Stratoanalysis of the Digital

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Abstract

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As we shape them, our tools have the power to shape us too. By using digital instruments that enhance thought, however, we are ending up thinking *through* them and becoming increasingly dependent on their configuration.

Today ubiquitous on the web, recommendation algorithms and homeomorphic interfaces mediate the relation between the psychosphere and the infosphere, automatically regulating themselves on our behaviours to suggest to us always new connections between ideas or products. Addressing the disruptive psychological and socio-political effects of such instruments, this research revolves around two main questions: How is digital technology grafted onto human life? How do machines perceive and change the world?

To answer these interrogatives, this research mobilizes the philosophies of Deleuze, Guattari and Simondon, in conjunction with concepts borrowed from the natural sciences and complexity theory, to articulate a connection between biological and technological thought and provide the theoretical background for an investigation of the current exploitation of our co-evolutionary relation with technology, elaborating on Leroi-Gourhan's definition of anthropogenesis as technogenesis and Stiegler's analysis of hyperindustrial exosomatisation. Against this background, the dissertation provides a holistic and multi-level description of the transformations that involve and relate life and the digital by developing and employing the descriptive method I call *stratoanalysis*. This method outlines three intermeshing levels of reality (the physicochemical, the organic and the socio-political ones) by outlining their processes of emergence, and describes their relationship with the digital stratum, that is, with the algorithmically mediated process of emergence of a new hybrid subject of power I call the artisanal cyborg.

Describing this figure and the form of power it is subject to, this work proposes to update our understanding of contemporary modalities of domination in view of the relation between the digital and the virtual, as the ontological dimension of possibility targeted by pre-emptive computational power.

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Introduction: The Pursuit of Life by Means Other Than Life

If I google Iceland from the UK, the first result that comes up is the website of a British supermarket chain that sells frozen food. The Wikipedia page on the Nordic country comes only second, following a map with big red pins indicating the closest shops to my apartment. In all its decadence, this result highlights two important aspects of our current situation as technical beings. First, the revolving door between the common memory available online and its re-activation is shaped by automatically generated suggestions that, rather than responding to a hypothetical criterion of relevance, are often produced on the basis of economic relations: in this case, the supermarket pays Google for advertisement space, and the Search algorithm allows its website to feature at the top of the results page. Second, the system mediating information retrieval and consumption deploys a majoritarian logic: the results of my query are shaped by the fact that I am googling from England, and because people that have done the same research from here have been more interested in the supermarket than in the country.

As of June 2021, the ten most popular websites ranked by total visits are Google, Youtube, Facebook, Wikipedia, Yahoo Japan, Amazon, Instagram, Twitter and a couple of porn websites (Clement 2021). Except for Wikipedia, all these websites have something in common: they run recommendation algorithms. These are one of the most interesting applications of machine learning, which in turn can be described as the property of automated systems that 'learn from experience'. This particular application deploys mathematical formulae from the fields of probability theory and statistics to predict the likelihood of specific outcomes out of large enough data sets. The goal of recommenders is to reveal patterns of correlations applicable in the form of suggestions to guide analogous actions in the future: from correlation, they aim at producing causation. In collaborative filtering recommender systems, this process starts with the identification of the 'neighbourhood' of users or items: this consists in all the users or items that share some features with the future target of suggestions. The neighbourhood is then analysed to extract patterns of correlations between actions or purchases: e.g., all the users that buy the laptop on which I'm writing have also looked into buying some sort of sleeve for it, or, the vast majority of people in this geographical area are more interested in a particular website rather than other ones connected to the same keyword.

Most of the music we listen to, the videos and movies we watch on Youtube, Spotify, Netflix or Amazon Prime, the posts we see on Facebook, Instagram or Twitter, the ads that seem to follow us everywhere we go on the web, have been recommended to us by an automatic system. While digital tools like Google Search are generally blackboxed, almost entirely automated and capable of regulating themselves on our behaviours to recommend us always new connections between ideas or products, they present us with an image of the world around which we will weave our thoughts and from which we will orient our actions. Given the necessity for platforms like YouTube to maximise screen time (i.e., users' exposure to ads), such pictures of the world are ultimately composed by the pieces of content that drive more revenue to the platform. Often, suggestions crystallise around what Eli Pariser calls 'filter bubbles' (Pariser 2011), ultra-specialised mediascapes tailored around the perceived tastes of users who will be proposed increasingly extreme content to be kept engaged, and the recommendation process has repeatedly led to waves of content sharing and emulation today referred to with the notion of virality (Parikka 2007). These phenomena increase the probability of specific types of content to be recommended to other users, but they also mean that, as stressed by former Google design ethicist Tristan Harris, young girls might end up getting recommended videos endorsing anorexia after researching diet tips (Harris 2019: 4), because this type of content works best at maximising screen time for that specific demographic.

In his work, Bernard Stiegler highlights how industrialisation extended writing, the process of discretisation of speech in reproducible units, well beyond the linguistic register (Stiegler 2010 [2009]: 10). Industrial machines and the context of reproducibility within which they were deployed allowed in fact such process of discretisation to be extended to gestures. During the Industrial Revolution, in fact, the movements of workers start being carefully broken down, disciplined and reproduced according to precise designs aiming not only at enhancing productivity but also at conforming human movements to those of the machines by which they will be progressively substituted. The development of digital technologies has instead given rise to what Stiegler calls 'hyperindustrialisation', the age in which the process of discretisation is extended further to allow the integration of cognitive behavioural patterns into systems designed for their reproducibility in silicon (30-31). Stiegler argues that every technical activity amounts to a form of exteriorisation of memory, and that this process causes what Plato referred to as *hypomnesis*, a weakening of the capacity to recall caused by the material supplementation of memory, the digitalisation of vast portions of human knowledge connects directly to the increasing reliance on the automation of exteriorised cognitive functions. By using digital instruments that enhance thought, we are ending up thinking through them and becoming increasingly dependent on their configuration. While we understand, invent and represent our reality, building a reserve of knowledge that will in turn affect our behaviour and inform the education of future generations in a feedback loop mediated by our ever-evolving technoscape, the material way to store and retrieve knowledge is increasingly concentrated in the hands of a few companies that attempt to administer our shared memories with the promise of presenting them to us upon request. This means that a new form of power has emerged, one that rather than depending on the ownership of the land or of the means of production, relies on the ownership of the channels through which information circulates (Wark 2004) and on the design of the processes through which this information is analysed.

This line of enquiry is complemented by earlier philosophical reflections on writing and its effects on noetic life and follows a tradition started by Plato's *Phaedrus* (2002), continuing with Jacques Derrida's reading of the dialogue in his 'La Pharmacie de Platon' (Derrida 1981 [1972]), and finally informing Bernard Stiegler's work on the relation between hypomnesis and anamnesis in the age of electronic writing and its capitalist administration. Following Gilbert Simondon's invitation to strive towards a fuller integration of technology as an object of culture and a more definitive dissolution of the incorrect opposition of technology to nature (Simondon 2016 [1958]: 15-16), this thesis aims at contributing to the field of digital studies by integrating digital technologies within a broader processual understanding of reality and describing this new technology of power and the processes of subjectification it engenders. Considering digital technologies of control as agents of change, my research focusses then on three main questions: How do complex wholes emerge from the interaction of simpler elements? How are digital technologies grafted onto human life and shape its noetic and social dimensions? How do machines perceive and change the world?

To answer these questions, and understand how digital technologies are affecting our lives, it is necessary to understand how this stage of technological evolution can be positioned in relation to the metaphorical discourses that, at least since the Greeks, have described human organs as simple machines and depicted early spring-powered automata as being alive (Canguilhem 2008 [1952]; Espinas 1903). This issue prompted me to develop an expanded account of digital technologies and to describe their effects against the background of life in general. This is important, first, because the metaphorical connection of human and machine has historically underpinned a relation of domination of the likes of that described, for instance, by the work of Foucault on discipline; secondly, because the degree of autonomy of digital technologies is today far greater than that of early spring-powered automata, and for this reason, it arguably approaches characteristics we have so far thought as exclusive to living beings.

The progressive concretisation of the metaphorical descriptions of humans as machines (a becoming-algorithmic of cognitive behaviours) and of machines as living beings (a becoming-alive of digital technologies) contributes to the constitution of the new regime of domination described by Deleuze's seminal essay on societies of control, which my research will expand by describing the logic, the vectors and the environments within which this modality of domination takes shape today. This study is informed by some of the insights provided by the philosophy of technology of Bernard Stiegler, which contribute to expand Deleuze's description of control and produce a holistic description of the complexity and hybrid registers within which human life individuates in the digital age.

Exorganic life

Following the work of the French paleoanthropologist André Leroi-Gourhan, it can be argued that human life as we know it today emerged thanks to the development of bipedality and the consequent liberation of the hand from the locomotive function it still assumes in other primates (Leroi-Gourhan 1993 [1964]: 19). This phenomenon, dating approximately 2.5 million years ago, encouraged a liberation of the face, no longer the most advanced point of the body of our ancestors or their primary means of interaction with their environment (1993 [1965]: 244). The liberation of the hand engendered an expansion of the frontal cortex area, permitting a progressive expansion of cognitive capacities and, eventually, the development of fictive language, of which we have evidence dating from about 70.000 years ago. Now free to manipulate its environment and thereby facilitate the metabolic functions of individuals to preserve the reproductive capacity of the species, the liberated hand couples with the expanded cortical fan of early hominids as one of the crucial factors enabling the slow flourishing of cultural systems. As highlighted by American palaeontologist and evolutionary biologist Steven Jay Gould though, 'there's been no biological change in humans in 40,000 or 50,000 years. Everything we call culture and civilization', he writes 'we've built with the same body and brain' (Gould 2000: 19).

According to French philosopher Bernard Stiegler, the emergence and development of cultures and civilizations are rooted in technicity, a property of our species that he describes as the capacity to exteriorise bodily organs, reproducing and enhancing their function through the manipulation of inorganic matter. This process, which he named exosomatisation (Stiegler 2018c: 26), allows 'the continuation of life by means other than life' (Stiegler 1998b [1994]: 17), that is, the evolution of psychosomatic and social organisations by means of technical organs. Shaping malleable matter into a tool, in fact, embeds in the new form assumed by the material its relation with a function, that is, particular behavioural traces that can be repeatedly re-activated through the relation of use. These patterns, from handling a chopper and using it for striking, to the neural pathways activated by reading, can be consequently transmitted to individuals that have not developed them autonomously, but inherit them via the mediation of the technical object, so that techniques can be transmitted intergenerationally and evolve with time. For this reason, Stiegler describes technology as an epiphylogenetic memory, a form of memory that individuals of our species both acquire during their life (epigenetic memory) and transmit to new generations through the mediation of material culture rather than that of genes (phylogenetic memory) (Stiegler 1998b [1994]: 71; 177). Thus framed, then, our relationship with technology is such that as we shape them, our tools have the power to shape us too.

The effects of such reciprocity are evidenced, for instance, by the consequences that the discovery of fire and its daily use, dating approximately 300,000 years ago, have had on our species. As highlighted by the studies of the anthropologist Richard Wrangham, in fact, cooking with fire represents one of the technologies whose diffusion has most impacted our evolution, not only because by exteriorising part of the digestive process it has made available the extra calories that have been invested in the expansion of the brain, but also because it has caused a chain of behavioural adaptations that have transformed social life ever since (Wrangham 2019: 152-155; 177). Technology, however, shapes both our habits and our habitats, and our environments also act retroactively as agents of change in the alternative, ultrarapid path of non-biological evolution that characterises human life. As shown by the work of other anthropologists like James Scott, this phenomenon can be registered in the development of technologies for the domestication of animals and plants that about 12000 years ago caused the adoption of sedentarism (Scott 2017: 68-70). The technological revolution of agriculture provoked significant changes in diets, altered bodily structures and forms of social organisation, reshaping at the same time the environments we inhabit. The Amazon forest is a great example of this: large portions of what is usually regarded as a wild, untamed environment have indeed been revealed to result from the pre-Columbian domestication of flora and other soil management techniques (Woods & McCann 1999). Zooming forward to the end of the 18th century, the technological advancements coalescing in the phenomenon of the industrial revolution would cause radical changes in the socio-economic organisation of most cultures across the world, altering our milieus to the point of causing the global shifts in climate we are witnessing with the Anthropocene.

The diffusion of digital technologies is today causing comparably important changes, impacting human habits and habitats. The term habit must today be considered in light of the automatisms fostered by post-industrial, consumerist society, as shown by the work of Bernard Stiegler, who studied the relation between automation and automatisms (Stiegler 2016 [2015]: 8-9), or Jonathan Crary and Byung-Chul Han, who have considered the adoption of technologically induced habits in relation to work and analysed their psychosocial consequences (Crary 2014; Han 2015). The term habitat, by contrast, must instead be understood in light of the idea that technology constitutes spaces that alleviate the selection pressure untamed environments would exert over humans, as proposed in different terms by philosophers Daniel Dennett, who writes about the de-Darwinising effect of culture (2017: 148), and Peter Sloterdijk, who frames this issue in terms of a 'greenhouse effect' experienced by animals raised within social environments (2016: 109). Nevertheless, as foregrounded by the work of Michel Foucault on the technologies of power that mould human behaviour by structuring disciplinary settings (Foucault 1995 [1975]) and recently proposed by British philosopher Gerald Moore (Moore & Stiegler 2020: 164), by inhabiting techno-cultural milieus we are exposed to different types of pressure, often designed and administered by the structures of domination underpinning broad socioeconomic hierarchies and enforced through the structure of anthropogenic milieus, from neighbourhoods and cities (Lefebvre 1967; Harvey 2003a), to the infosphere, in which we are plunged by ubiquitous media.

The digital revolution only started in the middle of the 20th century, and its consequences are already impacting individual and collective life beyond expectations. It is therefore critical to understand the signs of the mutations underway in our habits and habitats. Technological revolutions have always caused psychosocial, cultural and institutional crises, as highlighted by the work of Bertand Gille, who stressed that the different paces of technological innovation and social development cannot but generate forms of disadjustment (Gille 1978: 24-27). It is also within these crises that new structures of domination are easily put in place: as shown by the work of Naomi Klein, in fact, neoliberalism takes advantage of catastrophic events to dismantle social systems and create new market opportunities (Klein 2007: 6), an idea that Stiegler extends beyond the sole exploitation of natural disasters, pointing out that technology in general 'serves to create shocks and destruction, psychological as well as social and economic, and through that to paralyse thinking and nip any alternative possibilities in the bud' (Stiegler 2015 [2012]: 39), freeing the terrain for power grabs and economic profit in the wake of induced crises of disadjustment.

In a somehow prophetic essay, Gilles Deleuze named the paradigm of domination enabled by digital technologies 'control' (Deleuze 1995 [1990]). This can be defined as the logic through which contemporary power – be it political or economic – deploys technologies as the homeomorphic interfaces characterising web 2.0, recommendation algorithms, the addictogenic design of electronic stimuli funnelling individuals into radicalising spirals and filter bubbles, and exploits the viral vectors that cross the membrane between the infosphere and the psychosphere, generating chains of repetitions of the same ideas and behaviours across social groups, to exert a novel form of seamless and adaptive power over the population.

The subject of control emerges within specific physical environments: these are scattered with sensors that enable them to respond to specific features of their inhabitants, and are powered by blackboxed logical engines that analyse and predict behaviours in order to sway them in desired directions established by the agendas of (post-)political parties and private corporations. However, we have also been plunged in a whole new type of habitat: a cyber-space today perfectly integrated with analogue environments, a digital milieu whose rules are determined by private service agencies that monitor our activities and control access to information. This space acts as the background to what Simondon called processes of psychological and collective individuation: the interdependent processes of genesis and becoming of intellects and social entities. Rather than as substances, Simondon invites to consider such entities as the fleeting results of complex chains of events whose trajectories are open onto the influences of environmental circumstances. Understanding precisely how the cyber-space affects such processes, will help defining how digital technologies are grafted onto human life while sharing the interest that the philosopher of life Georges Canguilhem dedicated to the relation between health and milieus. The French medical doctor and philosopher defined pathology as an inability to create the environmental conditions that would allow an organism to flourish (Canguilhem 1991 [1966]: 183). Given the state of disadjustment produced by the lag between technological developments and the social regulation of the new affordances disclosed by these developments, we are struggling to keep up with technological change and the shocks it causes (Stiegler 2015 [2012]), failing to shape our own techno-cultural milieus. Overwhelmed by the pressures to produce, consume and pay attention that permeate our environments, we are retreating in something analogous to a survival mode, a state that Stiegler will call *bêtise*, or artificial stupidity (2018a).

In order to tackle these issues and propose a description of the changes underway in the social, economic and psychological spheres, my research develops a method that, after Deleuze and Guattari's work (1987 [1980]: 43), I call stratoanalysis. This method aims at describing the transformative relations that digital technologies establish within three intersecting registers of reality, the physico-chemical one, the biological one and the sphere encompassing human activity and its products. Rather than constituting static platforms piled one on top of the other, these strata describe the specific patterns of emergence leading to the individuation of physico-chemical, biological and psychosocial entities and must be considered as different levels of granularity, sets of intersecting processes that, at different degrees of complexity, determine the emergence of apparently simpler entities. Since anthropogenesis starts with technogenesis, the deep transformations that technological development drive in the intersecting registers in which human life expresses itself, manifest as emergent properties of complex, dynamical systems.

Complex systems emerge from the interaction of heterogeneous elements and display traits that do not belong to the elements, when considered in isolation (Silbersten & McGeever 1999: 182). In contrast to a Newtonian worldview then, complexity theory acknowledges the fact that some of the behaviours of dynamical systems can be unpredictable: instead of any central element governing the behaviour of the whole, complex systems owe their organisation to the local interaction of their parts and to their openness to the forces of their milieus, which must be considered as a source of influences rather than as an external ordering principle. Developing a processual understanding of human life in its markedly hybrid character is necessary to describe the effects of the specific types of digital technology I am interested in addressing: indeed, these participate in the emergence of the contemporary subject of power administered through the automatic modulation of the digital systems that contribute to our processes of individuation.

Addressing three registers of life as processes of emergence, stratoanalysis can help understand how control works, and identifying the blind spots that make this new system of domination so effective. Every process of emergence of a new whole projects in fact a certain degree of opacity on how the interaction of its heterogeneous elements takes place. An opacity installed at the centre of the assemblage between human and algorithms, and exploited by systems of power that dissimulate their effects behind an appearance of freedom. For this reason, my research proposes stratoanalysis as the holistic, processual account of reality most suitable for unveiling where control finds its grafting points in our lives and for describing how the reciprocal influences between the sociocultural register and the development of technologies are weaponised by forms of pre-emptive governmentality.

Digital life

In an interesting essay titled 'Is a Cambrian explosion coming for robotics?', former DARPA roboticist Gill Pratt wonders if we are living at the cusp of an extraordinary proliferation of the automata that will take over the world (Pratt 2015: 51). The key drivers of such a burst of diversification and complexification in the field of robotics would be Deep Learning and Cloud Robotics: the first is a design approach within the research on Artificial Intelligence, that allows machines to learn autonomously from the analysis of big volumes of data; the second, instead, is a modality of information exchange allowing robots to learn from other robots, in a sort of incremental swarm intelligence. Their combined development prompts Pratt to claim that 'Deep Learning will soon be able to replicate the performance of many of the perceptual parts of the brain' (52). However, he adds, until problems of 'generalizable knowledge representation and of cognition based on that representation' (61) are resolved, the world-shaping evolutionary potential of robots will be inevitably held back: lacking a synthetic version of consciousness, AI would not be smart enough to take over.

Yet, for Katherine Hayles, whose work on posthumanism focusses on the need to overcome the anthropocentric and essentialist divide between human and non-human cognitive systems, the assumption that AI would have to develop consciousness results from a mere projection of the categories through which we understand the human onto the machines we produce: ‘artifacts that seem to manifest human characteristics act as mirrors or “second selves” through which we re-define our image of ourselves’ (Hayles 2005: 132). This phenomenon is one of the latest expressions of a more general tendency to describe machines as living beings and organisms as machines: the heart as a pump, the computer as an electronic brain, cameras and microphones as eyes and ears and so on.

The anthropomorphic projection of consciousness as an evolutionary stage of AI rests on the belief that, distinguishing human beings from every other organism, this property marks its superiority. However, as stressed by Hayles, the centrality of such a key category for human exceptionalism needs to be downsized, for ‘most human behavior is not conscious but rather stems from both unconscious scanning and nonconscious processes’ (Hayles 2017: 66). Indeed, consciousness is ‘intermittent’. As already highlighted by Aristotle (2016) and stressed by Stiegler after him (2011a [2004]), and as I will show in chapter 4, the noetic faculty is not exerted continuously, but remains dormant, or in a state of potentiality for most of the time in which life functions are carried out under the guide of the senses. Hayles defines the set of processes through which organisms interpret information about the world and their bodies, the ‘cognitive nonconscious’. Largely inaccessible to consciousness though necessary for its emergence, the cognitive nonconscious is constituted by a series of pattern recognition mechanisms and automatic reactions to features of the environment that we share with both other organisms and some technical systems (Hayles 2017: 2).

Mediating ‘between consciousness and the underlying material processes of neuronal and chemical signals’ (6), nonconscious cognitive operations present humans with maps of their physical states and models of their relations with other objects. The emergence of a sense of self out of these maps contributes to the self-preservation of individuals (42). As highlighted by the neuroscientist Antonio Damasio, in fact, ‘the devices of consciousness handle the problem of how an individual organism may cope with environmental challenges not predicted in its basic design such that the conditions fundamental for survival can still be met’ (Damasio 1999: 303). Damasio describes consciousness as a mechanism for the preservation of homeostasis, the optimal state organisms tend to maintain against the frequent and possibly challenging alterations their chemical and physical balance undergo in their relation with the environment. In contrast to physicochemical, automatic mechanisms of regulation, consciousness allows ‘for the creation of novel responses in the sort of environment which an organism has not been designed to match, in terms of automated responses’ (304). While consciousness might be the most sophisticated way to preserve homeostasis, allowing its bearers to plan ahead of potential dangers to the organism and to produce adjustable structures that support collective life and the shared energetic economies I will describe in chapter 5, Hayles suggests that it is not the most efficient way to process information. To defend this idea, she stresses that consciousness has its costs:

> consciousness is belated, behind perception by several hundred milliseconds, the so-called “missing half-second”. This cost, although negligible in many contexts, assumes new importance when cognitive nonconscious technical devices can operate at temporal regimes inaccessible to humans and exploit the missing half-second to their advantage. (Hayles 2017: 44)

The idea of developing machines that ‘operate from a representation of the world’ (2005: 133) would equip robots with too slow a compass to orient swift action in the world. The consciousness that, for Pratt, robotics would need to take off and produce its own Cambrian Explosion is consequently not likely to be shared by machines. Besides requiring too much computational power (2005: 133), modelling AI on human consciousness would produce slow and clunky results ultimately unfit for real world scenarios.

Citing extensively the work of Australian roboticist Rodney Brooks, suitably titled *Cambrian Intelligence*, Hayles shows how complex behaviours of the type required by Pratt’s prediction do not need to result from unnecessarily complicated programming, and can instead emerge from simple rules underlying robotic action (Brooks 1997: 28; 43; 118; 169-170). Consciousness is in fact a complex behaviour spontaneously emerging, as a mode of awareness, or as sense of self, from nonconscious cognition and its underlying layer of noncognitive material processes. While consciousness counts those chemical and electrical signals coalescing in coherent body representations and sensory inputs systematised within spatiotemporal frames, nonconscious cognition is constituted by ‘the dynamic actions through which all cognitive activities emerge’ (Hayles 2017: 28), processes of differentiation that derive from the capacity of matter to respond in different ways to environmental stimuli, and change the development of chemical systems. ‘To use somewhat anthropomorphic language: in equilibrium matter is “blind”, but in far-from-equilibrium conditions, it begins to be able to perceive, to “take into account”, in its way of functioning, differences in the external world (such as weak gravitational or electrical fields)’ (Prigogine & Stengers 1984: 14).

The coordination of several noncognitive chemical agents can give the sense of impressive cognitive behaviour. This is the case of *Physarum polycephalum* or slime mould: while lacking a brain or neurons, this multi-nucleated unicellular protist can be habituated or ‘learn’ how to react to specific stimuli placed in its environment (Boisseau et al. 2016), shows evidence of a primitive form of externalised memory (Reid et al. 2012) and is notorious for being able to solve mazes, computing the shortest paths to food sources (Nakagaki et al. 2000; Nakagaki et al. 2007). Similarly, consciousness is an emergent property: as it does not produce representations of the states of individual neurons, individual neurons have no awareness of its states. If we define consciousness as the emergent mode of awareness guiding homeostasis within a register or at a degree of complexity superior to that of physiological physicochemical systems of regulation, then the sort of behaviours that eusocial insects have evolved to regulate – for instance, the temperature of a hive (Jarimi er al. 2020) – can give the impression, to an external point of view, of displaying at least conscious-like behaviours, i.e., complex behaviours meant to preserve a global, exteriorised homeostatic state, that emerge from the coordinated though nonconscious cognitive systems of individual insects. Phenomena of this type associate the research in biological systems to the fields of complexity and chaos theory: the disciplines studying respectively how, from simple causes, more complex and unexpected effects might arise, and how from the complex interaction of numerous elements, can emerge simple forms of order. This intersection represents an area of interest also for research in the field of distributed intelligence, which could help reframe Pratt's forecast by shifting attention away from the evolution of anthropomorphic AI and towards the idea that networks of simpler robots might well cause the emergence of the more complex behaviours that would allow autonomous machines to take over.

In view of this possibility though, Pratt's description of robotics requires an important clarification, for it does not apply exclusively to zoomorphic machines that carry out mechanical tasks in the physical world, but should be expanded to software that executes purely logical tasks. Classical definitions depict robots as machines capable of running a specific code and performing various movements in the physical environment in which they operate. Yet, with a slight variation, the term robot is also used to describe various autonomous software that can perform tasks in a purely logical environment. Google's search engine, for example, works thanks to a category of 'bots' called spiders or web crawlers: automatic programs that browse the net aggregating various kinds of metadata from different sites in order to index the web pages that will appear as search results. Although such programs lack a 'body', a stereotypical zoomorphic hardware, they are nevertheless cognitive systems (Hayles 2007: 20-25) equipped with the physical form that is the most appropriate for their function and in relation to the environment in which they are programmed to act. Pratt's idea of a Cambrian explosion for robotics applies consequently both to 'hard' robots outputting mechanical movements and to the purely logical, 'soft' bots that already play a major role in the contemporary digital landscape.

Pratt's reflection on this role represents one of the most interesting aspect of his short essay. Indeed, outlining the evolution of the relation between humans and machine as a political economy, the essay points out that, before the development and diffusion of mechanization, the human body constituted a central economic capital: from slavery to serfdom, the economies of entire nations were based on its investment in the retrieval of resources and in its indispensable function in the transformation of the environment. When the value of physical work declined due the diffusion of technological solutions that started taking over increasing portions of physical labour, though, the economic value of brainwork increased: mechanisms could not design, make decisions, plan or organize work. Following the logic of this progression, Pratt provocatively asks: 'If brains go the way of bodies, what inherent value will human beings have? […] In a future robotic economy, various characteristics of bodies and brains may have much less economic value, but the inherently human value of personal preferences will remain' (Pratt 2015: 59). Pointing out that internet companies like Google or Amazon have already profited beyond imagination from this 'residual' form of human capital, a topic I will touch upon in chapter 6, Pratt highlights a key element of the current state of the relation between humans and computational media, 'the quintessentially *cognitive* technology' (Hayles 2017: 34). Personal preferences are the expression of (often unconscious) cognitive processes taking place within digital interfaces and in front of sensors of all kind, that can be picked up by automatic systems programmed to detect them: machine cognizers (2006: 161) plugged in the same network in which human cognition expresses itself. Hayles refers to this setup as the cognisphere: 'the cognisphere gives a name and shape to the globally interconnected cognitive systems in which humans are increasingly embedded' (161). According to Hyles then, both acting and perceiving, humans and machines express their cognitive capacities within the same cognisphere, that connects them as a field of circulation of stimuli and responses.

Reframed within these coordinates, that circumscribe processes already underway, the question proposed by Pratt's essay could then become: how do cognitive automata take over the cognisphere? The importance of this field must not be underestimated: while its conquest might not yield visions of post-apocalyptic wastelands and humanoid robots openly hunting humanity, it does entail a war waged on the attentional resources of an atomised society whose critical capacities have been disintegrated by decades of consumerist indoctrination, neoliberal propaganda and by an open weaponization of differences, a society whose collective power for self-determination has been weakened by the regressive immiseration and mental health crises afflicting life in the environments shaped by capitalism and through the diversion tactics of post-politics of consensus. Plugged in the same cognisphere, humans and machines give rise to a circulation of affects through which a subtle process of automatisation of individual thought and collective life takes place as the latest implementation of those processes of vivification of machines and mechanisation of living beings that have long characterised the relation between technics and life. With my work, I propose to analyse these processes, scarcely considered by the great quantity of literature existing on the infrastructure and devices supporting the implementation of digital technologies in all aspects of contemporary life.

To broadly address some interesting elements of this complex panorama though, we could start by mentioning James Ash's *The Interface Envelope* (2016), an essay that, through the analysis of gamespaces and gamers' aesthetic experiences, shows how contemporary computation produces interactive, proteiform spaces whose effect is to surround their users conditioning their cognitive responses through the administration of stimuli specifically designed to extract economic profit from the interactions they host. More encyclopaedic works, like Adam Greenfield's *Radical Technologies* (2018), allow us to understand in detail the functioning of the technical objects through which cyber-spaces are integrated with analogue ones. While omnipresent devices like smartphones or IoT systems allow access to the web and enable daily use objects to collect and transmit information, for instance, full audio-visual immersion in digital spaces is already permitted by the development of augmented reality. In addition to fully integrated consumer goods, the evolution of automation, digital fabrication, and cryptocurrencies constitute other noteworthy implementations of computation in areas of life as fundamental as work, manufacturing and economic transactions, and allow the logics of machine learning and artificial intelligence to find additional grafting points in a world already heavily translated in binary code (Greenfield 2016: §10 ¶1-7). In a previous work, the American urbanist offered a critique of the smartification of urban environments (Greenfield 2013), showing how the neoliberal rhetoric of resilience and constant improvement, as well as the belief in the superiority of automatically-generated data-driven decisions over life are rapidly being implemented at the urban scale, completing the integration between analogue and cyber-spaces and the link between life processes and algorithmic analysis, as the combination of spontaneous organisation and reactive nudging we see at work in more classic screen-mediated interactions with the digital sphere. This process of integration is assisted by the technical advances in the field of biometrics: as highlighted by the bioelectronic engineer Michael Fairhurst (2018), this consists in the use of sensors to define, via the identification of measurable characteristics, the identity of individuals interacting with digital systems of all sorts. While biometrics can free uses from the passwords or physical objects used to log into systems or activate smart devices, and that might always be forgotten, lost or stolen, its application in the field of surveillance has converged with the broader risk-minimising logic signalled by the works of Foucault (2009 [2004]) and more recently described in its liaison with digital technologies by Antoinette Rouvroy as the core logic of algorithmic governmentality: the often biased pre-emptive profiling practices today being applied to a growing portion of public environments (Rouvroy & Berns 2013).

Among the works addressing the political implications of digital technologies, Benjamin Bratton's description of the structures supporting the cognisphere is particularly detailed, and the merit of his *The Stack: On Software and Sovereignty* is to have proposed a clear and comprehensive map of the technical network underlying contemporary computation, a multi-layered structure composed by different pieces of technology that work together and operate at different scales: 'infrastructures at the continental scale, pervasive computing at the urban scale and ambient interfaces at the perceptual scale' (Bratton 2015: 3-4). As an interactive complex of sensory environments, machine cognizers, and the programs that systematise and analyse the information they collect, however, the Stack does not interact only with human users. According to Bratton, every subject capable of interacting with this structure, can indeed be defined as a user: 'the User is not a type of creature but a category of agents; it is a position within a system without which it has no role or essential identity' (251). While broadening the scope of the relation between the Stack and the analogue features of the world beyond anthropocentrism, Bratton's work describes what the Stack does *with* the user, but not what it does *to* the user. In other words, while Bratton's description has the merits of being technically accurate, exceptionally broad and intuitively accessible, it does not allow us to recognize the effects of its layered structure on life, in its biological, noetic and sociopolitical registers of expression.

Such a description requires a long-overdue redefinition of the ontological coordinates within which this dynamical relation takes place. A first movement in this direction can be found in the pages that Alexander Galloway, in his work on the French philosopher Francois Laruelle, dedicates to the process of digitisation (Galloway 2014): the parsing of a physical continuum into discrete units. Instances of digitisation can be registered in both living and non-living systems that transform matter and energy, and can equally be seen at work behind perception and technical activities like writing or digitalization – the translation of physical continua like sound waves into binary digits. The work of Galloway on this topic, however, does not account for the modalities in which these digitised units, whatever their type, can establish reciprocal relations that generate new coherent wholes characterised by emergent properties. With its conceptual proximity to complexity theory, stratoanalysis allows instead to complement the description of computational processes of digitisation by outlining the emergence of the techno-living hybrids described by the likes of Leroi-Gourhan and Stiegler and to evaluate the effects of the process of emergence on the individual elements of the assemblage – the disadjusted psychological and social processes of individuation plugged into the digital machine. Yet, in order to map how the emergence of techno-living entities is mediated by today's technologies of control, another shift is necessary. This can be performed by adopting a stand that could be roughly situated between some of the tenants of new materialism (Dolphijn & van der Tuin 2012) and the characteristic approach of a little appreciated strand of speculative realism (DeLanda & Harman 2017). This position can be described through two basic ideas: 1) Not all that is real is actual; 2) Matter is not a passive receptacle of form.

First, while enduring properties provide objects with consistent distinctiveness in a world-in-flux, their apprehension does not offer a complete picture of things. Systems have tendencies that characterise the way in which they change in relation to environmental conditions, and also capacities, meaning the ways in which they affect and are affected by other bodies. As highlighted by DeLanda,

> unlike properties that are both real and actual, dispositions are real, but if they are not currently manifested, *they are not actual*. Some philosophers believe that the category of *the possible* is what is needed to conceptualize non-actual dispositions, while others (e.g., Bergson) felt the need to invent a new category of being (*the virtual*) to accommodate them within a realist ontology. (60)

By superimposing these distinctions onto the illustration of recommendation algorithms, one can understand the political importance of this ontological move to describe control societies. Big Data analysis extracts recurring behavioural patterns from the neighbourhood of a user. In the case of purchases, for instance, this can define a 'commonly bought together' baseline for suggestions: people that have bought a phone have also bought a bumper case. While these patterns are *actual* and emerge as a property of groups of users, they are understood by recommendation systems as an indication of the *virtual* tendencies – to purchase, watch, read or listen – of a specific individual, the target of suggestions. This user might not have yet purchased, read or watched a piece of content or product that users with similar characteristics or behavioural history have instead already interacted with, but the system assumes they could be inclined in doing so on the basis of previous correlations. Because of this assumption, recommenders select the most likely tendency a user would follow, and propose them more videos, music or posts in line with it. With content being increasingly designed to be consumed at an ultrarapid pace, as signalled by the endemic diffusion of 'stories' within social media, short snippets of audiovisual content meant to be seen only for a short amount of time, and creators being pushed by the always more competitive market of attention to capture users' attention through sensationalistic titles and thumbnails, suggestions end up foreclosing the many other possibilities through which the interest of a user could be expressed. Recommendation algorithms tend to collapse the vast array of possible uses of a platform onto one specific virtual tendency, effectively transforming correlation into causation, and conforming future individual behaviour to group behaviour. For this reason, in order to address the full scope of the effects of algorithmic control, the relation between life and the digital must be reframed as the relation between the digital and the virtual. The advantage of Deleuzean stratoanalysis is that it allows us to incorporate this shift into a holistic description of reality, formulated through the processual lens already crucial for Simondon's work on technology and individuation, while dealing with issues of complexity to account for the emergence of the subject of algorithmic control.

The second movement necessary to complete this description implies the necessity to account for becoming and the manifestation of novelty. To do this, rather than passive and inert, matter should be understood as eminently active and considered in its far-from-equilibrium states, in which its arrangements are sensitive to small variations in the environment that trigger processes of self-organisation. The opposite understanding, upheld by Aristotle, Saint Thomas of Aquinas and the scholastics, portrayed instead matter as the indeterminate receptacle of ideal forms. As I will show in the first chapter, this hylomorphic approach has informed the structures of domination spanning from the coercion of animals and the exploitation of natural resources to the disciplinary mechanisms described by Foucault (1995 [1975]). Focussing on the virtual dimension of tendencies and capacities, instead, the deployment of digital technologies as a tool for domination rests on an understanding of matter as lively and vibrant, and aims at following it in its spontaneous processes of individuation and self-organisation in order to exert a new form of dynamical control onto these process. Deleuze and Guattari liken this operation to that of an artisan, whose plane 'an artisan who planes follows the wood, the fibers of the wood, without changing location' (Deleuze & Guattari 1987 [1980]: 409), attending morphogenetic processes and carving forms that follow natural developments in the material.

Acknowledging the dynamicity of matter, neo-materialist approaches consider objects as the temporary results of their generative material processes, decentering the human to place it on a continuum with other processes of emergence. A processual understanding of reality, that conceives objects as momentary coagulations of the flows of energy crossing environments with different features, refuses consequently to adopt categories like that of the subject or individual as starting points for descriptions of reality, and rather considers them as entities whose character and emergence must be explained by tracing the morphogenetic processes that underline their emergence. This approach is the most appropriate to describe a technology that understands individuals and communities as the result of dynamical processes and attempts to dominate them by tampering with these very processes to nudge them in desired directions. This is precisely how automated cognisers take over: by conditioning humans through the administration of targeted suggestions, these systems transform correlation detection into physical causation, causing the emergence of those subjects of algorithmic power (Bucher 2018: 3; 34-35) I call artisanal cyborgs.

Structure of this work

A detailed description of the technical processes behind the emergence of the hybrid subject of digitally enforced domination requires the adoption of a different point of view compared to the one chosen by Bratton, and the production of a different type of map**.** For this reason, in the footsteps of Deleuze's *Post-Scriptum* (1995 [1990]), my work illustrates the passage between two modalities of domination: one that is perpetrated through the imposition of forms over thought or behaviours from a source that is exogenous to the processes of individuation, and another, engendered by digital technologies, that instead of sterilising the morphogenetic potential of individuation processes, exploits them through a feedback mechanism that modulates the tendencies and capacities of individual and collective bodies.

Building upon the Deleuzian notion of flow, which enables us to provide a processual understanding of the world, in the first chapter of this dissertation I develop the conceptual couple cut-out and flow-cut, the general processes through which continua of matter and energy are segmented into identities, to describe the emergence of the segmentary view of reality on which the first modality of domination, namely discipline, rests. Cut-outs separate systems from their morphogenetic processes and isolate them from their metasystems, restricting at the same time their latitude of action. The origin of cut-outs is related to the emergence of different levels of complexity and prolonged in the peculiar angles perceptive systems assume on reality (*Umwelten*). The notion of flow-cut describes instead how relatively still quantities are delimited and extracted from continua of movements or transformations only to be subsequently re-connected to compose visions of reality whose edges are shaped by systems that process matter and energy or by the technological apparatuses that enable perception of and action upon these processes (*technical Umwelten*). Against this background, I define the technical expression of flow-cut performed by digital technologies through the articulation of three operations: digitisation, a process described by Alexander Galloway (2014) and resulting from the combination of *flow-cuts* and *cut-outs*; grammatisation, an operation described by Sylvain Auroux (1994) and later expanded upon by Bernard Stiegler (2019 [2016]: 109) as a technical form of codification of digitised elements; and finally, the process of digitalisation as the standardisation and conversion of analogue elements into digital formats. These notions describe the perceptual and technical segmentations of reality, and their description is necessary to understand how machines perceive the world, and how the basis for the operations of control is produced against a background stream of becoming. Algorithmic control follows in fact the spontaneous morphodynamic development of behavioural patterns to nudge it towards desired directions, rather than imposing pre-determined exogenous forms over such patterns. Understanding the ontological and aesthetic shifts behind this difference will help informing forms of appropriate resistance that will be necessarily different from the ones we have so far developed to resist disciplinary modalities of domination.

