be inscribed within the sovereign, such as the sovereign's jurisdiction over inclusion and exclusion of bare life, contra Agamben's orientation on the subject. For this reason, this discussion does not consider Agamben's work in *Homo Sacer* (1998) as a starting point for the discussion of biopolitics.

39 While other scholars have taken up biopolitics as a study of the politics of life itself under biopolitical discourses, I do not attempt such an approach here, and will not engage with theorisations dealing with defining bio- as subjects of modern biology like genetics. Mills (2013) offers a clear orientation on the question of 'life' in biopolitics.

40 See also Parikka (2008) on the encounters between biology and biopower in the politics of swarming in networks.

41 Chapter 4, for instance, turns to the automated nature of algorithms and considers how they operate with the force of law, following Lessig (1999), McQuillan (2015), and Chun (2016). I also discuss in the same chapter logics of data organisation that are embedded in the code and programming. These discussions are situated on the technological substructures as Galloway and Thacker (2007) have illustrated.

42 Chapter 6 will be dedicated to unpacking the biopower and necropower involved in the production of such devices.

Chapter 2

43 This would go on to become a pressing need during the period of maritime exploration, where celestial markers are not accurate enough for navigation at sea. Chronometers were invented in order to keep time at sea, and from there distance could be calculated and deduced. This colonial technology will be picked up in Chapter 3 in discussing the biopolitics of time and clock technologies.

44 Other clocks in history have used different standards of units. See n175.

45 Already in 1670s, Gottfried Wilhelm Leibniz came close to the notion of computing today, when he developed the idea of a universal programmable problem-solving machine. He hypothesised that if all human experience could be understood by mathematical thinking, thinking could be a form of calculation. These calculations could in principle be solved by a machine. What was necessary was the design of a universal formal language (*characteristica universalis*) which could be used to formulate problems. He thought that a form of universal logic

calculation (*calculus ratiocinator*) would help supplement this framework and solve problems computationally. See further Davis 2011.

46 Note that this is also adjusted by what is known as the leap second, in order to coordinate atomic clocks with the rotation of the Earth, which is gradually slowing down due to tidal effects from the moon. The extra second added in 2012 caused several glitches and several major websites such as Reddit, LinkedIn, Foursquare and Yelp all experienced disruptions. Qantas's flight reservations system broke down so badly that flights were disrupted for 2 hours, and left thousands of passengers across Australia stranded. See coverage by Arthur (2012).

47 Computer scientists refer to the core of NTP as a clock discipline algorithm.

48 Master and slave clocks are used to refer to synchronisation mechanisms between clocks. Slave clocks are dependent upon the master clocks for accuracy, and receive a clock signal from the master clock so that they could be in phase with one another.

49 Strasbourg, Prague, Lund, to name a few.

50 This story is repeated over the ages. Today, we worry about the replacement of manual labour by robots and artificial intelligence.

51 Related to this, Boast (2017) argues that the hole-punching technologies develop the idea that messages could be encoded and transmitted electrically. They could travel as far as the telegraph wire could allow it. Based off these ideas, several coding systems were developed to enable people to communicate written messages through the telegraph. The Morse code, Baudot's code, Cooke and Wheatstone system, to name a few, eventually evolved into e.g. Fieldata, army encoding for field intelligence used by the US in 1950s, and Unicode and ASCII, which are still present in our computing systems today.

52 Dourish (2016) defines architecture as follows "So-called software 'architecture' concerns the arrangement of units, modules, or elements of a larger system, and the patterns of interaction between those units. The nature of the units and the nature of the communication between them depend both on the system's architecture and on the underlying platform. Units might relate to each other as libraries, as inheritance hierarchies, as containerized components, as client/server, or in a host of related ways." (5)

53 TCP works in conjunction with the Internet Protocol and is usually referred to as TCP/IP. The Internet Protocol is responsible for routing data from a source host to a destination host across a network.

54 See discussion above in the Introduction.

55 cf. Philip Auslander's *Liveness* (1999), who is doubtful of the claim that any cultural discourse can stand outside of capitalist ideologies.

56 Knight (2017) refers to this unpredictability and inscrutability as "The Dark Secret at the Heart of AI" in an MIT Technology Review article. See further Knight (2017).

57 Note however the errors that could ensue if the training data is not comprehensive enough. For instance, Google Photos famously made the mistake of tagging black people as gorillas in their facial recognition algorithm, because of inadequate training data with a variety of skin tones. Apple's iPhone X also has been experiencing difficulty distinguishing between Asian faces in the Face ID feature, as two Chinese women with clearly different faces managed to unlock the same smartphone. See reporting by Grush 2015 and Smith 2017.

58 We will return to the Mechanical Turk as Amazon's Mechanical Turk in the context of digital labour in Chapter 4.

59 See explanation in an older article from Levinovitz 2014.

60 9p-ranked player Myungwan Kim, among others, made this comment in *AlphaGo* (2017) the documentary.

61 This is reminiscent of the continuous shrinkage of needed space and equipment as computational power improves and becomes more concentrated in smaller and smaller devices, like the switch from gigantic early computers to the laptops and tablets we have today.

62 One could of course reminded of Kittler's provocation that there is no software, nor code, and here no algorithm, only electrical signals pulsing through hardware. See Kittler 1995.

Chapter 3

63 In the Introduction, I discussed Tehching Hsieh's *Time Clock Piece* which is a critique on the technology. Up to this day, this is still a common practice in workplaces around the world where workers have to punch time-cards to signal when they arrive at and leave work. This has also been digitalised through employee time tracking systems, and timesheet software take the place of this old, gigantic machine.

64 The preparation of children at a young age for time discipline is of course also present today, in the children's smartwatch example, Octopus by JOY, which I opened the Introduction with.

65 Tim Wu (2016) traces a history of what he terms “attention merchants” as our attention is monetised and captured by various tactics used in media. This includes advertising and attention grabbing techniques used across print media, radio, television and most recently, the internet and social media. The popular start-up Dopamine Labs, which I have briefly referred to in the Introduction, also shows the lucrateness of the attention economy where apps are geared to be addictive and thereby entice users to stay on the interface for as long as possible.

66 Consider also the techniques of chronocyclegraph developed by Frank Gilbreth and his wife, Lillian, in around the same time period. The couple used time-lapse photography, attaching small lamps to the worker’s hands or fingers to capture the motion paths they took to complete a certain task. By observing the light trails, they were able to determine the shortest and most efficient sequence of gestures. See coverage by Regine 2012.