To understand the effects of the digital on life, however, such notions must be supplemented by others that map the productive connections and the transformational vectors that cross borders and bodies, giving rise to hybrid phenomena of emergence, and technoliving modulations. The concept of stratification described in *Mille Plateaux* (Deleuze & Guattari 1987 [1980]), and further developed in chapter 3, offers a perfect tool to combine the two perspectives. Different strata typify different types of morphogenetic processes: the three main strata identified by Deleuze and Guattari represent the patterns that will be replicated, given the right conditions, in processes of emergence within the physicochemical, biological and anthropomorphic (i.e., technical and linguistic) registers. My work proposes to define the digital stratum as the pattern of emergence capable of translating all the other strata on a numerical plane, on which the process of emergence of the hybrid subject of algorithmic power is articulated. Having defined the process of digital stratification, I will explore the relation between the digital stratum and the other three major strata identified by Deleuze and Guattari, and describe how the digital stratum impacts the physicochemical register of emergence, its relation with the biological one, and, ultimately, how the technical and linguistic registers through which human life emerges as techno-living hybrid are impacted by the diffusion of the digital stratum. By doing this, I will provide insights into the impacts of the digital on life from three points of view: the one of assemblages, which deals with self-organisation, co-evolution and symbiosis (in chapter 5); that of life-functions or the behaviours typically displayed by living beings (in chapter 6); and a third, based on Schrödinger's understanding of life as something that fights entropy (in chapters 5 and 6).

Following discussion of the process of hominization *qua* technicization to which I have referred above (Stiegler 1998b [1994]: 141-142), chapter 5 connects its original formulation in Leroi-Gourhan's work to Keith Ansell-Pearson's reading of the Deleuzoguattarian concepts of *non-organic life*, *machinic phylum*, *and creative involution* (Ansell-Pearson 1999), notions based on the idea that life is not limited to the organic sphere and which, while delineating a broader sense of the concept, allow us to assess both the hybrid nature of our species and the life-like behaviours already displayed by digital entities. Against this background, I will describe the two processes through which the digital stratum is grafted onto human life and spreads its suggestions through the social sphere: a becoming-algorithmic of human beings and a becoming-alive of digital technologies (in chapter 6). While the first culminates in the emergence of the artisanal cyborg, its development requires a consideration of Deleuze's insights into matters of non-Euclidean space and adopts the notion of *smooth* or *Riemannian space* (Plotnitski 2005) to describe the peculiar character of the milieus in which digitally-mediated processes of individuation take place. Considering the relation between topology and individuation in Simondon (2020 [2005]: 159-161), and exploring how this is altered by computational technologies, this passage outlines the process of individuation of what Deleuze named the *dividual*

(Deleuze 1995 [1990]: 180), and that I define as the central node through which the stratum maps the tendencies of individuals and paves the way for the suggestions that will shape the emergence of the artisanal cyborg. This is an entirely digital process of individuation that, being analogous to the ones of living individuals proposed by Simondon (2020 [2005]: 163), allows for the continuous biofeedback at the basis of digital control.

Already evident in the modality of individuation of the dividual, the process of becoming-alive of digital technologies is more directly exemplified by the first instance of the digital transmutation of a life form: that of biological viruses. Chapter 6 considers this singular form of life and defines, through the concept of *cryptobiosis* (Keilin 1959), the notion of the *intermittence* of life, which in turn allows us to assess the effect of the digital on what Bernard Stiegler calls the noetic life of the mind (Stiegler 2011a [2004] : 152). On the basis of the correspondence between digital and biological viruses, it is possible to assess general virality as the cross-strata patterns of contagions (Sampson 2012) that underlie the diffusion of suggestions within the social sphere.

Subsequently focusing on the relation between the digital and social systems, in chapter 7 I show how the latter are linked to the advantages connected to the partial externalization and sharing of energy processing operations, and related to the production of what I define as *structures of mitigation*: material supports for socio-economic suprasystems that modulate possible oscillations in the afferent flows of matter and energy. Through a movement that ties together Schrödinger's definition of life (1992) to complexity theory, I then show how, while delivering from the stress imposed on them by the environments, these structures invest social subsystems with a new form of downwards causation, whose rationale is organisational and principle purely financial. This expresses as a new form of selective pressure exerted on the subsystem, and qualifies socio-economic suprasystems as additional agents of selection. Against this background, this chapter addresses the organisational formulas of *hygiene* (Gille, D. 1986), *security* (Foucault 2009 [2004]) and the rhetoric of *smartness*, which determine the configuration of the structure of mitigation from the dark ages to the smart city. Considering urban computerisation in relation to the forms of control exerted on citizens/users, this section proposes another account of the shift away from hylomorphic forms of domination and towards the morphodynamic one afforded by the digital stratum. The reading of this descriptive model is carried out in consideration of both Deleuze and Foucault's depictions of the analogue and computational mechanisms of domination, highlighting once again the need to think of the digital in relation to life and from a processual perspective: a substantial lack in accounts of digital urbanism similar to the one proposed by Bratton or Greenfield, whose critique focusses more specifically on smart cities.

Linking back to the cultural and economic suprasystem structuring the social relations it emerges from, and to capitalism as a logic for the organisation of nature, the conclusive section of this work focuses on issues related to the connection between capitalism, life and the digital. Here, I describe the role of marketing in the new scenario that Nick Srnicek (2017) defined as platform capitalism, a new type of supranational service economy that encourages self-exploitation through built-in addictive designs and the suspension of noetic intermittence (Crary 2014). Chapter 8 addresses then how digital capitalism employs the modulation of desire afforded by the digital, favouring the exploitation of the process of individuation and its development through cyberspace as the new frontiers of value production and accumulation. Against this background, the chapter reflects on the new class distribution produced by the liaison between the digital stratum and capitalism as a matrix of social relations, namely the relation between those who control the vectors through which information is circulated (Wark 2004) and the virtual fields of affordances whose interactions with the sensorium of the digital stratum are 'mined' for profit. I conclude the text with an hypothesis for the reconfiguration of our understanding of the notion of work in the context of this digitally-enhanced mutation of capitalism, that in the face of computational systems of control must be rethought in a post-human fashion as *abstract work*, that is, encompassing every dynamical system from which tendencies can be extracted through data analysis and whose development can be steered via the production of responsive infrastructures as we have already seen at work in the case of homeomorphic interfaces filled with smart ads and smart urban environments.

Mapping how machines perceive and change the world, and how the relation between the digital and the virtual is exploited to graft a new form of domination onto human life, this work hopes to provide some of the coordinates necessary to resist present and future applications of algorithmic control.

Chapter 1: From Flows to Mechanisms

In 2010, Facebook experimented with 61 million voters in the context of the American midterm elections, boosting voter turnout through a targeted messaging campaign that nudged around 340,000 reluctant users to the polls by leveraging their inclination to imitate their online friends (Corbyn 2012). Six years later, a political consulting firm provided the conservatives with the insight necessary to run highly personalised messaging campaigns on Facebook in the context of the US presidential elections (Cadwalladr 2017; 2020). In January 2021, a mob stormed the Capitol building. The crowd, led by Trump's supporters, had been largely gathered and expanded thanks to the profiling mechanisms and suggestion algorithms that, always on Facebook, have brought some to follow the cryptic, pseudo-revolutionary messages distributed by the anonymous 'Q', a figure today still wrapped in mystery (Wong 2020; Kuznia et al. 2021). These events show that smart machines are already changing the world. To understand how, though, one needs developing the right perspective on reality.

The deployment of tools like recommendation algorithms and smart ads for commercial or political purposes connects indeed two different types of processes: on one side, digitalisation, big data analysis and recommendation are thoroughly designed processes that follow predictable technical rules; on the other, the psychological and socio-political changes resulting from their deployment are instead spontaneous processes connected to instances of self-organisation and emergence. Designed and spontaneous processes are today connected by digital technologies, and the first influence the second to the point of constituting a technology of power supporting a new, digital, regime of domination. Yet, to understand how they relate and influence each other, these processes must first be connected to a more general dynamical matrix. Specific types of transformations, be they designed or spontaneous, constitute in fact only special cases of the more general dynamicity characterising reality, and showing how these different processes gain definition against this background will allow us to understand also how they can influence each other. For this reason, this chapter outlines the elements of a process-oriented ontology, describing the world as in-flux to then show how, out of the chaotic dynamicity of becoming, sets of forces coalesce in the ephemeral stability of objects and how perceptual systems, first emerging as a prerogative of living beings and then expanding also to electronic devices, translate this plane of pure becoming in their own terms. This description will allow us to understand how technical processes like digitalisation can be plugged into spontaneous ones, like human behaviours, follow their development and influence it by means of suggestions.

After describing this kind of processual understanding of reality, the chapter proposes the notions of flow-cut and cut out to address respectively the ways in which flows of energy and matter are parsed and codified by transformative systems, and how such systems carve, out of the chaos of becoming, particular points of view over reality. Think about the human eye, able to capture only a limited number of frames per second, parsing a continuous flow of light bouncing off a surface as performing a flow-cut, and then consider the difference between looking at a surface with the naked eye and with a microscope as an example of two different cut-outs. In the second section of the chapter, I use the notions of flow-cut and cut out in relation to technologically mediated perception to show how we have come to see the world through the tools we use to manipulate it, and address the consequent inclination to describe the world as a machine. The concluding section of this chapter will show how such a mechanising view has been adopted to devise systems of domination that map the behavioural patterns of living beings onto those of machines, reducing spontaneous processes to programmed ones.

Abstract machines

An atom is a distinct pattern of electromagnetically charged quanta of matter in a given space and time, a varying number of positive and neutral charges around which smaller negative charges spin at a distance. Among these patterns, that of carbon is one of the most interesting. Because of the arrangement of its electrons, it can bond with other elements in a variety of ways and make up a lot of different stuff: from carbohydrates, proteins, fats and DNA – that is, what we are made of, what keeps us alive and looking human – to pencils and diamonds, steel, the fizz in your drink and its plastic bottle, the fuel in your car, the asphalt on which it runs and almost all the fibres in our clothes. While carbon bonds are stable, they remain malleable enough to allow for easy rearrangements, so that they can constantly be made and broken and re-made by different systems that process its compounds. On Earth, carbon circulates between the hydrosphere, the biosphere and the atmosphere and, over longer periods of time, can get stored in the lithosphere. On the surface, for instance, plants capture carbon dioxide, water, and light to synthesize the sugars and carbohydrates they need to grow and reproduce. Photosynthesis shifts carbon from gaseous compounds to solid ones and when plants are eaten by other living things, these are transformed again. Feeding on organic carbon compounds, animals harvest energy and produce the molecules necessary for their own growth and reproduction. The systems chained into their metabolic trajectories break and re-make carbon compounds, eventually emitting carbon dioxide in the atmosphere and allowing for its circulation across the biosphere to start again.

The carbon cycle illustrates how the circulation of an atom through different transformative systems can both fuel them and contribute to their composition. Linked through the circulation of transitory patterns of matter and energy, these systems reorganise their connections with other elements, tapping into the compounds for energy and materials to grow. In the *Anti-Oedipus*, Deleuze and Guattari refer to these transformative systems as machines, and to the circulation of matter and energy patterns through chains of nested transformative systems in terms of flows:

> Every machine, in the first place, is related to a continual material flow (lzyle) that it cuts into. It functions like a ham-slicing machine, removing portions from the associative flow […] The machine produces an interruption of the flow only insofar as it is connected to another machine that supposedly produces this flow. And doubtless this second machine in turn is really an interruption or break, too. But it is such only in relationship to a third machine that ideally that is to say, relatively-produces a continuous, infinite flux […] In a word, every machine functions as a break in the flow in relation to the machine to which it is connected, but at the same time is also a flow itself, or the production of a flow, in relation to the machine connected to it. (Deleuze & Guattari 1983 [1972]: 36)

This definition encapsulates Deleuze and Guattari's processual understanding of reality, which highlights the primacy of becoming over being, and allows for descriptions of the world as a field of constant conversion between vectors of energy and matter, and the transformative systems that make and unmake their fluctuating connections, momentarily thickening into individual objects with extensive qualities. Indeed, one thing is saying that different actors exchange carbon atoms, another is to say that the pattern of carbon crosses, fuels, composes and gets transformed by different dynamical systems: in the first case, points enveloping and developing material processes constitute the centre of descriptions of the thoroughly defined, hierarchically organisable, somewhat sclerotic or dense face of material reality, while in the second, forces coalescing in objects and diverging in their possible becomings highlight the radical openness and dynamicity of a reality seen in its impermanence and creativity. To define the relation between these two faces of reality, the chaotic dynamicity of becoming and the ephemeral stability of the objects into which forces coalesce, Deleuze distinguishes between a plane of consistency or immanence, and a plane of organisation or development. We can understand them as different perspectives over reality**:**

> The plane of immanence is the movement (the facet of movement) which is established between the parts of each system and between one system and another, which crosses them all, stirs them all up together and subjects them all to the condition which prevents them from being absolutely closed. It is therefore a section; but […] a mobile section, a temporal section or perspective. (Deleuze 1986 [1983]: 59)

Transversal to all objects, the immanent plane of consistency is an open basin of free-floating vectors of energy and superimposing fields of forces that, for its abstract dynamicity, can be understood as a temporal perspective over reality. This plane is the background against which we tend to 'cut' well-defined sections, identify persistent nodes at the intersection of forces and carve, around them, closed systems assuming a perspective that, for the hard and fast lines it casts over the world, can be instead defined as spatial. As a pattern of energy and matter cutting through and being transformed by many different systems, an atom of carbon can become many things, and the plane of consistency can be understood as the totality of these possibilities. For this reason, Deleuze and Guattari define this plane as virtual, in contraposition to the plane of organisation, that is composed by concretised possibilities, and defined as actual. What the authors call abstract machines, the systems that cut the flow of matter and energy we have seen circulating as a carbon atom, is what will decide which of these possibilities will concretise. It is the system of forces by which flows are captured that compose them into this or that thing, that temporarily slows down its movement to assemble it into this or that component, crystallising this or that type of fuel. Once materialised, however, a concretised possibility preserves a certain openness to change that keeps it connected to the plane of consistency, open onto its possibilities of becoming. While temporarily coagulating in local, hazy material wholes then, the plane of consistency does not precede the plane of organisation, but cuts across its transformative systems of forces, cooling down here and there, constantly forming and dissolving surfaces into processes, too elusive to be conclusively delimited and categorized in the still mosaic of the plane of organisation.

In itself, the pure immanence described as the plane of consistency does not shatter in the myriad of objects we are used to perceiving. Nor does it refer to any subject that would transcend it. Rather, it is a plane of sheer becoming that Deleuze defines as '*a* life', choosing the indefinite article not to mark individuality, but to signal a multiplicity of virtual events that are, indeed, indefinite because non-defined, not distinct as concretised possibilities: 'A life is everywhere, in every moment which a living subject traverses and which is measured by the objects that have been experienced, an immanent life carrying along the events or singularities that are merely actualized in subjects and objects' (Deleuze 2006a [2003]: 387). Assuming the temporal perspective of the plane of immanence allows us to conceive the shifting tapestry of flows of matter and energy like the flows of carbon, nutrients, waste, and people, seeping through a plethora of interconnected transformative systems or abstract machines as vibrant, spontaneous, lively and *a* life, as the immanent dynamical reality that can get actualised in discrete, clearly separated organs and organisms. Here, every machine refers to other transformative systems, converging in the same abstract operation (Deleuze & Guattari 1987 [1980]: 514), that is, in the emergence of the plane of organisation in all its apparently separated parts and layers of complexity.

Allowing us to cut fast and hard lines across layers of reality, the formation of categories, of fixed coordinates and stable hierarchies, the spatial perspective of the plane of development constitutes the dominating viewpoint for looking at the world and acting upon it. This perspective is based on the formation of the many other dyads that have structured our perspective on life and our surroundings: 'Chief among these troubling dualisms are self/other, mind/body, culture/nature, male/female, civilized/primitive, reality/appearance, whole/part, agent/resource, maker/made, active/passive, right/wrong, truth/illusion, total/partial, God/man' (Haraway 1991: 177). As highlighted by Donna Haraway's work, these dyads ground systems of oppression subjugating what is posited as 'other', and inform the long history of techniques adopted for the instrumentalization of nature. Up to a point, in fact, the tendency to describe the world as being composed by still, isolable objects with defined essences and solid bodies ready to be manipulated has informed the production of power structures and techniques of domination, shaping at the same time the forms of resistance we have devised against them. Yet, with their development, digital technologies have contributed to a significant shift in these practices, enabling the diffusion of an alternative modality of organisation of nature that has rapidly been implemented as a tool for domination. In order to describe this new modality of power and to enable ourselves to challenge its present and future applications, we must understand how this new perspective stems from previous hegemonic models of organisation, and what differentiates their modalities of application.

To obtain a fuller picture of this change, one must trace a line that connects past and enduring perspectives on reality with future prospects of oppression. The perspective from which we describe the world determines how we relate to our surroundings, and the power of digital control will seem irresistible as long as we remain prisoners of the perspective on which analogue modalities of domination have so far been based. Elaborating on the relation between the plane of consistency and the plane of organisation, over the following pages I will describe two operations whose declination grounds the shift from traditional frameworks of domination to a new form of power whose exercise is based on the deployment of digital technologies. I will call 'cut-out' the way in which closed systems are delimited by their processes of emergence and by perception, while I will refer to 'flow-cut' as the parsing and codification of flows of energy and matter. This is the operation that Deleuze and Guattari ascribe to their chains of abstract machines, which can be exemplified by the capturing of static pictures of objects in movement. A flow of electromagnetic energy beaming away from the surface of the sun reflects on a surface, its atoms absorb some wavelengths and bounce back others as flows of photons. Some of these can hit a sensor, and shatter into millions of pixels that break them down further, discriminating between different wavelengths and classifying them according to intensity, translating the amounts of photons captured by individual photoreceptors into binary digits, stitching these up into sequences of zeros and ones, to finally inscribe them on a SD card. In this instance, the solar machine operates nuclear fission, emitting a first flow in which the atomic machine distributed on the surface of the subject photographed absorbs wavelengths, allowing an electron to bounce back as a photon. A second flow is captured by the sensor machine and the pixel machine, which in turn translate it into a segment of code that is picked up and inscribed on a memory card machine by a software machine. In the next section, I will focus on the notion of flow-cut to set the ground for the most basic operation through which digital technologies relate to the analogue dimension.

Flow-cut

The concept of *flux* enters the philosophy of Deleuze through his reading of Bergson (Deleuze 1988 [1966]). His work on the continuity of movement and duration (Bergson 1946 [1934]) aimed at describing the lived experience of time (1994 [1896]) and decoupling the temporal dimension from its representation in spatial terms, that is, from its reduction to a collection of separate moments tied together as distinct points on a line. Attempting to outline the authentic meaning of movement and becoming beyond the tendency to perceive reality in terms of distinct objects, definite states and the consequent reduction of transformations to mere connectives between still states, 'Bergson distinguishes three sorts of movement: qualitative, evolutive, and extensive. But the essence of this movement […] is alteration' (Deleuze 2003b [2002]: 37). The concept of flow must be understood in these terms, that is, both as movement or circulation, and becoming or transformation, rather than as signalling the connection between still states, which are but approximations of infinitesimal or very slow alterations crossing right through them. These movements and transformations, these becomings, are already separated from the plane of consistency, on which, for its purity, no individual object or particular transformation can be outlined and no reference point exists for movements to be perceived against. Flows are indeed always flows-of-something, and are only theoretically distinct from the codes they are segmented by, that is, from the patterns and forms in which systems of force make them coalesce. A flow can be exemplified by a Euclidean vector, a geometric entity graphically represented by an arrow, that is always equipped with a direction and a magnitude. Both these properties are relative to other points in space against which directions can be distinguished (as a frame of reference, Euclidean space itself is a coordinate system) and to a zero point against which magnitudes are measured (and represented by the length of the arrow). Unsurprisingly reprised in his books on cinema (1986 [1983]; 1989 [1985]), Deleuze's work on Bergson can give the impression of being a cinematic experiment with motion blurs and defocus aberrations (1983: 2). Taking further our example of photography, we can expand on this conception by imagining three stages of blur: the virtual, in which movement is given but nothing moving can be defined, the fluxes in which speeds and directions can be distinguished, and the still shots, in which the shapes of a subject assume definite forms, movements and transformations arrested and captured by the camera. Already assuming some distinction though still out-of-focus, flows are always in between the two planes we have just distinguished, the absolute motion blur and the still image. Passing through the plane of organisation, from a transformative system to another, or from machine to machine, flows are always relative to the codes imposed on them by transformative systems, and to some definition already developed: always flows of something.

Prompted by his students while he was teaching at Vincennes, in the December of 1971 Deleuze proposed a definition of flows that will provide us with some of the additional elements we will need to diagram the background dynamic our work develops from. For his own admission, and because of the nature of the topic, the definition provided by Deleuze is somehow limited, and instead of covering the full spectrum of meaning of the concept, brings with it a constellation of concepts and operations that are inseparable from the notion of flow. This happens precisely because there is no flow-in-itself: a flow is always an inseparable correlate of the ways in which it is discretised and it is always given in relation to the sharply defined figures of which it is a slight defocus. In this lecture, Deleuze highlights that the transformative systems crossed by flows have poles (Deleuze 1971: ¶1). These represent both the points of access and exit through which fluxes flow through a system, but signal also the points at which some quantities can be arrested. Light can be a good example of this. Above we have seen that the atomic layer constituting surfaces absorbs some wavelengths of the electromagnetic energy of solar light, while bouncing back others in a flow of photons that hit the eye. This subtractive operation produces what we perceive as colours. Poles have then a double significance: first, they represent the spatial coordinates required by a treatment of flows as vectors; second, they point at the inseparable correlates of the notion, that is, capture and codification. As features of a system already in place, without which flows cannot be identified, poles are defined as the means through which transformative systems capture flows. In this sense, since a flow can be represented as a vector, and such representation requires spatial coordinates, a flow can be conceived only in relation to what captures it and submits it to a form of codification. As Deleuze adds, in fact, that flows imply codes (¶1), and can only be grasped through operations that codify them (¶4).

Codification is the operation through which systems organise matter and energy in preparation for their utilization: it produces series of cuts on a flow that enters the body of the system, standardising the elements cut and making them compatible with the degree of complexity of the machine that will process them. Let us use a concrete example: to eat a steak, one cuts it in pieces, distributing its quantity through the use of tools like knife and fork. These determine a code that divides the steak alongside sharp lines and angles, in pieces of approximately the same dimension. One then masticates the pieces, further codifying that matter into boluses. These operations are performed to insert the food in one's mouth, a first system, then to swallow it, passing it through the pharyngeal system, after which the rest of the digestive system further decomposes the matter into smaller, soluble molecules to allow the assimilation of energy.

The operation of coding produces two simultaneous interruptions in the perspectival continuity of a flow, delimitating the units codified and producing patterns of intermittence: this is the case, for instance, of a flow of air, patterned in inhalation and exhalation cuts by the transformative system of a breathing animal. In Deleuze's definition, these units are what, between the two poles, is subtracted from the flow. A flow is cut, a code is applied, energy and matter captured, and a motion blur put in focus: because of this correlation, 'the flow itself is qualified as a function of the code' (¶4). As it is not possible to speak about flows-in-themselves, but only of flow-cut, with the correlated notions of code and capture, this operation must be conceived against the background of another type of cut that, as anticipated, consists in the delimitation of systems. These notions are necessary to address the role attributed to the digital as universal codification machine deployed for the organisation of life through an automatic operation that allows 'to dominate, orient or direct the flows' (¶9).

Technical *Umwelt*

As we have seen, the plane of consistency and that of organisation can be understood as two different perspectives on reality. But who these perspectives belong to, one might ask: who (or what) assumes them? In the first case, the answer is guided by the definition of the plane of immanence: this perspective is accessible exclusively as a theoretical outlook on becoming, for it describes a dimension of pure movement and absolute possibility, a radical immanence unrelated to subjects that would transcend it and not fractured in stable objects, a formless haze of the infinite different speeds of ''subatomic and sub molecular particles, pure intensities, prevital and prephysical free singularities' (Deleuze & Guattari 1987 [1980]: 43). In its mechanicochemical, extended configuration, though, the kaleidoscope of surfaces, distinct bodies and well-defined parts of the plane of organisation is another story altogether.

The things of which the plane of organisation is composed are complex and appear over multiple registers. The variety of ways in which objects manifest is one of the reasons why, for instance, it is so difficult to catch a fly. While the neurophysiology of sight allows us to perceive movement and produces the impression of its continuity, this is not grasped directly but reconstructed after the human eye cuts movements in an average of 60 'flashes' per second (Larson 2020): here, a pattern of photons bouncing back from a surface causes a reaction in the retinal photoreceptors, that will be ready to react to a new pattern only 1/60th of a second after every stimulus. The flashes are then translated in electrical impulses that travel from the eye to the visual cortex, where they are reconnected as photograms in a projector. The structure of a housefly's eye reacts instead to 250 patterns every second, meaning that when a fly looks at the world, this moves much slower than it seems to us, allowing for faster reactions (Laughlin & Weckström 1993). Since what the eye perceives of a surface is a flow of photons cut at specific intervals and grasped as a pattern of colours and intensities, things that appear static are subject to the same phenomenon, their stability being perceived differently by different sensory apparatuses. More generally, then, objects manifest in relation to systems equipped to react to some of their features, with some aspects of the world (such as ultraviolet light) being accessible only from particular standpoints and through specific apparatuses. While different living beings can easily be understood to have different perceptions of the same surface (Kevin & al. 2013), from the point of view of a muon, a subatomic particle that can cross right through bigger atomic structures because of its dimension, the tight weave of most 'solid matter' is nothing but a thick mist (Gibney 2018). Once we take into account the complex relations between forces, flows of energy and perceptive systems through which objects manifest, and imagine the variety of the registers through which these relations can be expressed, one realizes that objects themselves are nothing but the collections of all the possible ways in which they can be grasped or elicit a reaction in a body, the atomic structure of materials being but one of the profiles through which they can manifest, instead of their ultimate reality.

Deleuze addresses this topic in his work on Leibniz (1986; 1993 [1988]), where he defines objects as nothing more than the 'profiles' through which they manifest. These profiles are determined by specific points of view: 'The object is the connection of projections […] the synthesis of profiles. Every object is in profile. There are only profiles. To perceive is to create a synthesis in profile. (Deleuze 1986: ¶33). This means that the plane of organisation should be understood as the totality of the profiles through which portions of space appear to the points of view open over them: the point of view of the human, that of the fly or of an atom probe, a profile of touch that assesses consistence, one of sight that assesses opacity, and so on. Deleuze is careful in highlighting that this perspective on reality does not imply clichés of the like of '"To each his point of view, to each his truth"' (¶41), stressing instead that things refer to points of view because these represent the condition of possibility for their emergence as objects (1993 [1988]: 20-21).

While the plane of consistency is a perspective on reality that lacks any physical point of view and can be grasped only theoretically, the character of the plane of organisation is entirely a matter of perspectives. The plane is populated by an infinity of points of view (24), that is, by systems that can react to stimuli of different types and on that basis cut out portions of the milieu in which they are immersed. These sections of the plane manifest through a series of profiles, angles, perceptions or patterns of stimuli that are held together by the specific standpoint to which they relate. Still caught up in the pull of becoming, still in flow, every profile grasped by points of view tends to change, shifting into slightly different patterns so that 'every point of view is a point of view on variation' (Deleuze 1993 [1988]), and 'any point of view subsumes a series […] of transformations' (1986: ¶54), witnessing a succession of different patterns of stimuli in relation to the same portion of the plane. Like an anchor over a current, a point of view allows us to perceive localised changes and constitutes the standpoint from which shifts in the patterns grasped by perceptive systems can be both synthesized in one identity, and organised, that is, arranged among themselves and in relation to the point of view (1993: 21). Considered as an open collection of profiles and of their transformations, the status of the object as commonly understood changes significantly, so much so that Deleuze adopts the term objectile to stress the processual reality underlying every object carved out by a point of view: 'the [perception of the object] implies an infinite series of profiles, the synthesis of an infinite series of profiles. Thus it's the objectile; it's the object insofar as it passes through an infinite series. Or if you prefer […] it's the object insofar as it's defined through a group of transformations' (1986: ¶35).

So far, we have described the relation of becoming to being through a series of optical aberrations that is worth recapitulating. The plane of immanence is an absolute out of focus over becoming, where nothing can be distinguished nor constitute a point of view over it. Flows result from slightly more focused gazes over chaos, which appears now as a field of vectors, lines of force, and transformations, always referring to specific objects: a flow of photons, a flow of blood, a flow of pedestrians or of money. The plane of organisation is the world in focus, a collection of opacities and dense surfaces, sharp distinctions and modular structures. These objects manifest and keep on transforming only in relation to points of view over them, that project structure-dependent profiles over chaos, synthesizing patterns through which objectiles move (1993: 76-77). From this perspective, the plane of immanence is all but abolished, resurfacing between patterns as the blur that ties together the photograms projected on the screen. Nonetheless, becoming is relegated to a secondary role with respect to the unity of profiles that synthesizes still states and distinct objects, and can be reconstructed only after perceptive systems operate cuts over flows.

Different points of view on the plane of organisation are distinguished by their 'style', so that the portion of the plane they are open onto can be defined as a particular cut-out of it. The character of a cut-out is determined by the system occupying the point of view, that carves shapes out of the chaos of becoming, coagulating forces into surfaces with different textures and reacting only to flows of energy with specific characteristics, like in the case of audible sound frequencies. Every living being, for instance, is endowed with a certain level of perception of its surroundings that consists in a capacity to interpret specific signs to supports its survival. The simpler examples among these involve the passage of a molecule between bordering cells, which can elicit a response in the form of a chemical reaction, or molecular exchanges occurring at a distance, in which the right receptors are needed for relevant patterns of matter and energy to be captured by a receiving cell. More complex cases involve a dynamic medium of some sort: this is the case of the blood stream in endocrine systems (Hancock 2017: 11-18) or of acoustic waves propagating through the air between a speaker and a listener, vocal cords and eardrums, amplifiers, and microphones. The human auditory system is compatible with only a selected number of frequencies within the possible spectrum of acoustic waves, which are flows of energy propagating through a medium like air. This is an example of a cut-out: the sectioning of a portion of the plane that can interact with a system, the profiles through which patterns manifest to a particular point of view. The process of parsing an audible sound into distinct phonemes, translating the pattern obtained in the electrical intermittence of the nervous system, is instead an example of what I have defined above as a flow-cut.

The necessary compatibility between a pattern of matter or energy and its receptor, conditioning the capacity of a system to cut into the flows (Deleuze & Guattari 1983 [1972]: 40), is the result of the coevolutionary relation between organisms and their milieus. German biologist Jakob von Uexküll defined the specific models of the world that each life form has evolved for itself with the notion of *Umwelt*:

> This is the perceptible world that has been given to us, it contains everything we can see. And the visible things are ordered according to their significance for our life […] This island of the senses, that wraps every man like a garment, we call his *Umwelt*. It separates into distinct sensory spheres, that become manifest one after the other at the approach of an object. (Uexküll 2001 [1936]: 107)

As a direct result of a coevolutionary process, the set of thresholds determining the overall significance of the profiles collected by an organism is intimately tied with the mechanisms of survival that characterise a species. In the case of humans, however, this relation is altered by the phenomenon of exosomatisation. First proposed by American scientist Alfred J. Lotka (1925), this notion was introduced to designate the production of tools that imitate and extend the function of biological organs through the organisation of inorganic material (Stiegler 1998b [1994]: 143), and distinguish them from their endosomatic, or anatomical, parts. The idea has been taken up more recently by

Romanian economist Nicholas Georgescu-Roegen (1972), who stressed that 'At [some] point in time, man's evolution transcended the biological limits to include also (and primarily) the evolution of exosomatic instruments, i.e. of instruments produced by man but not belonging to his body' (81). The accent Georgescu-Roegen places on the connection between exosomatisation and evolution has successively represented an object of interest for the French philosopher of technics Bernard Stiegler, who adds that the processes of production and development of tools is exposed to the forces of the market and, consequently, to the emphasis placed by late capitalism on the maximisation of economic value to the detriment of individuals or collectives living within technologically mediated environments, who have effectively had their exosomatic evolution co-opted by commodification (Stiegler 2020: 10).

Exposing them to the cumulative character of technological evolution and its rapid pace, exosomatisation modifies human *Umwelten* to the point of characterising them as essentially technical, their boundaries noticeably shaped by cultural factors. The idea of a technical *Umwelt* can be further supported by von Uexküll's depiction of the difference between human and animal worlds:

> No animal will ever leave its Umwelt space, the center of which is the animal itself. Wherever it goes, it is always surrounded by its own Umwelt space, filled with its own sensory spheres, irrespective of how much the objects change. Man, on the other hand, when he wanders, tends to cut loose the space he moves in from his sensory spheres and thus to extend his paths in all directions. [Such] space that is cut loose from him and has its own center[: it] has become autonomous as have the objects within it. In the course of the centuries the center of the ever growing universe has changed its location several times. The geocentric universe, with earth at its center, was followed, after bitter struggles, by the heliocentric one with the sun as its center, that has persisted to the present day. (Uexküll 2001[1936]: 109)

Highlighting that human *Umwelten* are modified by techno-cultural developments, this passage implies that technically extended bodies, those bodies that Stiegler distinguishes as 'exorganisms' (Stiegler 2020: 259), can shift the point of view they occupy over the plane of organisation through the mediation of instruments (such as telescopes). These, in fact, can radically modify their *Umwelt* or even, allow a partial access to other *Umwelten*, like those of bats (for instance, through ultrasonic testing devices), and the constitution of entirely new points of view over the world. One of these points of view has been disclosed by computation and has soon been incorporated in the fields of machine perception.

The *Umwelt* of digital autonomous machines has already imposed its presence as the new dominant perspective for the organisation of nature, translating all points of view, codifying objectiles and exploding objects, into clouds of data. Before interrogating ourselves on how machines perceive the world, however, we must first understand how we perceive the-world-as-a-machine. Operations that tap into flows of energy and matter to process them into discrete quanta are in fact always preceded by a *découpage*, by the isolation of a system from the rest of the plane and the constitution of boundaries blocking out what does not have value for the body operating the cut-out. This idea can be exemplified by the system of a watermill, the portion of the wheel plunged in the water constituting a cut-out over the river while the palettes of the wheel operate a flow-cut, discretising its stream into kinetic impulses later converted in electrical energy. Everything that matters for the watermill is limited to these elements: other factors like where the river comes from or its exposition to the metasystem of the weather, are simply negligible. Reducing complexity to focus on the codification of flows, cut-outs generate blind spots in the connections between systems and the dynamic *hors champs* from which they have been isolated. They thus allow us to focus on the cyclical applications of flow-cuts on the streams of matter or energy that cross these systems from one pole to another. Particularly suited to the degree of complexity to which our senses give access, and defining the world as composed by a collection of sharply defined volumes and modular structures that can be easily handled and organised, mechanical physics has produced the dominant technical *Umwelt* of modernity, projecting around us a world compatible with a mechanics of solids in functionally closed systems. As I will show in the next section, life itself has been reduced to a series of mechanisms for easy handling.

Mechanisation of the living

Two interesting places to start a description of the mechanisation of life are Alfred Espinas's 'L'Organisme ou la machine vivante en Grèce au IVe siècle avant J.C.' (Espinas 1903) and Georges Canguilhem's famous essay 'Machine and organism' (Canguilhem 2008 [1952]). Together, these texts identify the three fundamental elements of the mechanisation of life and its correlate, the vivification of mechanisms, that we will have to consider in order to understand the success of digital technologies as a tool for domination. The first of these elements is the tendency to treat machines like living beings because of an effect of dynamic latency in spring-powered artifacts and the opacity of their internal functioning; the second is that, on the basis of the formal compatibility of their visible components and dynamics, machines become explicative models for life-functions; the third element, instead, concerns the fact that mechanisation is instrumental and that organisms are mechanised in view of their use.

Tracing back its origin to ancient Greece, French sociologist Alfred Espinas explains that the original model for the reciprocal analogical convertibility of machine and organism originates in the figure of the early 'spontaneous movement machine' afforded by classical mechanics (Espinas 1903: 704)[1] and is based on an analogy between movement patterns. The catapult mentioned by Aristotle in the book VII of his *Politics* (*Politics* VII.11 1131a40) is a spring machine that can accumulate and store energy. Since a safety rope or a hook keeps it compressed within the spring, the structure of the catapult allows this energy to be released at will, at a later time or in a different place then when it was stored. This produces a form of mechanical latency between input and output (here, the actioning of the gear and the shot), that breaks the flow of energy through the mechanism into two separable segments and, detaching the movement of the machine from the moment of accumulation of energy within its spring, produces the illusion of the catapult shooting autonomously. Because of this feature, Espinas writes that for the Greeks, the machine 'had been alive' (Espinas 1903: 705).

Constituting the interval of time in which energy is held within a structure, latency comports a transformation of kinetic energy into potential energy. The idea of potential energy derives from Aristotle's concept of potentiality, a notion that has been criticised by Bergson and Deleuze as false because it flattens the openness of becoming over an expectation of replicability, through a retrojection of actual forms on a matter deprived of its capacity for self-organisation. With Deleuze's words:

> the possible is a false notion, the source of false problems. The real is supposed to resemble it [...] In fact, it is not the real that resembles the possible, it is the possible that resembles the real, because it has been abstracted from the real once made, arbitrarily extracted from the real like a sterile double. (Deleuze 1988 [1966]: 98)

If allowed to develop, a potential will always resemble something else already concretised elsewhere, matching the model reality of which it is but a retrojection and a still undeveloped double. This framework does not allow for novelty, imposing over becoming a rigid, predictable structure. The notion of potential energy is indeed related to that of power. This, however, must be understood in the sense in which Deleuze and Guattari used the French word *pouvoir*, that designates a 'form-imposing or overcoding ability' (Bonta & Protevi 2004: 129-130), rather than *puissance*, that has a creative connotation. Energy is said to be potential when restrained and made latent: once freed, the system storing it will perform a specific action. Latency implies the notion of *pouvoir* because it imposes a 'code of conduct' on a flow, guiding the liberated movement in a pre-determined trajectory. Once the rope is cut, the arm of a catapult will swing over the portion of a curve and release the projectile on a predictable path. Besides fostering the assimilation of mechanisms to automata by disconnecting their movements from their source of energy, mechanical latency results also in the fact

[1] All translation from this source are mine.

that the energy stored by a mechanism will always already be channelled towards a predetermined direction. The separation of the spring-machine from its energy source and the prescribed way in which that energy is released represent then two basic elements of the mechanisation of systems.

The detachment between the input and the emission of energy causes an effect for which, writes Espinas, 'the movement being visible, the cause of the movement remain[ed] hidden; hence the astonishment of the spectator' (Espinas 1903: 705). Quoting Espinas's essay, Canguilhem too stresses that latency is what 'allows one to forget the relationship of dependence between the mechanism's effects and the action of a living being' (Canguilhem 2008 [1952]: 80). As a break in the flow of movement that frees the machine from human dependency by granting the artefact an appearance of independence, latency is, however, also at the core of the idea of automaton. In his *Meno*, Plato describes the marvel with which the Greeks admired sculptures that would 'run away' if not held back by a rope (Meno 97d). As in the case of Aristotle's catapults, these artifacts consisted in spring-powered mechanisms that accumulated energy to be released at will: in this case, though, their systems were blackboxed.

In his collection of essays *Pandora's Hope*, French thinker Bruno Latour defines blackboxing as follows: 'when a machine runs efficiently, when a matter of fact is settled, one needs focus only on its inputs and outputs and not on its internal complexity. This, paradoxically, the more science and technology succeed, the more opaque and obscure they become' (Latour 1999: 304). Pointing instead at the relation between power and knowledge involved in the blackboxing effect, in a 2010 lecture, Alexander Galloway describes its military origin. Enshrined in a black metal box, secret military technologies were sent, in 1940, from the US to Britain in the hope of helping the war effort. The technologies contained in a black box were protected from falling into the hands of the enemy by self-destroying mechanisms, allowing one to observe only their inputs and outputs (Galloway 2010: 5). While Latour describes blackboxing as a natural consequence of technical evolution, Galloway points to the fact that the same operation can be implemented by design, to engineer relations of externality between users and devices. As we have seen above, this causes a naturalisation of the relation input-output, and screens the ways in which blackboxed systems process the flows of matter and energy that cross them. As reported by Espinas, Aristotle writes on this topic in the first chapter of his *Mechanics*, stressing that: 'Machines are built in which the principle of motion is concealed, so that one only sees the curious effects of the combination without discovering the cause' (Espinas 1903: 707). The naturalisation of blackboxed systems is contemporaneous to the realisation that machines could not only *mimic* the most evident behaviours of organisms – their configuration could also *model* their movements (706). Mechanics came then to be treated as 'a rudimentary biology' (707), whose specific purpose was to model one of the functions of life: its dynamicity. If not exactly living, the machine is thenceforth regarded by the Greeks as at least the most faithful image of life, to the point where the concepts of organism and machine are almost confused in their conceptions. Everything that moves with regularity is, for the Greeks, diagrammable in mechanical terms (708).

Canguilhem's definition of mechanism adds important details for understanding their adoption as a model for living beings:

> A mechanism is a configuration of solids in motion such that the motion does not abolish the configuration. The mechanism is thus an assemblage of deformable parts, with periodic restoration of the relations between them. The assemblage consists in a system of connections with a determined degree of freedom […] The material realization of these degrees of freedom consists in guides – that is, in limitations on the movements of solids in contact. In any machine, movement is thus a function of the assemblage, and mechanism is a function of configuration. (Canguilhem 2008: 76-77)

Here, mechanisms are defined as sets of elements in relation to each other, and their functioning consists in putting these elements in motion. Mechanisms are designed to have repeatable effects, for which the initial spatial relations between their interconnected elements needs to be re-established after their displacement. Canguilhem's definition indicates then that the application of a mechanical model to organisms is connected to a certain expectation for the displaced parts to return to their original positions, that is, a certain expectation of regularity and predictability that easily becomes a projection of both.

The periodic restoration of the relations between the parts is, in fact, one of the properties that the technical *Umwelt* projects on nature as the hypostatised receptacle of resources to accumulate and manipulate. The key difference between open physicochemical systems and mechanical ones has then to do with the character of those physical 'limitations on the movements of solids in contact' (77) or guides, that guarantee the predictability and indefinite reproducibility of their behaviours or effects. In the process of mechanisation, these guides are considered as stable constraints over the degrees of freedom of a system. However, 'natural' constraints are in becoming, and their transformation is linked both horizontally, with other systems, and vertically, with metasystems and subsystems. The two models have consequently a different understanding of the energetic economy of systems.

In thermodynamics, entropy is the measure of disorder, and the notion corresponds to the general tendency of open systems towards energetic decay. On a global scale, entropy is commonly considered to mark the degradation of matter and the loss of available energy: the maximum of energy dissipation equals to what has been called 'the heat death' of the universe, a state of total absence of available energy, and therefore of any life or dynamism whatsoever (Adams & Laughlin 1997: 369-370). In a piece for the *LA Review of Books*, Stiegler defines entropy in terms of 'becoming, *devenir*. Negentropy [its opposite tendency] is what inscribes within a future, *avenir*. Becoming and future have until today been confused. It is this confusion that makes us powerless, and it is what the impasse of the Antropocene reveals' (Stiegler 2015a). The confusion highlighted by Stiegler ensues when one closes systems that have no definite borders, isolating them from the flows of becoming in which they are inscribed. If the *avenir* brings with it a vision, in fact, this cannot be other than a (additional) cut-out constituted by a partial area of interest or focus. In operating a cut-out, one imposes a vision of the future on a line of becoming, mechanising an artificially closed system in order to control it. Since a mechanism consists in the guides determining a cyclical displacement and re-establishment of movable parts, mechanisation (a tendency that Stiegler addresses in its most recent form, automatization) entails a vision of the future that wraps a *devenir* into a loop. Basing an entire economic system and its future on fossil fuels, for instance, amounts to confusing a *devenir* with an *avenir*, disregarding the entropic character of the process of extraction. When the positive feedback loops of that system overflow, every vision of future, every 'security', is torn apart by the re-establishment of a new power of *devenir* that leads to the suppression of the previously delimited system, and to a cascading failure of the other systems connected to it. In our age, the rigidity of the guides we have projected over nature is breaking down.

Together with latency and blackboxing then, the circularity of displacement and restoration of the position of the parts, and the rigidity of the guides determining such behaviour constitute two additional elements necessary to compose a full picture of the paradigm of mechanisation of nature that has become coextensive with the dominant technical *Umwelt*. This paradigm is in the process of being overtaken by another model, afforded by digital technologies. Before moving to the reasons of this shift, though, we must consider that the reciprocal analogical convertibility between living beings and machines is operated almost exclusively on a behavioural or dynamical level.

In his study of causality, Aristotle differentiated four types of causes that concur in the determination of objects: the material of which something is made; a formal cause, that determines its shape; an efficient cause, that points at the agency that has determined the production of an object, as in the case of an artisan; and a final cause, that is, the reason for which something has been made (*Physics* II 3). Abstracting from the material cause, and concealing the efficient one through latency and blackboxing, the convertibility between machines and living beings is predicated around their formal cause and the instrumental character of mechanisation. The final cause of a mechanised system consists indeed in the function one attributes to it, and around which one wraps or loops a segmented flow. Instead of playing on the level of their material configuration or composition though, these operations are set on the behavioural level of the systems they concern.

The guides allowing the reproducibility of the behaviours of mechanised systems operate by means of a reduction that limits the system's latitude of action, a limitation of its degrees of freedom, and establish the relation of instrumentality on the basis of one capacity of the system, while disregarding or blocking others. Such a reduction can be carried out through a standardisation of the behaviours displayed by animal and mechanical systems predicated on the basis of a Cartesian understanding of 'the substantial unity of all matter, regardless of its form' (Canguilhem 2008: 83). From this perspective, bodies can be treated in the same way, be codified by the same cypher. The reciprocal convertibility of animals and machines projected by the thus characterised technical *Umwelt* is consequently concerned with the level of movements, because they are what is most easily codifiable and reproducible with the instruments of classical mechanics.

Yet, as a modelling strategy, mechanisation works best when applied to vertebrates, that is, where joints and levers compose geometric patterns of movements in space. Here, the looping of movements around a function links easily to the domestication of the animal and its utilisation:

> The theoretical mechanization of life and the technical utilization of the animal are inseparable. Man can make himself master and possessor of nature only if he denies all natural purpose and can consider all of nature, including, apparently, animate nature – except for himself – to be a means (84).

This idea evokes the definition of cybernetics as 'the human use of human beings' proposed by Norbert Wiener (1988 [1950]). As highlighted by Canguilhem, in fact, in Aristotle's time, the slave was compared to a machine precisely because it was used as a tool. In light of this, one starts contemplating the idea proposed by Murray Bookchin that the human domination of nature derives, as a form of generalisation, from the domination of human by human (Bookchin, 1982 [1921]: 43).

At this point then, the main thing we should retain from Canguilhem's essay is not what differentiates a machine from an organism, but the reason why such differences are ignored, and what operation leads to their convertibility. The human use of living beings, and the tendency to close systems and loop around a function the flows that cross them, are both aspects of the same process: 'A machine is made by man and for man, with a view toward certain ends to be obtained, in the form of effects to be produced' (Canguilhem 2008: 86).

Over the preceding pages I have highlighted that those mechanising cut-outs projected by the technical *Umwelt* wrap flows into loops, and now we see why: isolated systems constitute such loops because they are attributed a function. This functionalisation is coextensive with the technical *Umwelt*, and depends on the fact that perception serves action (Bergson 1946: 160-161): we perceive something in particular ways because these reflect our capacity to act on the world, and such perspectives are determined by our instruments and tools. Towards the end of his essay, and in a move that anticipates the reasons for the paradigm change we register with the rise of the digital, Canguilhem reflects on Taylorism as the industrial logic structuring the relation between man and machine:

> [with] the first technicians of the rationalization of workers' movements, we see the human organism aligned, so to speak, with the functioning of the machine. Properly speaking, rationalization is a mechanization of the organism, inasmuch as it aims to eliminate movements that appear useless because they are seen solely from the viewpoint of output, considered as a mathematical function of certain factors (Canguilhem 2008: 96)

Soon, however, the industrial practices of rationalisation show their limits in terms of efficiency: its guides again too stiff, its exclusion of superfluous behavioural patterns from the loops of functionalisation, eventually counterproductive. For this reason, Canguilhem hints at George Friedmann's *Problèmes humains du machinisme industriel* (Friedmann 1954), a text that stresses the idea that the problems encountered by 'this exclusively technicist assimilation of the human organism to the machine' starts being overcome with the revolutionary introduction of a logic of adaptation of the machine to the human (Canguilhem 2008: 96).

The limitation of mechanisation will contribute to the political paradigm shift described by Deleuze's 'Post-scriptum sur les sociétés de contrôle' (Deleuze 1995 [1990]). The early metaphorical assimilations of living beings to machines I have outlined above underpin in fact the technology of power that Michel Foucault named *discipline* (2003 [1975]). This consists of a set of strategies for the rationalisation of gestures through the organisation of space and time that aim at moulding the behaviours of entire societies. In chapter 4, I will compare Foucault's notion of discipline with the modality of domination enabled by digital technologies: while discipline consists in an intermittent application of the hylomorphic model, the digital technology of power that Deleuze called *control* acts continuously, thanks to the more capillary integration in the life of individuals and societies afforded by computation, and the capacity to adapt in response to the information received. Rather than imposing a mould over behaviours, conforming behavioural patterns to predesigned diagrams, control modulates behaviours establishing a relation between digital machines and living beings more akin to grafting. In horticulture, grafting is the he operation through which two different plants are joined together and continue to grow as one. In the next chapter, I will use this image to signal how the shift from the metaphor of mechanisation to digital control allows to adapt machines humans and gently manipulate their behaviours, rather than reducing human gestures to mechanisms.

When humans are reduced to machines, and these start in turn to be adapted to the human, the relation between the two is designed to be exploited more efficiently. As we will see, such an approach tends to outperform the one-off application of the hylomorphic model of mechanisation and will constitute the background for the next phase of our brief overview: the invention of the cyborg. Moving beyond this model of domination, the next chapter will consider a different dynamic. Rather than flattening them onto a pre-established scheme, the modality of domination afforded by digital technologies connects the spontaneous behaviours perceived by machines to flexible algorithms designed to gently nudge individuals and communities towards desired directions.

Chapter 2: From hylomorpism to morphodynamics

In the previous chapter I have described one possible way to relate spontaneous processes, such as the behaviours of living beings, to designed ones, like the movements of machines, so that the latter can influence the former. This operation consists in reducing living beings to their behavioural patterns, and involves the looping of some of their capacities around a function imposed from the outside.

This chapter is going to point at hylomorphism, the idea that things result from the encounter of an inert matter with abstract forms, as the perspective behind mechanisation and define its use as a tool for domination. I will start by considering George Canguilhem's distinction between organisms and machines to describe the mechanisation of life as an application of a hylomorphic view of reality, a type of cut out that isolates the re-functionalised set of movements from the processes that have generated them and alienates systems from their own morphodynamic tendencies, leaving no space for self-organisation or novelty. I will then consider the notion of hylomorphism against that of emergence, to address the process-oriented understanding of reality that informs the modality of domination afforded by the flexible algorithms behind the weaponisation of big data analysis, recommendation engines and homeomorphic interfaces.

Ultimately, mechanisation alone cannot complete the transformation of the living into an object of design. Something in living beings always escapes mechanistic reductions. For this reason, and because of the post-WWII necessity to foster consumerism by manipulating desire, the model of machines has been substituted by a new strategy of domination that finds in digital technologies its key component. The final sections of the chapter will start introducing the subject of control, a modality of domination administered through the manipulation of dynamical technoliving hybrids epitomised by the conceptual figure of the cyborg. Considering the origin of the figure of the cyborg, I will then describe the parallax effect connected to instances of emergence and highlight how it conceals the effects of the digital component of contemporary life on its spontaneous development. In the final section, I will consider the notion of cyborg as it has been proposed by Donna Haraway and suggest another depiction of the notion, produced on the basis of the Deleuzian understanding of artisanal work.

Hylomorphism and emergence

The reciprocal convertibility between living beings and mechanisms is based on their movements. At this level, the dynamic schemes of vertebrates can be compared to and modelled by the movements of a machine. Canguilhem describes machines as rigid structures: 'An organism thus has greater latitude of action than a machine. It has less purpose and more potentialities' (90). Mechanisation reduces the latitude of action of organisms, orienting their movements towards a purpose by physically reducing their degrees of freedom and concealing their full array of possibilities. By contrast, life is 'improvisation', writes Canguilhem, 'the utilization of occurrences; it is an attempt in all directions' (90). The form of domination projected by the technical *Umwelt* and developed alongside classical mechanics consists in a reduction of possibilities for self-determination, a limitation obtained through the imposition of a function.

As I have anticipated, mechanisation is based on prioritising the formal cause over the material and efficient ones. When a living body is mechanised, it is reduced to its motor function. This is configured as a discrete pattern of cyclical movements that is co-opted and re-functionalised. Mechanising a horse, for example, consists in selecting a new function for its movements: pulling a carriage, for instance. Once assigned this function to the system, its mechanisation consists in reducing its latitude of action ideally to the point of leaving out only the specific pattern of movement deemed useful. One is interested only in how the horse moves on a surfaces, on its pulling capacity, rather than in the movements performed during mating, or in the position assumed by the animal when it goes to sleep.

Once reduced to a circular set of movements looped around a function, the formal cause of the body is configured as a dynamic pattern. This pattern is the only element of interest for the agent performing the mechanisation of a body, because its functional reduction imposes a specific form on it. This form results from the external imposition of physical constraints and entails a more general reduction of the horizon of possibilities, of the 'freedom of movement' of the living body. This makes mechanisation a particular instance of hylomorphism: the imposition of form on a behavioural pattern, a hylomorphism of dynamics, of movements rather than of shapes. Hylomorphism is the doctrine that conceives objects as composed by inert matter and form, a stable and determining order imposed from a transcendent source (Simondon 2020 [2005]: 21-22; 35-36; Bonta & Protevi 2004: 97). The emphasis of this perspective is, again, put on the formal layout of the object, but reveals another dimension of cut-outs. Indeed, mechanisation is not only operated as the horizontal isolation of a system, which secludes a set of movements from the dynamical complexity of the system of which it is part and loops these movements around a superimposed function, but it enacts also a vertical closure of the system. In other words, the cut-out operated on a system in view of its mechanisation isolates the re-functionalised set of movements from the processes that have generated them and alienates them from their own possibilities of evolution. The standardisation of matter, whose organic or inorganic character is irrelevant for the mechanisation of movements, is then also correlated to its sterilisation: matter becomes no more than a chaotic and passive element in need of a formal structuration, without which it cannot produce anything new.

On this note, in his discussion of the difference between machines and organisms, Canguilhem stresses an extremely important element: 'In the machine, the rules of a rational accounting are rigorously verified. The whole is strictly the sum of the parts' (Canguilhem 2008: 88). Canguilhem's precision recalls book H of Aristotle's *Metaphysics* (Aristotle 1994: 39), where the Greek philosopher considers the difference between parts and wholes and what constitutes the latter. In his famous commentary of the text, D.W. Ross highlights that this specific passage is concerned with the unity of definitions, meaning that, according to the philosopher, a thing cannot be defined by producing a list of its parts (and of their definitions), but has to be defined in itself, insofar as qualitatively different from a mere aggregation of its subcomponents. Ross adds that 'a definition is one not by external union but by being the definition of one object' (Aristotle 1997: 273). The difference between a set and a system finds its root in this idea. A proper definition of a whole cannot consist in the listing of its parts, nor in the description of the boundary that groups them, but demands the description of something that, by virtue of the relations of the parts rather than of the properties of its individual elements, stands 'over and above' them, giving it the character of a unitary object. In the discourses considering the combination of separate parts or elements to form a coherent unity, the phenomenon because of which such a whole is considered in some way 'more' than the mere sum of its parts is called emergence (Miller & Miller 1992: 8). By saying that, in machines, wholes are the sum of their parts, Canguilhem is basically saying that there's no emergence in the machine.

Yet, the concept of emergence and the extent to which it applies are still very much debated. To understand the limits of mechanisation, I must present at least a sketch of this issue. For this reason, it is probably useful to start by following Peter Corning's appreciation (2002: 21-22) for the definition provided by the economist Jeffrey Goldstein, who considered emergence as the 'the arising of novel and coherent structures, patterns and properties during the process of self-organization in complex systems' (1999: 49). This definition uses many notions that are crucial for our discourse: it hints at complex systems, self-organisation, novelty and coherence, as well as at the issue of determining what exactly is it that emerges. Complexity theory studies the appearance of relatively simple structures from more intricate sets of heterogeneous interacting elements. Complex systems emerge from the interaction of these elements and display properties that have a number of distinguishing characteristics. Usually, biological systems present the tendency to organise themselves autonomously, constituting structures or patterns through which they manifest some form of collective order. The first characteristic of emergents is consequently that they arise as a result of a dynamical process, in most cases an instance of self-organisation, and that they constitute what Corning describes as a 'macro-level' when compared with the plane of interaction of their components. This level is endowed with a certain coherence, that is, it hosts 'integrated wholes that maintain themselves over some period of time' (Corning 2002: 22). In the rest of this work, I will speak of the emergent macro-level as a *suprasystem*, while the plane of interaction of its components will be referred to as its *subsystem*. As we will see, this feature of emergents can give rise to different rhythms, according to which, for example, the members of a society can come and go, but that society will not change at the same pace: suprasystems change more slowly than subsystems. Moreover, the supralevel has a capacity to exert a certain influence on the subsystem from which it originated, a causal power generally defined as 'downwards causation' (Schröder 1998).

A classic example originally used by John Stuart Mill (2011 [1843]: 426) to describe the phenomenon of emergence is the one of the molecules of water. Taken singularly, the atoms of hydrogen and oxygen that compose H_2O do not interact with a flame as when combined in the right way: thrown on the flame, they will make it grow bigger. Combined, instead, they have the capacity to put out fire, but are also constrained in a structure that keeps them combined. For the atoms to be separated, the compound must be invested with energy, for instance, by an electric impulse that can trigger the process of electrolysis. This example is useful to describe several important elements of emergence. The first of these is that one can combine atomic elements to obtain molecular wholes, that is an object situated on another level of complexity. The concept of emergence represents an interesting way to connect different degrees of complexity, such as 'cells, organs, organisms, groups, organizations, communities, societies, and supranational systems' (Miller & Miller 1992: 1): with a certain approximation, that is, leaving external conditions and triggers aside, each of these degrees is constituted by and through the interactions taking place within the previous level. As stressed by the American biologist J.G. Miller, though,

> the fact that systems at each level have systems at the level next below as their principal components does not mean that it is possible to understand any system as just an accumulation of lower-level systems. A cell cannot be completely described by summing up the chemical properties of the molecules that compose it, nor can an organism be described by even a detailed account of the structure and processes of its organs (8).

In other words: living beings are composed, but every level of complexity of this composition, if considered in its elements, does not fully account for the emerging level it gives rise to. There is always something more to the parts that results from their interaction. Life itself emerges from non-organic components and the relation of these components is not equal to that of the components of a machine: as emergent, living beings are not even nearly as decomposable as machines, nor likewise modular. As confirmed also by the results provided by quantum mechanics and quantum field theory, in fact, 'the world is much more complex and intertwined than the current cartography of scientific disciplines leads us to believe' (Silbersten & McGeever 1999: 189). There are cases of 'fusion' or 'non-separability', for instance, in which no amount of energy can dissolve the relation between the elements of the subsystem because these elements have disappeared, are 'spent' or have simply become inseparable. This is what happens in the instance of the co-evolution between early hominids and techniques, two elements that we cannot separate anymore. As discussed by the primatologist Richard Wrangham, for example, humans evolved to eat cooked food after the discovery of fire. Because of the higher nutritional value of cooked food, this change in diet has freed time once dedicated to digestion, chewing and foraging, but has also helped develop a less energy demanding digestive tract, which, for Wrangham, has freed up energy to grow bigger brains (Wrangham 2009: 113-114). As I will discuss in chapter 5 then, humans emerge, and they are not separable from their technology.

Wholes relate to their milieus in a way that is not accessible to the parts: 'higher-level systems [can] exploit environments not available to less complex systems' (Miller & Miller 1992: 8). For instance, the configuration of our technical *Umwelt* results precisely from this relation between the human as emergent and the milieus it can access through the mediation of its technological prostheses. Silbersten and McGeever corroborate this idea, claiming that by emergence 'we mean features of systems or wholes that possess causal capacities not reducible to any of the intrinsic causal capacities of the parts nor to any of the (reducible) relations between the parts' (Silbersten & McGeever 1999: 182). Wholes are such because they have causal capacities that are distinct from the (notional) sum of the causal capacities of their components: the difference between the elements of the subsystem and the causal power of a suprasystem is of qualitative order. This is connected to the third and most important element we can grasp from the example of water molecules: the subsystem of mixed but not bound gasses does not possess the same properties of the suprasystem H_2O, like wetness, or the property to dissolve salt. Emergence is what occurs when the quantitative, reductionist stand finds itself in front of qualitative novelty, or when the extensive properties of an ensemble give way to the intensive character of a whole.

On this matter, the literature distinguishes between epistemological and ontological emergence. The difference between the two has to do with the validity of the alleged novelty of the emergent. The appearance of novelty is the fundamental prerequisite of emergence, and makes it a concept that excludes any form of reductionism aiming at deducing emergent properties from the sum of the properties of the individual elements:

> The concept of emergence that takes non-deducibility to be the essential criterion is, therefore, based on the assumption that for emergent properties no composition principle exists […] what we want to be able to deduce are certain properties of the compound, such as, whether it is flammable, whether it is an acid or whether it dissolves other substances. (Schröder: 1998: 438)

If one cannot deduce the properties of a compound from an analysis of its parts in isolation, the supralevel is considered to be an instance of ontological emergence. If one can, the instance of emergence is said to be simply epistemological: the properties of the emergent were in principle deducible, and the novelty of the suprasystem merely indicates our lack of knowledge of the properties of the elements. Jürgen Schröder defines instances of epistemological emergence as follows: 'A property is emergent as long as either we do not have the right theories about the properties of the parts or we have [them] but not the computational power to deal with the increasing complexity […] In both cases properties cease to be emergent when the right tools […] are developed' (445). This, however, doesn't create a problem, for it signals that one can make a property cease to be emergent only *post factum*. Moreover, emergents are always given within synergistic interactions with other objects: it takes a flame to reveal the wetness of water, as it takes a grain of salt to manifest its diluent capacity. As put by Corning:

> Wholes produce unique combined effects, but many of these effects may be codetermined by the context and the interactions between the whole and its environment(s). In fact, many of the "properties" of the whole may arise from such interactions. This is preeminently the case with living systems. (Corning 2002: 24).

Considering emergence a mere epistemological phenomenon is an error probably connected to the favouring of physics over chemistry to describe reality. Physically speaking, an emergent will interact with physical laws, whose effects are already known. In the case of chemistry, instead, the result can be verified only empirically, i.e. *post factum* (DeLanda & Harman 2013: 42). Aware of the possible shortcomings of using epistemology as the only way to determine the authenticity of cases of emergence, Schröder proposes then to use downwards causation, rather than non-deducibility as a criterion: 'Downwards causation is the influence the relatedness of the parts of a system has on the behaviour of the parts' (Schröder 1998: 447). An example of this is the case of H_2O, in which the atoms combined in a covalent bond will require an external input of energy to be separated.

In the political register, where collective entities emerge out of social relations among individuals, the difference between ontological and epistemological emergence is irrelevant. Every instance of ontological emergence has also an epistemological side to it, and this encourages vertical cut-outs, causing the parallax effect one registers between coupled levels of complexity of the type suprasystem-subsystem, that reinforces the tendency to blackbox emergent, non-decomposable wholes. In his book *The Parallax View*, Slavoj Žižek defines this effect as the 'constantly shifting perspective between two points between which no synthesis or mediation is possible' (Žižek 2006: 4). In other words: either one either sees the 'whole', but misses the parts, or one sees the parts but misses the whole. This effect blackboxes the properties of emerging wholes when these are observed from the point of view of their elements and, at the same time, conceals to the parts the downwards causation the whole exerts on them. Moreover, it causes a naturalisation of institutions or economic suprasystems that strengthens the resilience of structures of dominations by concealing and naturalising also the effects of targeted interventions on the relations between the components, carried on to obtain designed suprasystemic results. For instance, the capitalist exploitation of the Hobbesian characterisation of human nature (*homo homini lupus*) (Hobbes 1983 [1642]: 24) derives precisely from the naturalisation of a relation between individuals, which is in truth the effect of a form of downwards causation of economic and political suprasystems that foster competition for their self-preservation. Friedrich Engels put this quite clearly in a letter from 1875 in which he criticises also the capitalist appropriation of the theory of evolution:

> The whole Darwinian theory of the struggle for existence is simply the transference from society to animate nature of Hobbes' theory of the war of every man against every man and the bourgeois economic theory of competition, along with the Malthusian theory of population […] the same theories are next transferred back again from organic nature to history and their validity as eternal laws of human society declared to have been proved. (Engels 1936 [1875]: ¶5)

Victims of the parallax effect established between social relations (parts) and the political and economic spheres governing their organisation (emergent 'wholes'), individuals that accept this description cannot easily see how the condition they ascribe to their fellows results from a downwards effect of the economic whole which, once emerged from their relations, has progressively detached itself from serving the mere sum of their needs. Once properties are separated from their process of emergence, in fact, the paradigm of mechanisation can re-functionalise wholes by ordering their parts, letting the mechanised whole exert a designed form of downwards causation on them and thereby produce the effects it aims at promoting within the social machine.

To move back to Canguilhem and the paradigm of mechanisation then, the idea that there is no emergence in the machine means that its parts are not constrained like those of living beings. Since the machine can model only the functional focus of connected but isolable parts, it remains a paradigm that operates properly only in the extensive dimension (surfaces, forms, movements, quantities). Intensities, non-decomposable and non-additive qualities, lie beyond its scope. This is the limit of mechanisation, and it assumes central importance in its overcoming by the paradigm afforded by digital technologies. Indeed, a significative intensive quality to keep in mind here is in fact desire: the economic conditions of post-1945 capitalism made necessary a way to dominate the human so that desire could become object not just of programming (that too easily translates into the suppression of desire), but of tuning, of modulation.

The new paradigm

To fully understand this issue and the direction in which mechanisation has been overcome, we must look at another definition of emergence. This has been provided by John Protevi (2006) in a line of work further expanded by Manuel DeLanda's *Intensive Science and Virtual Philosophy* (2013). Protevi defines emergence as the '(diachronic) construction of functional structures in complex systems that achieve a (synchronic) focus of systematic behaviour as they constrain the behaviour of individual components' (Protevi 2006: 19). As described above, the downwards causal power of emergent systems constrains the relation between the elements of their subsystem. This effect 'focuses' their behaviour and contributes to the development of the suprasystem's own causal power. A molecule, for instance, can often present what is called a functional group, a group of atoms that initiates chemical reactions between the molecule they form and another molecule (Nič et al. 2009).

It is by speaking of the synchronicity and diachronicity of effects, however, that Protevi offers two interesting elements to our discourse. With the first term, he refers to order emerging at once within components, as in the case of the functional group, while with the second he designates the emergence of non-deducible properties of the whole, including, for instance, its capacity to exert causal power. Protevi proposes then a third category of emergence, which he names 'transversal'. This can be either synchronic or diachronic and generally indicates 'Assemblages formed from biological, social and technical components' (Protevi 2006: 20). What Protevi is referring to, specifically, are those instances in which the social, the biological and the technological registers intersect and give rise to new organisations of the components (heterostratic synchronic transversal emergence), or to the co-evolution of the elements in an assemblage (heterostratic diachronic transversal emergence). These types of emergence are the result of the connection of different levels of complexity (hence their heterostratic character), as different in scale as societies and individuals, and as different in latitude of action as a scrap piece of metal and a person. As we will see, it is on the basis of a productive combination of heterostratic elements belonging to the biological, the social and the technical registers that, in conjunction with the mutations of milieus and the evolution of technology, a new type of emergent has recently surfaced. With it, a new paradigm for the instrumentalization of the human, whose power goes well beyond that of mechanisation, is being implemented.

Being essentially modular, the framework of mechanisation does not allow us to model the interpenetration of components' separate evolutionary lines. As we have seen, in fact, cut-outs modelled on the technical *Umwelt* tend to separate the systems they circumscribe from their morphogenetic and developmental dimensions. When one of these evolutionary lines is technical, and follows what in the next chapters I will define as a pseudo-Lamarckian logic of development, it becomes possible to intervene in the manipulation of diachronic transversal emergents before these manifest. At once guided through suprasystemic downwards causation and characterised by a non-discernibility of the elements analogous to what we have seen taking place in cases of fusion, the diachronic emergence of a transversal emergent makes use of the parallax effect it produces to naturalise its character, concealing the surgical interventions that contributed to its development. In this context, the stand post-humanists assume against the essential difference between natural and artificial (Miah 2009: 91; Braidotti 2013: 15, 82; Hayles 1999: 4) does not simply amount to a correction of a theoretical misconception, but allows for a description of the new ground on which digital domination is based.

The post-WWII expansion of the territories of globalised capital meant that the paradigm of functionalisation needed to adapt to the paradigms of mass production and consumerism. The new subject that power needed to produce for its own preservation and expansion had not only to work and obey, but also to buy, consume, and vote: in a word, to desire. For this reason,

> In order to absorb the over-production of unnecessary goods, the 1940s saw American industry implementing marketing techniques first envisaged by Freud's nephew Edward Bernays in the 1930s. These techniques became increasingly advanced throughout the rest of the century as returns on investments were made on economies of scale requiring ever bigger mass markets. In order to reach these markets, industry developed an aesthetic particularly well adapted to audiovisual media, which refunctionalized the aesthetic dimension of the individual according to the interests of industrial development, causing him to adopt the behaviours of consumerism. (Stiegler 2014 [2004]: 5)

It is rather difficult, if not impossible, to implement these actions through a hylomorphic imposition of behavioural patterns, simultaneously guiding their outcomes and guaranteeing their repetition under the guise of freedom. So, after WWII, one could identify a shift between hylomorphic power, in which ideal wholes are meant to be but the sum of their parts, to a form of morphogenetic control, in which form emerges from a continuous modulation of matter. Form is not *imposed* anymore, but *followed* in its process of emergence and modulated through experimental adjustments in the design of the technological component of a transversal assemblage.

Eventually, mechanisation alone could not complete the transformation of the living into a machine: something in living beings eludes reduction and reproduction by geometrical analogy, while something in the machine as a model needed to be overcome in order to balance mass production with overconsumption. A hylomorphic view of the world does not contemplate the emergence of form, because it imposes one. Mechanisation functionalises the body to enhance its performance in relation to a predetermined task that is carried out through repetitive movements diagrammable in mechanical terms. As we have seen, the form imposed consists in a behavioural pattern: what a mechanised body does, results then from the isolation of a specific functional pattern and the (often physical) foreclosing of other possible comportments. Mechanisation alone is a purely extensive paradigm, whose preferred targets are codified gestures and whose time is far from gone. If one needs to target desire though, one must step into the realm of tuning, of the modulation of intensive values. This has been concretized in a shift beyond the design of circumscribed behavioural patterns to be reproduced and towards the fabrication of what causes a behaviour in the first place. While the paradigm of mechanisation consisted in building material closed loops, the new one points towards constituting more and more abstract open circles of amplification. These make it so that the perceived need to act increases in intensity, so that impulses become irresistible, and allow every unresisted impulse to feed back in a tension-increasing machine that promotes more impulses as well as making unsatisfaction the norm. Reduction starts giving way to amplification and to the continuous re-fashioning of individuals as transversal emergents, which allows for the development of a sense of freedom made available only to be exploited.

The re-conceptualisation of positive reinforcement as a marketing strategy, the management of free time through the administration of information to relaxed subjects whose forces have been spent already in the workplace, or wiped away by permanent precarity and unemployment as existential conditions, have all provided the raw tools for an exploration of what truly lies beyond a behaviour, and opened the space for an experimentation in the assemblage between individuals and technologies that finds in the figure of the Cold War cyborg its prototype. Since there is no emergence in the machine, the mechanisation of a body is indeed clear and open: the slave knows to be treated like a robot, that their back and arms are parts of a machine. The workings of this paradigm are clear and addressable: the workers can rebel and break the machine. With the emergence of the individual as transversal assemblage, instead, and as in any case of emergence, one encounters a parallax effect that conceals the ways in which the body is programmed, because the cyborg emerges from the connection of the technology and the user. This brings with it a naturalisation of features and a further alienation of social systems from their self-organising potential, making the condition of the new subject of morphogenetic power more hopeless.

In addition to overcoming the downsides of tight mechanisation, as I will argue in chapter 8, the diffusion of digital technologies has provoked a series of shifts in the notion of work itself. Enabling an unprecedented diffusion of cognitive labour (Berardi 2005), the collapse of the separation between work time and leisure (Crary 2014: 74), and unlocking the possibility to extract value from behavioural patterns unrelated to any form of production or human activity (Moore 2015: 14), the morphogenetic model of domination mobilised by digital technologies serves economic powers just as much as political power.

The artisanal cyborg

Rejecting the notion of essence, the taxonomies grounded on its (more or less aware) application to every field of reality, and denouncing the antagonisms deriving from this structure of thought, Donna Haraway's work proposes a critique of hierarchical rules and classificatory binaries established as tools for domination (Haraway 1991: 177 -178). To articulate a political move beyond these surreptitious dualisms, in her *Cyborg manifesto* she offers the picture of a hybrid world in which there's no separation between, among others, human and machine. Through the notion of cyborg, the entity that populates such a world, she describes in one stroke the reality *beyond* these binaries, in an ontological sense, and the reality *past* these divisions, that stands as the political horizon to struggle for: we have always been hybrid, she argues, and there's no concrete division between the dualisms gradually piled up by historical structures of power to ground the forms of domination by which they are alimented. Within this context, Haraway believes that 'Cyborg imagery can suggest a way out of the maze of dualisms in which we have explained our bodies and our tools to ourselves' (182), and advocates for the liberation of the cyborgs that we have always been (176).

The political significance of this argument is clearly highlighted by Haraway herself: in the past, 'machines were not [really] self-moving, self-designing, autonomous. They could not achieve man's dream, only mock it. They were not man, an author to himself, but only a caricature of that masculinist reproductive dream. To think they were otherwise was paranoid. Now we are not so sure' (152). The uncertainty expressed by this passage is being dispelled by the incidence that digital technologies are having on mental and social ecologies, gradually overshadowing mechanisation as the most efficient tools to structure and enforce relations of domination. On this matter, Haraway is quick in stressing the connection between ontology and politics that I believe to be crucial for my description of digital domination: 'By the late twentieth century, our time […] we are all chimeras, theorized and fabricated hybrids of machine and organism; in short, we are cyborgs. The cyborg is our ontology; it gives us our politics' (150).

Haraway's manifesto addresses not only one version of the cyborg, but two: 'The political struggle is to see from both perspectives at once because each reveals both dominations and possibilities unimaginable from the other vantage point' (154). The most common figure associated to the *manifesto* consists in the 'oppositional' (170), 'illegitimate' (177) cyborgs Haraway calls the reader to produce, hybrid beings whose character is in the making beyond all the differences produced by dualistic and hence hierarchical descriptions of the world, a liberating figure that produces its own connections with its surroundings and is open to experimentation. This is the *cyborg-to-be* to become the *cyborg-we've-always-been*, a mutant figure always in becoming, constantly fleeing attempts of surcodification. It is precisely in relation to the issue of codification that we find in Haraway's *manifesto* the main points of interest for our discourse: through the figure of the oppositional cyborg, in fact, the author de-codes the divisions that power uses to establish itself in the hybrid reality we occupy and whose character is concealed by a plethora of surreptitious dualisms. However, also the strategy of domination afforded by the digital overcomes this paradigm of division, the organisation of the world through oppositional categories like 'natural', 'human', 'animal' or 'woman'. This strategy is epitomised by another, prior, conception of the figure of the cyborg only hinted at by Haraway (154). To understand this mutation in the strategies of domination, it is necessary to articulate the difference and tension between the two figures of the cyborg *beyond* divisions and the cyborg crafted out of these division by the Cold War race for power. While Haraway's cyborg has the emancipatory power to develop hybrid bodies beyond their naturalized forms, allowing them to build empowering alliances, the second one has the opposite power, not emancipatory, but restraining, and it is conceived as a tool in which the integration human-digital is designed to guarantee exogenous control.

We can distinguish these two figures on the basis of the distinction proposed by Protevi and described above: the first, which I will call the oppositional cyborg, is a case of heterostratic *synchronic* transversal emergence, in which the reorganisation of components kept separated by the code imposed on them by structures of domination, the social, the biological and the technological spheres, give rise to novelty in the form of a new organisation that defies the power of traditional institutions' downwards causation. By contrast, the second, 'artisanal', cyborg consists in a case of heterostratic *diachronic* transversal emergence, in which novelty emerges via the co-evolution of the components in the form of controlled subjects. I use the terms artisanal and crafted to describe this figure with reference to a passage in which Deleuze and Guattari define the morphodynamic approach of those that understand matter as

> matter in movement, in flux, in variation, matter as a conveyor of singularities and traits of expression. This has obvious consequences: namely, this matter flow can only be followed. Doubtless, the operation that consists in following can be carried out in one place: an artisan who planes follows the wood, the fibers of the wood, without changing location. But this way of following is only one particular sequence in a more general process. For artisans are obliged to follow in another way as well, in other words, to go find the wood where it lies, and to find the wood with the right kind of fibers. (Deleuze & Guattari 1987 [1980]: 409)

In contrast to the hylomorphism of the industrial couple machine-cast/inorganic matter, the figure of the artisan operates through a morphodynamical approach that instead of impressing a form, carves one out of a matter already expressing a specific tendency for its manifestation.