67 Taylorism is often discussed in conjunction with Fordism, the system of mass production in early twentieth century by the Ford Motor Company. Fordism involves the mass production of standardised goods on a moving assembly line with dedicated machinery, which relies on organised labour. Also in the same historical period is the motion and fatigue studies by Frank and Lillian Gilbreth, which takes on an even deeper investment on workers’ bodies than Taylorism. In addition to the chronocyclegraph experiments, they also measured heart rate of workers to see how much they could function at optimal level before their fatigued states reduce productivity.

68 Incidentally Xinjiang has been singled out in Western media accounts as the city where Chinese authorities experiment with heavy technological surveillance and big data policing. See for instance coverage in *Reuters* 2018.

69 Noonday guns are found in other former colonies such as Hong Kong and Cape Town. In the nineteenth century, the purpose of the gun was to allow ships in the port to check the accuracy of their marine chronometers and calibrate their clocks.

70 Time Memorial Day (時の記念日) is still observed by communities in Japan to this day, even though it is no longer an official holiday. One of the highlights is the Rokoku-sai (The Water Clock Festival) which takes place at the Omi Shrine in Shiga Prefecture, with ritualistic dance and offerings.

71 In Japan, this particular practice of morning exercise supported by public radio broadcast has persisted up to this day, since its introduction in 1928.

72 Let us not forget that GMT time is also the basis for UTC, which I have discussed in Chapter 2 as the standard for Network Time Protocol. Insofar as

GMT represents a colonial world order, its legacy is completely present in today's digital time protocols, and our vastly interconnected world from plane/ rail travel to internet connectivity would not function properly without such a centralised system.

73 This is equivalent to over a million pounds today.

74 Other maritime powers like the French and the Dutch were also keen on developing maritime technologies and chronometry was also part of the exploration.

75 The following information on the marine chronometers is based on information displays at the Royal Observatory Greenwich in London in 2016.

Chapter 4

76 This filmic exploration of what OS's can do is in line with current technological developments, even though Samantha, being a kind of diegetic prototype, is partly anthropomorphised in the film. Samantha attempts to understand her own existential conditions as a consciousness without a (female) human body, in a way quite similar to what is understood as distinctly human behaviour. She develops her personality and learns about her capacity for emotions, all the time wondering if the feelings are merely manifestations of earlier programming. The evolutionary ability embedded in her algorithms enables her to develop beyond what is expected, and together with other OS's, she even can write her own upgrades. At this stage of technological development, this is something that current OS's are not programmed nor expected to do. But the perfect voice recognitions, seamless interactions with the user, and reliable functionalities are all target milestones for OS systems in development.

77 Graham Harman and Timothy Morton, amongst others, also work on related strands of object-oriented philosophy, and speculative realism.

78 Feminist science studies scholar Karen Barad discusses similarly the role of apparatus in co-constructing the experiments. See further Barad 2007.

79 See coverage in Matney 2016.

80 The 4 transactions include: transferring money to a friend, buying flowers for his mother, ordering a ride on Uber, and booking a weekend getaway.

81 One example is how users ask Siri to tell a joke when it first came out. Developers have been hiring comedians and writers to help create jokes for their OS's as users like to ask them to tell jokes. See Wired's experiment to see if Siri,

Alexa, Cortana or Google Home is the funniest OS. I also make a quick reference to this phenomenon in this chapter.

82 In the next chapter, I will discuss specific cases of predictive analytics and look at products currently in development in relation to personality prediction and mental health services.

83 See further Oremus 2016b.

84 See further Tosswill 2015.

85 See further Oremus 2016a.

86 The team identified 174 unique cookies belonging to 87 different companies on tested websites. The cookies mainly belong to: Google (90%), Facebook (46%), Twitter (24%) and Amazon (10%) as well as the Infomediarities Gemius SA (36%), Httpool (7%) (Share Lab 2016).

87 See further Share Lab's three-part research (2016a; 2016b; 2016c).

88 Noting the amount of modules involved, we can see the composite interactions of multiple modules and the machinery of calculations which have taken place in just one operation of ad targeting that is sometimes referred to as the 'ad-targeting algorithm'. Through the analysis of Share Lab, we can see how much the term 'algorithm' really works as a shorthand for all the calculations which perhaps mask the intricate computational processes behind. This chart is only covering one aspect of ad targeting that is calculated based on social connections.

89 For a rich ethnographical study of how people's different relationships to labour configure their experience of time in the contemporary, see Sharma 2014.

90 Material labour regimes are also changed by the demand for smart devices. I will discuss this in relation to circuits of labour in Chapter 6, bringing the focus to the precarious work in mines and in factories.

91 It is also interesting perhaps to note how on-demand labour demands the workers to be 'free' and ready to be 'called on' during their shift hours. On one hand they could be overloaded by demand, but on the other they could also be waiting for nothing. Deliveroo workers for instance would usually get a base rate per hour that is below the minimum wage threshold, and must depend on deliveries (and tips) to add to their hourly wages.

92 The example of Amazon's pickers in their warehouses which I discussed in the Introduction also falls under this renewed rhythm of work. The speed of their product picking has to be fast in order to match the promise of efficiency through same-day or next-day delivery services.

93 See Chapter 3 for the discussion on mechanical mediation of time and the rise of time as a unit for compensation vis-à-vis Thompson 1967. Paying on a task-based basis is not new, but the micro size of the unit is very much a product of the digital age.

94 For example, users learn prompts like “Create a meeting on Friday” or “Find a nearby restaurant” or “Send text message to John”, standard sentence forms that Siri would recognise.

95 I acknowledge here the long tradition of work by feminist scholars in the discussion of domestic work and caring as immaterial labour, bringing recognition to these types of work as labour.

96 In the older version of the essay (2000), she also refers to the digital modelling of virtual spaces in games like Multi-User Dungeons (MUDs) and MOOs (Object-oriented MUD). The reference to website-making also belongs to an older generation of Web usage—still remember Geocities?

97 See further Independent news article Sulleyman 2017.

98 These test features are not rolled out to all users but to select test groups for A/B testing, except in Facebook’s case, there are many concurrent different test versions on any given day across their global platform that it goes way beyond a two-version split testing. The A/B option is available though to their advertisers. See further Facebook Business’s “About Split Testing”.