Power always manages to appropriate, pervert and utilize the instruments used to resist it, and the creation of this second type of emergent reveals a strategy that in a certain sense moves on the same lines of Haraway's critique. Here, domination does not depend on mutually exclusive categories and strategic frameworks one needs to blur and evade. Rather, it is implanted in the very elements from which individuals emerge as technoliving hybrids. In this case, one must understand how the pieces are arranged together, that is, how this strategy of domination that finds in the digital its key component is directly grafted onto human life. While Haraway's oppositional cyborg indicates a concept that overcomes divisions, the artisanal cyborg has more to do with the activity of making heterogeneous components compatible: it is on this point that the issue of the cyborg connects with that of the code. McKenzie Wark clearly defines the difference between the oppositional cyborg's de-codification of binaries and the artisanal cyborg's relation to the code: 'the cyborg is […] not so much that which is *beneath* the proletarian, as that which is *between* the worker and her apparatus. Or rather, between three kinds of boundaries: between the organism and the machine, the animal and the human, the physical and the nonphysical' (Wark 2016: 146). I am primarily interested in the artisanal cyborg for this reason: we have always been hybrid, but power structures have progressively intervened in fractioning this hybridity in order to maintain the oppositional logic at the core of the hylomorphic relations of domination it enforced. With the mobilisation of digital technologies of power, instead, the hybridity of the subsystem is mediated by the unequivocal communicator and general intermediary of the code, that constitutes a universal plane of translation.

As I have highlighted, functionalisation rests on a standardisation of the components or movements in play, and the case of the artisanal cyborg is no exception. While the strategy of mechanisation operated a codification from above, so to speak, determining the behaviour of a mechanised body through the form imposed on its behavioural pattern, work on DNA has caused 'the reconceptions of machine and organism as coded texts through which we engage in the play of writing and reading the world' (Haraway 1991: 152). For Haraway, this operation entailed codification of everything, 'the translation of the world into a problem of coding', initiating a 'search for a common language in which all resistance to instrumental control disappears and all heterogeneity can be submitted to disassembly, reassembly, investment and exchange' (164). As highlighted by Wark, the translation of everything characteristic of post-war Europe and the US accompanied the impetus for an equally universal commodification, and hence the exposition of every codifiable domain to the new forms of power. 'Information is more than a powerful metaphor extended via substitution into an explanatory causality of the world, or even for the cosmos. It becomes a powerful means of organizing worlds' (Wark 2016: 148). This movement initiated a shift from the *metaphor* of mechanisation to the *proportion* of programming: if the first can be formalised as h=m, humans equals machines, in the face of a specific function they share, the second looks instead more like $h{:}c_1=c_2{:}m$, where the code is not what gets imposed from one term to another, but the common level on which both terms are translated and that, instead of being imposed from above as over-codification determining the function of both machine and organism, operates in-between, as the grafting language that links and plugs the human and the digital into each other.

Wark goes a step further in clarifying the character of this plane of translation. 'Code becomes the master layer in the stacked protocols by which an organization is managed. In genetics, code becomes the part via which a whole can be reductively understood. In place of messy flesh, the clean execution of command and control' (142). This universal reification through codification, this compatibilization of the living and the electronic as components of an artisanal cyborg, is what opens the doors for a new form of power. By pointing at a new plane of translation that allows the compatibilization of the elements of the assemblage constituting the artisanal cyborg, Haraway adds in fact that: 'Information is just that kind of quantifiable element […] which allows universal translation, and so unhindered instrumental power (called effective communication)' (146). Here, the author touches on the issue we are concerned with, but doesn't go all the way, making it necessary to complement her perspective. In the instance of mechanisation, we have a transferral of form based on a difference between the terms through which this form is transferred. This operation is necessarily that of an imposition, an explicit reduction of freedom. What we have with the diffusion of the grafting code is instead the capacity to design mediations between the machine and the human that are connected through the same plane of translation. The behaviours of the human are translated on this plane, and it is on this level that the communication between human and machine takes place. So that the electronic machine can adapt to the human in a gentler process of grafting: 'Control strategies will be formulated in terms of rates, costs of constraints, degrees of freedom […] No objects, spaces, or bodies are sacred in themselves; any component can be interfaced with any other if the proper standard the proper code can be constructed for processing signals in a common language' (163).

In order to discuss the functioning of the artisanal cyborg, how it works in relation to the control strategies hinted at by Haraway, we must look back to the invention of the concept of cyborg, understand the conditions on the basis of which such an adaptation of the machine is performed in a constant fashion and, later, consider the dynamics by which the biotic component of the assemblage is open to this grafting.

Entropy-defying solutions and biofeedback

The model of diachronic hybrid emergence proposed by Protevi is epitomised by the conceptual figure of the cyborg and, in its concrete incarnations, assembled through the fusion of digital devices and living beings. The birth of the notion of cyborg occupies the opposite side of the spectrum of freedom and empowerment inhabited by Haraway's oppositional hybrid. The figure of the cyborg emerged from the mists of the Iron Curtain and is connected to that new form of colonialism symbolised by the space race, a competition for technoscientific superiority. The conquest of new territories, the opening of new areas in which to install monopolies and cultural hegemonies will culminate in the fabrication of a space with the aspiration of transcending geopolitical borders, namely cyberspace, the environment through which the artisanal cyborg will emerge as the new subject of algorithmic power.

The exploration of the inhospitable environment of outer space raised the problem of the preservation of the homeostasis of astronauts. This notion designates the 'state of consistency' (Lovelock 2000 [1979]: 144) held by organisms, despite changes in their environment, regulated through chemical feedback loops. These loops are series of causal relations characterised by a certain circularity: feedback is, as the name implies, an effect acting 'back' on its cause. Since the phenomenon takes place within circuits of chained causes and effects, it defies the proportionality of classical mechanics, generating feedback with increased or diminished causal power compared to their causes: small changes can develop into massive disruptions (as in the case of the famous butterfly effect), and perturbations can be mitigated to be of minor consequence. The latter is the case of homeostasis, an optimal status that the physiology of organisms preserves through a series of chemical negative feedback mechanisms.

It was with this problem in mind that Nathan Kline and Manfred Clynes invented the notion of the cyborg. The former a clinical psychiatrist and the latter electronics expert and inventor, in the 1950s the two collaborated on a project at the Rockland hospital with the goal of developing the psychopharmacological and technical means for the creation of 'artifact-organism systems which could extend man's unconscious, self-regulatory controls' (Gray 1995: 29). Rather than envisaging the creation of autonomous hybrids, the idea behind these cybernetic systems was to implement an unprecedented degree of elasticity in the machine that the human was to be meshed with. With the explicit intention of participating in human evolution, the project aimed at designing 'instrumental control systems which will make it possible for our bodies to do things which are no less difficult' than allowing a fish to live on land (30). Achieving this meant that 'Perturbations had to be studied as part of a self-regulating system [to engineer] compensatory changes in response to toxins' (XIII): the idea of a self-regulating entropy-defying human-machine system is not possible without programming. For this reason, Clynes and Kline conceived the cyborg as 'an exogenously extended organizational complex functioning as an integrated homeostatic system unconsciously' (30-31).

This definition describes the space traveller, whose biological needs have been eliminated from the equation of labour: rest time and bodily functions are not only disciplined on the basis of a division of time, but, in the face of the hostility of outer space, removed from the control of the individual and entrusted to an automatic system attached to them. Despite the claim that the cyborg 'frees men to explore' then, what it does is free them from the concerns with their own survival:

> If man in space, in addition to flying his vehicle, must continuously be checking on things and making adjustments merely in order to keep himself alive, he becomes a slave to the machine. The purpose of the Cyborg, as well as his own homeostatic systems, is to provide an organizational system in which such robot-like problems are taken care of automatically and unconsciously, leaving man free to explore, to create, to think, and to feel. (31)

One doesn't really see how this means to free individuals from a slavery to the machine instead of concretising the exact opposite condition, with the line between emancipatory liberation and loss of control becoming quite blurry. In addition, it can be argued that there's nothing to create and think in space, nor to explore, really, there's just to work for a new colonisation endeavour. The artisanal cyborg is the perfect worker, not because the technology to send fully automated robots into space was lacking, but because it is in the emergence of an entity that is at the same time controlled but also capable of improvisation and problem solving that one can obtain better results. Think about work-to-rule strikes: following precisely all the rules devised for human workers can cause problems in the production process. The rhetoric of the cyborg marks the implementation of a certain understanding of individual freedom as a resource that should be exploited and not only as a variable to limit. This exploitable freedom, however, cannot be left unbridled nor imposed by force anymore, and it must result from the emergence of a carefully crafted hybrid entity.

Exogenous control and efficiency must therefore be guaranteed by a set of unobtrusive interventions: 'hypnosis per se may prove to have a definite place in space travel […] we are now working on a new preparation […] so that pharmacological and hypnotic approaches may be symbiotically combined' (Gray 1995: 31). The idea at work here is that of programming the individual, and that such a program should be made resilient by a certain level of adaptability or elasticity in the behaviours demanded by the astronaut, to be reinforced when necessary by the remote control of psycho-physiological feedback loops. Aware that the cyborg could lose efficiency because of the needs of its biological component, Clynes and Kline consider pharmacologically induced wakefulness as a key feature of the cyborg, and propose the use of 'drugs known as psychic energizers' (31) that can increase productivity and reduce the need to sleep of a few hours. It becomes clear at this point that these systems have nothing to do with enhancing the human, but aim at a production of value to its detriment: the human is reduced to not much more than some sort of support.

In places, Clynes and Kline's program feels like a lucid description of contemporary society: they don't differ much, in their mechanisms and goals, from the techno-social machine for the deprivation of sleep described by Jonathan Crary in his *24/7*. *Late Capitalism and the End of Sleep* (Crary 2014). In this short but fundamental book, Crary describes the assault that capitalism is carrying out on sleep with the diffusion of 24/7 environments, stimulants, entertainment, jobs, and the unwitting production of value for the companies that monetise attention (9). In his book, Crary reflects explicitly on that 'imposition of a machinic model of duration and efficiency on the human body' (3) that post-industrial capitalism deploys with no recourse to violence but through techniques and according to models prefigured by the invention of the cyborg. The issue described by Crary has to do not only with attention capturing devices, but also and foremost, with 24/7 environments. Already cued on the fact that human-machine assemblages always take place against the background of specific environments, Kline and Clynes take into account the space in which the cyborg needs to act and to which its automated components must provide some sort of adaptive functionality. They consider the environment of outer space to be too homogeneous and devoid of action to stimulate the brain as needed to preserve its healthy functionalities and avoid psychotic episodes that can compromise the mission. To face this eventuality, and support the remote administration of drugs necessary to prevent them, the authors envisage that 'the structuring of situations so that action has a meaningful sensory feedback should reduce these difficulties' (Gray 1995: 33). This operation is expanded upon in a short essay by Manfred Clines in which the author describes the concept of *'sentics'*.

The premise on which this notion is based is that claustrophobic spaces, the lack of human contact or long and forced cohabitation in narrow environments can be the cause of stress and deprive the astronaut of the emotional satisfaction necessary for their full functionality. Following several years of experimentation, Clynes proposes a system for the 'psychological homeostasis' of the cyborg: a technique that relies on a reiterated simulation of emotions that should promote the correspondent feelings to be actually 'felt' by the subject. Clynes uses his experience as a musician to support the idea that emotions can be crafted at will and, rather than being necessarily provoked by any specific individuals or situations, can be raised by some sort of atmosphere. What he then names a 'sentic cycle' constitutes 'a way in which the entire spectrum of emotions may be experienced in fantasy without need of specific external contexts and associations' (38). Sentics is based on the experimental evidence that Clynes has collected over the years, and supposedly confirming that to every emotion corresponds a dynamic output, a movement of the body. Through the reiteration of these movements, the corresponding emotional state is supposed to be experienced. Without going into details and leaving to someone else the task to explain the mechanisms behind this technique, it is interesting to consider the sequence of emotions devised by Clynes in the light of their reduction to mechanical movements:

> As a person sits […] and expresses a sequence of 30 to 40 expressive actions of a particular emotion, called E-actions, and experiences the emotion, the rest of his body becomes very quiet, almost as if asleep. At the end of such a sequence a word announcing the next emotion is heard on the tape and another sequence of E-actions begins. In this way a person can traverse substantially the entire spectrum of emotions. The standard sequence of sentic states that has been used consists of no emotions, anger, hate, grief, love, sex, joy, reverence. (Gray 1995: 38)

In this passage, the author is clearly describing a path to docility and obedience, dispositions obtained through conditioning, a means unquestionably subtler than those adopted by the mechanising functionalisation of industrial societies but that nevertheless ties with the reduction of biological features to mechanically modellable behavioural patterns. 'The process provides [the subject] with a reservoir of calmness […] replacing hostile aggression, and constitutes a satisfaction in itself' (37): in comparison, the imposition of orders on individuals is an obsolete and limited method to guarantee required performances.

Hybridity, the effects of psychoactive drugs, the surfacing of the unconscious, psycho-physiological control and induced docility are themes the work of William S. Burroughs weaves together in a potent mixture of personal reflection and direct experimentation. Heir of the fortune accumulated by the Burroughs Corporation, founded by his father in 1886 and for a period second only to IBM in the field of computer manufacturing, Burroughs battled against the expectations of his family, 'where displays of affection were considered embarrassing' (Morgan 1988: 26) by choosing bohemianism over the injunctions of authoritative figures like that of his father. His major concerns were related to the issues of power and authority, and how to escape control and keep ones' body free from conditioning, against the limits of will and self-control. For these reasons, the beat novelist developed a particular fascination for the Mayan culture that he studied in the early fifties in Mexico.

The main point of interest, for Burroughs, was that Mayan law had been recently discovered to be enforced without the use of violence:

> it seems that the priests used to obtain their power and to act upon the will of subordinate classes without the presence of any form of police or army. This was made possible by fine techniques of supremacy, including a communication strategy modulated through recallable sensations which in turn can be activated remotely with measured timing and techniques. (Obsolete Capitalism 2018: 23)

The interest in these alternative techniques for the control of individuals was fuelled also by Burroughs' reading of *The Living Brain*, a book published in 1953 by the British neurophysiologist William Gray Walter (Walter 1963). An early cybernetician, Walter worked on missile technology like Norbert Wiener, perfecting guiding systems and radar apparatuses. After the war he moved to work on electroencephalography, developing an improved machine that enabled the detection of brainwaves. In 1960, he discovered CNV, contingent negative variation, the first event-related potential (ERP) discovered: by measuring brain response to events like movements, sensations or more generally cognitive instances, he noticed that signs of electrical activity in the brain are detectable up until half a second earlier than a person's apperception of the movements they were about to perform. Among Walter's discoveries was the correlation between the sight of flickering lights and the brain. As highlighted by Andrew Pickering, whose *The Cybernetic Brain* chronicles the achievements of cybernetic research from the 1940s onwards, 'Walter became interested in flicker and incorporated it into his EEG research in 1945, when he came across a new piece of technology that had become available during the war, an electronic stroboscope' (Pickering 2011: 76). Exposure to this device could cause seizures in epileptic subjects and, if set up differently, analogous effects in the response of non-epileptic individuals. These experiments, which proved the possibility of altering psychophysiological states through electronics were at first conduced in a linear way: the flicker was looked at by the individual, whose brain was plugged into a translation apparatus, the EEG, that displayed brain activity. In a second instance, however, this line was curved into a loop and the reaction of the brain to the input was reconfigured as inter-action: the EEG was communicating back to the flicker, whose emissions adapted to the variations provoked in the subject's brain.

This structure is essentially that of a feedback between the machine and the organism: something else entirely if compared to the relation established by the model of mechanisation. As Pickering rightfully notices: 'What acted in these experiments was genuinely a cyborg, decentered combination of human and machine' (78). Pickering describes these loops as *biofeedback*: 'techniques for reading out 'autonomous' bodily parameters such as brain rhythms and displaying them to subjects thus making them potentially subject to purposeful intervention' (83). No doubts about the type of intervention Burroughs had in mind while reading of these ideas. As he writes in his *Naked Lunch*: 'The logical extension of encephalographic research is biocontrol; that is control of physical movement, mental processes, emotional reactions and apparent sensory impressions by means of bioelectric signals injected into the nervous system of the subject' (Burroughs 1992 [1959]: 147).

In 1963, Scottish psychiatrist J.A.C. Brown published a book titled *Techniques of Persuasion: from Propaganda to Brainwashing* (Brown 1983) with the intent to deflate the diffused concerns regarding mind control that followed the development in cybernetics and was creeping in the public knowledge in the atmosphere of the Cold War. Brown's argument essentially pointed at the power of will to resist any altered state induced by biofeedback devices (305) and to the necessity for a bigger environment to be prepared in order for these tools to work their form of control over individuals. In traditional ritualistic settings, for instance, 'People are deeply excited by drumming and chanting, not by the mechanical effect alone but because they believe in the particular creed that they signify and permit themselves to pass into a state of frenzy' (305). As highlighted by Andreas Killen, a historian of Cold-War brainwashing narratives, the emphasis on the power of will and self-control addressed by both Brown and Walter, nonetheless opened 'the door to alternative forms of conditioning and to the experience of radically altered states' (Killen 2017). It is in this scenario that Burroughs's attention to the subject should be positioned, as can be inferred from two essays in particular that he wrote in the seventies, 'The Electronic Revolution' (1970) and 'The Limits of Control' (2013 [1975]), which elaborate on the same elements put forward by Kline and Clynes. While the first is a more artistic rendering of the same ideas, in the second Burroughs reflects on the issue of control from the Mayan chronicles to the line that runs from Pavlov to the cybernetic discourse of Walter, and adds an important element to the discourse around the efficacy of biofeedback control:

> words are still the principal instruments of control. Suggestions are words. Persuasions are words. Orders are words. No control machine so far devised can operate without words, and any control machine which attempts to do so relying entirely on physical control of the mind will soon encounter the limits of control. (38)

This passage points at the fact that control depends on a much larger context than the one devised in the experiments of cyberneticians: a larger narrative or a system of beliefs. Moreover, the essay analyses the notion of control, differentiating it from more rigid, and consequently more fragile forms of domination: 'the more completely hermetic and seemingly successful a control is, the more vulnerable it becomes' (38-39). For this reason, Burroughs identifies suggestion as the preferred approach to overcoming the pitfalls of overbearing mechanisation (38). This idea is in line with the biofeedback paradigm that leaves the subject a certain margin of freedom in order to exploit its reaction to the stimuli deriving from the machine to tune its subsequent outputs and continue the line of communication between the two components of the cyborg.

The emphasis already placed on the importance of words becomes then the way in which Burroughs points to the political function of mass media: 'Modern control systems are predicated on universal literacy since they operate through the mass media' (39). These contribute on one side to creating that system of belief we have seen to be necessary for the emergence of the controlled cyborg, an environment that disappears as a background, or an atmosphere: 'another essential factor in control is to conceal from the controlled the actual intentions of the controllers' (40). This set of ideas characterises the shift away from the closed system of mechanisation modelled on the technical *Umwelt* developed with pre-industrial and industrial technology, whose intentions were out in the open and therefore easier to oppose or resist, and an open and more dynamic system of domination, whose inner functioning is blackboxed (Obsolete capitalism 2018: 28-29).

While mechanisation flattened spontaneous processes over designed ones by reducing living beings to their behavioural patterns and conforming these to the movements of machines, carefully repurposing by looping them around a function, the new modality of domination effectively exploits freedom thanks to the flexibility of the designed processes afforded by algorithms. Control connects then spontaneous processes to designed ones through machine perception and allows for the latter to influence the former through the suggestions produced by a biofeedback loop. In the next chapter I will address in detail how the process of biofeedback operates through the implementation of digital technologies and how the plane of translation on which the type of domination that Burroughs and Deleuze named control, grafts this system onto the process of the emergence of its individual and collective subjects. In chapter 4, I will then focus more specifically on how control operates as a form of transindividual biofeedback, that is, as a loop connecting individual behaviours and collective tendencies programmed to source the most impactful suggestions and modulate processes of individuation both at a psychological and at a socio-political level. I will do this by proposing my definition of the conceptual figure of the *dividual*, originally proposed by Deleuze in his 'Post-scriptum' (Deleuze 1990a: 244). As I will show, the dividual is the central node through which digital control accesses and exploits the reciprocal relation of psychosocial development identified by Gilbert Simondon as the continuous process of co-individuation through which the psychic and the collective transform and influence one another.

Chapter 3: Principles of Stratoanalysis

In the first chapter, we have seen how codes can be imposed externally, as in the case of mechanisation, or emerge spontaneously, in relation to cut-outs that prepare flows to be discretised and transformed by complex systems. This is in the case of sight, with different eye structures cutting flows of photons at different intervals. In this chapter I will discuss how the flow-code relation develops in the one between elements and wholes in process of emergence. I will do this in order to show how digital technologies are deployed to exert power on processes of individuation rather than imposing behavioural moulds on already individuated subjects.

In the first section I will define the notions of assemblage and multiplicity, two concepts that are necessary to understand the relations between parts and wholes in instances of emergence. In such contexts, in fact, heterogeneous parts come to work together as wholes, generating entities characterised by tendencies and capacities that are different from those of the parts. Rather than addressing objects as still collections of properties, the notion of multiplicity allows us to consider things from the point of view of how they affect and are affected or other objects, and how they change in relation to environmental conditions. I will argue that this point of view on reality is not only adopted by anti-essentialist schools of thought, but also characterises how digital machines 'perceive the world' in its dynamicity. In this way, algorithms can figure out and produce the conditions for the emergence of hybrid cognitive assemblages in which the machine proposes specific portraits of the world to users whose behaviour is altered by the calculated efficacy of recommendations.

Finding recurrent patterns in the ways in which things come to be, change, or react to their environments is key in this operation and constitutes also the way in which Deleuze and Guattari describe the complexity of the world between the plane of immanence and the plane of organisation, that is, between pure becoming, and the sclerotized face of actualized possibilities, or the hard and sharp appearance of distinct objects. In the following sections of this chapter, I will show how the classification of these recurrent patterns of emergence allows the two authors to produce their theory of stratification, a descriptive device that accounts for the physico-chemical, the biological and the 'human' layers of complexity of which the world is composed: that is, how chemical compounds, forms of life and technically produced things come to be.

Complexity and virtual fields

Deleuze and Guattari account for the process of emergence with their theory of stratification and through the notion of assemblage, a concept for which it is now important to provide a minimal definition. Assemblages are definite entities that result from the interactions between heterogeneous components and that, once emerged, exert on them forms of downwards causation. They can become component parts of other assemblages and, 'Because the ontological status of all assemblages is the same, entities operating at different scales can directly interact with one another, individual to individual, a possibility that doesn't exist in hierarchical ontology' (DeLanda 2016: 19). This means that, while a virus and a society are assemblages (of nucleic acids and proteins the first, of individuals and technology the second) inscribed within different degrees of complexity, the two can well interact and generate effects with downwards causal power. Assuming a non-hierarchical perspective that reflects their reciprocal organisation, assemblages can however be grouped in relation to the stratum within which they operate, or classified on the basis of the strata from which they borrow their components: 'A single assemblage can borrow from different strata, and […] a stratum or element of a stratum can join others in functioning in a different assemblage' (Deleuze & Guattari 1987 [1980]: 73). The concepts of assemblage and of strata are indeed intimately connected, with the first being classified in relation to the second. Yet, to grasp the concept of stratum, one must review a series of other ideas and consider the tenets of Deleuze's ontology, in particular in its relation to complexity theory.

So far, I have used the term complexity to mark those systems that display a spontaneous emergence of order among their components and as a whole, display emerging tendencies and capacities. These capacities can be exerted horizontally, in relation to systems with the same level of complexity as the emergent layer, and downwardly, that is, over the elements from which the suprasystem emerges. Despite the absence of a formal definition of what complex systems are, a working definition can move from the fact that these are composed of both elements and their relations. These connections organise the elements in patterns and cause the system to behave like a whole. The importance of the relations shared by the elements is such that these assume a more central role than the components themselves. We can see this using again the example of H_2O. In themselves, atoms of hydrogen and oxygen are systems constituted by subatomic particles and a set of forces. In relation to the process of emergence in which these can be involved, though, they are probably better labelled as 'components' or 'elements'. The relation in which these elements can find themselves is a pattern, a specific 'configuration' of the set. Together, the elements and the forces connecting them and generating a specific organisational pattern can be called a 'subsystem'. This is only a relative term, and its attribution presupposes the eventual emergence of the molecular level, a new layer of causal power generated by the subsystem and manifesting in relation to the environment of the emergent, that can instead be called its 'suprasystem'.

Set aside the top-down effects of downwards organisation directed by the emerging suprasystem, a complex system appears devoid of any dominant centre governing the behaviours and interactions of the elements. These results mainly from the spontaneous local interaction of the parts: 'agents only interact with […] a small number of other agents which form their local neighbourhood. Yet, in the longer term these local actions typically have global consequences, affecting the complex system as a whole' (Heylighen et al. 2017: 125). The limited range of interactions that the elements establish according to such a 'principle of locality' determines the non-linear character of complex systems. Non-linearity is the principle for which the output of a system results in something more, less, or entirely different from the input. And it

> means that there is no proportionality between cause and effect. On the one hand, small fluctuations may be amplified to large, global effects by positive feedback or "autocatalysis" […] On the other hand, feedback can also be negative, so that large perturbations are suppressed, possibly resulting in the stabilisation of a global configuration (126).

The configuration of the network of relations connecting the elements of a subsystem can thus determine phenomena of amplification through which relatively small alterations in the initial state of a system can produce large transformations in its later states. This feature constitutes the main point of interest for chaos theory. The relations of the elements can also trigger metasystemic feedback loops that, within a certain threshold, '[suppress] deviations from an equilibrium state' (122) of a system, preserving its homeostasis. For instance, too much CO_2 freed into the atmosphere triggers an increase in oceanic sequestration. While the elements of a system can become so interdependent that minimal variations in the state of any component can significantly alter all the others in unpredictable ways, instances of fusion resulting from a paramount degree of interdependence defy any tendency to reductionism by making it impossible to discern the elements of a subsystem, and assume a perspective for which

> distinct entities (particles) remain distinct […] In other words, in the Newtonian world view there is no place for novelty or creation: everything that exists now has existed from the beginning of time and will continue to exist, albeit in a somewhat different configuration. (119)

In contrast to the Newtonian worldview then, complexity theory acknowledges the fact that some of the behaviours of dynamical systems can be unpredictable. Complex systems are intrinsically open (121) and exposed to the influences that from their milieus can trigger variations in their behavioural patterns. Yet, this openness to the milieu, and the definition of behavioural patterns in relation to 'external stimuli […] are to be seen not as the source of the order the system assumes, but only as occasions or "triggers" for internally generated order' (Bonta & Protevi 2004: 18).

Instead of any central element governing the behaviour of the whole, complex systems owe their organisation to the local interaction of their parts and to their openness to the forces of their milieus, which must be considered as a source of influences rather than as an external ordering principle. Maintaining the necessity of external sources of order would reduce complex systems to closed sets of elements whose matter has been sterilised, that is, dispossessed of its self-organising capacities, and made into the passive, linear receptacle of an abstract design. The fact that specific rules (and rulers) often appear to be the only sources of organisation, describes a precise strategy of domination that has been enforced through the imposition of boundaries limiting the capacities of matter. Since the local interactions of the elements are the source of the suppressed spontaneous order that can cause the emergence of a suprasystem, their degree of connectivity assumes crucial importance. At a certain level, in fact, it stops being useful to consider the subsystem as a composition of parts in relation, and it becomes more valuable to consider the same subsystem as a network through which flows pass and are transformed. More than the properties of the elements then, it is the topological configuration of this network that matters the most in an evaluation of the effects and transformations occurring within and through a system.

The behaviours of complex systems can be mapped by diagramming their dispositions, that is, their tendencies and capacities. While dynamical system theory accounts for dispositions by sketching the phase spaces of systems, a multidimentional diagram in which all the possible states of a system are represented in relation to the variables that trigger transformations, Deleuze accounts for the dynamical character of complex systems with the notion of multiplicity. To do so, the philosopher deploys the notion of virtuality to account for the totality of possibilities of becoming related to a system open onto the plane of immanence. As anticipated, Deleuze borrows the notion of virtuality from Bergson, who used it in substitution of the notion of potentiality to identify the field of possibilities in which systems are immersed. Consisting in the mere retrojection of an actual event, the notion of potentiality does not suffice to account for the conditions of transformations, nor, as we will see further down, for how these conditions can configure bifurcations in the virtual behavioural pattern of a system. For instance, understanding a seed as a potential tree tells only part of its possible story, conforming the morphodynamic potential of the object to a preestablished model. A seed can well become food for a bird, but can also rot or be collected and stored in a freezer. The virtual dimension is the one that accommodates what Manuel DeLanda calls the *dispositions* of systems (DeLanda & Harman 2017: 60), that is, their tendencies and capacities. In contrast to their properties, these are not necessarily actual, though they are just as real. The following passage offers a clear example of what DeLanda means with the notion of disposition, and mobilises the concept in relation to instances of phase-shifting:

> the mind-independent identity of a given body of water can be established by determining its actual properties (its volume, purity of composition, temperature, speed of flow) but that determination does not exhaust its reality. Such a body of water may exist presently in the liquid state, but it is part of its reality that at a certain temperature it can become steam or ice, that is, that it has a real tendency to boil or freeze under certain conditions. The fact that it is not in a gaseous or crystalline state at this moment does not make its tendency to become gas or crystal any less real. Similarly, the identity of a body of water is partly determined by its capacity to affect other substances, such as its capacity to dissolve them. The exercise of this capacity demands an actual interaction with acids, alkalis, or salts, but the absence of interactions does not make it any less real. (DeLanda 2002: vii-viii)

Moving from a realist reading of Deleuzian ontology, in his *Virtual Science and Abstract Philosophy* (2002), DeLanda argues that the properties of objects are insufficient to account for their reality. In short, there is more to what surrounds us than what we can see in a given moment, i.e., what these things can do, what can be done to them, and what they can become. Tendencies can be described as the set of critical points marked on a vector that explicates the variation of parameters relative to a body's conditions, while the notion of capacity signals the ability of a body to affect and be affected by others. The collection of the tendencies and capacities of a system constitutes what we could name its virtual field, that is, the portion of the virtual plane 'surrounding' an actual object, or an indication of how an object, as a portion of the plane of organisation, is still open onto the plane of immanence. A virtual field is a complex space constructed through the vectors that indicate the possible directions in which a system can change. It is a space of possibilities. The possible variations of a system's state are related to the alteration of some of its conditions or to its interaction with other systems and do not manifest to simple observation, but are revealed through active experimentation, which consists in pushing a system beyond the boundaries of the states in which it is found, to study how it reacts (22). The regularities discovered through this process indicate the general tendencies of a dynamical system and can inform on its possible behaviour and conditions of transformation (26-27).

Maps can be drawn of the vectors, thresholds and junctures unearthed through experimental activity, diagrams that represent the becoming of systems: 'A list or constellation of affects, an intensive map, is a becoming […] The image is not only a trajectory, but also a becoming. Becoming is what subtends the trajectory' (Deleuze 1997 [1993]: 64-65). The type of space used to diagram the virtual field of dynamical systems becomes thus central: indeed, this has to account for a potentially unlimited number of dimensions, equal to the number of interactions a system can maintain and, for this reason, it cannot be Euclidean. To understand how the behaviour of systems can be diagrammed through a phase space then, a graphic rendition of a system's virtual field, we need first to clarify the character of the space in which this diagram will develop. The first move, to understand this particular view consists in getting rid of some prejudices regarding space: 'First of all, a space is not just a set of points, but a set together with a way of binding these points together into neighbourhoods through well-defined relations of proximity or contiguity' (DeLanda 2002: 15). In Euclidean spaces, these relations are fixed and specified by the proximity of points to the transcendental Cartesian axes imposed on an otherwise homogenous plane. Topology, instead, considers surfaces themselves as spaces and does not base its calculations on stable relations between points or areas, that can be instead reconfigured at will (Plotniski 2005: 191). For Deleuze, the key point of interest in topology, and in particular for the non-Euclidean geometry devised by German mathematician Bernhard Riemann (187), resides in the fact that, through these perspectives,

> all spaces, mathematical or physical (or still other), become subject to investigation in their own terms and, essentially, on equal footing, rather than in relation to an ambient or otherwise uniquely primary space. This view, as Deleuze and Guattari indeed suggest, leads to a kind of horizontal rather than vertical, hierarchical science of space […] (200)

In addition to this framework for a horizontal or flat ontology, Riemann's work provides Deleuze and Guattari with the notion of the manifold, which they recast around the idea of 'multiplicity'. As signalled also by DeLanda, this theoretical stance over space derives from the work of Carl Friedrich Gauss on the infinitesimal calculus and its application to the two-dimensional geometry of curves:

> Gauss realized that the calculus, focusing as it does on infinitesimal points on the surface itself (that is, operating entirely with local information), allowed the study of the surface without any reference to a global embedding space. Basically, Gauss developed a method to implant the coordinate axes on the surface itself (that is, a method of "coordinatizing" the surface) and, once points had been so translated into numbers, to use differential (not algebraic) equations to characterize their relations. (DeLanda 2002: 4)

Not limiting his investigation in the bidimensional realm dealt with by Gauss, Riemann took things a step further, by considering n-dimensional spaces, or, more accurately, understanding surfaces as spaces with a variable number of dimensions. It is inspired by this expansion that a Deleuzian multiplicity is conceived as a multidimensional space that is not inscribed in an enveloping structure of reference (5). Moreover, as highlighted by Plotnitsky,

> A (continuous) manifold is a conglomerate of (local) spaces, each of which can be mapped by a (flat) Euclidean or Cartesian, coordinate map, without allowing for a global Euclidean structure or a single coordinate system for the whole, except in the limited case of a Euclidean homogeneous space itself. That is, every point has a small neighbourhood that

can be treated as Euclidean, while the manifold as a whole in general cannot. (Plotnitsky 2005: 194)

Manifolds/multiplicities are bundles of spaces whose relation is not overdetermined (188). These 'chunks' of space are the dimensions of the manifold, open sets of points whose extension can partially overlap with other sets and form new subspaces. Because of this, topology allows us to calculate the areas of extremely complex geometrical figures: the rough surface of an asteroid, for instance, requires the division of its surface into different neighbourhoods whose dimension can be calculated as if they were chunks of Euclidean space, and subsequently stitched back together. By constituting spaces as open sets of points linked to other chunks of space instead of being subject to enveloping geometries, this perspective allows us to diagram morphogenetic processes more accurately, to 'Make maps, not photos or drawings' (Deleuze & Guattari 1987 [1980]: 25), to consider the possibilities of defocus with regard to a still image, for 'The map expresses the identity of the journey and what one journeys through. It merges with its object, when the object itself is movement' (Deleuze 1997 [1993]: 61).

Objects, as we have seen, are not defined by their essential traits, whose determination can be a political more than an epistemological operation. Since n-dimensional Riemannian spaces can be studied without the need to embed them in enveloping, structured and metring spaces of higher dimension (DeLanda 2002: 4; 125), the virtual field of affordances or phase space of a system can be mapped by making each of its tendencies correspond to a dimension of a manifold, the notion that in Deleuze and Guattari's ontology substitutes for that of essence. Depicting dynamical systems by diagramming their physical processes, manifolds correspond to the virtual space of possible states of a system, and are constituted by a flexible number of dimensions, each corresponding to a variable of the system. The number of relevant ways any object can change, are called its degrees of freedom:

> A pendulum, for instance, can change only in its position and momentum, so it has two degrees of freedom. (A pendulum can, of course, be melted at high temperatures, or be exploded by dynamite. These are, indeed, other ways in which this object can change, they simply are not relevant ways from the point of view of dynamics.) A bicycle, if we consider all its [five] moving parts […] has ten degrees of freedom (each of the five parts can change in both position and momentum) (DeLanda 2002: 5-6).

The degrees of freedom of a virtual field of possibilities are relatively easy to identify in manufactured systems like thermometers (that have only one dimension) or pendulums (two dimensions), mechanical systems that are closed or at most open only to a selected number of external variables. The same task becomes much more complicated, though, if one seeks to map the virtual fields of living systems, be they individuals, evolving life forms or groups with emergent properties. Whatever their source, each degree of freedom is mapped as a dimension of the manifold and, once all its dimensions are connected together through differential calculus (5), the topological space becomes the field of possible states of the system. In this method of representation, a specific state in which the system can be found is indicated by a point on the manifold: a simple one in the case of a unidimensional state space, or a coordinate of convergence found between multiple dimensions of a more complex manifold. To the changes of the system corresponds the topological translation of this point in the n-dimensional space of the manifold: in the unidimensional state space diagrammed by a mercury thermometer, for instance, this point indicates only the temperature of an environment. This translation can be followed in time and the points indicating the state of the system, joined by a line or trajectory, can be followed to study the evolution of the system, so that this particular way of describing the world enables us to depict processes and transformations, possibilities and potentials rather than mere still states.

The analysis of trajectories that represent the course of a process can lead to finding recurrent patterns in the topology of its manifold. 'The main pioneer of this approach was another great nineteenth-century mathematician, Henri Poincaré […] He discovered and classified certain special topological features of two-dimensional manifolds (called singularities) which have a large influence in the behaviour of the trajectories' (6-7). Singularities represent the possibilities that structure the manifold and diagram the transformations of a system by mapping its virtual field. These are material-independent and can also be mechanism-independent (8), meaning, they can represent the common points towards which heterogeneous systems tend in different ways. The singularities composing the state space of a system are not given all at once, but manifest over time as a consequence of the evolution of the system, or in conjunction to the mutation of the relevant conditions in which it is immersed. Points in the system can be pushed, causing phase-shifts or 'bifurcations', while other singularities can function as attractors, indicating the states towards which specific systems usually tend. Recurrent types of attractors detail the tendencies shared by a variety of systems independently from their material basis. Irrespective of their type, be it 'steady-state', 'periodic' or 'strange', 'what matters is that attractors are *recurrent topological features*, which means that different sets of equations, representing quite different physical systems, may possess a similar distribution of attractors and hence, similar long-term behaviour' (7). Portions of a sequence can thus be observed in completely different processes: 'from a Deleuzian point of view, it is this universality (or mechanism-independence) of multiplicities which is very significant. Unlike essences which are always abstract and general entities, multiplicities are concrete universals' (13). A good example of this, on a high level of complexity could be represented by venom, a toxic secretion that evolved independently both as a tool of defence and of predation by a wide variety of animals, vertebrates or not.

These are the fundamental elements with which we can now move towards a description of the workings of that master layer described by Wark (2016: 142) and Haraway (1991: 146) as the grid of universal translation between living beings and machines, necessary for the compatibilization of the two in view of the emergence of the engineered cyborg. It is important to keep in mind that the diagrams mapping the behaviour of a system outline its virtual field, the portion of the plane of immanence that lies in-between states and connects every concretised possibility that from the perspective of the plane of organisation, appears as stable and distinct. Its phase space indicates the tendencies and, when considered in connection to other diagrams, the capacities of a system, that is, the ways in which a system can respond to the eventual interaction with other systems, and therefore how its virtual field of affordances intersects other phase spaces. The virtual dimension is a continuum populated by such multiplicities, which consist in the shifting diagrams of the morphodynamic power of actual systems. Once coordinated, the dimensions by which these multiplicities are composed, point at the conditions that the relevant parameters of a system must meet for it to assume a specific state; the conditions in which processes of actualisation give rise to a definite, concrete configuration of the system. Intersecting or partially overlapping, these diagrams depict the virtual field of every system, included those that more evidently result from assemblages.

As anticipated, the capacities of two systems can interlock to form an assemblage and give rise to a new set of tendencies and capacities that constitutes the emerging phase space of the whole. For instance, individuals can get injured and lose the use of their legs, so that they cannot move in the same way. The degrees of freedom of their bodies change, their capacity to walk or climb stairs being suppressed. Using a wheelchair can partially repristinate the degrees of freedom in relation to flat surfaces. This, however, will alter other parameters: the hands of an individual might be busy pushing the wheels, therefore producing an incompatibility between a movement of the chair and the capacity, for instance, to hold an umbrella. Here, the capacity of two systems are joined and give rise to a new set of affordances, from the tendency to strengthen the muscles in the arms, to the whole capacity to circulate of a disabled body. This simple association of a biological and a mechanical element highlights the heterogeneity typical of assemblages, that can be classified on the basis of the strata from which they 'borrow' their elements (Deleuze & Guattari 1987: 73). It is now time to define what a stratum is.

Stratification

The notion of stratum allows us to understand how stasis emerges in a world in process. DeLanda maintains that the notion 'points towards a new form of materialist philosophy in which raw matter-energy through a variety of self-organizing processes and an intense power of morphogenesis, generates all the structures that surround us' (DeLanda 1995). The self-organising power of matter and its morphogenetic creativity generate processes of emergence marked by recurrent traits that Deleuze and Guattari collocate between the plane of immanence and the plane of organisation. The world, they argue, is:

> permeated by unformed, unstable matters, by flows in all directions, by free intensities or nomadic singularities, by mad or transitory particles […] simultaneously occurs upon the earth a very important, inevitable phenomenon that is beneficial in many respects and unfortunate in many others: stratification. Strata are Layers, Belts. They consist of giving form to matters, of imprisoning intensities or locking singularities into systems of resonance and redundancy, of producing upon the body of the earth molecules large and small and organizing them into molar aggregates. (Deleuze & Guattari 1987: 40)

Going back to the motion blurs and defocus aberrations through which I have described the plane of immanence, flows and the plane of organisation, we can add that stratification is the process that calibrates the lenses to put reality in focus. As we will understand in a moment, these lenses generally come in three default settings that highlight atomic structures, molecules, and people: an atom probe, a microscope, and a camera.

Strata are abstract patterns of actualisation common to a wide variety of processes. They express the results of environmental, metasystemic or horizontal sets of forces that make processes of actualisation assume specific recurrent characteristics. Strata are modalities, patterns of emergence that arise from the collection of traits common to morphogenetic occurrences. In other words, strata result from morphogenetic processes, but only in the sense that they represent the patterns that will be replicated, given the right conditions, in processes of emergence. While a multiplicity consists in the virtual field of affordances of a system (fashioned by its tendencies and capacities), and an assemblage constitutes an actual emergent whose phase space results from the intersection of the dispositions of its components, the process of emergence amounts to a process of actualisation of some capacities of its components. Consequently, given the material- and mechanism-independent character of multiplicities, one can look at actualisation processes and, according to their traits, collocate them on different strata, that is, marking them as presenting specific abstract patterns of actualisation whose recurrence is set by the broader metasystemic conditions in which these processes unfold. This is what Deleuze and Guattari mean in saying that 'A single assemblage can borrow from different strata' (Deleuze & Guattari 1987 [1980]: 73). Seen from this perspective, Deleuze and Guattari's theory of stratification is not just a theory of emergence but one that traces common operational patterns of emergence. A stratum is an abstract pattern of emergence; stratification is the process of actualisation in relation to common patterns; and a stratified system is an actualised entity seen in relation to its patterns of emergence. When it comes to considering assemblages and the transversal emergents I have mentioned in the previous chapter, this view allows us to understand the character of the relations between strata through the idea that they can impact one another in a heterarchical manner:

> The strata are extremely mobile. One stratum is always capable of serving as the substratum of another, or of colliding with another, independently of any evolutionary order. Above all, beween two strata or between two stratic divisions, there are interstratic phenomena: transcodings and passages between milieus, intermixings. (Deleuze & Guattari 1987 [1980]: 502)

The analysis of this heterarchy of intersecting strata is performed by what I call stratoanalysis, a study that follows the development of lines of transversal becoming through the patterns of their emergence. For stratoanalysis, I therefore mean looking at how a specific stratum emerges from another – a process we might call stratogenesis – but also at how its emergence impacts other strata.

The next section will focus on the general traits of processes of stratification by describing the notion of double articulation. From this will follow a brief description of the three major strata pinpointed by Deleuze and Guattari: the physico-chemical, the biological and the anthropomorphic ones.

Double articulation

Deleuze and Guattari discuss stratification in the third chapter of *Mille Plateaux* (1987: 39-74), where they start off by using a geological vocabulary to draw a parallel between the temporary emergence of stability, the progressive complexification of the degrees of granularity composing material reality, and the gradual 'cooling' process of a planet from its original chaotic, unstable, or 'magmatic' condition (40), all the way to the emergence of geological formations, the appearance of life and its organisation through language: stages of reality-in-focus that could be described, as anticipated, through the eyes of an atom probe, a microscope, and a camera. Within this geological framework, strata are defined as layers, levels of thickness on the fluid, unformed state of the Earth, here and there called 'plane of consistency', 'of immanence' or 'the body without organs', and epitomising the virtual dimension: 'the strata are spinoffs, thickenings on a plane of consistency that is everywhere, always primary and always immanent' (Deleuze & Guattari 1987 [1980]: 70). The theory of stratification describes then the series of processes taking place between the two dimensions of Deleuze and Guattari's ontology, the virtual and the actual, that is, a flowing state and a stratified one, the hot and the cool, the absolute motion blur and the sharply-in-focus perspective over reality. One confusion that this geological metaphor can generate has to do with the idea of strata as layers: it is true, in fact, that the three major strata identified by Deleuze and Guattari build up one upon another, as one needs the physico-chemical register for the biological to emerge and so on. However, highlighting an obvious genealogical relation, that is expressed by strata nesting into one another risks introducing hierarchical organisation in a context in which, instead, emergence complicates the relations parts-wholes beyond the degree of set theory. As elements of a non-hierarchical taxonomy, strata are better described as levels of granularity instead of stackable surfaces. This idea helps both illustrating the interdependence of the strata and their mutual, heterarchical interactions: 'The strata are extremely mobile. One stratum is always capable of serving as the substratum of another, or of colliding with another, independently of any evolutionary order' (502). This is the fundamental line that helps us take into account the effects that strata exert on each other. Indeed, if strata were considered as solid, compact layers piled up one on top of the other, non-contiguous, separated layers would not be able to 'impact' one other directly. A geomagnetic event of the proportions of the solar storm of 1859 (Tsurutani et al. 2003), for example, wouldn't be able to wreck the global economy (National Research Council 2008), impacting on a layer that defines human activities without its effect being transmitted first through the biological stratum. In the opposite direction, industrial activities wouldn't threaten life on the planet without first impacting directly on its physico-chemical stratum, overwhelming the negative feedback loops of the climatic metasystem with pollutants.

To describe the difference between the strata, and map how these patterns of emergence differ, Deleuze and Guattari define a logic of 'double articulation', that is, the recurrent scheme through which environmental systems of forces transform matter: 'Each stratum exhibits phenomena constitutive ofdoub le articulation. Articulate twice, B-A, BA' (Deleuze & Guattari 1987: 40). This articulation is extremely variable, and the philosophers introduce it by adopting a geological vocabulary that, rather than being metaphorical, allows us to focus on a relatively simple case (41) of physico-chemical stratification: the formation of sedimentary rocks. DeLanda dedicates a few lines to this example in *A Thousand Years of Nonlinear History* (1997), where he identifies the two main processes leading to the origin of the formation of this type of rocks: sedimentation and consolidation. Sedimentation starts when the elements erode a mountain, and the resulting pebbles of different sizes and shapes are transported by rain and rivers towards the sea. This movement actively shapes the pebbles: a complex system of interacting forces exerted on these materials (the river's power and length, the topography of the land it cuts through, the material of the riverbed and so on), the river is a sculptor. Often, the final destination of these rocks is the bottom of the ocean or of a sea, where currents sort rocks that have roughly the same dimension (59-60). This process too is operated by a set of forces and properties that cause physical interactions in the moving liquid. After sedimentation has taken place, adds DeLanda,

> a second operation is necessary to transform these loose collections of pebbles into a larger-scale entity: sedimentary rock. This operation consists in cementing the sorted components together into a new entity with emergent properties of its own, that is, properties such as overall strength and permeability which cannot be ascribed to the sum of the individual pebbles. The second operation is carried out by certain substances dissolved in water (such as silica or hematite, in the case of sandstone) which penetrate the sediment through the pores between pebbles. As this percolating solution crystallizes, it consolidates the pebbles' temporary spatial relations into a more or less permanent "architectonic" structure. (60)

While the first two processes, *erosion* and *sorting*, come together to structure the more complex process of sedimentation, the operations of mechanical *consolidation* and *cementation* produce a new whole out of the parts originally eroded from a mountain. Consolidation is a mechanical process that, for instance, reduces the volume of the set, increasing the density of accumulated grains because of the increasing pressure of the pile. A process of chemical cementation adds then to this mechanical operation generating the final form and consistence of the emergent sedimentary rock. In this example, one can appreciate the set of interconnected operations coordinated according to the logic of the double articulation: the first articulation, that of the macro-operation of sedimentation, is composed by the processes of erosion and by the transportation/sorting of the material; the second, the operation that DeLanda names consolidation, is instead composed by the operations of mechanical consolidation and chemical cementification. Using the categories I have described above, we can say that the coupling of flow-cut and cut-out are at play within the first articulation, with flow-cut roughly corresponding to the erosion of the mountain (a series of cuts in a tectonic, thus really slow, flow of matter) and cut-out to the sorting process taking place according to the unique characteristics of the milieu. The second articulation instead coordinates the processes by which parts of some sorts build up stronger and stronger relations, until these create the conditions to generate the emergence of a new whole, the sedimentary rock.

Defining the genetic process that leads to the emergence of relatively static formations through the logic of double articulation, Deleuze and Guattari explain then not only the emergence of form, but also that of substance, terms that, in their work, assume a revisited meaning. As highlighted by Brent Adkins in his *Critical Introduction and Guide* on Deleuze and Guattari's *Mille Plateaux* (2015), the shift in the meaning of these traditional notions is performed with the intent to 'sever the connection between these terms and a metaphysics of discontinuity' (45), that is, from worldviews that favour the production of sharp distinctions between things and the consequent stability of hierarchical representations. Deleuze and Guattari account instead for both form and substance as the results of processes connected according to the following scheme: 'a passage from substance to form [first articulation] and from form to substance [second articulation]' (44). This passage of *Mille Plateaux* is crucial in this regard:

> The first articulation chooses or deducts, from unstable particle flows, metastable molecular or quasi-molecular units (substances) upon which it imposes a statistical order of connections and successions (forms). The second articulation establishes functional, compact, stable structures (forms), and constructs the molar compounds in which these structures are simultaneously actualized (substances). (Deleuze & Guattari 1987 [1980]: 40-41)

First, the matter that enters the process must be extracted from the milieu in which it is flowing and configured as the result of the forces at play in the system it enters (substance$_1$). Secondly, the elements selected in such a way are grouped according to relations that can be expressed in statistical terms and are relative to the average distribution and character of the parts (DeLanda 2016: 51-52). In this way, substance$_1$ is organised in patterns that constitute form$_1$. The first articulation moves then from the selection and processing of some configuration of matter or energy that assumes the role of substance$_1$, to a first consolidation of statistical patterns that assume the role of a first emergent form$_1$. The second articulation takes up this formation of matter (form$_1$) and consolidates its relations into functional structures through operations that make of the statistical form$_1$ an extensive, often non-modular structure (form$_2$), in which the relations of the parts assembled give rise to the emergence of a new molar entity featuring, as we have seen, affordances (tendencies and capacities) whose origin is not reducible to the mere sum of its component parts: substance$_2$. In the example of stratification we have considered above, for instance, the pebbles resulting from erosion (substance$_1$), are sorted in piles of rocks with similar characteristics (form$_1$). Form$_2$ results from the process of consolidation clumping up together the sorted pebbles, then glued together by chemical reactions that give rise to sedimentary rocks with a new field of affordances, or substance$_2$.

The logic of double articulation distinguishes then between two operations of formation and two instances involving substance, one consisting in a capture and one amounting to an instance of emergence. To mark the roles of these couples and group them, Deleuze and Guattari employ two terms borrowed from the work of Dutch linguist Louis Hjelmslev, namely content and expression, and use them to label the distinction between the first and the second articulation, highlighting the character of their reciprocal relation and their respective roles in the composition of a macro-process of emergence. The first articulation describes in fact the selection or capture of what assumes the abstract role of content in the process of emergence, that is, any configuration of matter that has entered a stratum and becomes the subject of its operations. The density of the relations developed within this content conduces, through an assemblage of the units that have been prepared in the previous articulation, to the emergence of novel molar structures out of a set of processes through which the formed matter of the content layer produces or expresses emergent properties.

Once we reject any form of essentialism and the primacy of form over matter, things can be understood according to the kind of processes that give rise to their consistency, that is, on the basis of how, at any level of complexity the relation of the integral couple flow-code develops into the creative relation part-whole in a particular instantiation of the abstract structure of double articulation. As highlighted by DeLanda in fact, 'the genesis of both geological and social strata involves the same engineering diagram' (2005: 59), but strata differ in the 'type' of matter they transform and in relation to the concrete operations through which the various stages of the general diagram of emergence (extraction, coding, overcoding and expression) are executed. In his commentary on *Mille Plateaux*, Eugene Holland stresses that, consequently, the three strata identified by Deleuze and Guattari as the most relevant for stratoanalytic descriptions of the world – the physico-chemical, the biological and the anthropomorphic – are 'to be distinguished not in terms of their levels of complexity or degrees of organization, but rather in terms of the distinctive mode of double-articulation that characterizes each of them' (Holland 2013: 61).

The simplest difference between modes of double articulation resides in the fact that 'a stratum [has] a unity of composition, which is what allows it to be called a stratum: molecular materials, substantial elements, and formal relations or traits' (Deleuze & Guattari 1987: 49). Different strata have different unities of composition or elementary components. In the case of the physico-chemical stratum, this unity of composition is defined on the basis of the minimal threshold of energy and the conditions necessary for matter to form and maintain aggregates: in the geological stratification we have considered above, for instance, this unity of composition was defined by the sediment. In the same fashion, a nucleic sequence (44) can represent the unity of composition of organic strata. On this point, Deleuze and Guattari suggest that

> In biochemistry, there is a unity of composition of the organic stratum defined at the level of materials and energy, substantial elements or radicals, bonds and reactions […] there is no vital matter specific to the organic stratum, matter is the same on all the strata. But the organic stratum does have a specific unity of composition […] and presents everywhere the same molecular materials, the same elements or anatomical components of organs, the same formal connections. (45-46)

Consisting in patterns of emergence articulated according to the abstract diagram outlined above, each stratum differs from others on the basis of the units of composition it extracts from its substrata. The humblest particle, the minimum amount of energy, the simplest bond or reaction, the angles of molecular geometry, a carbon-containing molecule, a patch of tissue or a gland, flower, leaf and stem, a seed a fruit and the wood, branch and root, bone and joint, vascular tissue and blood cell, anatomical patterns, gesture and speech, tool and hand: these are some of the examples of what can be taken up as the unity of composition of a stratum, listed on the basis of the fundamental idea that 'Materials are not the same as the unformed matter of the plane of consistency; they are already stratified, and come from "substrata"' (49).

The characteristics of substrates, however, are not the only factors differentiating stratification processes, for emergence operates also in relation to a number of 'parastrata': the dynamical systems that constitute the exterior milieu of a stratum, and whose characteristics impact on the process of stratification. Since stratification processes are open to the influences of the parastrata, the same content can express itself in different ways as a consequence of the forces to which the process is exposed. Essentially, the idea of parastrata brings about the discourse of the associated milieus and of their importance for articulation, for there is no necessity that a content expresses itself in a specific way. In the language of complexity theory then, the relation between strata and parastrata highlights the synergistic character of the process of stratification, which manifests, for instance, in the relation between genotype and phenotype. Here, the parastrata influence the second articulation:

> Anatomical elements may be arrested or inhibited in certain places by molecular clashes, the influence of the milieu, or pressure from neighbors to such an extent that they compose different organs. The same formal relations or connections are then effectuated in entirely different forms and arrangements. (46)

This influence generates what Deleuze and Guattari call the 'the principle of the simultaneous unity and variety of the stratum: isomorphism of forms but no correspondence; identity of elements or components but no identity of compound substances' (46). In other words, being open to the influence of the parastrata, each stratum has the capacity to produce, from the same elements, a variety of substances of expression while different strata, despite the variety of materials they articulate, can produce 'isomorphisms', that is, the emergence of analogous forms. In chapter 6, I will describe an interesting instance of this eventuality instantiated in the cases of biological and computer viruses, a behavioural isomorphism we can find in the biological stratum and the digital one. For now, though, we will continue to consider the difference between the physico-chemical, the organic and the anthropomorphic strata identified by Deleuze and Guattari and examine the modalities in which their contents get expressed.

The three strata

Besides involving different units of composition, strata are differentiated by the way in which their content gets expressed, that is, by how the first articulation develops into the second one. For the physical stratum, this process is triggered by the crossing of a threshold. In the case of the emergence of sedimentary rocks, this limit is relative to the density of the pile of pebbles and the amount of pressure they are under. Another example consists in the freezing point of a liquid. The temperature at which water starts to freeze is generally 0°C. After this parameter is met, the liquid starts to shift its phase, and a firm and more orderly structure emerges among its atoms. When they overcome the respective thresholds, physicochemical systems find themselves a new, relatively stable state, to which corresponds a new field of dispositions, marked in turn by new thresholds. Deleuze and Guattari call the passage from a state to another 'induction'. The term indicates a transition between a molecular condition and a molar one, that is, between intensive, metastable state rich with potential energy and one in which the tensions of the previous state of the system are resolved in the production of new, mostly extensive, structural properties. The first case can be exemplified by the swirling movement of particles suspended in a liquid, where their concentration has passed the point in which the particles can be dissolved (supersaturation), while the second can be understood as the condition of solid, sedimented rocks or the recurrent structure of ice crystals.

To understand fully the process of induction, however, we must introduce the notions of territory and the associated movements of deterritorialization and reterritorialization. The notion of territory indicates a set of significant relations between a body and selected parts of its milieu: 'Territories are fashioned from parts of milieus, and composed only of those milieu materials that have meaning and function for the territorial assemblage […] Territories contain that which is owned or used, actually or in reserve' (Bonta & Protevi 2004: 158). While the discussion of territory in Deleuze and Guattari omits reference to von Uexküll's work on the milieu (Deleuze & Guattari 1987: 314; 1994: 185-186), it is important to highlight that the reference to space this notion brings with it, and the ideal boundaries of the set of relations that constitute a territory, are subordinated again to movement and transformation. Deleuze and Guattari write explicitly that 'The territory is […] an act that affects milieus and rhythms […] A territory borrows from all the milieus; it bites into them, seizes them bodily […] It is built from aspects or portions of milieus' (Deleuze & Guattari 1987 [1980]: 314). A territory is a cut-out. Crucial, then, become the movements of deterritorialization and reterritorialization, defined by Adrian Parr as the operations freeing up 'the fixed relations that contain a body all the while exposing it to new organisations' (Parr 2010: 69). *Qu'est-ce que la philosophie?* (Deleuze & Guattari 1994 [1991]), contains an interesting example of these phenomena:

> The merchant buys in a territory, deterritorializes products into commodities, and is reterritorialized on commercial circuits. In capitalism, capital or property is deterritorialized, ceases to be landed, and is reterritorialized on the means of production; whereas labor becomes "abstract" labor, reterritorialized in wages. (Deleuze & Guattari 1994 [1991]: 68)

To return to our description of physico-chemical stratifications and their relation with the movements of territorialisation and deterritorialization, Bonta and Protevi do the work of relating both to the language of complexity theory that we are adopting:

> In complexity theory terms, deterritorialization works by increasing or decreasing the intensity of certain system states past a critical threshold, which either moves the system to a previously established but non-actualized virtual attractor ("relative deterritorialization"), or indeed prompts the release of a new set of attractors and bifurcators, new patterns and thresholds ("absolute deterritorialization"). (Bonta & Protevi 2004: 78)

The first deterritorialization one can register in a process of stratification corresponds to the removal of a substance from the set of relations in which it is embedded and its consequent exposure to a new set of processes (reterritorialization). Here, once a threshold value is crossed, the substance taken up in a physical stratum changes its phase, acquiring a new multiplicity. A second deterritorialization will then be made available through the emergence of a substance of expression that can be taken up in other systems and processes. If the operations of coding and decoding constitute forms in both the first and second articulations (e.g., a river sorting out pebbles), deterritorialisation and reterritorialization describe the capture and production of substances (e.g., the erosion of a mountain and the consolidation of sedimentary rocks) (70). Each stratum can be said to perform deterritorializations, which are not only physical, but can also be cognitive or linguistic: what distinguishes the three strata considered by Deleuze and Guattari is also the modality with which this deterritorialization is performed. In the physical stratum, this process is defined as 'voluminous' and 'superficial' (Deleuze & Guattari 1987: 59). The example used by Deleuze and Guattari, in a move that clearly recalls the influence that Gilbert Simondon's philosophy of individuation has had on the theory of stratification, is that of crystal formation (Simondon 2020 [2005]: 13). Crystals increase their volume by adding layers to their surface, which can be considered as being wrapped around the stable core of the germ that starts the process of crystallisation in a supersaturated solution. Hence their superficiality. The progressive growth of the crystal deterritorialises its parastrata into the structure of the crystal. Essentially articulating the expansion of a stratified core that incorporates new substances of contents deterritorialising bits of its parastratum, induction is characterised by a high level of dependence of the expression on the physico-chemical characteristics of the content. The emerging substances will preserve a significant number of traits that result directly from their statistical incidence in the substances initially extracted by the process.

The degree of dependence between content and expression is another factor that distinguishes strata from one another. This depends on the character of the unity of composition of the stratum and results from the array of different operations linking the first articulation to the second. A particular configuration of this relation distinguishes the second major stratum described by Deleuze and Guattari from the physico-chemical one, revealing at the same time the new role assumed by parastrata in relation to these specific patterns of emergence. The biological stratum is characterised by a specific capacity manifested by its substances of expression: while a crystal expands its surface but does not, in itself, possess the capacity to produce more crystals, a biological entity can reproduce. Deleuze and Guattari call this different 'spreading modality' of the stratum *transduction* (Deleuze & Guattari 1987: 60), a term that in biology indicates the horizontal transferring of genetic material through a viral vector. The two philosophers, however, do not embrace the precise use of the term adopted in genetics, and borrow it to indicate, in more general terms, how processes of biological stratification are initiated. The molecular materials that initiate this process of stratification are not extracted or incorporated directly from the parastrata, but transferred from an individual substance of expression, from an actual stratified living being (or two), to the interior of another entity (in the case of sexual reproduction). In his commentary on the theory, Brent Adkins poses it in these terms: 'Transduction allows the transfer of material directly from the interior of one assemblage to the interior of another assemblage. The transduced material is then replicated through genetic reproduction' (Adkins 2015: 52).

In the biological stratum, a quantity of genetic material is transduced to become the matter of a new process of stratification, with nucleotides taken up as substance of content, and genes as patterns of nucleotides, constituting the new form of content. This articulation is organised in the genome, the full amount of DNA of an organism, and expresses in an individual of the species, a new substance emerging out of the biological stratum. Because of the way transduction works, the characteristic property of the stratum is defined as *linearity*, meaning that, differently from the voluminous modality of expression of the physical stratum, in biological processes of emergence, 'a single line detaches from a population and is able to produce a new population' (56). Yet, this line does not entail simple replication. In contrast to what we have seen happening with the physical stratum, where the volume undergoing a process of *induction* preserves its identity through its stratification, the identity of the elements transduced can shift away from the original configuration of the genetic material transferred from a process of emergence to another. This happens because the form of content of the biological stratum can result from the combination of the material from two separate individuals, as in the case of sexual reproduction, and is subject to errors in the copy. For this reason, we start to see why the linearity of this stratum is not that of a replication chain, but describes a vector of variation, whose changes are also subject to the influence of the parastrata.

In the biological stratum, in fact, parastrata do not simply consist in the sets of forces that trigger phase changes, nor must they be considered a field of growth, their elements ready to be incorporated in the superficial expansion of stratifying entities as in the case of crystals. Rather, they shape the way in which contents are expressed. In other terms, 'environmental factors (part of the parastrata) place pressure on expression' (54) and, along the linear diffusion of the biological stratum, cause a population to shift towards the prevalence of specific characteristics. This both topological and statistical character of the unity of the stratum is dependent on the fact that

> Anatomical elements may be arrested or inhibited in certain places by molecular clashes, the influence of the milieu, or pressure from neighbors to such an extent that they compose different organs. The same formal relations or connections are then effectuated in entirely different forms and arrangements. It is still the same abstract Animal that is realized throughout the stratum, only to varying degrees, in varying modes. Each time, it is as perfect as its surroundings or milieu allows it to be […]. (Deleuze & Guattari 1987 [1980]: 46)

The variety of the biological stratum resides both in the variability of the form of content caused by the operation of transduction, and in the independence of its expression, because the emergence of phenotypical traits is not directly dependent on the configuration of the genetic material captured by the stratum in the first place. The expression of the biological stratum is consequently characterised by a greater independence from the content compared to what we have seen in the physical stratum: 'for example, the redness of sandstone (expression) is completely dependent on the amount of iron oxide in the sediment (content) [while] Eye colour is […] an expression of genetic content, but it is also widely variable' (Adkins 2015: 52). This entails that, contrarily to what one can register in cases of physicochemical emergence, the traits of the virtual field of affordances of the substances of expression of this stratum can be modified by the alteration of a great number of factors. However, in the case of the biological stratum one has to consider the fact that the process of individuation of a substance of expression does not terminate with its emergence, but continues indefinitely, allowing for further modifications of the substance's field of affordances.

The third stratum is defined as anthropomorphic or alloplastic, a term that indicates its capacity to bring about modifications in the milieu in which the correspondent processes of emergence take place. Starting from the form of content that consists in the hand, Deleuze and Guattari describe a set of essential traits of this pattern of emergence. One has to be careful, though, not to consider the hand as an object, but both as an abstract element of an alloplastic pattern and a concrete patterning force: ‘In this context, the hand must not be thought of simply as an organ but instead as a coding (the digital code), a dynamic structuration, a dynamic formation (the manual form, or manual formal traits)’ (Deleuze & Guattari 1987 [1980]: 60-61). These traits are the product of an evolutionary process, a series of synergistic deterritorialisations through which a ‘line’ coming out of the biological stratum has passed. Such processes define the animal occupying the position of the substance of content as a ‘deterritorialised ape’:

> with the hand as a formal trait or general form of content a major threshold of deterritorialization is reached […] Not only is the hand a deterritorialized front paw; the hand thus freed is itself deterritorialized in relation to the grasping and locomotive hand of the monkey. The synergistic deterritorializations of other organs (for example, the foot) must be taken into account. So must correlative deterritorializations of the milieu: the steppe as an associated milieu more deterritorialized than the forest, exerting a selective pressure of deterritorialization upon the body and technology (it was on the steppe, not in the forest, that the hand was able to appear as a free form, and fire as a technologically formable matter). Finally, complementary reterritorializations must be taken into account (the foot as a compensatory reterritorialization for the hand, also occurring on the steppe). (61)

The description of this stratum is articulated in view of the tendency towards exosomatisation characteristic of the human species, that is, the tendency to the exteriorisation, through the organisation of inorganic matter, of organs and functions, and the consequent hybridity of human life caused by the influence of technical prostheses. The set of transformations outlined above summarises the process of evolution that the ‘deterritorialised ape’ has undergone to enter the new stratum. What Deleuze and Guattari describe as the progressive deterritorialization of the forest in the steppe, in fact, amounts to the physico-chemical process that slowly restructured the parastrata of the ancient ape, entailing the exposition of its evolutionary line to an open space. This contributed to the selection of the upright stance as an advantageous trait in an environment in which sight offers the possibility to expand the field of responsiveness to the milieu, allowing the identification of prey and threats from far away. Deterritorialisation of this kind permitted the liberation of the hand from its merely prehensile and locomotive functions and, further down the line, allowed for the manipulation of the inorganic matter through which the body would exteriorise a growing number of its functions in the tool.

This parastratic deterritorialisation and the synergistic liberation of the hand are connected by Leroi-Gourhan to another important morphological transformation involving the mouth: ‘With erect posture, the hand takes over as the organ of association [so that] labiodental contact is no longer dominant as in quadrupeds, nor even equivalent as in many monkeys' (Leroi-Gourhan 1993 [1965]: 224). Freeing the mouth from the role it assumes in other primates, the upright stance allowed for a development of the frontal cortex area and, subsequently, for the development of language. The importance of the extension of the hand in the tool, and of the emergence of language as functionalised vocal substance testify the fact that this third pattern of emergence identified by Deleuze and Guattari does not simply re-articulate its substance of content but, especially through the emergence of manual formal traits, directly operates modifications in its parastrata. This is the reason for this stratum to be called alloplastic:

> [the] third major grouping of strata, defined less by a human essence than, once again, by a new distribution of content and expression. Form of content becomes "alloplastic" rather than "homoplastic"; in other words, it brings about modifications in the external world. Form of expression becomes linguistic rather than genetic; in other words, it operates with symbols that are comprehensible, transmittable, and modifiable from outside. (Deleuze & Guattari 1987 [1980]: 60)

In this definition, the tool is described as a form of content in itself, a material extension of manual traits deployed in the operations through which the human re-organises its milieu for its capacity of codifying any sort of malleable matter.

While the first articulation thus comprises the living substance of content of the deterritorialised ape and the form of content of its manual traits, the second articulation of the stratum concerns the emergence of an instrumental use of the vocal substance and its linguistic formalisation. As form of expression, language is itself an instance of exosomatisation, 'a "secretion" of the anthropoid's body and brain' (Leroi-Gourhan 1993 [1964]: 91) consisting in a transmittable codification standard that gives the anthropomorphic stratum a singular power of deterritorialisation compared to the others. Deleuze and Guattari call *translation* the characteristic operation of this pattern of emergence:

> Translation should not be understood simply as the ability of one language to "represent" in some way the givens of another language, but beyond that as the ability of language, with its own givens on its own stratum, to represent all the other strata […] the translation of all of the flows, particles, codes, and territorialities of the other strata into a sufficiently deterritorialized system of signs, in other words, into an overcoding specific to language. (Deleuze & Guattari 1987 [1980]: 62)

The main implications of this property of the stratum are four. First, translation characterises the alloplastic stratum as possessing neither a voluminous nor a linear spreading pattern, but what is defined as an overcoding capacity or *superlinearity*. Second, since 'translation is possible because the same form can pass from one substance to another, which is not the case for the genetic code, for example (62), this capacity testifies to a greater independence of expression from the content, and to an even more important independence of forms from the substances they codify. Third, since alloplasticity imposes manual formal traits on unformed matter, this stratum represents one of the roots of hylomorphism. Superlinearity produces in fact the totalising attitude that gives humans the illusion of superiority and of mastery over the other strata and their parastrata.

The fourth consequence of the alloplastic character of the third pattern of emergence is played in relation to the alterations it causes in the multiplicities of the substances involved. As we have seen above, every process of emergence changes the virtual field of affordances of the matter it articulates: in the case of the crystal, one registers a phase-shift from a supersaturated liquid to a solid, while in the case of the organic stratum one can register expansions and reductions of this field with the expression of the genotype in the phenotype and the development of the latter over time. We have seen that the fundamental operation characteristic of the third stratum, translation, allows it to expand in a peculiar way, that is, not only through the biological reproduction of its substance of content, but by technical means. Indeed, a form or set of forms developed at a certain point of this process of stratification can be applied to substances extracted from any other. This includes the alloplastic stratum itself. Every individual substance of content that undergoes anthropomorphic stratifications does not have, for instance, to develop a language of its own, and its linguistic form of expression consists essentially in a codification exerted on its vocal substance by the influences of a cultural parastratum or milieu.

From the point of view of virtual fields this means that the alloplastic stratum has a certain power to limit the multiplicities emerging from other strata. A linguistic form can indeed be imposed on different entities and re-codify their substance of expression, manipulating their phase space through the linguistic plane. As we will see, this operation has an impact on the virtual field of affordances of these substances and determines how they will be taken up by further alloplastic stratifications. In short, making it possible to manipulate virtual fields of affordances on a linguistic plane, translation allows us to project the results back onto its actual objects. This type of operation can comport some form of reduction of the multiplicities of the substance re-codified and the preparation of matter for the combinations made available by larger alloplastic structures. At the origin of the hylomorphic model, for instance, an act of translation sterilises matter, mutilating its virtual field of tendencies and capacities to prepare it to receive a form. This operation has consequently an impact on how and which of the virtual dispositions of a body will actualise. In other words, descriptions and narratives shape not only the actual relations between things but also the power of actualisation of their tendencies and capacities.

In the next chapter, I will show how these narratives come to constitute what Deleuze and Guattari define ‘regimes of signs’, semiotic systems so pervasive and structured to be able to significantly shift processes of emergence within a society. Superlinearity, the capacity of the stratum to *overcode* all the others, allows the third stratum ‘to organise other strata’ in such a fashion. Hence its fundamental alloplasticity: the third stratum describes how is it possible to *make* something emerge or *prevent* something from emerging, at the same time giving the illusion that strata are organised hierarchically, with the alloplastic one acting on but not being acted upon by the other ones. The third stratum can then modify multiplicities with different instruments, be they linguistic or more directly technical. The way in which this sort of operation is carried out is the object of the next chapter, in which we will look at formations of power supported by technical apparatuses and at digital technologies more in detail.

Chapter 4: Stratogenesis of Control

In the previous chapters, I have addressed the notion of virtual fields of affordances to show that a full description of the behaviour of complex dynamical systems must take into account their tendencies to change and their capacities to affect and be affected by other bodies. The affordances of a system are virtual, that is, they are real, yet not necessarily actual. Just like the tendency of an ice cube to melt and its capacity to cool down your drink manifest only given the right conditions, the affordances of a system can be identified by experimentally altering key parameters of a system and following its development. Highlighting, with the example of atoms of hydrogen and oxygen, that the virtual fields of affordances of different bodies can form sometimes inseparable blocs and generate emergent fields of affordances with novel tendencies and capacities (as with H_2O), I have then considered the notion of emergence itself, outlining the three major strata identified by Deleuze and Guattari: the physico-chemical, the biological and the anthropomorphic one. Strata represent widespread patterns of emergence and are constituted by the traits common to different morphogenetic processes.

The previous section, focussed on the anthropomorphic stratum, has stressed how this brings about modifications in the world by projecting over the milieu the manual traits that constitute its form of content: a digital form of coding that expresses a tendency to manipulate matter and, eventually, to extend bodily functions into tools. This chapter will continue to discuss the alloplastic stratum and focus more specifically on the process of grammatisation. An instance of flow cut that applies to vocal flows of expression, grammatisation allows for their reproducibility by parsing them into discrete units whose configuration and use are consolidated through technical supports like dictionaries and grammars. The first two sections of this chapter will then show how the emergence of language and its grammatisation are followed by a grammatisation of gestures. These are two key passages that I will place on the line of an historical process that, leading to the grammatisation of thought operated by digital technologies, entail the development of two distinct modalities of domination: Foucauldian discipline and Deleuzean control. The second section of the chapter will describe the development of the paradigm of digital control and distinguish it from the disciplinary model, the modality of domination based on an underlying grammatisation of gestures we have started to understand, in Chapter 1, as integral to the mechanisation of life.

The second half of the chapter will define the digital stratum as the pattern of emergence of those diachronic transversal emergents I have defined above as artisanal cyborgs. Against this background, I will refer again to the notion of virtual fields of affordances to show what makes of control an exceptionally effective tool for domination. By describing the process of modulation as the continuous modification of a virtual field of affordances through the biofeedback mechanisms produced by the digital stratum, the last section will show how continuous modulation impacts the virtual fields of affordances of these hybrid individuals through the power of suggestion, the form of expression that the digital stratum outputs in the analogue dimension to close the biofeedback circle of control.

Emergence of the digital stratum

What does it mean that, in the alloplastic stratum, language emerges as a form? To what extent does superlinear translation relate to the manipulation of virtual fields of affordances? And what is, more generally, the role of technology in relation to the virtual dimension? In order to answer to these questions, we need to take into account the technical process that constitutes a language. The description provided by Deleuze and Guattari at this point is indeed quite generic and accounts, at most, for the evolutionary traits that have made possible the appearance of linguistic capacities in the 'deterritorialised ape'. A more precise description of the emergence of a language, however, could be obtained by describing the progression through which this form of expression emerges from vocal substance, that is, a process of emergence whose axes are still the operations of cutting and coding, but whose character becomes essentially technical.

In order to connect this process of emergence to the various types of cuts I have defined in the previous chapters, one should consider the notion of digitality advanced by Alexander Galloway in his book on François Laruelle (Galloway 2014). Rather than a mere overview of Laruelle's philosophy, in its pages Galloway proposes 'something like a prolegomenon for future writing on digitality and philosophy' (51), an attempt at describing the necessary elements to pose the question of the ontology of the digital. Attributing the initial developments of a philosophy of digitality to the figures of Socrates and Plato, the first thinkers to describe the world in terms of 'essence alienated into instance, speech grammatized into writing, idea extended into matter, memory exteriorized into media, authentic life separated from inauthentic life' (52), Galloway requires the reader to expand the horizon of meaning of the notion of digitality from designating data processing electronics based on binary code, to a more general process designating

> the making-discrete of the hitherto fluid, the hitherto whole, the hitherto integral. Such [a] making-discrete can be effected via separation, individuation, exteriorization, extension, or

> alienation. Any process that produces or maintains identity differences between two or more elements can be labeled digital. (52)

Digitisation is the process through which a plurality comes to the fore, through which things come to be, are perceived and thought in their distinctiveness. Digitisation is an operation that can be performed in numerous ways, influenced by various forces and acting at different levels of complexity, for it results from the combination of those operations of *flow-cut* and *cut-out* I have described in the first chapter. As we have seen, digitisation has a spontaneous origin and a 'homoplastic' character: things differentiate because of physical, chemical and biological processes triggered by complex intersection of forces, particular conditions of the milieu, or by chance. In the alloplastic stratum, though, we register the first instance of a special form of digitisation in the exteriorisation of bodily functions typified, in humans, by the extension of the hand into the tool. As anticipated, Bernard Stiegler refers to this process as the progressive externalisation of the organs, a prosthetisation (Stiegler 1998b [1994]: 133) perpetrated through an organisation of inorganic matter that in a certain sense continues life (in both its biological and noetic registers) by means other than life. Exosomatisation is an alloplastic form of digitisation, or a digitisation produced *to operate* and *by operating* changes in the world. For Galloway, 'Such processes of externalization are at root digital, because they extend the one beyond its own bounds, thereby branching the one, splitting it, alienating a part of the one into an external object' (Galloway 2014: 52). To get back to the emergence of language as a form then, one must understand that there is no language without technical externalisation and that, consequently, this form must rest on some sort of exosomatic digitisation.

The process is delineated by French linguist and historian Sylvain Auroux, who describes the emergence of languages as forms of expression in relation to one of the modalities of alloplastic digitisation he calls grammatisation:

> This process of "grammatization" profoundly changed the ecology of human communication and gave the West the means of knowledge and domination over other cultures on the planet. It is strictly speaking a technological revolution which I do not hesitate to consider to be as important for the history of humanity as the agrarian revolution of the Neolithic era or the industrial revolution of the 19th century. (Auroux 1994: 9)[2]

By no means secondary in importance to the technical revolutions that made available agriculture and mass production, the process of grammatisation follows the development of writing. While writing operates as the discretisation of speech that allows its reproducibility and later modification, and alphabetisation corresponds to a standardisation of orthography, of the gestures producing this

[2] All translation from this source are mine.

discretisation, grammatisation represents an ulterior stage of codification of the vocal substance. This is performed through the production of dictionaries and grammars, two technical objects respectively performing cuts (typologies) and imposing relations between them (sets of rules), two mechanisms perfected between the V and the XIX century that 'tending to replace juxtaposition by integration into organic units' (19). Supported by these 'linguistic tools' (20), grammatisation consolidates the use of a language, that is, codifies the possible uses of a form of expression that can be applied to contents extracted from any stratum.