99 In Chapter 6, I will provide a closer look at the peculiarities of the QS movement, and the disciplinary and biopolitical power QS devices hold.

100 Jon McKenzie discusses this in terms of a military-industrial-academic (MIA complex), which is evident for instance in the predictive policing example I will discuss in Chapter 5. Initially developed by a mathematics professor, the software for crime prediction is adopted by and sold to police agencies in multiple countries. It also spawns research into other predictive regimes like counter-terrorism efforts.

101 See above discussion in Chapter 1.

102 The Chinese vending machine reference is illustrated in a current affairs programme by RTHK on Big Data in Hong Kong and China (RTHK 2017). Facial recognition software and emotion analysis algorithm run to provide real-time ‘readings’ of the emotional state of the person standing in front of the vending machine.

103 See further Haggerty and Ericson (2000), who argue that surveillance is becoming more dependent on an electronic ecosystem of sensors and software, and Lyon (2003, 2015)'s seminal works in surveillance studies.

104 This is the term the NSA uses to refer to the intimate profiling of individuals. See further MacAskill et al. 2013.

105 Current developments in law and policy aim to counter this by demanding algorithms (and the companies behind them) to be accountable for why certain decisions are made. It remains to be seen the effectiveness of such legislation under EU's General Data Protection Regulation.

106 To recap, programmable automata from eighteenth to nineteenth century show the desire for automation that is eventually materialised in digital algorithms. The rupture between the analogue and the digital is partly represented by programmability, coded instructions that bring algorithms into general purpose computation.

107 See further Chapter 3 of Amoore 2013 for a detailed analysis of the biometrical border and immigration control systems in the West. She discusses how the 'risky individual' comes to figure through the computation of chains of variables.

108 There are several accounts from the US on the use of predictive algorithms to help identify children who may suffer from abuse or neglect from their parents. Case workers use these predictive tools to help ascertain whether they should organise a house visit and See Hurley 2018 and Eubanks 2018.

109 This is explained in the Dutch VPRO documentary series Tegenlicht on Smart Cities (VPRO 2016).

110 I will, for instance, discuss criminal sentencing under the heading of Biopolitical Racism in this chapter, and predictive policing in Chapter 5.

111 This bypassing of human consciousness in data processing is one of the major sites of concern. Writing from the academic practice of sociology, the authors take the process of slowing down and translating back to human consciousness as a way to make sense of relationships in the data, such as statistical correlations. This process is important within sociological methodology in order to translate data into meaning that fits systems of human behaviour. Replacing this methodology with a machine-oriented one means that the academic world of sociology no longer has a monopoly over the collection and analysis of data collection. Technologies of collection as well as analysis remove the human (and also human expertise) from the equation.

112 I will further analyse this in Chapter 5 in relation to predictive technologies for mental health.

113 Chapter 6 would continue this line of thinking when considering the effects of quantification and measurement in the phenomenon of Quantified Self.

Chapter 5

114 Between the seventeenth-eighteenth century, *raison d'état* rose as the rationale of government in reaction to the religious civil wars in Europe following the Reformation. *Raison d'état* means that governments would not “subordinate the ends of the state to divine command or to a particular faith” (Garland 1997, 177). The duty of the state was to enhance its strength, wealth, population and its competitive position in relation to other states.

115 In Chapter 1 under the heading “biopower is economical” I explained how scarcity is understood in a security paradigm, where it is considered better to let certain people starve than to have a general scourge of hunger. In Amoore (2013), she analyses how English WWII accountants were recruited to study the data for war time rationing, showing how deeply entrenched statistics was in securing success in war efforts. The calculations were made not to take over from the market with government rule but to carefully calculate what the necessary controls are such that the market could operate within expected boundaries. The details are captured in Chapter 1 of her book.

116 Deviants, of course, are significant within the works of Foucault himself, and the history of biopower is very much developed in association with studies of sexuality, criminality, and madness.

117 See also Deborah Stone’s classic critique on the purported neutrality of numbers from a public policy perspective in Chapter 7 of her book (1988).

118 In the UK, the General Register Office was officially established in 1837, part of an effort to improve and smoothen data collection and analysis.

119 Amoore (2013) gives an account of how such forms of governance became an important tool during World War II in England, as part of her genealogical study of biopolitical governance through statistical means. In the book, she offers a detailed history of targeted governance through economy, taking note of Foucault’s observation that the art of governance is to introduce economy into the management of the state, and how statistical normalisation supports the securitisation of the state. Her work is very much a continuation of Hacking’s studies in the 1980s and 90s, bridging the Foucauldian style of inquiry into the post-9/11 era, as she argues

how older forms of statistical analyses and data collection anticipate the logics of big data governance and contemporary security agenda in anti-terrorism efforts in the West.

120 It is perhaps interesting to note that Babbage was himself fascinated by the possibility of numbers. He wanted to compile a list of constants from that of the solar system (distances of planets, revolutions, force of gravity) to numbers of known species in various animal classifications. Babbage was also interested in the enumerations of people, including mortality rate, proportion of sexes, proportion of sickness amongst the working class. Ian Hacking (1990) sees his eccentric enthusiasm as representative of the interest in numbers in the historical time period, and it is no coincidence that Babbage's interest in mathematics came hand-in-hand with his computing inventions.

121 See further Campbell-Kelly et al., 2003.

122 The list of attributes collected by the 1880 US census includes: Race or color: whether white, black, mulatto, Chinese, or Indian; Sex; Age; Civil or conjugal condition: whether single, married, widowed, or divorced; Occupation; Number of months unemployed; Whether sick or otherwise temporarily disabled so as to be unable to attend to ordinary business or duties on the day of the enumeration: what was the sickness or disability?; Whether blind, deaf and dumb, idiotic, insane, maimed, crippled, bedridden, or otherwise disabled; Whether the person attended school during the census year; Cannot read; Cannot write. (Hollerith 1889, 241)

123 For instance, Google modelled flu trends based on searches conducted by people. By aggregating search queries, the service provided estimates of flu and dengue fever activity based on location of IP addresses.

124 Dana Luciano (2007) has demarcated 9/11 as an ahistorical and exceptional time, stating that 9/11 is seen as a transcendent traumatic event that requires universal mourning. This has been discussed in Chapter 1 under the subheading "Biopolitics and Time: Chronobiopolitics".