Here, a *grammè* is conceived as a spatial *discretum* cut from a temporal continuum, and as the minimal unity notched on a physical support serving as an externalised memory, of which the open process of grammatisation sets down the rules of combination with other *grammes*. Linguistic tools are the result of a digitisation of enunciation: dictionaries are born as thematic lists of elements (48-9) that are kept distinct because of sounds and meanings, while 'grammar supposes the decomposition of the utterance into parts' (62) and codifies the rules for the re-combination of these units. Emerged from regular usage (115), or better, from the portion of usage taken into consideration by the groups of intellectuals that, in a culture, are responsible for the structuration of externalised memories, of *hypomnemata* (Derrida 1981 [1972]: 107), linguistic rules crystallise in the set of relations that will regulate the composition of words and phrases. As a process of digitisation of the vocal continuum complemented by a regulation of the articulation of utterances, grammatisation consists in a series of operations of formalisation and abstraction (Auroux 1994: 165) from which derives the constitution of a language as a fairly malleable form. As we have seen, this implies the emergence of a superlinear plane of translation that allows for processes and flows from the most disparate degrees of complexity to be accounted for, to be expressed. Everything can indeed find an expression more than once: homoplastically, by expressing *itself*, that is by emerging from a stratum, and by *being expressed* on the alloplastic stratum through a superlinear translation (Deleuze & Guattari 1980: 62).

On this note, Auroux claims that 'without the second techno-linguistic revolution, modern natural sciences would not have been possible if not in their beginning, at least in their social consequences' (Auroux 1994: 27). Such consequences do not concern only the advancement of scientific knowledge and the diffusion of literacy, for grammatisation has produced benefits with regards to 'commercial and political relations […] military expeditions […] importation/exploration of a religious doctrine […] colonization' (91). Besides the fact that the imposition of a language is a fundamental aspect of the establishment of cultural hegemonies in colonial contexts, these advantages are connected to the power the technicisation of language has on the structuration of cognitive architectures (64; 97-98), an influence obtained, according to Auroux, through the diffusion of language-specific paradigms (110).

The idea of conceiving grammatisation in relation to its capacity to structure cognitive architectures, mental pathways and systems of association, relates to the instillation of patterns of thought by means of the adoption and reproduction of linguistic paradigms. While relating, on one side, to the power exerted by superlinearity on multiplicities, this idea connects also to the broader issue of automation and involves the more general process of externalisation and re-internalisation of *hypomnemata*. As we will see, especially through the forms of grammatisation developed during the XXth century, this relation between alloplastic translation and the structuration of cognitive architectures has rapidly unveiled its power to support the necessities of the market that started flourishing in the new global space devised after WWII. It is on the basis of this property that Stiegler will describe 'Digital technology [as] a new stage of writing (and thus also of reading), an industrial system founded on the production and activation of traces, of "grammes" and "graphemes" that discretize, *affect*, reproduce and *transform every flux and flow* (well beyond just language)' (Stiegler 2015 [2012]: 7). Before being able to touch on this issue, though, we must consider the more recent history of grammatisation, and its process of extension in other areas of life.

Through his reading of Auroux's work, Stiegler broadens the sense of the notion of grammatisation beyond the linguistic sphere, understanding the process in the more general terms of a discretisation complemented by an imposition of synthetic rules for the combination of grammes:

> with the transfer of the automaton from Vaucanson to the mechanization of the workshops of royal manufacturing and with the advent of arithmetic machines, the process of grammatization began to move beyond the sphere of language. Consequently, as an analytical technology of the discretization and reproduction of gestures, then of perception, then of the analytical operations of the understanding, it was able to take hold of every field of existence, while the motive power of combustion took humanity into the thermodynamic era of the Anthropocene. (Stiegler 2016 [2015]: 201)

Understanding the issue of technics in terms of an exteriorisation of memory, Stiegler claims that this process exposes the externalised patterns of movement or thought to exogenous ordering forces: 'When technologically exteriorized, memory can become the object of sociopolitical and biopolitical controls through the economic investments of social organizations, which thereby *rearrange psychic organizations* through the intermediary of mnemotechnical organs, among which must be counted machine-tools […] and all automata' (Stiegler 2010 [2009]: 33-34). The grammatisation of gestures follows then the grammatisation of language on the line of an historical process that, leading to the grammatisation of thought, entails for Stiegler a progressive loss of *savoir-faire* and *savoir-vivre* (2015 [2012]: 20). This loss amounts to an abandonment of emergent patterns, be they gestural or intellective, at the mercy of hylomorphic impositions of exogenous paradigms that affect skills and knowledge by forcing them respectively to conform to and be exteriorised in mechanical or digital machines, affecting at the same time possible emergent patterns of social relations, whose configuration depends on the characters of the most diffused technical means of communication. Grammatisation comes to assume a central role in Stiegler's critique of contemporary society, for the hypomnesic material it produces, 'of which alphabetic writing is a case, tends always to replace what it "amplifies" by substituting itself' (2016 [2015]: 29).

The grammatisation of gestures is the key operation behind that mechanisation of life I have described in the first chapter, and its historical development of results, today, in the development of algorithmic control. As Stiegler delineates it, this history began at the end of the Upper Palaeolithic, when

> when humanity first learnt to discretize and reproduce, in traces of various kinds, the flux and flow running through it and that it generates: mental images (cave paintings), speech (writing), gestures (the automation of production), frequencies of sound and light (analogue recording technology) and now individual behaviour, social relations and transindividuation processes (algorithms of reticular writing). (11)

Already introduced by Auroux with a reference to automation (Auroux 1994: 169-167), the latest segment of the history of exosomatisation is more directly addressed by Stiegler as the electronic and multimedia 'evolution and extension' of alphabetical writing that underlies the development of digital technologies (Stiegler 2011b: 46-47).

We can now list the first traits of the stratogenesis of the digital, that are linked to the elements of its first articulation. The stratum follows the line of technical digitisation initiated with the extension of the hand in the tool, and it is a product of the third revolution of grammatisation. Its process of capture consists in the protean operation of digitalisation, that constitutes the substance of content we could identify as the binary digit. Digitalisation imposes a form of content on this substance through metadata structures that rest on the great standardisation and compatibility of the grammes collected. This first operation of in-formation consists in a process of translation that is not only superlinear but *destratifying*, for it cuts and translates every sort of flow into the binary language, reducing the complexity of what has been captured to expose it to a separate field of concatenation of digital grammes. The digital evolution of grammatisation gives thus rise to an unprecedented level of abstract functionalisation, that engenders a higher degree of independence of form from emergent paradigms and an increased malleability of the 'rules' concatenating the grammes.

Even more interesting than mapping how digitalisation develops from linguistic grammatisation, then, is understanding what, in the processes of digital grammatisation, makes it an effective tool for domination. I have already mentioned that linguistic grammatisation has been useful in the imposition of colonial regimes (Auroux 1994: 91) because of its capacity to spread, through the paradigms it produces, patterns of thought that slowly supplant indigenous world views (Flores-Rodríguez 2012: 29). In the case of industrial labour, instead, the grammatisation of gestures has allowed a mechanisation of factory workers, their bodies reduced to an assortment of volumes and hinges, their movements conformed to those of the machine and synchronised with its rhythms. Even though the matter grammatised by these processes varies considerably, from vocal substance to movements and volumes, the way in which their respective grammes are connected allows us to understand where does their potential for domination stem from. In the case of linguistic grammatisation, grammar *emerges* as a set of rules for the combination of grammes from the use of a language. These rules can be used as a tool for domination once the paradigms emerged within a culture are imposed on the grammes of another process of cultural stratification, suppressing its morphogenetic potentials with the pressure of an exogenous form. In the case of industrial labour, instead, the virtual field of affordances of a factory worker results more directly restricted by the imposition of a dynamical form, an exogenous code that operates a reduction of that body's original phase space, concatenating its movements on the basis on a non-emergent criterion. The source of this code lays within the logic of mechanisation and aims at flattening workers' multiplicities onto those of the machines they are integrated to. Because of the exogenous character of such codification, this case can be described as exemplifying 'an operative concatenation between previously formatted agents of meaning (bodies, or machines) which have been codified, or formatted according to a code' (Berardi 2014: 18).

Another useful example concerns audio-visual grammatisations: in the case of cinema, for instance, where one can take the single shots as grammes, their montage can prepare the emergence of a specific effect. A good example of this phenomenon is the Kuleshov effect (Kuleshov 1973: 69-70). Produced by Soviet filmmaker Lev Kuleshov, the famous montage sequence alternated the same head shot of actor Ivan Mosjoukine with three other shots: a bowl of soup, a woman and a small coffin. Despite the face of the actor being expressionless in the first, third and fifth shots, the effect obtained by their montage with these objects is surprising: the spectator has the impression that the actor is looking at these objects, and that his expression conveys respectively his hunger, arousal or mourning for a dead child. The purposeful articulation of cuts and their recombination, produce the emergence of meaning. This modality of synthesis, through which the concatenation of the grammes can be devised to produce (and reproduce) the emergence of a specific effect, can be detected also in literature or in poetry. In these types of constructs, one can take the scenes of a novel or the elements of a metaphor as grammes and notice how the Kuleshov effect extends beyond cinema to represent a more general form of synthesis. As I will show, this effect is today reproduced by recommendation algorithms and homeomorphic interfaces, for they connect portions of cyberspace and chunks of information according to a blackboxed logic that, while promoting a maximisation of engagement, provides the user with a 'sense' of the world.

Forms of content can then either emerge spontaneously from a stratification process or be imposed exogenously by the alloplastic stratum. Exogenous forms shape the virtual field of affordances of new substances of expression, concretising classical instances of hylomorphism (in-formation), or limiting a multiplicity through a process of standardisation and/or analogy, as in the case of the con-formation of the worker's movements to those of a machine. Digital technologies have progressively developed the capacity to overcome a limitation of the con-formation processes that has always threatened its efficacy: con-formative applications of exogenous forms are in fact necessarily episodic, consisting of a series of separate instances whose gaps leave space for the form imposed to deteriorate and even for some morphodynamic potential to develop spontaneously, drifting away from its designed outcomes. This is the reason why, for example, safety training refresher courses or other corporate forms of periodic indoctrination are held as often as possible. The increase in the capacity to analyse virtual fields automatically, discloses instead the possibility for their continuous manipulation. Digital technologies like recommendation engines can exclude morphodynamic deviations from the forms designed by capturing as much as possible of the virtual fields of the objectiles they are connected to and adapting these designs to the process of emergence they allow to control. Once we understand how the Kuleshov effect works, if one watches the experiment again and again, one starts to dissociate the grammes, and the effect of their concatenation loses its strength. If the experiment could 'sense' the reaction of the spectator, though, and the montage adapt accordingly, its effect could be kept strong by tweaking the scenes and their connection on the basis of the traits detected as the most striking for the spectator. The special relation between the digital and the virtual and the capacity of the first to produce biofeedback are the two essential reasons for the success of interactive computation as an instrument of domination and for its affirmation across the areas of multimedia, work and communication.

The loop inside the stratum

As we have seen, grammatisation is the handmaiden of automation: once selected and defined, the spatial *discreta* cut from a temporal continuum we call grammes are re-combined according to emergent or exogenous rules that allow to replicate with accuracy their possible arrangements. This is true for speech, where the right combinations of words must be produced in order to convey a meaningful message, and in the case of the mechansiation of gestures, where the repetition of streamlined movements assures productivity. To understand the character of digital grammes and how they are produced, we must consider that every stratum is connected to its matter by a 'surface of stratification'. This surface has ''on one side it faces the strata (in this direction, the assemblage is an interstratum), but the other side faces something else, the […] plane of consistency (here, it is a metastratum)' (Deleuze & Guattari 1987 [1980]: 40) and functions as a membrane that, in the case of the digital stratum, joins the computational and the analogue dimensions through a vast and multifaced array of sensors and interfaces, respectively regulating the capture of matter and outputting the form of expression of the stratum. As for the other cases of grammatisation, grammes often need to be homogenised according to some external criterion: this happens through their translation on a plane that, for instance, can reduce all the movements and parts of a body to mechanical movements and volumes. In the case of the digital stratum, sensors format reality, producing that standardisation that is at the base of its processes and is expressed in binary code.

Let us take two examples of the process: the keyboard of a laptop and a digital camera sensor. In the first case, every key stroke activates a switch. This operation closes a circuit and signals a position to the processor. Such a position refers to a character map, a cypher whose purpose is to translate the position in which the current has flown through in a series of bits, that is, a collection of on/off commands, the possible states of a physical system with only two states that can be an electrical switch or two current levels in a circuit. In the case of digital cameras, instead, opening the shutter exposes a vast array of photosensitive cavities. In colour cameras, these cavities are covered by a filter that allows only 2/3 of the spectrum of light in, for each is devoted to a primary colour and consequently can only register the correspondent wavelength. Once the shutter is closed, the machine analyses how much light has hit the sensors and establishes a correspondence between the intensity of the signal and a binary cypher that correspond to each of these cavities with 8 bits per pixel, meaning 256 possible combinations of 0s and 1s. The software of the camera then combines the information to obtain the string that will code the entire picture. In both cases, the capture of substances of content into the stratum amounts to a destratification of reality. I call destratification the process of cutting and translating every sort of energy flow into binary language, that is, a signalling of the presence or absence of an electric impulse employed to translate a feature of the analogue dimension. The binary digit is the unity of composition of the stratum, characterising all its substances of content. These digits are connected in linear strings that are in turn arranged on the basis of the form of content of metadata structures. The characteristics of these additional layers can vary between systems and individual machines but, in general they extend the scope of the form of content through categories that can generate an indefinite number of other layers of codification. This layered level of the stratum is the field of application of the set of rules that guide the synthesis of the grammes. Digital stratification automates these connections, sourcing the criterion for the synthesis of the grammes in a singular way. The form of these connections, in fact, cannot come from within the morphogenetic processes they are meant to cut, destratify and ultimately repress, nor can be imposed exogenously every time, but results from biofeedback loops that impose, as shifting codifications, the results of data analytics and pattern recognition. This form of content results from calculations operated within the second articulation of the stratum.

First, destratification explodes things and events in data points. These constitute the substance of content of the stratum, that is expressed by binary digits. Being the grammes exposed to a process of digital codification, data points grouped according to metadata ontologies are connected by automatically produced forms of content. These derive from the substance of expression of the stratum, whose emergence is reached through a passage from the level of individual interactions with digital machines, to a supra-individual level of pattern analysis that assesses and classifies the types of data sets collected within the first articulation. This produces the internal loop of the stratum, for the form of content results from the pattern recognition operated when data sets are combined at the supra-individual level, in which data banks reunite data points from separate destratified interaction and constitute profiles. The internal loop of the digital stratum is then constituted by the circulation of codes-patterns extracted from the substance of expression of analysed profiles and imposed as forms of content. This circular process is reflected by the following definition of computational pattern recognition proposed by Christopher Bishop, Laboratory Director at Microsoft Research Cambridge and a professor of computer science with expertise in the field of machine learning: 'The field of pattern recognition is concerned with the automatic discovery of regularities in data through the use of computer algorithms and with the use of these regularities to take actions such as classifying the data into different categories' (Bishop 2006: 1). Between the form of content and the substance of expression of the digital stratum, there is a positive feedback loop that improves the accuracy of the profiles constituting the substance of expression of the stratum, that is, specific supra-individual patterns of interaction with the sensor layer. It is the weaponization of automated pattern recognition that has allowed the biofeedback of control. Without it, the digital stratum would not have developed a second articulation and would have remained a passive form of electronic writing. Rather, the interior loop of the stratum links destratification to the field of psychometrics, the realm of profiling and big data analytics.

In order to grasp the character of the emergent substance of expression of the stratum, but also the political implications of the forms of expression it produces, we must now start to consider the parastrata of the digital stratum and their relation with its first and second articulation. As highlighted in *Mille Plateaux*, in fact, the second articulation of an alloplastic stratum requires a broader context to be accounted for, because

> Content should be understood not simply as the hand and tools but as a technical social machine that preexists them and constitutes states of force or formations of power. Expression should be understood not simply as the face and language, or individual languages, but as a semiotic collective machine that preexists them and constitutes regimes of signs. (Deleuze & Guattari 1987 [1980]: 63)

As the macro-phases of a pattern of emergence, the articulations of alloplastic strata develop firstly against the background of large socio-political contexts that have to do with how material systems prepare the conditions for the emergence of the new (Bonta & Protevi 2004: 130) and secondly, in relation to pre-existent regimes of signs, namely, forms of expressions of contiguous strata. These conditions exert a selective effect on the processes of formation we register in a stratum and, in the case of the digital, link to the socio-political conditions that have shaped the evolution and deployment of computational technologies of domination.

Control

To gain a fuller picture of the digital stratum it is necessary to contextualise it within the social conditions that pre-exists its development, that is, within the system of forces that shape its typical operations, a significant portion of which consists the regimes of signs within which alloplastic strata develop.

A general definition of this notion must start form the concept of order-words, that Deleuze and Guattari describe as the most essential units of a language: order-words are performative utterances that concretise transformations. The many examples proposed by the authors fall within the following coordinates: 'the fundamental forms of speech are not the statement of a judgment or the expression of a feeling, but "the command, the expression of obedience, the assertion, the question, the affirmation or negation," very short phrases that command life' (Deleuze & Guattari 1987 [1980]: 76). Order-words are the units that guarantee the alloplastic power of a language, its capacity to bring about modifications in the world, shaping virtual fields of affordances and steering processes of various kinds in specific directions. This is clear when the authors specify that 'Language is not life; it gives life orders. Life does not speak; it listens and waits. Every order-word […] carries a little death sentence' (Deleuze & Guattari 1987 [1980]: 76). Such a cryptic remark should be read in light of Deleuze's late essay, 'L'immanence: une vie...' (Deleuze 2006a [2003]), in which the indefinite article *une* equates the plane of immanence, the virtual dimension, to life: 'A life contains only virtuals. It is composed of virtualities, events, singularities' (Deleuze 2006a [2003]: 388). These virtualities coexist with the accidents of an individual life in the relation of non-correspondence established between singularities on a multiplicity and actual accidents. Order-words are performative speech-acts that make something happen in the moment in which they are pronounced: a promise, for example, implies an act taking place within the statement itself and characterises a transformation that goes beyond its utterance, causing an actual series of concatenated transformations. More specifically, order-words provoke what Deleuze and Guattari call 'incorporeal transformations' (Deleuze & Guattari 1987: 80-81), i.e., the ways in which the relations of bodies change according to order-words. To pronounce an individual 'guilty' in the context of a trial, for instance, does not affect their actual, physical body, but causes a transformation that attaches to that body and determines its new capacities, deploying at the same time a novel horizon of tendencies. As a function of language, order-words are always transmitted within a social field, outside of which they have no effect, and are always historical, that is, the incorporeal transformations they initiate on individual or collective bodies always have a date. This field is defined as the set of 'dominant significations' that constitute the context 'of an established order of subjection' (Deleuze & Guattari 1987 [1980]: 79). According to Deleuze and Guattari, a given social field consists in a concatenation of speech-acts through which hierarchies are established, and whose configurations characterise the different regimes of signs, that is, on the context within which a stratum deploys its substance and forms of expression.

The context in which the digital stratum unfolds as a pattern of emergence can be described by looking at the 'Post-scriptum sur les sociétés de contrôle' (Deleuze 1995 [1990]), where Deleuze describes the characteristics of post-industrial societies and the modality of domination these develop and deploy by means of computational machines. The essay describes in broad terms the 'new system [regime] of domination' (182) engendered by the adoption of digital technologies as an instrument of power and the associated form of subjection that its author names *control*. As anticipated above, Deleuze borrows this term from William Burroughs's essay 'The Limits of Control' (Burroughs 2014 [1975]). In the essay, Burroughs highlights the importance of words for this technology of power, and mentions the notions of order and suggestion (Burroughs 2014 [1975]: 38). These notions will reveal to be incredibly precious to differentiate societies of control from other systems of domination.

Indeed, Deleuze defines societies of control by comparing them to Foucault's disciplinary societies. Discipline is a technology of power (Foucault 1995 [1975]: 30) that concretises, as a general policy, the physical equivalence between individuals and machines already posited by Descartes. Such equivalence, originally conceived from an anatomico-metaphysical register, is realised within the techno-political sphere (136) through the design of physical structures that at the same time produce or mould subjects and assure their efficiency as parts of a 'functioning' society. Disciplinary societies are indeed arranged as intricate machines that must be kept constantly under check for their performance, a goal that can be achieved only in the absence of friction between their parts and if each of them is always ready and prepared to carry on its task. The aim of discipline is a functionalisation of social bodies obtained via the imposition of rules through which 'The body is constituted as a part of a multisegmentary machine. (Foucault 1995 [1975]: 164). To this extent, disciplinary societies set up a series of strategies to make the bodies of which they are composed 'docile', that is, 'that may be subjected, used, transformed and improved' (Foucault 1995 [1975]: 136). This effect is obtained through the design of environments like schools, prisons, barracks and factories: 'All these are local, regional forms of power, which have their own way of functioning, their own procedure and technique' (Foucault 2007 [1976]: 156) and whose configurations impose different sets of rules on the individuals they host, effectively moulding their behaviours.

Discipline operates a codification of both virtual fields of affordances and physical spaces through architectures and order-words. A sentence, a conviction, but also a guilty plea that generate utterances of the type 'délinquant, délinquance', effectively give order to life, that is, organise the virtual field of the individuals to which they are attributed, and so do official declarations of, say, sexual deviance or of mental illness. Sodomite, insane, criminal, all these order-words are dependent on 'dominant significations' that enforce 'established order of subjection' correlated to disciplinary societies, and their utterance provokes incorporeal transformations within the virtual fields of the individuals to which they are ascribed (Deleuze & Guattari 1987 [1980]: 79). These transformations trigger and are enforced by interventions in the physical space that, while physically limiting the degrees of freedom of multiplicities, serve also the purpose of a re-functionalisation of individuals, through the re-codification of those phase spaces that have opened up on possibilities deviating from the established norm. It is considering our reading of the concept of virtual fields, then, that the following remark of Foucault on the effects of discipline should be read:

> Discipline […] dissociates power from the body; on the one hand, it turns it into an "aptitude", a "capacity", which it seeks to increase; on the other hand, it reverses the course of the energy, the power that might result from it, and turns it into a relation of strict subjection. (Foucault 1995 [1975]: 138)

While not being exclusively repressive, the processes of individuation described through the tenets of discipline have an essentially hylomorphic character, and disciplined subjects result from the imposition of a form on virtual fields of affordances, forced through the often-violent carving of these fields of *puissance*. These forms result from the structuring of physical spaces and the forceful brakes they impose on virtual fields just as much as from the dominant significations of discipline as a narrative, with its incorporeal transformations and intangible forms imposed on multiplicities. As put by Deleuze in his 'Post-scriptum', 'Confinements are *molds*, different moldings' (Deleuze 1995 [1990]: 178). Moulding is the general process that the philosopher uses to describe the activities of disciplinary societies, in which power 'both amasses and individuates, that is, it fashions those over whom it's exerted into a body of people and molds the individuality of each member of that body (179-180). This process amounts to the imposition of a program on the body, its codification as a form of overdetermination.

As suggested in the 'Post-scriptum', disciplinary societies reached their peak at the beginning of the 20th century, after which the centrality of moulding as a paradigm of domination started to decline. From World War II onwards, one can say that 'we are entering a society that could be called a control society' (2006b [2003]: 321) whose paradigm rests on the deployment of computational technologies. The kind of machines that characterise control societies should be considered as the product of a mutation of the social system previously dominated through the paradigm of discipline, and what has led to their adoption as tools for domination This technological development is more deeply rooted in a mutation of capitalism (1995 [1990]: 180). I will describe this mutation of capitalism in more detail in the last chapter of this work, limiting myself to highlight, for now, that this caused a progressive shift away from the centrality of production and, in turn, the general crisis of disciplinary sites of confinement like the factory. Deleuze notices that this crisis is accompanied by a decline of the other institutions of disciplinary societies like the school, that is in the process to be replaced by solutions for continuous education, as exams are being substituted by frequent assessments. This specific crisis is indicative of a more general tendency of societies of control, that is the passage from the fixed phase spaces hylomorphically and intermittently imposed through disciplinary spaces of confinement, to a more fluid and attentive approach to the morphodynamic capacities of individuals' multiplicities. Such a shift can be summed up as follows: 'In disciplinary societies you were always starting all over again (as you went from school to barracks, from barracks to factory), while in control societies you never finish anything' (179). This means that the process of in-formation of the virtual fields of affordances is not carried out through sharply distinct phases anymore, but blends into a continuous form of control of its morphodynamics, that is, becomes the shifting object of an apparatus of domination that is capable of adapting to the human material onto which it is grafted, and to gently steer it towards prescribed goals that are perceived as emergent by the subject. Deleuze defines this operation as modulation:

> Confinements are *molds*, different molding, while controls are a *modulation*, like a self-transmuting molding continually changing from one moment to the next, or like a sieve whose mesh varies from one point to another […] business, training, and military service

> being coexisting metastable states of a single modulation, a sort of universal transmutation. (178-179)

I define the process of modulation as the continuous modification of a virtual field of affordances through the biofeedback mechanisms produced by the digital stratum.

This technology of power has an essential requirement: it must produce a certain sense of freedom, whose utility is double – it makes control bearable and produces more interactions, alimenting and perfecting more and more the pattern recognition analyses operated at the level of the substance of expression of the stratum. Reflecting on the limits of control, Burroughs already claimed that systems of domination 'try to make control as tight as possible, but at the same time, if they succeed completely, there would be nothing left to control' (Burroughs 2014 [1975]: 38). The novelist highlights that when the individual is perfectly aligned with a machine there's simply no control anymore, because such an eventuality would kill the subject, taking its 'life' in the act of depriving it of its capacity to actualise its virtual field of possibilities. For this reason, modern and contemporary systems of domination are not based only on the brute force of policing and incarceration, but integrate 'universal literacy since they operate through the mass media' (39). In control societies, then, space and time are manipulated in such a way that domination becomes gentler, to the point of turning into an activity of constant choice-engineering presented as freedom:

> Control is not discipline. You do not confine people with a highway. But by making highways, you multiply the means of control. I am not saying this is the only aim of highways, but people can travel infinitely and "freely" without being confined while being perfectly controlled. That is our future. (Deleuze 2006b [2003]: 322)

Although not really faced with the end of the spaces of enclosure, we are nevertheless witnessing their progressive substitution, as paradigms for the intervention into virtual fields of affordances, by something probably even more resilient: 'in fact, the more completely hermetic and seemingly successful a control system is, the more vulnerable it becomes' (Burroughs 2014 [1975]: 39). If control societies 'no longer need, or will no longer need, places of confinement' (Deleuze 2006b [2003]: 321), it is because the possibilities for domination disclosed by digital technologies, and more specifically by their vast distribution and portability, can be grafted more directly onto individuals. The movements of the subjects of control societies are not constrained through the imposition of a fragile order on space and on their bodies. Rather, their behaviours are constantly tracked and assessed, on one side monetised and transformed in a new source of value, while on the other, alimenting a quick biofeedback machine administering subtle behavioural modification outputs. With Deleuze's words: 'Control is short-term and rapidly shifting, but at the same time continuous and unbounded, whereas discipline was long-term, infinite, and discontinuous. (1995 [1990]: 181).

In disciplinary societies, the forces that kept individuals in their moulds were exerted as discrete impulses and their source was notably external: professors, parents, doctors, cops, priests. In control societies, these forces are instead internalised: one cannot blame the police, cannot fight the professor or the parents, because there will be no professors, no wardens or doctors anymore. In control societies these forces are internal to the individual, grafted onto its psyche, and activated through the electrification of their libido, constantly connected to the digital machine they carry in their pockets. An interesting key for interpreting this passage is offered through one of the most obscure passages of the 'Post-scriptum': 'A snake's coils are even more intricate than a mole's burrow' (181). While the mole imposes a new order in the ground, structuring chambers and tunnels, the biblical snake seduces the inhabitants of the garden with the possibility of knowledge: to be like a god, it *suggests* to Eve that she bite the apple. These suggestions, prepared through the internal loop of the digital stratum, constitute its forms of expression, and are what the stratum outputs through its interfaces on the human matter it comes in touch with through destratified interactions. These suggestions, or hypernudges, as King's College professor of law, Karen Yeung, has named them, are the secret behind the success of smart ads and the actuators of that continuous modulation of virtual fields operated 'via a recursive feedback loop which allows dynamic adjustment of both the standard setting and behaviour modification phases of the regulatory cycle enabling an individual's choice architecture to be continuously reconfigured in real-time' (Yeung 2017: 7).

The grip of control is not the body anymore, nor some 'soul' or essence of individuals: to the history that goes 'from lacunary, global power to a continuous, atomistic and individualizing power' envisaged by Foucault (2007 [1976]: 158-159), Deleuze adds a technology of power that is, instead, able to strike deeper than the surface of the body, exploding interactions or destratifying features and activities in 'immaterial' clouds of data points to address them as manifestations of tendencies (interests and inclinations) and capacities (correlations). While the power of discipline

> amasses and individuates, that is, it fashions those over whom it's exerted into a body of people and molds the individuality of each member of that body […] In control societies, on the other hand […] Individuals become "dividuals", and masses become samples, data, markets, or "banks". (Deleuze 1995 [1990]: 179-180)

While suggestions are the forms of expression of the digital stratum, the dividual is its substance of expression. In the next chapter, I will describe in detail the process of individuation of this substance, showing how it results from the analytic processes that take place over vast, supra-individual collections of data, or Big Data. For now, it is important to stress that the dividual informs the operations of modulation and represents a new political entity emerging from the stratum and assuming central importance in the context of the diffusion of control as a new technology of power.

Before making a last, important point on the passage from discipline to control, it is crucial to understand that the latter does not come to substitute the first, but overwrites it in areas in which a technology of power that moulds disciplined behaviours could be enhanced through the use of data analytics, and substitutes it instead, by offering the illusion of freedom, in areas in which power profits more from the engineering of choice and from the modulation of desire obtainable through a biofeedback mechanism. In general, though, while discipline aims at forming and maintaining functional subjects, imposing an order over their virtual fields of affordances, control prefers to intensify the needs of dysfunctional consumers to plug them in the machine of consumption (of products as much as contents) through streams of targeted suggestions. Indeed, as I will show in chapter 8, and as already suggested by Deleuze in his 'Post-scriptum' (1995 [1990]: 180), the diffusion of digital technologies and their integration in processes of psychological and collective individuation has triggered a mutation of capitalism as a matrix of social relations. The last chapter of this work will focus on the implications of this shift for a Marxian analysis of relationships of power and propose to update the notion of work in light of the power that the digital has to extract value from virtual fields of affordances. In the next section, then, I will show how continuous modulation impacts the virtual fields of affordances of these individuals through the power of suggestion, the form of expression that the digital stratum outputs in the analogue dimension to close the biofeedback circle of control.

Cut-up cartography

Above, I have defined the digital stratum as a special kind of *Kuleshov machine*: a system for the automatic connection of grammes that produces the emergence of designed political effects. As I have described it, the digital stratum produces connections at different levels of its articulation. At the level of the form of content, it recombines the discrete units destratified from the flow of interactions with its sensorium. At the level of the substance of expression, it combines supra-individual behavioural patterns in the psychometric profiles that compose the emerging figure of the dividual. At the level of the form of expression, instead, the stratum outputs series of suggestions through its interface layer, closing the loop of biofeedback.

It is now time to focus on this last level of connection, in which the rules for the combination of the grammes are, indeed, the product of the automated mechanisms that generate the dividual, but are administered in order to perform a design, materialise a program. While the design met by the application of disciplinary techniques over the field of industrial labour was that of the machine and the program imposed over the bodies of the subjects fostered an optimisation of production, in the case of the digital stratum, instead, such programs can cover everything from maximising screen time (Tufekci 2019a), encouraging consumption, increasing interaction rhythms to short-circuit critical capacity (Han 2017: 12; 45), and proposing effective political messages (Cadwalladr 2017; Tufekci 2018). Its plasticity results from the combination of the tendencies users have manifested, with a rapid capacity to update suggestions accordingly. In his work on the painter Francis Bacon, Deleuze highlights that this is one of the things that can be done with a code, that is, 'One can code the extrinsic elements in such a way that they would be reproduced in an autonomous manner by the intrinsic elements of the code' (Deleuze 2005 [1981]: 114). With the development of the second articulation of the digital stratum, due to the diffusion of Big Data analytics and of portable, connected devices, it is now possible to codify the 'intrinsic' elements of digital environments (the binary grammes), in order for their associations to be reproduced autonomously in the 'extrinsic' dimension of cognitive links and automatised behaviours: a transformation of algorithmically sourced correlations between destratified interactions into causation.

To this end, the flow of information through which users navigate, and from which individual units of content are cut through the interface, becomes the stage of the hypermontage of the Kuleshov machine that is the digital stratum. Internet activist Eli Parises has described one of the clearest examples of this effect of the digital stratum with the idea of *filter bubbles*:

> the new generation of Internet filters looks at the things you seem to like – the actual things you've done, or the things people like you like – and tries to extrapolate. They are prediction engines, constantly creating and refining a theory of who you are and what you'll do and want next. Together, these engines create a unique universe of information for each of us – what I've come to call a filter bubble – which fundamentally alters the way we encounter ideas and information. (Pariser 2011: 10)

A filter bubble is the result of the first loop of the stratum and its walls host the projection of a biofeedback Kuleshov machine that gives users a 'sense' of the world. Since the way in which we perceive the world determines how we act on it, the digital is having a relevant effect both at an individual and a collective level, affecting world politics and economics in unprecedented ways precisely because it mediates and structures (by formatting) the connections between individuals and representations of reality.

I have already pointed out the fact that, to fully understand the tendencies lurking behind these changes, one must put becoming, instead of being, at the centre of one's discourse. This shift is crucial to fight the power of hylomorphic descriptions of reality validating fascist impositions of order, and its adoption is made even more urgent by the necessity of addressing the digital as a tool for domination. This power is, in fact, based on the computational analysis of virtual fields of affordances re-produced through the inter-relation of individual interactions and the extraction of behavioural patterns to constitute dividual profiles as supra-personal, abstract models of virtual spaces. These models are in turn attributed to evaluate further interactions and direct the process of modulation of desire and behaviours outputted through suggestions in a process that is inherently morphodynamic, for it follows and modulates the development of behaviours and desires instead of imposing a mould on them. In the face of the shifting maps of the virtual dimension that the computational power of control is producing automatically, it is clear that we cannot devise descriptions or lines of resistance to the machine of control if we don't also abandon essentialist descriptions of reality, now obsolete also as a tool for domination. Control, in fact, is the emergent property of the 'cognitive assemblages' (Hayles 2017) we institute with computational 'technologies of representation' (Srnicek 2013), instruments that are supposed to enhance our comprehension of complex systems. In short, it is in the eyes of the machine itself that essences give way to multiplicities, because the real field of application of digital control consists in the multidimensional spaces of possibility that map bodies' dispositions. It is on this basis that the digital modulates the spontaneous emergence of order and the self-organising power of social systems, rather than operating as other hylomorphic technologies of power.

Rather than blindly imposing physical limitations that affect the spaces of possibilities of individuals then, the digital stratum follows the behaviour of these systems by looking at how they change in relation to a variable and mark points in its electronic phase space. Connecting these points allows us to draw a series of vectors, whose sums will represent as many tendencies of the system. As we have seen, this cartography allows also to delineate the capacities of a system, that is, how it affects and is in turn affected by other systems. Through these kind of maps, one can describe the interweaving of separate virtual portraits. Besides of phase shifts, the instance in which a system changes its behaviour entirely, requiring a new phase space to describe its dispositions, a multiplicity can undergo another type of mutation, that is caused by the constitution of cross-strata or transversal assemblages.

The digital surface constituted by sensors and interfaces, and the grammes that behind these surfaces are connected to form descriptions of the world out of discrete units of content, is an integral part of the cognitive assemblage out of which artisanal cyborgs are crafted. Katherine Hayles defines these assemblages as the emerging systems formed by bio-social and technological components in which the elaboration of information is carried *with* and *through* a technical system: 'Because humans and technical systems in a cognitive assemblage are interconnected, – she writes – the cognitive decisions of each affect the others' (Hayles 2017: 118). Control is a self-deforming cast, a biofeedback Kuleshov machine, and stratoanalyisis can indicate where it finds its grafting points in our lives while defining how this reciprocity of influence is balanced when the digital serves the commercial sphere and algorithms inform a new form of pre-emptive governmentality (Rouvroy & Berns 2013). In general, in fact, if the tools we use allow us to expand the range and depth of our cognition, the same tools impel us also to assume specific points of view. What the design of the digital re-produces, in the artisanal cyborgs we are constantly shaped into, is not so much a cognitive decision, as Hayles has suggested, but a *decision over cognition*: modulating how and what we see of the world, suggestions, as performative utterances determine what we can do with it. In other words, by looking at the world through the eyes of a machine we are presented with a new map of our possibilities, a phase portrait of the world and of our capacities that, in itself, is turned in an instrument for control.

In a typical technological assemblage, to the phase space of a body is added that of a tool, or of an instrument. These can cause the first multiplicity to enhance its capacities or to diminish them, to dissipate a tendency or to acquire a new one: e.g., using a wheelchair if unable to walk, or relying on a calculator instead of exercising computational capacities. In the case of cognitive assemblages, one does not simply expand the first map nor provoke a phase shift. What happens, instead, resembles more an overlapping, a partial superposition of two virtual landscapes: an experiment in *cut-up cartography*. If these maps represented urban landscapes, with roads and buildings, the result of this operation would be the discovery that some familiar roads do not lead anywhere anymore, are blocked by a wall, or that they lead to entirely new places: to new crossroads, new *agoras* or malls. Easily gaining the upper hand in cognitive assemblages, the digital stratum conceals or blocks some lines of the phase spaces of users, while emphasizing others: texting rather than talking face to face, swiping through lists of potential partners rather than meeting people organically. Consequently, the capacities to affect and to be affected of the body attached to a digital platform change in accordance with the phase space traced by the stratum.

Let us look at an example: recommenders select a specific type of content understood as 'interesting' for the user. They do this by following the user's behaviour on a platform and confronting it with the behaviour of other users. By identifying correlations at this supra-individual level, the algorithm proposes then other pieces of content that appear as highly likely to be consumed by the individual user. By leveraging this logic, recommenders and homeomorphic interfaces conceal the possibility for the user's curiosity to be sparked by other pieces of content. They enhance the tendency of users to increase consumption of uniform content, that needs to be progressively more exciting to maximise screen time. This can push the user down a radicalizing rabbit hole and prevent them from finding other pieces of content that, offering critical counterpoints, would allow them to bifurcate towards other other ideas, other ways to see the world and act upon it. The virtual field of affordance of the original user is thus superposed onto that of the platform they are using: some of their original capacities are concealed, and some of their original tendencies are enhanced by the recommendation engine.

A cut-up cartography puts together two heterogeneous sets of possibilities and constraints. On one side, those determining the behaviours of our bodies, both social and physical. On the other hand, the configuration of markets, the precise design choices determined by specific business models, the virality of a piece of content and other variables, constitute the constraints within which the forms of expression of the digital stratum are emitted, shaping suggestions calibrated according to the parameters revealed by the analysis of the substance of expression. In this condition, our bodies endure downwards causation from the emerging hybrid assemblage they contributed to form. Clearly, platforms are subject to modifications connected to user's behaviours as well, but these are captured to reinforce the appeal of the vectors that keep on feeding the machine of control: the compulsions to increase screen time, consume, and the increase in interaction rhythms short-circuiting critical capacity are all adjusted to the tendencies users have expressed. Moreover, by limiting the virtual range of possibilities, control can afford to allow for a certain range of perceived freedom, that can be then exploited either to further prevent specific conducts (Rouvroy & Berns 2013) or for commercial purposes.

'The singularities that specify the character of a multiplicity are not given all at once, they unfold' (DeLanda 2002). As such, a cut-up cartography can obscure how the tendencies underlying the assemblage can be shifted. It conceals our bifurcations, casting a zone of opacity on the vectors that the digital cannot exploit. Being quite hard to map with exact precision the developments of a system, what we can do is study *how* systems change, rather than *in what* they change. In doing so, an important thing to address is what makes the virtual behaviours of these hybrid systems opaque. In other words, what we can do is to try to understand where this opacity is produced by the different transversal assemblages we compose every day, and how this is turned into an instrument of power. What are we missing out on when we are steered by the suggestion of the digital stratum, by being coerced in an assemblage that enhances only the tendencies that benefit the market? Which bifurcations are concealed when we stare at the world through our screens and what tendencies are instead enhanced, and for which purpose? As I have showed in the previous chapters, this opacity is the result of emergence itself, which generates a sort of parallax effect: either one sees the elements and loses the emergent effects of their relation or one looks at the whole and the interactions of the elements are blackboxed. The cognitive assemblages of humans and technical systems, in this case, conceal the modulation promoted by the digital stratum, making it so that the user and the artisanal cyborg emerging from their interaction with the stratum are in a relation of parallax: 'I'm not so easily influenceable' cries the artisanal cyborg. Military blackboxes, the objects from which this notion derives, are opaque precisely to hide the internal mechanism of technologies that grant tactical superiority to their handlers. As highlighted by Galloway (2001), the black box is designed to self-destruct, if opened. As a consequence, all the promises to open the blackbox ultimately result in the loss of the emerging function in favour of a partial understanding of the relations between the elements, but never in how these elements limit each other's capacities. It is by looking at where this opacity is placed, then, that maybe we can understand how dynamics of change are captured, how transformations are prevented, how frustration is converted into hate and horizontalized or expressed in radicalisation processes.

Helping to understand where the opacity originates, how it is used as an instrument of power and even how can it be turned *against* power, stratoanalysis could allow us to envisage new ways to re-effectuate the abstract machine of the digital stratum, designing assemblages that displace this kernel of opacity as useful obfuscation (Brunton & Nissenbaum 2015). The pursuit of that direction, however, is not the object of the present work, and will have to wait for another occasion. The next chapters will describe how the computational stratum impacts upon others, changing the world around us and human life itself, exerting control through the special relation between the digital and the virtual I have described above and that we have to map as the best battlefield to fight for the possibilities of self-determination of social and intellectual life. Only then will it be appropriate to reflect on the weapons needed for this new effort of resistance against domination: 'It's not a question of worrying or of hoping for the best', Deleuze writes in his 'Post-scriptum', 'but of finding new weapons'. (Deleuze 1995 [1990]: 178).

Chapter 5: The Becoming-Algorithmic of Human Life

Stratoanalysis describes the transformative relations that the digital stratum, as the pattern of emergence of the artisanal cyborg, establish within three intersecting registers of reality, the physico-chemical, the biological and the anthropomorphic one. One of the most crucial interactions for the emergence of the subject of digital control is the interaction between the digital stratum and the anthropomorphic one. This chapter will address in greater depth how the digital stratum is grafted onto human life and describe the process of becoming-algorithmic of human life as the modality of individuation (Ansell-Pearson 1999: 154) preceding the constitution of the artisanal cyborg. This consists in a circulation of code between two multiplicities plugged together, one human and one digital, and articulates through the central operation of the stratum, consisting in the individuation of the dividual, the stratum's substance of expression. In order to address how control exploits this link between the digital and the virtual, however, one must first understand the evolutionary relation between exorganisms and their prostheses (Stiegler 1998b [1994]: 50). As pointed out by Bernard Stiegler after the work of Leroi-Gourhan and his description of the process of hominization (Leroi-Gourhan 1993 [1964]), human life both emerged and co-evolved with technics:

> The human is human only insofar as he exists outside of himself, in his prostheses. Before this externalization, the human does not exist. In this sense, if one often says that the human invented technics, it would be perhaps more exact [….] to say that it is technics, a new stage in the history of the life, which invents the human. (Stiegler 1998a: 190)[3]

The description of the alloplastic stratum we have seen Deleuze and Guattari proposing in *Mille Plateaux* (1987: 60-63) stresses that such a relation of 'reciprocal invention', which must be understood as being still in process, results from the emergence of manual traits as a patterning force and of the consequent development of a linguistic matrix of superlinear codification presiding the constitution of regimes of signs and incorporeal transformations. This sort of double causal register is based on a development of the fundamental node constituted, for Leroi-Gourhan, by the 'relationship between the face as bearer of the organs of nourishment and the forelimb as an organ not only of locomotion but also of prehension' (Leroi-Gourhan 1993 [1964]: 19) in the earliest anthropoids. As the French paleoanthropologist shows in the two volumes of *Le Geste et la Parole* (1993 [1964; 1965]), the development of bipedalism (19) shifted this relation, causing the liberation of the hand from locomotion (25), and the consequent emergence of the manual form of content, with a full investment

[3] All translation from this source are mine.

of the hand in the manipulation of inorganic matter as well as the development of the brain as a consequence of the upright stance (74-83), allowing for an expansion of cognitive capacities and the instrumental use of the vocal substance (112-116): tool and language as expressions of the same process of articulation (114). From that point, as highlighted by American paleontologist and evolutionary biologist Steven Jay Gould, 'There's been no biological change in humans in 40,000 or 50,000 years. Everything we call culture and civilization we've built with the same body and brain' (Gould 2000: 19).

Technical evolution

Elaborating on Leroi-Gourhan's work, Stiegler adds that exteriorisation, a process that the French paleoanthropologist defines as an exudation coextensive with human evolution (Leroi-Gourhan 1993 [1965]: 239), 'the continuation of life by means other than life' (Stiegler 1998b [1994]: 17). To understand how the digital stratum is currently re-inventing the human, we must now ask what Stiegler's claim means in relation to the notion of virtual fields of affordances, and describe the link between exosomatisation and evolution from the perspective that understands the plane of immanence itself as 'a' life, *une vie*, the self-organising power of matter defined in its creativity (Deleuze 2006a [2003]). From this perspective, the idea that exosomatisation continues life through the organisation of inorganic matter does not simply mean that toolmaking 'extends' human life, allowing for an expansion of the capacities and altering the tendencies of individual and collective virtual fields through instrumentality. Sure, the relation of use of a technical object increases or limits some of the capacities of its users and impacts their sociobiological tendencies: this is evident for instance in the case of the Neolithic Revolution, with the development of agriculture and the physical and cultural consequences of sedentarism, spanning from the constitution of new regimes of signs to the selective breeding of plants and its dietary effects on human physiology (Wells & Stock 2020). Despite being the most immediate to grasp from an anthropocentric point of view, though, this effect does not describe the full scope of exosomatisation. Exteriorisation constitutes in fact the catalyst for further processes of organisation whose character is in large part independent from human ingenuity (Stiegler 1998b [1994]: 49), for life, as self-organisation, continues in the inorganic realm according to purely technical constraints:

> the inert, although organized, matter qua the technical object itself evolves in its organization: it is therefore no longer merely inert matter, but neither is it living matter. It is organized inorganic matter that transforms itself in time as living matter transforms itself in its interaction with the milieu […] hylé qua dynamis. (49)

In other words, exosomatisation does not amount to a process of continuous exteriorisation because technical objects carry within them operational and organisational patterns that can be analysed, extracted, repurposed, reproduced and expanded upon (67-69), nor does it consist in a process of constant invention understood as the creative intervention of exorganisms on inorganic matter, through which form simply follows function and is imposed on matter hylomorphically. Exosomatisation initiates instead a process of material evolution that develops through internal, purely technical constraints and actualises in relation to its milieu.

Stiegler describes technical objects as repositories of epiphylogenetic memory (177). As put by Ian James, 'This neologism combines the terms 'epigenesis' (i.e. the modification of genetic information by environmental influences) and 'phylogenesis' (i.e. the evolutionary development of the species)' (James 2012: 194), and is used to denote the process by which not only mnesic traces but also behavioural and material patterns accumulate in the structure of technical objects, are transmitted through the circulation of artifacts and evolve from the forms assumed in previous instances of the organisation of inorganic matter. The attribution of a phylogenetic character to technology does not amount to a mere metaphorical comparison of technology with biology, but indicates that the evolution of the patterns through which inorganic matter is organised does not come down to the development of human design alone: 'There is a historicity to the technical object that makes its descriptions as a mere hump of inert matter impossible. This inorganic matter organizes itself. In organizing itself, it becomes indivisible and conquers a quasi-ipseity from which its dynamic proceeds absolutely' (Stiegler 1998b [1994]: 71). One of the great discoveries of the techno-morphological analysis conducted by Leroi-Gourhan is in fact that technical objects possess not only capacities (to chop, to strike, to insulate etc.) that can modify their users' virtual fields of affordances, but also tendencies (Leroi-Gourhan 2018 [1945]: 58). These connect separate 'technical facts' as the unique instantiations of more general technological lines that are actualised, with significantly analogous results, by separate cultures, and differentiated by the environmental and ethnic conditions in which they emerge (Stiegler 1998b [1994]: 35-36). Physics does not suffice to diagram these tendencies (1998a: 189), as in the case of the fusion point of a rock or of the flexure of a steel beam, because technical facts emerge from their own histories and evolve according to their specific morphodynamic principles (1998b: 76). Technical objects must therefore be considered as endowed with virtual multiplicities whose dimensions are not limited to the capacities they express as relations of use or in interactions within technical ensembles, nor to tendencies manifested through their relation with physical conditions: they rather consist in material expressions of a deeper, exquisitely technical virtual tendency that 'does not simply derive from an organizing force – the human – it does not belong to a forming intention that would precede the frequentation of matter, and it does not come under the sway of some willful mastery' (Stiegler 1998b [1994]: 49).

Gilbert Simondon individuates the conditions for the evolution of technical objects in their configuration as systems: 'The technical being evolves through convergence and self-adaptation; it unifies itself internally according to a principle of inner resonance' (2016 [1958]: 26). The technical object is a modular construct of parts, each with their own tendencies and capacities. In order for their ensemble to work, that is, for their capacities to coordinate and for their tendencies to be reciprocally limited, each part must fit with the others, 'converging' in a smoothly and coherently operating whole that generates a consistent function. This process of adjustment represents for Simondon the progressive 'concretisation' of a technical object, its genesis:

> there is a primitive form of the technical object, the abstract form, in which each theoretical and material unit is treated as an absolute, and is completed according to an intrinsic perfection that requires, in order for it to function, that it be constituted as a closed system; integration into an ensemble in this case raises a series of so-called technical problems that must be resolved and which are in fact problems of compatibility between already given ensembles. (27)

Once defined as functional systems, technical objects can be seen to evolve according to a criterion that Simondon identifies as the progressive refining of their internal coherence. The philosopher refuses indeed to share the common understanding of the degree of refinement of a technical object, its degree of technical perfection or technicity (xvi), in terms of practicality or cost-effectiveness (Chabot 2013 [2003]: 12), whose convergence is often epitomised by an increasing degree of automation, preferring instead to define technical progress as a general tendency towards an increased 'sensitivity' of technical ensembles to external information (Simondon 2016 [1958]: xvi). Against this background, Simondon proceeds to describe computational machines as highly refined technical objects not insofar as they constitute more or less perfect automata, which would not be more advanced than the moving statues we have seen marvelling the Greeks, but as functional ensembles characterised by a high degree of indeterminacy:

> Modern calculating machines are not pure automata; they are technical beings that, beyond their automatisms of addition (or of decision according to the operation of elementary switches), possess a great range of possibilities for the switching circuits, which allow for the coding of the machines operation by reducing its margin of indeterminacy. This primitive margin of indeterminacy is what allows the same machine to extract cube roots or to translate a simple text, composed of a small number of words and expressions, from one language into another. (18)

Thanks to the polyfunctionality of their components, these technical ensembles turn out highly sensitive and adaptable to external information. The effects of the diffusion of these machines differs significantly from that of automatization, but their destinies converge in the development of biofeedback control.

Closed and predictable devices of all sorts used to illustrate biological behaviours, to imitate life, and as a model of efficiency deployed to limit the phase space of living beings, automata can for instance enhance the reach of human capacities in hostile conditions or by replicating behavioural patterns while removing the need for intermittence in their execution by living beings. Furthermore, as the diffused automatization of the industrial era has already showed, they can greatly sway psychological individuation and social tendencies to self-organisation by promoting the formation of biopsychic automatisms (Stiegler 2016 [2015]: 44) in their users. By collapsing the work of reasoning and the accumulation of experience related to the performing of specific tasks into the activation of blackboxed, exteriorised processes, automata contribute to a more general impoverishment that Stiegler, after Marx (1973 [1939]: 692–93), calls 'proletarianization' (Stiegler 2010 [2009]: 21) to denote not the concentration of assets in the hands of the capitalists and the consequent enslavement of the labour to the sale of its work power for a salary, but the loss of knowledge caused by its exteriorisation and grammatisation (29-31). Contributing a great deal to this process, only initiated with the physical automation characteristic of industrial technology, computational machines with a high degree of indeterminacy open the space for the implementation of biofeedback mechanisms. The degree with which the tendency towards indeterminacy has concretised in the technical fact of Big Data analytics, combined with its speed, constitutes for instance technical ensembles endowed with the capacity to perceive a vast variety of interactions and regulate their own behaviour automatically. The algorithms at the centre of the digital stratum can then perform as an abstract Kuleshov machine that connect pieces of content to output, in the form of suggestions, a sense of the world to their users. Besides of a short-circuiting of critical capacities, these suggestions cause the formation of further social and psychic automatisms and, most importantly, allow for their rapid and automatic modulation.

In order to understand the conditions of the deployment of indeterminacy as an instrument of control then, one must shift the attention from exosomatisation and instrumentality, that is, from what the human can do with the machine, an intertwining of virtual capacities, to consider how machines perceive and change the world, that is, to the relation between human tendencies manifested through actual interactions, and the capacity of the machine to analyse them and regulate its behaviour accordingly. Grafting is the process through which two living parts of a plant are joined, their separate lives become one and their destiny is intertwined, a process in which 'two becomings interlink and form relays in a circulation of intensities pushing the deterritorialization ever further' (Deleuze & Guattari 1987 [1980]: 10). While it might be easier to understand how the capacities of exorganisms and calculators intertwine in the relation of use, we must think about the way in which their tendencies interact, and do it by bearing in mind that human evolution is mediated by technology and culture (Gould 2011: 222).

This condition can be described through the notions of individuation and its transindividual declination, as proposed by Simondon and further elaborated on by Stiegler. Attributing primacy to the process of individuation over the notion of individual, Simondon argued for a study of its genesis to account for its character (Simondon 2020 [2005]: 1-2), that is never given in advance and, in the case of biological entities, is always open to further transformations. Individuation is the process of transformation that presents observers with specific although momentary states of things: physical, biological, psychical and collective (12) entities result from processes of individuations that constitute the discrete and transient elements on the plane of organisation. With the notion of transindividual, that he uses to describe the relation of individuation connecting individuals and collectives, Simondon refuses the psychologist and sociologist points of view – both relying on the position of substances, both affected by parallax effect – over the relation part-whole that would understand society as being formed by individuals in the first case, and individuals as being formed by society, in the second (9) and proposes instead a reciprocal relation of psychosocial development, that is 'an individuation with two faces, a single operation with two products or results: psychic being and the collective' (Combes 2013 [1999]: 25). Instead of conceiving the relation between individuals and collectives as the modular composition of a social construct (Simondon 2020: 332-333) or through the model of subjectivation as production of individuals by the collective, Simondon offers then a view of the relation that seems closer to that of emergence and downwards causation, a condition in which the whole must be seen as in-process as much as the parts, and in which reciprocal influences cause their transformations to run parallel. For Stiegler, technics create the space for the constitution of circuits of transindividuation: 'this psycho-social individuation generates the transindividual, that is, shared meanings, […] which always themselves presuppose supports, or carriers, that enable them to be transmitted through time […] noetic psychic individuation, that is, thinking, is conditioned by technical individuation' (Stiegler 2020: 23-24). The evolution of technologies through which individuals share meaning impacts then the relation of transindividuation as the co-individuation through which the psychic and the collective transform and influence of one another: ''This means that individuation is not double but triple; psychic, collective and technical, each one unthinkable without the others' (Stiegler 2014 [2004]: 70). The transformation of techno-symbolic milieus, of concrete machines and regimes of signs, impacts then the psycho-social relation of individuation, that is, how humans individuate beyond the biological register and as collective entities.

The technical tendency towards the development of ensembles characterised by a high degree of indeterminacy defines today the wide variety of capacities of computational machines. Thought in relation to the external milieu that shapes this tendency and harnesses its power, that is, late capitalist society, with its need to craft voters and consumers, this technical tendency must be considered in relation to psychosocial tendencies and their development. The artisanal cyborg emerges precisely out of this intertwining of technical capacities and anthropological tendencies.

Creative involution

How to understand the way a technoscape and a biosphere, an infosphere and a psychosphere can interweave, can be grafted one into the other, if not from the point of view of their own emergence, that is, by looking at their differences as branching out from the same plane? As we will see, the cross-strata relation involving technical capacities and human tendencies and engendering 'nonhuman becomings of human beings' (Deleuze & Guattari 1987 [1980]:503), cannot be understood in terms of filiative variation, that is, in terms of progressive differentiation, but exclusively in those of cross-strata emergence and of transversal becomings. These phenomena can be conceived as instances 'of symbiogenesis – the principle of synthesis of heterogeneous organisms in a system-consortium' (Kozo-Polyansky 2010: 122). Popularised by the work of American evolutionary biologist Lynn Margulis on the emergence of new life forms through symbiosis (Margulis 1998: 113, 134-40), the idea of symbiogenesis can be traced back to the intuitions of Empedocles (Kozo-Polyansky 2010: 121) and his theory of *φιλότης* and monstrous formations (Empedocles & Wright 1981: 54), according to which behind the origin of living creatures lies a combination of heterogeneous elements into organic wholes whose character revealed to be fit for survival and reproduction. The concept has then a long history (Kozo-Polyansky 2010: 121-126) that nonetheless has never seen it acquiring the stance occupied, on the political plane, by ideas like competitive selection (Margulis & Sagan 1997 [1986]: 28-9, 124, 219) or by loose interpretations of notion of descent with variation in terms of evolution as improvement (Gould 2011: 137). Yet, as highlighted by Margulis, symbiosis constitutes one of the fundamental dynamics behind evolution:

> In certain cases cohabitation, long-term living, results in symbiogenesis: the appearance of new bodies, new organs, new species […] Symbiogenesis […] refers to the formation of new organs and organisms through symbiotic mergers […] All organisms large enough for us to

> see are composed of once-independent microbes teamed up to become larger wholes. As they merged, many lost what we in retrospect recognize as their former individuality. (43-44)

With the intent to escape both substantialism and a progressivist misinterpretation of evolution, the theory of emergence devised by Deleuze and Guattari echoes these ideas and implements them in their description of life as vibrant collection of intermeshing virtualities on a plane of immanence, 'immanent life carrying along the events or singularities that are merely actualized in subjects and objects' (Deleuze 2006a [2003]: 387) in creative instances of emergence. From this perspective, in fact, every element of the plane of organisation actualises from the same 'phylum': 'the machinic phylum is materiality, natural or artificial, and both simultaneously; it is matter in movement, in flux, in variation, matter as a conveyor of singularities and traits of expression' (Deleuze & Guattari 1987 [1980]: 409). The emergence of living organisms results from what Deleuze defines as the self-organising 'the power [*puissance*] of nonorganic life' (Deleuze 1995b [1990]: 143), the creative power of the dynamical, non-stratified state of the world, constituted by materiality in flux and constantly interlocking in ephemeral nodes. Here, the intersection of flows of matter and energy gives rise to physical and chemical phenomena of self-organisation, like in the case of chemical clocks or of solitons (DeLanda 1992: 130-131); as phenomena of self-organisation manifest and their assemblages gain complexity, bioids start to emerge as 'chemical system[s] sensitive of small fluctuations during [their] self-assembly' (131), the simpler chemical systems capable of cumulative acquisition and conservation of information (Decker 1979). Life is the emergent property of assemblages of nonbiological material, 'a property of form, not matter, a result of the organization of matter rather than something that inheres in the matter itself […] life is a kind of behaviour, not a kind of stuff' (Boden 1996: 53) displayed by complex chemical system in a status of nonequilibrium, that is, disspative structures that have to constantly process energy to preserve their structure (Kauffman 2014 [1995]: 22).

Designating life as an emergent property of abiotic processes and aleatory assemblages allows us to conceive the manifestation of novelty on the biological stratum not exclusively in terms of hereditariety and random variation, with their emphasis on individuated biological organisms and on a vertical transfer of form (Ansell-Pearson 1999: 140), but from nonfiliative dynamics of the likes of horizontal gene transfer or symbiosis, that translate as instances of creative '"communication of a code or an axiomatic" which informs the flows' (10) regardless of phyletic boundaries:

> becoming is not an evolution, at least not an evolution by descent and filiation. Becoming produces nothing by filiation; all filiation is imaginary. Becoming is always of a different order than filiation. It concerns alliance. If evolution includes any veritable becomings, it is in the domain of symbioses that bring into play beings of totally different scales and kingdoms, with no possible filiation. (Deleuze & Guattari 1987 [1980]: 238)

Describing novelty as the result of virtual amalgamations or horizontal communication of codes, Deleuze can re-elaborate Bergson's creative evolution (Bergson 1998 [1908]) as creative *involution* to indicate the dynamics of intertwined multiplicities: 'to involve is to form a block that runs its own line "between" the terms in play and beneath assignable relations' (Deleuze & Guattari 1987 [1980]: 239). As in fact 'assemblages cut up the phylum into distinct, differentiated lineages, the machinic phylum cuts across these lineages and makes them coexist' (Ansell-Pearson 1999: 141), allowing for the connection of their multiplicities. The phylum can consequently be 'considered to be "creative" because its field of production is not differentiation […] but the formation of *blocs* which create their own lines of invention' (162), that is, because it brings about the formation of assemblages intertwining not only individual sets of capacities, but also of tendencies, included the evolutionary lines of individual phyla. The most famous example of these kinds of blocs consists in the pollination mechanism emerged through the co-evolution of wasps and orchids, a symbiotic relation in which the shape and pheromones of the flowers attract male insects that, attempting copulation, end up pollinating the flower. Here, in a horizontal communication of code circulating through the processes of emergence of both individuals, the wasp becomes a liberated piece of the orchid's reproductive system, [while the orchid] becomes the object of an orgasm in the wasp, also liberated from its own reproduction. (Deleuze & Guattari 1987 [1980]: 293). Their coupling results in a spiral of intertwined becomings that involves wasp and orchid and deterritorialises one on the other, transforming both in a co-evolutionary, but nonfiliative sense: 'There is a block of becoming that snaps up the wasp and the orchid, but from which no wasp-orchid can ever descend' (238). As a nonfiliative, involutionary relation, the hybrid bloc of life formed by the wasp and the orchid connects their virtual fields of affordances, interweaving their evolutionary tendencies and dragging them both in a new direction, the cross product between two vectors that will share as a common destiny: 'In complexity theory terms, the new assemblage, the symbiosis, is marked by emergent properties above and beyond the sum of the parts' (Bonta & Protevi 2004: 59).

As highlighted by Ansell-Pearson, novel forms of life are not only the result of filiation, but also 'of "monstrous couplings" involving heterogeneous components that "evolve" in terms of recurrence and communications' (Ansell-Pearson 1999: 141). This implies that living beings are or may be involved in assemblages that open up their limits to 'transversal', nonlinear becomings that connect 'the disparate in terms of potential fields and virtual elements, and crosses techno-ontological thresholds without fidelity to relations of genus or species' (170). Despite being cross-phyletic though, the bloc formed by the wasp and the orchid does not cross strata. A better example, for us, might be offered by the hermit crab and its shell, a bloc of becoming that 'snaps together' an animal and a physico-chemical construct, joining two separate strata. Lacking, over its abdomen, the hard plating typical of other crustaceans, the hermit crab protects its soft lower body with the shell left behind by a dead snail. The tail of hermit crabs has evolved to perfectly occupy the swirls of the abandoned shell and has developed muscles to adhere to its interior walls. Fossil evidence has recently showed that the Upper Jurassic ancestor of the crab, was not only occupying the shells of ammonites, but hunting down the animal, now extinct (Mironenko 2020). With the extinction of the ammonite, the hermit crab has formed a new bloc of becoming with the sea snail, but in the meantime it too has changed, adapting its diet (Orton 1927) and developing a more patient attitude towards the previous occupier of its prospective habitation, that drives hermit crabs to line up in order to exchange ill-fitting shells in a collective behaviour called 'vacancy chain' (Lewis & Rotjan 2009).

Adopting this perspective, Deleuze and Guattari can help us clarify the relationship between life and the digital in terms of virtual fields of affordances, as a bloc of becoming involving the organic and the inorganic and causing emergent social behaviours. This task requires a definition of life that explains not only the hybrid character of human life, related to technicality since its appearance, but one that accounts also for the transformations undergoing in the techno-cultural modality in which human evolution expresses itself, and its connection to the digital stratum and the loops (of destratification, data analysis and suggestion) allowed by computation's high degree of indeterminacy. This conception of virtual or nonorganic life allows us to take into account the formation of 'monstrous crossbreeds' (Deleuze & Guattari 1987 [1980]: 157) as those between the human and the technical, the chemical and the electrical, and to think the interactions of these registers in terms of virtual fields, understanding novelty 'not so much [as] a question of "evolution", with its perfectionist and progressivist values, but more [as] a question of passages, bridges, and tunnels; a question neither of regression nor of progression but of "becomings"'(Ansell-Pearson 1999: 150). From this point of view, the characterisation of control as a 'new monster' in Deleuze's *Post-scriptum* (Deleuze 1995 [1990]: 178) assumes the character of a synecdoche, for the monstruosity of the artisanal cyborg consists precisely in the formation of a cross-strata pattern of emergence.

The role Deleuze and Guattari attribute to technology and the way they extend the meaning of the notion of symbiosis to characterise the intertwining of multiplicities is therefore fundamental to understand the condition of emergence of the artisanal cyborg:

> technology makes the mistake of considering tools in isolation: tools exist only in relation to the interminglings they make possible or that make them possible. The stirrup entails a new man-horse symbiosis that at the same time entails new weapons and new instruments. Tools are inseparable from symbioses or amalgamations defining a Nature-Society machinic assemblage. (Deleuze & Guattari 1987 [1980]: 90)

A full description of phenomena of this type, in fact, cannot be limited to the actual character assumed by cross-phyletic assemblages, that can be described by a combinatory diagram of the capacities of socio-technical emergent, but must account for the intertwinement of their tendencies: in other words, it is not just about understanding how the stirrup enhances the capacities of a rider, but how this new condition will alter both the horse, the rider and the phyletic lines or social systems in which they are plunged. The technosphere and the biosphere can, and indeed do, interweave because all their components are expression of the same virtual dimension of becoming, the same machinic phylum that cuts across 'techno-ontological thresholds' (Ansell-Pearson 1999: 170) allowing the formation of blocs of becoming. In the case of humans, whose evolution is techno-cultural, this bloc connects the high level of indeterminacy of computational machines to the socio-psychological tendencies of individuals, projecting a line of emergence in the social dimension. As the transformation of the bloc of becoming formed by the hermit crab and the snail's shell shapes the social behaviour of the animal, so the emergence of the artisanal cyborg shapes human social life. Given the technocultural dimension of human evolution, one could map a *becoming-algorithmic* of human life as a tendency passing through the exosomatisation of mental processes and the somatisation of automatically generated suggestions. As the becoming-wasp of the orchid is complemented by the becoming-orchid of the wasp, through a circulation of codes that in-form the multiplicities of the elements of the bloc, so one can also expect a *becoming-alive* of digital technologies, whose necessary condition is guaranteed by the high degree of indeterminacy characteristic of computational machines and by their level of automation.

The next chapter, will look more in depth at the idea of life as behaviour and attempt a description of the first signs of the becoming-alive of digital technologies complementary to the becoming-algorithmic of human life. The next section of this chapter will instead add one more element to the description of the latter, illustrating how the circulation of code informing the reciprocal deterritorialization of the human and the digital takes place at the centre of the bloc, between destratification and suggestion or between the outer and the interior loop of the stratum, e.g. at the point of formation of the dividual as substance of expression.

Riemannian cyberspace as a new regime of individuation

Considering how individuations take place within digital milieus will provide us with an understanding of the dynamics internal to the bloc of becoming I have described, allowing us to describe not only how human capacities can be extended through exosomatisation and the relation of use, but how human tendencies towards transindividuation are woven together with the tendency towards indeterminacy of technical objects into a co-evolutionary line. This will lead us to picture how the indeterminacy of digital machines serves the stratum as a tool for domination, that is, what happens, at the heart of this technoliving bloc of becoming, in the age in which the tendency to develop a high degree of indeterminacy has resulted in the implementation of a capacity to map virtual fields of affordances through the destratification of enormous numbers of interactions and their automated analysis. In order to do this, we have to look at the notion of individuation as defined by Simondon, and consider its relation to the topology of the digital milieu in which it takes place. Considering again Deleuze's insights in matters of non-Euclidean spaces will then position us to describe the emergence of one of the central concepts of the 'Post-scriptum sur les sociétés du contrôle' (Deleuze 1995 [1990]), the dividual, from the standpoint of its associated digital milieu.

As we have seen, the hylomorphic framework isolates the imposition of form from the influence that environmental conditions have on matter and on its formation. From a morphogenetic point of view, instead, that accounts for individuation as a process culminating in the emergence of form rather than focussing on its imposition, and from a morphodynamic point of view that understands individuated beings as being in process as well (Simondon 2020 [2005]: 159-160), the milieu in which individuation unfolds triggers and influences transformations, constituting fields of forces out of the interplay of which matter organises itself, form emerges spontaneously and possibilities actualise. For Simondon, who conceived ontogenesis and becoming in these terms, the method to describe such processes cannot consequently consist in 'The method employed consists in not being given beforehand the realized individual that must be explained, but in grasping the complete reality before individuation' (52). Part of this picture of pre-individual reality must consequently consider the milieu associated with a process of individuation (49-50).

A process of individuation and its milieu are tied together through unique sets of relations that constitute what Simondon calls *regimes of individuation*: specific configurations of matter and energy that influence processes of individuation taking place, at any degree of complexity, within them. Recognizing this connection, Simondon proposes that, 'Instead of supposing substances so as to account for individuation, we have chosen to take the different regimes of individuation as the basis of various domains, such as matter, life, mind, and society' (12). The artisanal cyborg has no substance: it is the result of a process of hybrid individuation mediated by the milieu through which it unfolds. These regimes can consist in sets of forces, chemical conditions, ecosystems, with their distribution of nutrients, temperatures and species, or in socio-technical settings as various as historically determined regimes of signs and technoscapes, with their routes and channels for the circulation of energy, matter and information, their rhythms and intensities.

An interesting example of the centrality of the milieu for individuation is polyphenism (Yang & Pospisilik 2019). Given the same genes, the female embryos of some species of ants can develop in two different types of workers – of impressively different sizes (some are up to 100 times bigger than others) and with or without wings – or into a queen, the only fertile individual of the colony that in some cases can live for decades, while workers do not usually live longer than a few months (Chittka et al. 2012). Environmental circumstances such as temperature, nutrition or chemical environments altered by pheromones, determine the development of the embryos and their processes of individuation into members of a specific cast: rigid morphological and behavioural forms emerging as the diverging expressions of the same genomic pool. In most cases, if a queen dies, the whole colony is set to capitulate. However, in the case of Indian Jumping Ants, in which the caste system is not as rigid, workers can still become functional queens after the death of the original one, and even start other colonies independently (Peeters et al. 2000).

While the death of a queen shifts the chemical regime of pheromones, altering the relations of the ants' colony, on a longer time scale, the modification a living species produces in its environment (a behaviour related to the necessity to enhance fitness named niche construction), can cause a readjustment of selective pressure, that will influence evolution (Odling-Smee et al. 2003: 116-118). In the case of humans, psychic individuations cannot be given as isolated from collective individuations, and both develop within a pre-individual field that Stiegler identifies as constituted by retentional apparatuses (Stiegler 2014 [2004]: 51), that is, physical repositories of exteriorised memories composing technical milieus. As we have seen above, the milieu produced by the diffusion of industrial machines lends itself to segmenting individuation processes in the hylomorphism of disciplines: sites of enclosure constitute casts applied over standardised, sterilised matter, upon which dynamical forms, compatible with the movements of the machines, are imposed by proximity and regulated through the organisation of space. This milieu is subject to the imposition of a transcendent source of order that overdetermines an uniformed space (Foucault 1995 [1975]: 147-148), classifiable for this reason as Euclidean (Deleuze & Guattari 1987: 485). Digital instruments instead, which in their earlier forms allowed for the grammatisation and thereby the expansion of cognitive faculties as perception and understanding (Simondon 2016 [1958]: 130), in their reticulated configuration, their most diffused and accessible current form, operate to articulate and suggest cognitive connections. For this reason, digital technologies alter the relation between topology and individuation that we can appreciate in the case of discipline: in order to produce such connections, the digital necessitates a different type of space, that this time is not Euclidean, since it is not defined by the necessity to reproduce ideal dynamical forms by encasing that which occupies the space in rigid structures.

In the era in which every relation seems to be mediated through such a material environment based on destratification and automated connection of grammes, then, 'generalized computation brings calculation fully into the characteristic mechanisms of what Simondon calls psychic and collective individuation. In other words, hyper-industrialization brings about a new figure of the individual' (Stiegler 2014 [2004]: 48). To account for the emergence of this figure, the artisanal cyborg, we must map the conditions in which users and collectives individuate, or attempt to do so (60), through the interfaces and within the spaces opened up by the platforms articulating the web. In their definition for the MIT Press Lexicon of software studies, Cramer and Fuller stress that the term interface derives from chemistry, where it indicates a membrane shared by 'two bodies, spaces or phases' (Cramer & Fuller 2008: 149) and that from there it has been borrowed by informatics to denote the point of connection between the user and the layers of hardware and software through which computational machines are actioned and structured. Among recent works focussing on the notion (Farman 2012; Galloway 2012; Bratton 2015: 219-251), that of British social scientist James Ash focuses more specifically on videogames' interfaces, interestingly defining them as

> localized foldings of spacetime that work to shape human capacities to sense space and time for the explicit purpose of creating economic value for the designers and creators of these interfaces [, an operation that] can be understood as a new form of power, which I term envelope power (Ash 2015: 3).

Ash's idea of interfaces as foldings qualifies videogame environments as topological spaces: as we have seen in the second chapter, topological objects can be continuously bent and deformed in shapes that will be considered homeomorphic as long as their core properties remain the same, e.g., if an object has a hole, and this is not closed by its deformation, the process will render an object with the same topological shape. It is for this reason that, in topology, a mug and a donut can be considered homeomorphic. From a topological point of view then, that considers surfaces as spaces themselves and liberate them from the overcodification of cartesian axes as the coordinates against which every dimension is measured in Euclidean spaces (Plotniski 2005: 191), 'a space is not just a set of points, but a set together with a way of binding these points together into neighbourhoods through well-defined relations of proximity or contiguity' that constitute a non-Euclidean space (DeLanda 2002: 15).

Taking this idea into account, we can focus on a more general trait that seems to characterise the interfaces associated with web navigation, as those of search engines (Ash 2015: 21) and those of the most popular social network platforms. For Ash, in fact, interfaces should be understood as technical environments (17) whose articulation generates processes of spacing (12), 'where something such as space [...] appears as a particular kind of phenomenon through the construction of relations and non-relations between objects that make up the interface (140-141)'. As junctures or surfaces between, for instance, users and software applications, interfaces produce spaces by ‘folding’ into what Ash names ‘envelopes’:

> Interface envelopes are homeomorphic in the sense that they actively bend, modulate and shift within a series of limits. This allows them to accommodate and respond to what players are doing while engaging with the interface. (81-83)

User interfaces mediate the interactions with blackboxed systems, outputting a visual rendition of the stratum’s surface of stratification, in which users ‘navigate’, and presenting them with a partial output of the calculation performed in the background. This output can be perceived as a reaction of the system to inputs and, when this system portrays a physical environment like in the case of videogames, such a reaction amounts to a shifting scenario that rotates or bends in response to the user’s actions, enveloped in a homeomorphic space.

In his essay titled ‘L’homme et l’objet’, Simondon seems to reflect in similar terms when he defines a peculiar class of artifacts that he defines as ‘enveloping’. These objects are distinguished by their internal structures, which organises the space they envelop influencing the relations of the individuals they contain (Simondon 2018: 22). By responding to the inputs of their user, interfaces generate processes of spatialisation by rearranging these relations. To facilitate the instrumental relation established between the user and the computer, human-machine interfaces separate and translate into each other incompatible layers through symbolic membranes. In doing so, they add capacities to the bodies they connect, allowing both sides to act upon one another (they form, for instance, a feedback loop between mechanical inputs, visual outputs, cognitive responses and more mechanical inputs). It is not important then, if in car racing games it is the car to move on the road or if this stays still at the centre of the screen while the racecourse runs around it: what matters is that, in the visual interface that occupies the screen, the 3D models of both the car and the racecourse are both stretched, bent and turned over in response to the user’s interactions with the game. In order to fully understand how processes of individuation develop through the digital milieus in which they take place, that is, through the interfaces separating and connecting users to blackboxed algorithms, and to grasp how these processes of individuation are manipulated by the forms of power that Ash recognised as capable of being wielded through the manipulation of digital environments, one should consider the specific character of such spaces.

As shown by Michel Foucault, a functional organisation of space is instrumental to the constitution of relations of power that mould the subjects that circulate through them (Foucault 1995 [1975]: 138). It is possible to argue that the digital stratum, produces a new type of enveloping object with varying geometry, a homeomorphic space, through the articulation and re-organisation of ‘the projective, perceptual cinematic, semiotic layer on a given instrumental landscape, including the frames, subtitles, navigable maps, pixelated hallucinations, and augmented realities through which local signification and significance are programmed' (Bratton 2015: 71). The peculiarity of digital enveloping objects is not limited to the way in which these organise the relations of the groups of objects they contain, an aspect that can nevertheless be appreciated in search engines, whose results establish a hierarchy of 'specific sites and individuals over others through ranking them and creates value from these rankings, without having to communicate any kind of formal ideology to the use' (Ash 2015: 21). Another character of interest consists in fact in the specific way they bring items together: 'What differentiates environments or spaces from one another is how objects and beings can access other objects that make up that environment' (142).