125 Eric Siegel, formerly an assistant professor of computer science at Columbia University, is now a leading expert on predictive analytics. His work, amongst others, is part of the driving force behind the creation of an entire industry that focuses on predictive analytics. Every year, Predictive Analytics World runs conferences and training events in metropolitan cities like New York, London, Berlin, and San Francisco, attracting attendees from diverse sectors like finance, insurance, healthcare, marketing, and education.

126 Predictive policing's staunch supporter and developer is Jeffrey Brantingham, an anthropology professor at UCLA, who leads a funded research project on the

Mathematical and Computational Modelling of Crime. His work shows the deep entanglement of predictive analytics and the military-industrial-academic complex discussed by McKenzie 2001. Predictive analytics requires the concerted effort of multiple institutions and parties and the synergy of their labour from various sites of power. The expertise in the area is very much supported by the knowledge and creativity of academics developing these tools and offering them for business or security purposes.

127 For instance, the first example of predictive policing shows the entanglement with performance standards and the principle of cost-cutting through prediction. As put forward by Siegel, “predictive analytics operates with extreme solution-oriented intent” (2013, 90). Using predictive software allows policing efforts to be less resource-intensive by veering towards machine-aided decision-making.

128 *Uniform Crime Reporting Statistics: Their Proper Use*, FBI (Jan 2011), <https://www.fbi.gov/about-us/cjis/ucr/ucr-statistics-their-proper-use>

129 See PredPol’s testimonies on the product website: <http://www.predpol.com/results/>

130 The said testimonies have been criticised as cherry-picking to paint a view of the effectiveness of the software (Cushing 2013).

131 This is the tagline appearing on company website.

132 A web crawler is an Internet bot that browses the World Wide Web, typically for the purpose of indexing webpages. Crawlers can be used to update a search engine’s indices of others sites’ web content, or to scan pages for certain keywords or specific content. A good example would be the crawlers sent out by internet monitoring agencies of the Chinese government to look for sensitive terms and keywords on social media which would subsequently be censored on said platforms.

133 See further Fineberg et al. 2017 and Monteith et al. 2015.

134 This aspect also links to the discussion of social credit systems that are beginning to pop up in the Chinese internet domain (see further Creemers 2018), and the popular cultural reference in TV series Black Mirror’s *Nosedive* (2016).

135 I have already discussed earlier that this desire is linked to post-9/11 politics and the belief that the attacks could have been averted if officials had known where to look in the data and how to understand the data that they had.

136 See further work by e.g. Angela Davis (2000; 2011) on the prison-industrial complex and the problem of mass incarceration in the US.

137 Jay Bolter and Richard Grusin (1999) proposed that all media functions upon the notion of ‘remediation’, by way of “translating, refashioning, and reforming other media, both on the levels of content and form” (Manovich 2001). In re-mediating older medium, new media/ contemporary technologies also re-mediate prior social and cultural modes of communication.

138 See for instance Calders and Žliobaitė 2013, Barocas and Selbst 2016. Virgina Eubanks (2018)’s book has a telling subtitle—“How high-tech tools profile, police, and punish the poor”.

Chapter 6

139 QS is not entirely novel in the current epoch. Crawford, Lingel and Karppi (2015) study the emergence of public weight scale as a precursor to self-monitoring with technology. They describe how Early European public scales came with inscriptions, such as one from the late 1880s in Paris, which offers the homily: ‘He who often weighs himself knows himself well. He who knows himself well lives well’. Others have used analogue ways to keep track of one’s habits through journalling, or the simple bathroom scale. The idea of self-regulation is simply reterritorialised through QS today.

140 Strava is one of these sporting apps which allows users to track their activities and compare with other users to unlock achievements and compete on leaderboards. See further <https://www.strava.com/features>

141 Lumo Lift, a posture-adjustment device, which I will discuss in the next section boasts a corporate client list that includes Google, Facebook, Yahoo, ExxonMobil, Nestle, accenture and AXA insurance.

142 Some companies have already rolled out insurance discounts if customers could provide their QS data which shows that they fit the active lifestyles prescribed by the policies. See the work of Tega Brain and Surya Mattu in art project *Unfit Bits* that playfully suggests ways to ‘cheat’ the QS system, so that people could benefit from the discounted insurance packages (<http://www.unfitbits.com/>) and the interview by Abend and Fuchs (Brain et al. 2016).

143 This is Lumo Lift’s marketing tagline.

144 Lumo makes full use of big data technology in order to optimise its products, noting that over 15 million pieces of data have been collected in the first half year since its launch. The data scientists became interested also in the time of day when people are most likely to slouch. Using this information, they train the algorithm to be more vigilant in times of the day when people tend to slack.

145 Hong also uses the term “sensory and epistemic labour” (2016, 6) to describe the mode under which digital labour is taken.

146 See also “grey collar” workers (Qiu 2010) who engage in repetitive work processes in the production process, like database operators, technicians and software testers. Online game ‘farmers’ who play non-stop to collect gold in games may also be considered under this category.

147 Instead of swiping for love matches like Tinder and the main app of Bumble, BFF encourages same-sex platonic friendships and allows women and men to swipe for potential friends (BFFs, #girlsquad).

148 In cases of QS, scholars refer to open-source sharing of data as an alternative practice that gives ownership of data to the users. Unfortunately, the majority of end user agreements as they stand today typically state that the company providing the technology either fully owns or has full and complete rights to the data. This might also include the right to repackage and sell anonymised data sets to other companies. Larger corporations like FitBit even charges users US\$50 a year in order to download records, while others charge a monthly subscription fee.

149 Reflections on the subject of resistance can be found in the Conclusion and the Coda of this dissertation.

150 See further Delanda 1997.

151 This is reminiscent of the dwindling of media attention to continuous war in ‘other’ed parts of the world that can be contrasted with heightened attention to the spectularity of terrorist attacks in the West. See for example Martin and Petro 2006, and Hochberg 2015.

152 Nixon points out, for instance, how living with digital devices may have reduced our attention span, making it more difficult to focus on the slowness of non-spectacular violence. “Ours is an age of onrushing turbo-capitalism, wherein the present feels more abbreviated than it used to—at least for the world’s privileged classes who live surrounded by technological time-savers that often compound the sensation of not having enough time” (8).

153 Summers was fired shortly after the leaked memo, but subsequently served in the Clinton administration.

154 Samsung medical centre, a subsidiary of the Samsung Group, joins Microsoft Korea to develop pilot medical projects with AI technology and cloud storage, analysing medical data, optimising clinical decision making, and creating prediction models for specific diseases.

155 Jack Qiu noted that he still noticed the nets around their buildings when he visited the Guanlan plant in spring 2016.

156 Pun, Chan and Selden (2015) write that the students are considered cheap labour, as they are not eligible for bonuses and the company does not have to pay insurance and welfare benefits for them. Assume that they hire total of 150,000 student interns at various Foxconn factories for a month during peak season, the savings from not providing them with welfare benefits is roughly 45,000,000 yuan (based on 2015 figures). The company can save more than US\$ 7 million alone by hiring student workforce for a month.

157 Pun, Chan and Selden (2015) document ethnographical accounts of the plight of working for Foxconn and the precarity of their labour. Their descriptions fit very well Berlant's notion of cruel optimism, where the wages are enough for subsistence but do not offer any form of upwards mobility. Chinese male workers tend to see themselves as breadwinners of the family but the salary for a husband is not enough to cover a family of three. Many of these male rural migrant workers leave their wives and children at home and move to work in the city. See Chapters 5-7 of their book for interviews and descriptions.

158 The original reads 「為品牌利潤、付出青春年歲竟成幻夢」 「為富豪財勢、耗盡身心健康竟成泡影」 ; translations by Chan and Pun 2010.

159 We have seen, in Chapter 3, how telegraph cables enabling connection between empire and colony were laid even before electricity was made widely available to the public. These submarine cables are key players in the history of world time alignment, and the designation of London as the zero-point of GMT and the centre of the world. I will return to this point in the Conclusion.

160 In Aboriginal culture, Ancestor Spirits came to the earth in human form and as they moved through the land, they created animals, plants, rocks, and all the landscapes. Once this creation process ended, the ancestral spirits themselves transformed into trees, stars, rocks, watering holes or other objects. They become the sacred sites of Aboriginal culture, linking people and land, past and present. Dreaming tracks link ancestral history and sacred sites across the entire continent.

161 For a concise and well-defined introduction to the field of new materialism, see Dolphijn and van der Tuin (2012). See Bryant et al. (2011) for an overview of speculative realism and object-oriented theories.

Conclusion

162 Even though Amazon insists that Echo only streams recordings when the ‘wake-word’ Alexa activates the device, Echo is always listening in your living room with far-field technology to detect when a user has uttered “Alexa”, a truly environmental digital device that operates in the background, always sensing and collecting data, in complete alignment with Hansen’s twenty-first-century media. The device is technically capable of streaming voice recordings 24 hours a day, 7 days a week as long as it is connected to the internet.

163 It can also control several smart devices in an Internet of Things style, for instance, controlling aforementioned Nest thermostat temperature through voice commands if you enable the integration with said device. You simply have to say “Alexa, turn the room temperature up to 22 degrees” and it will be able to send a command to the device.

164 See Buxton 2017, Fessler 2018, and Mafi 2018 about the subject.

165 This is the answer Alexa gave in a YouTube video by Steve Crowder, an American conservative political commentator who made the video to suggest that Alexa is a ‘far-left’ OS, programmed by “blue-haired angry feminists” and “social justice warriors”.

166 According to the reports, Alexa used to say “well, thanks for the feedback” when users say “you’re a bitch” or “you’re a slut” before 2017.

167 According to Pennebaker, 14.2% of women’s words were personal pronouns compared with only 12.7% for men, meaning that women tend to use about 85,000 more pronouns per year than men.

168 On August 12 2017 in Charlottesville, Virginia, a white supremacist protest was organised using Facebook event. During the protest, a man rammed his car into a crowd of counter-protestors, setting off a chain reaction that injured at least nineteen people and claimed one life. See for instance coverage in Diep 2017.

169 See *SCMP* 2011; Chen 2013; *CFS* 2017.

170 In the Coda, I will address several artworks which aim at bringing what is imperceptible into the domain of apprehension. I will in particular discuss a tabletop board game “Quantified” developed by artist Janna Ullrich which embeds into game mechanics aspects of digital processing and data analysis, allowing the too-fast processes of algorithmic time to be experienced in the game play.

171 These studies foreshadow the industry of QS and the close monitoring of physiological states of employees by wearables. See further Chapter 2, Moore (2018).

172 This slogan appeared in Pun, Chan, and Selden (2013) in Chinese. This is my translation.

173 See also James Bloodworth's *Hired: Six Months Undercover in Low-Wage Britain* (2018) where the author went undercover in Amazon warehouse in Rugeley. He describes his experience as follows—"If I had to characterise it in a word, it would be fear. Fear of going to the toilet, fear of taking a day off. You're scared of getting the sack if you phone in sick." (Wilding 2018)

174 It has recently been exposed that Amazon's gadgets like Kindle and the Echo series (with voice assistant Alexa) are produced under similarly exploitative conditions in Foxconn Hengyang. Hengyang is in a province with less stringent labour laws and Foxconn workers there earn barely half the salary Foxconn workers in Shenzhen get (where Apple gadgets are made). See reporting by Chamberlain 2018a and 2018b.

175 There are other alternatives to the mechanical time system and the Gregorian calendar system used. "Jewish zmanim and Christian canonical hours are defined in terms of seasonally variable hours that served as points in time rather than as set durations. Edo period Japanese clocks divided the day into six daylight and six nighttime seasonally variable hours, and they created clocks to represent these seasonal variations. Chinese timekeeping and Hindu jyotish (astrology) are anchored to the interaction of celestial cycles." (Birth 2016, 75) In contemporary life, Chinese culture, for instance, uses a dual calendar system that includes both lunar calendar and Gregorian calendar, while the Ethiopian calendar calculates the birth of Jesus on a different date and is seven to eight years behind the Gregorian calendar. See also his monograph (2012) for a deeper analysis.

176 This point can be further explored through Starosielski's monograph project where she maps the materiality of network infrastructure with cultural histories, with an attention to the colonial systems the infrastructure extend upon.

177 This makes "the right to be forgotten" an important legal subject for the current epoch, which gives individuals the right to force companies on the internet to delete out-of-date, irrelevant personal data.

178 MTurkers have speculated on forums like Reddit that the platform no longer accepts new workers outside of the US since 2012, but this is not verified officially by the company and some European MTurkers have reported their successful applications in the meantime. In any case, non-US citizens working on

MTurk can only earn salary in Amazon credit, meaning that their earnings can only be spent by purchasing items on Amazon.

179 The planetary scale of computation referred to here could be compared to Benjamin Bratton's notion of the stack—"Planetary-scale computation takes different forms at different scales—energy and mineral sourcing and grids; subterranean cloud infrastructure; urban software and public service privatization; massive universal addressing systems; interfaces drawn by the augmentation of the hand, of the eye, or dissolved into objects; users both over-outlined by self-quantification and also exploded by the arrival of legions of sensors, algorithms, and robots. Instead of seeing all of these as a hodgepodge of different species of computing, spinning out on their own at different scales and tempos, we should see them as forming a coherent and interdependent whole. These technologies align, layer by layer, into something like a vast, if also incomplete, pervasive if also irregular, software and hardware Stack." (2015, 5)

180 See also Beer 2016 on the concept of "metric power".

181 It is perhaps interesting here to note that in one of Foucault's definitions of governmentality, he resorted to the example of a ship, reminiscent of maritime exploration and where the industries of security like risk calculation, and insurance historically emerged. "What is it to govern a ship? It involves, of course, being responsible for the sailors, but also taking care of the vessel and the cargo; governing a ship also involves taking winds, reefs, storms, and bad weather into account. What characterizes government of a ship is the practice of establishing relations between the sailors, the vessel, which must be safeguarded, the cargo, which must be brought to port, and their relations with all those eventualities like winds, reefs, storms and so on." (Foucault 2007, 97)

182 Take for example the self-surveillance work of Bangladeshi-born American Hasan Elahi, which he developed after being mistakenly listed as a suspected terrorist by the FBI in 2002. A privileged artist and professor at Rutgers University, he had the means necessary to prove that he was not the man they were looking for, producing an archive of calendar appointments in his Blackberry to account for his whereabouts. Even then, it took several months and dozens of interviews with the FBI before his name was cleared. See further Romein and Schuilenburg 2008, and Elahi's Tracking Transcience website.

Coda

183 The term has been claimed by a California-based wellness organization "Digital Detox" which runs "pure, unadulterated [summer camps] for grown-ups"

to go off-grid, unplug, and sing songs around the campfire. See <http://digitaldetox.org/>

184 You can download them here: <http://www.mollymcleod.com/wallpapers/>

185 Note however what kind of data these apps actually collect on your smartphone and whether you are also monitored by the app that is supposedly helping you reduce phone usage.

186 I hesitate to recommend many of these apps because they seem to incorporate QS tracking, only this time they track how much time one is off the phone (iOS app Mute Screen Time Tracker would be a prime example). Dopamine Labs, which I referred to in the Introduction, broadens their clientele by offering companies addictive apps and individual consumers ‘Space’ which purportedly can get rid of addictions. See <http://youjustneedspace.com/>

187 See discussion below under the heading “Appropriating the Blockchain” for more information on the Fairphone project.

188 <http://codecoat.net/>, or if you use a TOR browser, <http://tlmjvu4oeu3tqoe2.onion/> (project website in Dutch)

189 See also Birchall 2017 on the right to opacity in the digital age, reframing Édouard Glissant’s work in the context of data sharing and surveillance (Birchall uses the term “shareveillance”).

190 I have discussed this in Chapter 4 in relation to Hansen’s “perverted pharmacology” (2015b) and the work done by Share Lab (2016a; 2016b; 2016c).

191 See Ghostery’s report here <https://www.ghostery.com/lp/study/>

192 The Guide is available at <https://ssd.eff.org/>

193 The people behind the project are: Paulo Pedercini (design), Michael Pineschi (concept), and Minusbaby (music).

194 Video footage can be found at <http://shintaro-miyazaki.com/?work=algorhythmicsorting>

195 Description at <http://tegabrain.com/The-Frogs-Nose>

196 See coverage in Tiku 2018.

197 Others have requested data archives from e.g. Tinder. French journalist Judith Duportail received over 800 pages from Tinder with three years worth of data, and realises she has disclosed locations, jobs, pictures, interests with details down to music tastes and food preferences. See coverage in Duportail 2017.

198 Apply Magic Sauce is featured in Privacy Paradox series on WNYC's *Note to Self* Podcast, with an interview with the creator Michal Kosinski: <https://project.wnyc.org/privacy-paradox/>

199 Data X is currently working on *Fuzzify Me*, a browser extension that will be a one-click tool to clear out ad categories Facebook assign, and deny advertisers access to these categories and limit the scope of ad targeting.

200 Fairphone I is a #Failphone. The company has joked about it as much. I, like other users, have sent the phone in for (free warranty) repairs multiple times. But to do so requires one to first enter the factory mode, run certain diagnostic tests, and record the results on a repair form. Factory mode is in Simplified Chinese (with basic English translations) and requires navigating through menus using physical buttons (no, touchscreen does not work). You can imagine the challenge this task would pose to someone who has little literacy of non-GUI systems. It felt as if I was intruding into a layer of the phone's system I would otherwise not be allowed to enter. After successfully completing the diagnostic test, I immediately felt a heightened affinity to the gadget because Fairphone has made me jump through these hoops just so I could get the phone fixed. It is part of Fairphone's philosophy to help increase digital literacy and to bring users closer to their gadgets.

201 'YOU' became the chosen person because of the rise of user-generated content via social media platforms. The tagline of the magazine cover reads "Yes, you. You control the Information Age. Welcome to your world."

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Summary

This project maps the influence of past and current technologies on human perception of time and its biopolitical implications. The work is fashioned after the aims of Michel Foucault's genealogical approach to contextualise how cultural practices and discourses emerge, and understand the conditions of possibility which structure their developments. Foucault's genealogy of biopower is understood as a 'history of the present' that digs into the past in order to uncover the conditions under which one may understand, evaluate, and critique contemporary phenomena. I study the theoretical foundations of biopower and connect these underpinnings with a variety of historical and contemporary examples that demonstrate the interconnections between technology, time, and biopower.

Biopower, in a nutshell, refers to the power exercised in the regulation of populations and the management of 'life itself'. Foucault observes a shift in the West in the late eighteenth-century where a more efficient exercise of power is inaugurated, rather than relying on the power of the sovereign to manage and kill. In a population, bodies are assigned different values in a relative logic of calculating, measuring and comparing, and a biopolitical calculus is in place to decide who gets to live and be cultivated for labour and (re)production and who is left behind to die. How do these histories of discipline and biopower intersect with time technology, and how do these ideas transpose and map onto our current day and age of network culture?

The invention of clocks historically provided a tool under which one could measure time in equal units. The standardisation of the equal hour has enabled time to be seen as a tradable unit. Clocks gave rise to a logic of quantification and measurement, a logic which has historically been co-opted into a regime of labour

and slave management. This has been examined in light of plantation labour in times of American slavery (Mark Smith) and in English factories during the Industrial Revolution (E. P. Thompson). Time measurement provides quantification of labour with scientific precision, generating a rhythm that shapes bodies subjected under its control, whose worth may be measured through the value of productivity and output. Time mediation is thus seen as a defining moment in the technological epoch which drove the development of industrial capitalism.

Just as the clock enabled quantification of time, data-crunching algorithms today enable abstraction of user input into a future-oriented, predictive regime of calculations, subjecting users to new rhythms such as push alerts, biometric data-tracking and statistics-based predictions. This leads to regimes of algorithmic governance, re-organisation of labour practices, and inaugurates forms of profiling and surveillance of internet users at unprecedented scales. Temporality, specifically a beyond-human temporality, has become the *modus operandi* of twenty-first-century media (Mark Hansen). These new logics of quantification and tracking operate at microtemporal scales in their own machinic temporalities (Wolfgang Ernst) that undercut human perceptual awareness. Algorithmic time, in other words, displaces the centrality of human experience. Whatever appears on the digital interface for our registration and response becomes perceptible *after the fact* of microtemporal processing. As human end-users, we are always late to the scene. The future-orientedness of this process suggests a different mediated relationship to experiential time, what Hansen terms 'feed forward'. Feed forward places the centrality of human consciousness in question, as we use faster algorithms to replace conscious thinking and decision-making.

With the proliferation of devices like smartphones, smartwatches, and apps like social media platforms, twenty-first-century media run in the background, mediate processes beyond our conscious apprehension, and are ubiquitous in nature. The speed and scale of such algorithms cannot be perceived simply on the basis of our sensory apparatus, and the functioning of such objects is at odds with the temporality of experiential time. It is therefore pertinent to study the implications of time and the technologies which mediate it, in order to gain an understanding of the effects of twenty-first-century media on our daily lives.

Through what I term 'techno-chrono-biopolitics', I connect the theoretical grounds of biopolitics with time mediation to illustrate how biopower emerges in the technological dispositifs that mediate senses of time. Techno-chrono-biopolitics, in other words, highlights the technological and chronological dimensions of biopower. The concept looks into how specific technological developments have contributed to different ways time is rendered, calculated, and used in specific contexts, and how these result in the different temporalisation of bodies, changing rhythms of day-to-day life, and the organisation of life on the whole. This study

is thus dedicated to exploring the temporal dimensions of twenty-first-century media technology and the political implications therein, driven by the question: if clocks were seen as key to the imposition of clock discipline, how do twenty-first-century media, with their mode of beyond-human time mediation, impose power on the population? The chapters demonstrate the contemporary relevance of Foucauldian biopolitics and its intensifications (Jeffrey Nealon) and permutations in societies of control (Gilles Deleuze), performance (Jon McKenzie), ontopolitics (Brian Massumi), necropolitics (Achilles Mbembe), and geontologies (Elizabeth Povinelli), amongst others. Through a variety of examples, the project offers an intricate analysis of the technical dimensions of how these time-related technologies work, how human and machine co-construct the digital milieu we occupy, and how these effects materialise in selected settings and geopolitical locations.

Throughout the project, I make reference to examples and case studies from various locales and different moments in time, as well as film and artistic works which offer reflections on the technologies. These rich examples show the heterogeneity of techno-chrono-biopower, in its material manifestations, geopolitical reach, and the temporal scales it deals a hand in. The calculus of Foucauldian biopower's 'making live and letting die' is mapped across bodies globally, and follows from a longer history of exploitation, marginalisation, and dispossession. Criss-crossing across a variety of scenes and settings, from the nineteenth-century English factory floor to today's gigantic Foxconn factory complexes in China, from the Antebellum slaves in the US to the present-day coltan miners of Congo, from the non-human time of machinic process to the durational tracking of human activity, this project maps how biopower operates through technologies of time, and unveils the planetary scale of techno-chrono-biopolitics. An attentiveness to historical antecedents, present manifestations, and future projections altogether creates a larger picture of the speeds and rhythms in which biopower functions under the auspices of digital network culture.

Samenvatting

Dit proefschrift onderzoekt de invloed van historische en hedendaagse technologieën op de menselijke perceptie van tijd en de biopolitieke implicaties daarvan. Michel Foucaults genealogische methodologie wordt hierbij gebruikt om culturele praktijken en discoursen te contextualiseren, en de condities te begrijpen die deze ontwikkelingen mogelijk maken. Foucaults genealogie van de biomacht is te karakteriseren als een 'geschiedenis van de tegenwoordige tijd' waarbij de verleden tijd wordt onderzocht om hedendaagse fenomenen vanuit een kritisch standpunt te kunnen interpreteren en evalueren. Op deze manier onderzoek ik de theoretische grondslagen van biomacht en laat ik, aan de hand van diverse historische en hedendaagse voorbeelden, verbanden zien tussen technologische ontwikkelingen, tijd en biomacht.

Biomacht is, in een notendop, de macht die uitgeoefend wordt door het reguleren van het biologische en sociale leven op grote schaal. Foucault merkt op dat in het Westen aan het einde van de achttiende eeuw macht steeds meer vorm krijgt in praktijken van efficiëntie en disciplineren, in plaats van als de macht van de soevereine heerser die mensen controleert en kan doden. Onderdeel van biomacht is dat lichamen in een populatie verschillende waarden toegekend krijgen op basis van een logica van berekenen, meten, en vergelijken. Deze biopolitieke berekening vormt de basis voor wat Foucault beschrijft als de macht om 'te doen leven en laten sterven' (*making live and letting die*): wie moet worden klaargestoomd voor arbeid en (re)productie, en wie kan worden achtergelaten om te sterven. Deze studie gaat over het verband tussen biomacht en tijdstechnologie, en hoe deze principes vorm krijgen in onze hedendaagse netwerkcultuur.

Vanuit een historisch oogpunt maakt de uitvinding van klokken, waarbij tijd wordt opgedeeld in gelijkmatige eenheden, de meting van tijd mogelijk. De standaardisatie van het uur maakt meting en kwantificering van tijd mogelijk, waarmee tijd een verhandelbare eenheid wordt. Deze logica ligt aan de basis van georganiseerde arbeid en slavenmanagement. Deze ontwikkeling wordt in dit proefschrift besproken aan de hand van plantagearbeid tijdens de Amerikaanse slavernij (Mark Smith) en de opkomst en organisatie van Engelse fabrieken tijdens de Industriële Revolutie (E. P. Thompson). Tijdsmeting zorgt voor kwantificering van arbeid met een wetenschappelijke nauwkeurigheid, waardoor een ritme ontstaat waar lichamen aan onderworpen worden. Deze lichamen worden kwantificeerbaar gemaakt op basis van de waarde van hun productiviteit en output. Deze kwantificering en meetbaarheid is een drijvende kracht geweest in de ontwikkeling van het industrieel kapitalisme.

Zoals de klok de kwantificering van tijd mogelijk maakte, zo maken data-crunching algoritmes een nieuw, toekomstgericht, voorspellend regime van berekeningen mogelijk, waar gebruikers aan onderworpen worden door middel van push alerts, biometrische data-tracking, en voorspellingen gebaseerd op statistiek. Dit leidt tot nieuwe regimes van algoritmisch bestuur, reorganisatie van arbeid, profilering en het surveilleren van internetgebruikers op een ongekende schaal. Temporaliteit, met name een temporaliteit die voorbij gaat aan menselijke waarneming, wordt de *modus operandi* van eenentwintigste-eeuwse media (Mark Hansen). Deze nieuwe logica's van kwantificering en tracking functioneren op microtemporele schaal (Wolfgang Ernst) en daardoor buiten menselijke waarneming. In deze processen staat algoritmische tijd centraal in plaats van de menselijke waarneming. We kunnen pas reageren op wat we op onze digitale interfaces waarnemen *na afloop* van deze microtemporele processen. Als menselijke eindgebruikers komen we zodoende altijd te laat. De toekomstgerichtheid van dergelijke processen impliceert daarom een andere relatie tot de temporaliteit van de menselijke waarneming. Hansen karakteriseert deze relatie als 'feed forward'. Deze nieuwe relatie tussen technologie en menselijk bewustzijn impliceert een decentralisatie van de rol van het menselijke bewustzijn.

Eenentwintigste-eeuwse media zoals smartphones en smartwatches, en apps als sociale media platforms zijn alomtegenwoordig en tegelijkertijd blijft hun manier van functioneren grotendeels buiten ons bewustzijn. De snelheid en schaal waarop zij opereren zijn niet toegankelijk voor menselijke zintuigen en staan op gespannen voet met de temporaliteit van menselijke ervaringstijd. Mijn onderzoek laat zien hoe deze technologische ontwikkelingen bijdragen aan een andere temporalisatie van lichamen, veranderende ritmes van het dagelijks leven, en de organisatie van het leven in het geheel.

Met de term *'techno-chrono-biopolitics'* verbind ik de theoretische grondslagen van biomacht en tijdmediatie om te laten zien welke rol biomacht speelt in de technologische ontwikkelingen die onze ervaring van tijd beïnvloeden. Met andere woorden, *techno-chrono-biopolitics* belicht de technologische en chronologische dimensies van biomacht. Als klokken kunnen worden gezien als de sleutel tot het opleggen van klokdiscipline, hoe kunnen we dan de manier begrijpen waarop eenentwintigste-eeuwse media hun macht opleggen aan populaties? De hoofdstukken demonstreren de hedendaagse relevantie van de biopolitiek van Foucault en werpen licht op onder andere de intensivering (Jeffrey Nealon), de permutaties in *societies of control* (Gilles Deleuze), de *performance* (Jon McKenzie), de *ontopolitics* (Brian Massumi), de *necropolitics* (Achilles Mbembe) en de *geontologies* (Elizabeth Povinelli). Door middel van uiteenlopende voorbeelden biedt deze studie een gedetailleerde analyse van de technische dimensies van historische en hedendaagse technologieën van tijd, hoe mens en machine samen het digitale milieu vormen waarin we leven, en wat het effect hiervan is in specifieke contexten en op specifieke geopolitieke locaties.

In dit proefschrift verwijs ik naar uiteenlopende historische en hedendaagse voorbeelden en ook naar artistieke werken die reflecties bieden op de besproken technologieën. Deze voorbeelden laten de heterogeniteit van *techno-chrono-biopower* zien, door de materiële manifestaties, het geopolitieke bereik, en de temporele schalen waarop biomacht opereert. In deze bespreking wordt Foucaults biomacht in kaart gebracht en hoe die invloed heeft op lichamen wereldwijd, waarmee een lange geschiedenis van uitbuiting, marginalisatie, en onteigening aan het licht komt. Van de negentiende-eeuwse Engelse fabriek tot de hedendaagse gigantische Foxconn-fabriekssteden in China, van de Antebellum-slaveneigenaren in de VS tot de recente ontwikkelingen rondom coltanmijnwerkers van Congo, van de non-human tijd van machinale processen tot de langdurende tracking van onze activiteiten door middel van eenentwintigste-eeuwse media. Door de combinatie van historische voorbeelden, hedendaagse verschijnselen en een vooruitblik op mogelijke toekomstige ontwikkelingen wordt een beeld geschetst van de snelheden en ritmes waarin biomacht functioneert binnen onze digitale netwerkcultuur.

Biographical Note

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Wan is the founder of Performance Studies international's "Future Advisory Board", an international collective of emerging scholars and artists that promotes trans-cultural, trans-generational, and decolonial perspectives in the field. She has served on the Board since its establishment in 2015, and the team contributes regularly to *Global Performance Studies* as part of a collaborative writing, editing, and curatorial practice.

Outside of her academic endeavours, Wan volunteers periodically at the Dutch National Foundation for the Promotion of Happiness (*Stichting de Vrolijkheid*) and works on theatre projects with asylum seeker youths. In the past, she has collaborated with various artists in staging contemporary dance and physical theatre productions, and creating site-specific performances in Hong Kong. She is also a professional translator, editor, and event manager.