In the previous chapter, I have introduced the notion of Riemannian space, a space free from overarching structures of reference, that allows us to consider surfaces as dimensions in themselves and to account for a variable number of dimensions. This understanding of space is necessary to describe virtual fields of affordances as the shifting virtual diagrams characterised by as many dimensions as the tendencies and capacities of the actual systems they describe. Yet, this conception enters the philosophy of Deleuze and Guattari to describe, more generally, 'An amorphous collection of juxtaposed pieces that can be joined together in an infinite number of ways: we see that patchwork is literally a Riemannian space, or vice versa' (Deleuze & Guattari 1987 [1980]: 476). This type of space is defined as smooth, and is opposed to striated spaces, those spaces whose organisation is submitted to a higher code that organises the points of which they are composed in well-defined and fixed systems of distance. These two spaces are not given if not as processes of smoothening and of striating (Bonta & Protevi 2004: 151), their distinction maps onto the one between the plane of consistency and the plane of organisation and it is used to describe processes and effects one can identify at many different levels of emergence and registers (144): in music as in mathematics, technology and politics, the smooth and the striated convert one into the other either as the result of codes that segment spaces into homogeneous units, assigning a purpose and a place to every entity within them, or through the molecular power of that which escapes a striation, the amorphous fluidity crossing hard surfaces or sharp lines of organisations.

The smoothening process that produces in the interface as an enveloping homeomorphic object, finds its antecedents in art. This is the case of the double exposure of early chronophotographic studies, with its pictorial complement to be found in the combination of visually distorted and temporally diachronic chunks of space of cubism. However, it is clearly cinema to have developed this smoothening process of visual spaces through film editing techniques. In this case, in fact, if space underlying a sequence shot can be said to be Euclidean, with every point connected to the others in a definite and invariable fashion, the space underlying a *montage* is Riemannian, a *patchwork space*

(485) that connects discontinuous chunks of space following, for instance, cross-frame movements. With the separation between coding interfaces and user interfaces in the 90s (Cramer & Fuller 2006: 150), this technical smoothening becomes part of the digital stratum, where it shifts away from purely visual registers and predetermined effects to structure a paradigm of circulation that will subtend a new regime of individuation, with hyperlinks allowing the recombination of synchronic but non-contiguous chunks of cyber-space hosting items, pieces of content, products and other users.

Within this techno-symbolic milieu, a piece of content can be compared to a shot, with the work of the director and the mechanisms of the editing room in the hands of blackboxed algorithms. Here, indeterminacy meets automation, and any type of interaction leading to the recognition of an expected trait activates the loops of the stratum. The process of individuation circulating through these environments and crossing the series of suggestions put together through the hypermontage of recommendation algorithms constitutes an automated Kuleshov effect. From the systematisation of actual behaviours associated with a body, the machine recognises tendencies, a number of virtual lines that can be traced through multiple series of pieces of content which that body could enjoy, engage with or repost. The interface suggests than a specific content, situated somewhere onto one of those lines. This operation structures automatically the space in which the user individuates by putting together discontiguous chunks of cyber-spaces, and modulates the subject in a specific direction.

Besides of allowing a seamless connection of disparate spaces, the particular dimensionality of the digital causes also an extreme distancing of what ends up outside of 'filter bubbles' (Pariser 2011). As already warned by Deleuze and Guattari, in fact, the smooth itself can be drawn and occupied by diabolical powers of organization' (Deleuze & Guattari 1987 [1980]: 480), and this pharmacological aspect of the interface allows new polarising striations to emerge spontaneously. From this perspective, platforms and search engines hold the power to impose particular striation styles or motives over the smooth cyberspace: a hierarchy of results, shaping the interface on the basis of what is 'relevant', a category too easily equated with that which 'exists', and by articulating navigation from suggestion to suggestion. This new type of striation, however, differs from analogue ones (as navigation systems, cartesian axes or state-imposed borders), because it is subordinated to movement, instead of being imposed as a restriction over circulations. This takes us back to the correlation of processes of smoothening and striating and their reciprocal convertibility: 'How does smooth space become striated? How does striated space become smooth? These are not symmetrical operations and their mixtures and tendencies produce different kinds of assemblages' (Adkins 2015: 231). Cyberspace is the result of what Deleuze and Guattari define as 'retroactive smoothing' (Deleuze & Guattari 1987 [1980]: 482), a smoothening of an already heavily striated space, namely the scientifically and socially metricised, subdivided, organised space in which processes of transindividuation have taken place so far. If the infosphere has achieved its smoothening with the development of the world wide web, however, it has by now been transformed in a new territory to dominate. In their study of these kinds of spaces, Deleuze and Guattari already noticed this possibility: 'The sea, then the air and the stratosphere, become smooth spaces again, but, in the strangest of reversals, it is for the purpose of controlling striated space more completely' (480). The same phenomenon can be registered in finance, with the global consequences of the liberation of capital flows and globalisation (490; Easterling 2016: 25-26 ; 31) where 'a valorisation of the dissolution of boundaries and structures, of fluidity, of the unplanned and the spontaneous' (Sasso & Villani 2003: 134)[4] has created more instruments for domination by expanding inequality.

Originally spread as an instrument of freedom, cyberspace has soon been striated again in a kaleidoscope of automatically generated striations that favour its co-optation by capital and convert it into an effective tool for capillary and dynamical domination. It is the character of this cyber-space, the smootness of the homeomorphic interface connecting individuals to the digital stratum that defines the technology of power of control. Allowing a certain margin of freedom, while constantly modifying their environment on the basis of their behaviours, the interface modulates processes of individuation. We must now consider an additional step of this process: within this regime of individuation, in fact, Deleuze claims that individuals become dividuals (Deleuze 1995 [1990]: 180). To understand what a dividual is, and what role it plays in digital individuations, we have to embark over a study of its emergence as a technical object.

The challenge of relativity

Let us recapitulate: individual interactions with the interface layer of the stratum (substances of content) are destratified by its sensorium and grammatised into series of zeros and ones. Metadata are assigned to these series as a form of content. Once overcoded , destratified series of individual interactions form groups that fill data banks at a supra-individual level, i.e., for one type of interaction, say, watching a video with specific tags, a group is formed by collecting all the interactions of the same type registered across extended time periods and different users. It is at this point of the pattern of emergence of the artisanal cyborg, that its substance of expression is articulated. The supra-individual level of the stratum, in fact, is object of data analytics, a series of practices that extract patterns from data banks (Kitchin 2014: §6; Belcastro et al 2016), through which new interactions with the stratum

[4]All translation from this source are mine.

will be then categorised. This is the reason why I have suggested that there is a circularity, a first internal loop, between the form of content and the substance of expression of the stratum, that is, between the way data are classified and the formation of relevant categories. The result of data analytics, however, serves also the function of informing the topology of the interface, translating the insights offered by machine-generated correlations. The homeomorphism of the digital milieu makes it so that the processes of individuation taking place within it can vary as much as its topology adapts following recommendation algorithms (Tufekci 2019b).

In his account of the individuation of physical objects, Simondon recognizes the importance of the topological configuration of the milieu in which the process takes place (Simondon 2020: 160-161). Following the Stieglerian interpretation that understands preindividual milieus of exorganisms as technological systems, it is possible to think that the relation between the topology of homeomorphic milieus like digital interfaces and the processes of individuation that develop within them share some characteristics. While, on one hand, people individuate *through* digital processes of grammatisation, as through a technique like writing, and this process leads to the emergence of the artisanal cyborg, on the other hand, something else undergoes a purely digital process of individuation, whose development is necessary for the second loop of the stratum to deliver its suggestions: Deleuze's dividual. What I call the dividual is a digital entity whose individuation takes place within the milieu fashioned by the digital stratum. This process of individuation begins with the extraction of data points I have called destratification, but does not end there: the dividual is not a destratified individual, rather it is what influences individual and collective processes of individuation by informing the suggestive organisation of interfaces. Rather than a digitally destratified analogue individual, the dividual is a digital objectile. In order to understand this crucial component of the technology of power of biofeedback control, however, we must consider the character of the first cybernetic problem, whose resolution has generated the beginning of the dividual's technical lineage.

Joining the efforts shared by a network of 700 American universities dedicated to produce technoscientific research and innovations that would have helped the Allies with the war effort, in 1940, then MIT math instructor Norbert Wiener started working on the development of an automatic system built to extract, from the information made available by radar technology (Galloway 2011: 4), precise predictions of the movements of aircrafts and, on the basis of such predictions, anticipate their position to quickly and precisely aim antiaircraft artillery and gun them down. As put by Conway and Siegelman in their biography of the father of cybernetics, Wiener was essentially 'trying to design an electronic system capable of performing the supreme feat of human intelligence – envisioning and predicting events in the future – and then acting on that foresight' (Conway & Siegelman 2004: 108).

This historical event and prodigious fit of collective ingenuity ties the origin of cybernetics to the epistemological gridlock that Florian Sprenger calls the 'challenge of relativity' (Sprenger 2018: 2). With this formula, the historian and media theorist describes 'The operational and epistemic impossibility of […] simultaneously determining both of these variables – location and motion – in a single act of observation' (2). Winer's solution to this technical and epistemological problem initiates a technical lineage (Simondon 2016 [1958]: 44-51) of automatic machines devoted to the extraction of predictive information from the tendencies displayed by the objects analysed, and the adoption of this information to regulate future behaviours (Sprenger 2018: 3).

A crucial stage of the evolution of the technical lineage initiated by Wiener's predictor and the real explosion of the adoption of this technology coincide with the development of mobile technologies (Kitchin 2014: §5 ¶8-9; §6 ¶2). The wireless broadband communication systems modelled on the GSM and LTE standards rely on radio towers with limited coverage, whose distribution forms cellular networks. Often, the portable devices connected to the network leave the radius of the tower from which they receive signal and enter the area covered by another one. The passage could cause mobile devices to lose connection. However, these devices hold a series of addresses whose transmission allows their identification on the network, as IP, IMEI, phone number etc. (Sprenger 2018: 7): 'In this sense, such technologies react to the same challenge as missiles or drones and can be described as a part of a new solution: technologies of automatic self-registration' (3). In his thorough description of the global megastructure of computation he names *The Stack*, Benjamin Bratton dedicates dozens of pages to the issue of addresses, offering a couple of insights that it is worth highlighting. In general, for any event or thing to be perceived by the Stack, the multi-layered structure composing the technical network of digital technologies, its identity must be expressed in machine language (Bratton 2015: 367). By assigning addresses to instruments and results of destratifications, the digital produces 'a new regime of segmentation and organization [that] overhauls relations between what is enrolled within it, and does so regardless of whether it is organizing physical or virtual space' (194). The superposition of cyberspace over physical, concrete territories is then operated as a striation of its destratified, smoothened space: a physical location becomes the IP number of a router, an individual its NHS affiliation number, or the biometric data extracted by an activity tracking wristband. Destratification and addressing proceed along parallel lines: in the eyes of the Stack then, 'if something has an address […] it is present, and stripping something of its address, or turning off its address, erases it from that world' (205). From the point of view of digital systems, however, two objects that are adjacent in the physical world can have non-sequential addresses, and objects designated by sequential addresses can be located in two physical locations far from each other. In addition to a new striation, then, 'addresses provide a space of relationality between things that exceeds the relations they might already possess as natural objects' (205). This new space of relationality is crucial to understand the homeomorphism of digital interfaces, while the idea of tracing objects in movement through their addresses develops in the mechanism of biofeedback control. Indeed, it is on the basis of their addresses, or better, the addresses of their devices and the addresses of the cookies they hold, that the behaviours of users are monitored and their circulation within cyberspace is tracked, so that the paradigm of the age of control becomes to follow rather than to enclose, as in the case of disciplinary societies. Allowing free circulation, digital control exploits freedom to infer the tendencies of individuals. As highlighted by German philosopher Byung-Chul Han, 'now freedom itself, which is supposed to be the opposite of constraint, is producing coercion' (Han 2017: 2). This freedom helps the work of biofeedback predictors that shape, with their suggestions, the homeomorphic interface in which individuals and collective circulate and try to transindividuate. In this scenario, as put by David Savat, '"control" comes to be so subtle that it may well present itself in the form of "choice"' (Savat 2009: 57), rather than disciplinary imposition.

Reflecting on Deleuze's *Post-scriptum*, Savat interprets then the notion of dividuality as relating to the coexistence of analogue disciplines and biofeedback controls, so that individuals have two identities, are doubly trapped by different machineries of domination (58-59). However, I believe this interpretation offers only a partial picture, one that does not take into account the point of view of the digital stratum and its internal operations, that can be framed by looking at the process of individuation of a purely digital entity triggered precisely by these addresses.

The individuation of the dividual

Deleuze's *Post-scriptum* mentions the notion of dividual three times only, each of which provides a clue essential for its interpretation. The first occurrence of the term sums up the differentiation between disciplinary and control societies: the philosopher maintains that 'We're no longer dealing with a duality of mass and individual. Individuals become "dividuals", and masses become samples, data, markets, or "banks"' (Deleuze 1995 [1990]: 180). This does not simply amount to the translation of an object perceived by the stratum into the binary digits of its operative language (the process I have called destratification), for in that case Deleuze would have probably spoken of 'dividualisation' or written that individuals 'dividualise'. Rather, as highlighted also by art theorist and philosopher Gerald Raunig, 'Dividuality implies not (only) the dividedness of entire single things, but rather an extension, a distribution which moves, scatters, disperses, spreads through diverse single things […] The dividual emerges in dispersion, in the transversal distribution, in drawing the abstract line that traverses and concatenates the concrete single things' (Raunig 2016: 65). Deleuze seems to point at the transformation of one ‘thing’ into another. These ‘things’ are, first of all, the subjects of two distinct technologies of power: the individual subject of disciplines and the dividual subject of control. The third occurrence of the term, that is related to the transformation of medicine with the advent of the regime of control, helps expanding upon this point:

> In the hospital system: the new medicine “without doctors or patients” that identifies potential cases and subjects at risk and is nothing to do with any progress toward [individuation], which is how it’s presented, but is the substitution for individual or numbered bodies of coded “dividual” to be controlled. (Deleuze 1995 [1990]: 182)

The notions of ‘potential’ and ‘risk’ associated to people and subjects do not attest to individuation because they depict singularities with virtual fields of affordances: as I will expand upon in Chapter 8, a risk is not an actual object but, just as ‘the potential for X to happen’, a virtual point on a diagram depicting possible states of things. By speaking about substituting the individual (its actual state of health or set of symptoms) with a dividual to be controlled, Deleuze points at the substitution of the indivisible subjects of disciplines with clusters of virtual singularities, the numerical entities, rendered by numerical values to be modulated by a system that assesses the tendencies, and at times the risks, for specific conditions to materialise. The dividual material to be controlled here is then the digital objectile destratified from a dimension of individuals’ multiplicities.

The idea that individuals become dividuals denotes then first of all a substitution of subjects in the eyes of power: it marks the fact that the subject of disciplines is an actual, indivisible body, while the second is a cluster of data diagramming the tendencies of a user. This cluster does not simply result from a process of destratification because, as we have seen in the first chapter, the only way to unveil the tendencies of a body is by experimentally push its system beyond the boundaries of its actual state: scientific observation, however, cannot be limited to one occurrence of an event, and requires multiple iterations out of which tendencies can be extracted only as averages of the effects of manipulation. This happens also in the case of the dividual, where the cluster of data diagramming the tendency of a body does so only because of the passage to the supra-individual layer of data analysis we have previously mapped as the passage between the first and the second articulation of the digital stratum, i.e., the passage between its form of content and its substance of expression. Studied the behaviour of many users, control systems extract their average tendencies and project them back them onto the individual level, marking new individual interactions as singularities on a pre-mapped virtual field of affordances (Schrage 2020: §4).

The dividual is not simply the destratified, the individual as it is perceived by the eyes of the machine. The second passage of Deleuze’s *Post-scriptum* uses the term as an adjective, to describe an electronic key or identification card that allows its carrier to access areas of the city. However, he adds, this kind of card could be 'rejected on a particular day, or between certain times of day; it doesn't depend on the barrier but on the computer that is making sure that everyone is in a permissible place, and effecting a universal modulation' (Deleuze 1995 [1990]: 182). The card holds an address, and its behaviour, along that of multiple other cards, can be monitored by an automated gatekeeping system. All the destratified behaviours associated to such a class of addresses form dividuals, and the universal modulation effected on their basis does not simply apply to the plastic of a card, the limbs of the individual of the metal of the gates, but to the virtual field of affordances of a citizen, whose tendencies (like to about for a specific route) can be modulated, and whose capacities (like that of going back home or accessing a newly restricted areas) can be curbed. Here, the old idea of the 'information highway', can be revised through the image of the autoroute Deleuze proposed in his 1987 lecture on the creative act, and that I have already mentioned above: 'people can travel infinitely and "freely" without being confined while being perfectly controlled. That is our future' (Deleuze 2006b [2003]: 322), that is, to be transformed through a modulation of our virtual field of affordances. To further understand the character of the dividual, though, one must look at its specific process of individuation as a digital entity. As such, the digital dividual is made of binary traces, it is exosomatic, and therefore it individuates as other physical objects do.

For Simondon, individuation establishes communication between 'disparates', that is, between 'at least two different dimensions, two disparate levels of reality, between which there is not yet any interactive communication' but between which potentials are distributed (Deleuze 2003a [2002]: 87). In the case of the individuation of the dividual, these heterogeneous realities are those of analogue interactions with an interface and supra-individual pattern recognition algorithms, while their 'potentials' are possible interactions or clicks on one side, and possible suggestions, or overall arrangements of the interface on the other. As we have seen above, the digital and the analogue dimensions are both separated and put into communication by an interface, that articulates 'a transductive mediation of interiorities and exteriorities' (2020 [2005]: 252) feeding the digital stratum with ever new substances of content and the milieu with suggestions. The operation of transduction is posed by Simondon at the centre of his description of ontogenesis, and defined as

> a physical, biological, mental, or social operation through which an activity propagates incrementally within a domain by basing this propagation on a structuration of the domain operated from one region to another: each structural region serves as a principle and model, as an initiator for constituting the following region, such that a modification thereby extends progressively throughout this structuring operation. (2020 [2005]: 13)

This operation of progressive structuration assumes a peculiar character in the smoothness of cyberspace. Here, this process does not propagate through contiguous portions of space but follows instead the line of circulation constituting the patchwork of navigation via hyperlinks, structuring the homeomorphic milieu of interfaces by connecting non-contiguous pieces of content and sites of interaction. As Deleuze and Guattari stress then, when they describe smooth spaces, 'space and that which occupies space tend to become identified, to have the same power' (Deleuze & Guattari 1987 [1980]: 488): individuating in such a milieu, the dividual is itself a patchwork, a cluster of non-contiguous, destratified, individual interactions. How does this process start though?

When he describes the modalities through which physical processes of individuation develop with the example of crystallisation, Simondon highlights how the ontogenesis of the crystal is triggered by the accidental appearance of a germ into a supersaturated liquid (Simondon 2020: 65). Constituting a quantum of information, the germ acts as a catalyser, a singularity that brakes the metastable equilibrium of the crystal's pre-individual field. Analogously, the individuation of the dividual is triggered by a digital germ: an IP address, someone's login details, the presence of a cookie in a browser, the IMEI code of a smartphone, can all act as the piece of information that opens a space of aggregation for automatically gathered clusters of 'personal' data. These pieces of information catalyse data clots that are enriched by every activity online associated to the same address or set of addresses.

In synthesis: an address has a certain behaviour in cyberspace; the traits of this behaviour are destratified and patterns are discerned within the cluster they form; These patterns of individual interactions with the interface are gathered at the supra-individual level of the dividual, from which tendencies can be inferred through big data analysis and, on their basis, suggestions can be produced; These suggestions will populate the interface presented to the same address, when this will connect to the stratum again. A process of this type leads to the control the user through the modulation of its virtual field of affordances. Originally developed as identification tags necessary to guarantee the connection of mobile devices to cellular networks, addresses are then used to seed control. This is often delivered as 'personalisation' but ultimately guides the implementation of choice engineering and gives rise to the biofeedback hypermontage of a Kuleshov machine providing the users a sense of the world through the manipulation of the interface and the combination of digital grammes like videos or posts in a feed, that is, the combination of chunks of cyberspace in a specific path through which the user's process of individuation will take place. 'insofar as it's defined through a group of transformations' (Deleuze 1986: ¶35) that are all present in the eyes of the machine scanning it from different points of view, i.e., separate filters over it to discern different kinds of patterns, the dividual constitutes a technical objectile, an entity taken into account only as a momentary frame in a morphodynamic process.

The operations of transduction taking place between the analogue and the digital, and through the articulations of the digital stratum, affect both the milieus interfaced through its exterior loop. Its biofeedback mechanism operates a transformation of correlation into causation, an operation hinging precisely on the individuation of the dividual. While it is well known that correlation does not imply causation and that, despite the technocratic faith in the power of Big Data (Anderson 2008), patterns can emerge as spurious correlations (Claude & Longo 2016: 3) simply because of the sheer number of events destratified and analysed, by displaying suggestions based on the correlations revealed by the analysis of the dividual, and by tailoring the interface on the basis of these correlations, the stratum will enow them with a causal power, because they will guide the subsequent interactions of the user. As reported by former Google design ethicist Tristan Harris: 'you have this example of teen girls who started watching dieting videos, like what kind of food should I eat? They get recommended anorexia videos because they're better at holding onto that demographic and they recommended this millions and millions of times' (Harris 2019: 4). When the only type of content the user is proposed by the interface is the one that results the most likely to be engaged with through an analysis of the correlations emerging from the dividual, this is going to be the content the user will end up watching and be affected by.

Allowing for these operations, the dividual epitomises the great margin of indeterminacy reached by digital technologies, a trait that, for Simondon, 'allows the machine to be sensitive to outside information' (Simondon 2016 [1958]: 17). This characteristic is crucial for understanding the difference between control and other technologies of power, for its distinctive form of subjectivation exploits the mechanism of individuation and the way in which this takes place through digital platforms. When control steers the lives of the users, it encourages interactions only to further map and exploit the tendencies that can be extracted from the destratification and dividualisation of behaviours. Moreover, the unceasing process of individuation of the dividual approaches the traits of those that Simondon ascribed to living beings:

> there is physical individuation when the system is capable of receiving information a single time, then develops and amplifies this initial singularity by individuating in a non-self-limited way. If the system is capable of successively receiving several inputs of information (of compatibilizing several singularities instead of iterating the single and initial singularity cumulatively and through transductive amplification), then individuation is vital, self-limited and organized. (2020 [2005]: 163)

Highlighted also by Deleuze in his review of *L'Individu et sa genèse physico-biologique* (Deleuze 2003a [2002]: 88), the distinction proposed by Simondon is today increasingly blurred. According to this definition, in fact, the individuation of the dividual seems to be a hybrid one, whose character echoes

Deleuze's definition of control as a new monster (Deleuze 1995: 178), half inanimate and half alive, initiated by a germ like that of the crystal, but also able to receive an indefinite number of inputs.

With the development of the technical tendency towards indeterminacy and the automation of more complex processes of calculation, however, the development of algorithms able to aggregate data from the non-contiguous sites of multiple interactions allows the dividual to constantly individuate and to feed the recommendation machine with ever new patterns. It is precisely by harnessing the dynamic characteristic of this process of individuation, and because its vast margin of indetermination allows it to be grafted onto a variety of human processes of individuation taking place through the digital, that the modulation of control takes place. From this point of view, the dividual seems then to individuate, at least partially, as a living being, suggesting that the technical umwelt conditioning the mechanisation of the living and the converse vivification of machines we have seen marvelling the Greeks might be shifting into a becoming-algorithmic of human life, constituted by the emergence of the artisanal cyborg, and a becoming-alive of digital technologies, whose initial sign is the hybrid individuation of a digital objectile. In the next chapter, I will focus more directly on this second operation, and look at the simplest instantiation of the process of becoming-alive of digital technologies, considering the digital transmutation underwent by viruses as beings on the verge of the realm of life.

Chapter 6: The Becoming-Alive of Digital Technologies

As we have seen, Deleuze and Guattari describe the world as being composed of three different strata: a physicochemical, an organic and an anthropomorphic one. My stratoanalysis of the digital aims at signalling the emergence of a new stratum and at placing it within this map, updating its configuration to show how the digital stratum works as a pattern of emergence and how it interacts with the other three. Since strata are not static platforms piled one on top of the other and their distribution within complex actual entities resembles more that of different levels of granularity: 'The strata are extremely mobile. One stratum is always capable of serving as the substratum of another, or of colliding with another, independently of any evolutionary order' (Deleuze & Guattari 1987 [1980]: 502). The points of contact between colliding strata are always double-sided and the effects of the interaction can be registered within both patterns of emergence: One never deterritorializes alone; there are always at least two terms, hand-use object, mouth-breast, face-landscape. And each of the two terms reterritorializes on the other. (Deleuze & Guattari 1987 [1980]: 174). Like Chapter 5, this section looks at the collision between the digital and the organic strata. As the becoming-wasp of the orchid is complemented by a becoming-orchid of the wasp, the involutionary relation between life and technics produces a transformation complementary to the 'becoming-algorithmic' of human beings I have described above: a 'becoming-alive of digital technologies' whose signs we have started to see in the hybrid character of the individuation of the dividual.

In this section, I will focus on a more evident instantiation of this process by looking at an existing life form whose most characteristic traits are replicated by digital technologies, and consider how its behavioural pattern gets reinvented by its digital transmutation. First, then, I will look at the connection between biological and digital viruses, and then I will look at how the stratum itself adopts a form of abstract virality to propagate suggestions (its forms of expression) as a virtual contagion. To effectively describe this facet of the relation between life and the digital, however, I will have to adopt a slightly different approach. So far, in fact, I have defined life in terms of the self-organising power of matter. In doing so, I have not considered more traditional definitions of life because, studying exclusively objects based on carbon-chain chemistry and being an analytical rather than synthetic discipline, biology would not have provided satisfactory insights in the hybrid character of exorganismic life (Boden 1996: 39-40). However, studying differences and correspondences between life forms and their digital counterparts requires the support of a list of behaviours characterising life as it emerges from the organic stratum.

Defining life

Arguably, the first philosopher to define life through a list of typical functions is Aristotle (Matthews 1995), who, in his *De Anima* proposed a list of *dunameis tēs psuchēs*, the psychic powers or powers of the soul. In this section, I will describe these features and confront them with the list of characteristics contemporary biology seems to agree upon.

Although varying in the text, the functions identified by Aristotle are 'self-nutrition, growth, decay, reproduction, appetite, sensation or perception, self-motion, [and] thinking' (185). According to the philosopher, though, 'should even one of these belong to something, we say that it is alive. (Aristotle 2016: 413a20-25). While most living beings share some of these characteristics, then, not every species possess them all: sessile organisms like sponges or corals are not capable of self-locomotion, while the jellyfish *Turritopsis dohrnii* can return to its polyp state, reversing its biotic cycle instead of dying of old age (Piraino et al. 1996). Perhaps even more interestingly, some of these characteristics are shared by both organic and inorganic entities. In her *Unthought*, for example, Katherine Hayles decouples the notions of thought and cognition on the basis of the neuroscientific discovery of cognitive processes inaccessible to consciousness (Hayles 2017: 10) and highlights how cognitive functions distribute throughout mixed systems like those formed by spiders and their webs or those constituted human-technical assemblages (115-116), and extend to self-piloting electronic systems like self-driving cars, drones and trading algorithms (120). '[T]echnical devices cognize, and in doing so profoundly influence human complex systems' (5); yet, arguing that a self-driving car is alive sounds absurd. The character of the life-functions identified by Aristotle might therefore require some more attention before being used as a compass in the search for digital life.

In his commentary on the text, Gareth Matthews suggests that, since for Aristotle something has to possess just one life-function to be categorised as alive, all the items of *De Anima*'s list must share a common trait. The easiest way to find such a feature consists in 'nesting' Aristotle's life-functions: 'The idea is that everything with power p_3 has p_2 (though not the other way around), and everything with p_2 has p_1 (though not the other way around)' (Matthews 1995: 188). In other words, while not all life-functions are necessary, the presence of some of them might presuppose others. For Aristotle, in fact, the power of self-nutrition 'can be separated from the others, but among mortal beings the others cannot be separated from this […] Being alive, then, belongs to living things because of this principle' (Aristotle 2016: 413a31–b1). That is, anything that possesses a life-function is then also capable of self-nutrition. In addition, the philosopher stresses that everything that is living strives towards reproduction (415a27–b2), even though this function can be nested into self-nutrition like the others, and despite the fact that some living beings cannot reproduce either because they are sterile, too old or young. This idea introduces a key distinction between two complementary levels, the one of individuals and that of kinds or species, so that, from the point of view of lineages, the capacity to reproduce becomes as necessary as the power of self-nutrition is for individuals.

The fundamental signs of life, nutrition and reproduction (415a22-25), are then both necessary, but within two different registers: that of individual preservation and that of the preservation of a form of life (Matthews 1995: 191). Yet, the fact that reproduction is not constantly exercised also in the individuals that are capable of it, points at a crucial element of Aristotle's argument, that will soon reveal its full importance for our discussion: indeed, the philosopher describes life-functions as *powers* or capacities. As such, the distinctive behaviours of life are not necessarily exerted with continuity: as I will show more in detail, living beings do not reproduce or nourish themselves continuously, but rather *intermittently*. Focussing on these two functions and their contemporary understanding will help to shed light on this important aspect.

Determining the functions necessary to life has more recently been the object of a 2008 interdisciplinary conference held in Paris under the title 'Defining Life'. The resulting conference proceedings (Gayon et al. 2010) offer a broad take on the great variety of traits and definitions that different disciplines are proposing to identify something as living. In the attempt to find 'which terms in the definitions are the most frequent and, thus, perhaps, reflecting on the most important points shared by many' (Trifonov 2012: 259), Edward Trifonov has confronted the vocabulary utilized in more than a hundred formulas. Adopting an approach similar to by Matthews's, Trifonov has then clustered the terms that, within these definitions of life, share a common principle and has concluded that 'self-reproduction (replication) appears to be the most inclusive term […] That is, if self-reproduction is going on, it can proceed only on condition that metabolism, […] energy and material supply are also in place' (261). Since reproduction can be exercised or not, the nearest necessary function for living individuals remains metabolic activity. So far, we seem to be not too distant from Aristotle's essential list of life-functions: reproduction and self-nutrition. However, scientists describe the function of self-nutrition in terms of metabolic activity, while the function of reproduction, assumes a more detailed description in the light of Darwin's work: 'the tandem self-reproduction with variation should be considered as one indivisible term of very clear Darwinian meaning […] "every system capable of replication and mutation is alive"' (262).

Unfortunately, this use of the term 'Darwininan' is neither clear, nor does necessarily help to restrict our field of inquiry in the quest for digital life. Darwin's original conception was limited to the idea that living individuals descend with modification from common ancestors and that variations are selected by their exposition to the environment. The father of evolutionary theory did not specify the mechanisms of variation, for which one must wait until the 20th century rediscovery of Mendelian particulate inheritance and the development of molecular and population genetics (Gould 2002: 67-68;409; 418-419). Nor did Darwin detail the workings of what he called natural selection. The English naturalist ignored dynamics like those of endosymbiosis, genetic drift and horizontal gene transfer, today explaining variation through an updated conceptual framework projecting the evolutionary synthesis of Darwinian evolution and Mendelian genetics (MS) within a wider web of causal relations (Extended Evolutionary Synthesis) (Laland et al. 2015: 2). This framework acknowledges the relation of reciprocal causation between organisms and their environments, and proposes a series of models for a more inclusive theory of inheritance according to which, for instance, 'post-fertilization resources (e.g. hormones), behavioural interactions between parents and offspring (e.g. maternal care), parental modification of other components of the biotic and abiotic environment (e.g. host choice) and inheritance of symbionts directly through the mother's germ cells or by infection' (4) contribute to morphogenesis. Moreover, Darwin ascribed the agents of selection to 'natural' conditions and limited the scope of 'artificial' selection to selective breeding (Darwin 2008 [1859] xix; 148). In truth, the two factors influence each other extensively, and their difference must be reduced to a matter of rhythms: as highlighted by Daniel Dennett, 'Environmental changes due to cultural innovations change the landscape of phenotypic expression so much, and so fast, [...] that they can in principle change the genetic selection pressures rapidly' (Dennett 1996: 338).

Using 'Darwinism' as a proxy for selection, then, does not help us narrowing our field of research. As noticed already by Leroi-Gourhan with the relation between technical tendencies and peculiar concretisations, environmental pressure applies also to cultural behaviours, techniques and artifacts, and the products of culture are subject to 'natural' selection just as organisms are object of 'artificial' selection, broadly understood as a consequence of human niche construction, that contributes to alter selective pressure over life forms within and across the epigenetic, physiological and ecological registers (Laland et al. 2015: 2). In addition, evolution models the *effects* of self-reproduction, and these effects can be registered only considering individuals related by filiation. Darwinian evolution makes sense only for a lineage and in terms of populations, it 'does not refer to the evolution of an entity, but to the evolution of the form of that entity' (Ma 2016: 2). Ignoring this detail risks conflating series with individuals. To avoid this problem, Wentao Ma proposes the useful distinction between a *life form*, that is capable of Darwinian evolution, and a *living entity*, a self-sustaining organism that '*might* engage in Darwinian evolution' (3), a distinction that re-introduces the necessity of thinking reproduction as a power.

Consistently vague with regards to this distinction, the definition provided by NASA in 1994 proposes that 'life is a self-sustaining chemical system capable of Darwinian evolution' (Joyce 1994). Still informing NASA's Life Detection program, this characterisation is marked by an important shift from self-nutrition to self-sustainment. While a life form is a series composed by living entities in a relation of filiation, a living entity is a system capable of self-sustainment by exchanging energy with its environment, and might or might not reproduce. As I have stressed above, these characteristics have to be considered as *powers*, that is, as functions that are not necessarily exerted at all times. As organisms don't reproduce constantly, we should verify if, and in which sense, it is possible for an organism to self-sustain without exchanging materials with its environment, and whether, in that case, it could still be said to be at least potentially alive. In other words: is it possible to say that something is alive if it doesn't exchange energy with its environment through some sort of metabolic process? So, for example, are seeds alive? And in what sense? In what does this self-sustainment ultimately consist? These questions set us up for an investigation of the limits of all these definitions of life, and it is at the borders of life itself that we will find some indications regarding the becoming-alive of digital technologies.

The intermittence of life

According to David Keilin, who coined the term, cryptobiosis could be described as

> the state of an organism when its metabolic activity is at its lowest ebb, sometimes reaching a hardly measurable value, and in some cases actually coming to a standstill, the physiological and biochemical processes being reversibly arrested for different periods of time. (Keilin 1959: 150)

This state can be the result of three conditions or their combination: the lack of oxygen, of water, or an exposition to very low temperatures (Clegg 2001: 613). In its different forms, this phenomenon has been observed in a variety of living beings such as tardigrades, plant seeds, roundworms and rotifers. There is, of course, some dissent around the attribution of the living status to organisms found in this state. For example, some believe that an organism cannot survive the total lack of water and that cannot therefore be said to 'resurrect' after the cessation of basic biological processes caused by desiccation, while others think that it is actually possible, and call this phenomenon anhydrobiosis. As James Clegg points out though, although anhydrobionts can be found in a state in which they don't display any sign of metabolism, since such a state has been observed to be reversible, they are not 'dead' either, because 'suitable rehydration produces an obviously living organism' (615). This is possible because anhydrobionts can survive in their ametabolic state by producing disaccharides that 'protect macromolecules and membranes against the destructive effects of water removal by replacing the primary water of hydration and through the formation of amorphous glasses (vitrification)' (616).

Living beings in the cryptobiotic state of anhydrobiosis vitrify their cells through processes that 'protect structure but prevent function' (620), and are therefore still capable of 'self-sustainment' for an indefinite period of time without exchanging materials with their environment. As put by Clegg then, 'we may conclude that there are three states of biological organization: alive; dead; and cryptobiotic' (615). As paradoxical as it could seem, cryptobiosis proves that both the essential life-functions I have defined above are not necessarily exerted with continuity: and metabolic processes too can be, at least in some cases, indefinitely put on hold. The fact that life, defined through these functions can be suspended opens the space to conceive a sort of 'intermittence of life'. Intermittence is the status of what is coming and going, of what is, but in a discontinuous manner. The intermittent is what can be, and indeed sometimes is, but not continuously: a property or a process that does not actualise 'once and for all' and that, when it is not actual, exists as a possibility inscribed in a virtual field of affordances.

Cryptobiosis is an extreme case of dormancy, a suspension of the normal foraging activity of animals that in mammals can take place over winter (hibernation) and in other animals, like insects, fish and amphibians, can take place in summer, when temperatures rise to possibly harmful levels for the organism (aestivation). In *Darwin's Dangerous Idea*, Daniel Dennett reflects upon the intermittence of life by considering the evolutionary function of sleep. Overturning the impression of sleep being maladaptive because it exposes unreactive organisms to predation, the philosopher stresses how plants live their lives in a vegetative state. While animals must hunt for food, i.e., waste energy to retrieve energy, plants carry on the same metabolic functions, processing energy to grow and reproduce, in an arguably more efficient way: As Dennett suggests then, 'It is *being awake* than needs an explanation […] Animals – unlike plants – need to be awake at least part of the time in order to search for food and procreate […] being awake is relatively costly, compared with lying dormant' (Dennett 1996: 339). Since animals must hunt in order to survive, but they are not constantly hunting, Dennett's comparison calls for a closer consideration of Aristotle's classification of living beings in relation to the intermittent character of their life-functions.

The idea of intermittence enters the philosophy of Bernard Stiegler through his reading of Aristotle's *De Anima* and a reflection on the relation that the Greek philosopher draws between the nutritive, the sensitive and the noetic souls. 'Nesting' the life-functions he identified, in Books II and III Aristotle classifies them from the most common to the least diffused among living species, arguing that plants possess only nutritive and reproductive capacities (the essential properties of a vegetative soul), while animals also possess the faculty of sensation (sensitive soul) and humans possess all of the above plus the capacity to think (noetic soul). In *Passer à l'acte*, Stiegler expounds the relation between this classification and the Aristotelian description of life-functions as powers:

> [the soul of animals] is sensory through acting only when it reproduces itself. The rest of the time, it remains in the inferior mode of the vegetative soul, which Aristotle also calls nutritive. The same applies to the intellective or noetic soul: it is only rarely in action and remains most of the time in the sensory mode. (Stiegler 2009 [2003]: 13)

This idea allows Stiegler to depict both his life-changing experience with incarceration and his philosophical activity through the figure of the flying fish that will become the symbol of his school, *phamakon.fr*. The image assumes for him a double role, at the same time existential and philosophical: on one side, it describes the condition of incarceration – 'in my cell, where I was *like a fish out of water'* (14) –, in itself a disciplinary administration of intermittence, an interruption of relations and a suspension of activity, both temporal and spatial; on the other, it describes Stiegler's philosophical activity: 'From then on, philosophy consisted of considering the milieu while being able to extract oneself from it, in the same way as a flying fish can leave the water: only intermittently' (14). From *Passer à l'acte* onwards, the notion of intermittence will appear in many of Stieglers' other works but lack a dedicated and in-depth treatment, a sketch of which is proposed only in the first volume of *Mécréance et Discrédit* (2011a [2004]). Here, the philosopher tackles again Aristotle's *De Anima* and considers the faculty of reason, *νους*, in its relation to sensibility, *αἴσθησις*. The idea emphasized is that, when an organism possesses the faculties that characterise two or more souls, as it is the case of animals and humans, the most common of them relates to the least diffused as a power relates to an activity.

In animals, for instance, the vegetative faculty 'underlines' the sensitive one as the baseline activity necessary for its exercise. The latter, however, is exercised only episodically, the rest of the time leaving animals in a state close to the vegetative one. The same applies to the power of noesis. As stressed by Stiegler, in fact,

> the noetic soul is not always in action: its mode of being ordinary is to be simply sensitive, which means that it remains in the stage of inert power, of its powerless power. It is only intermittently that it passes to the sensational stage of the noetic, which is also its extraordinary stage. (2011a [2004]134)

While plants exercise exclusively their vegetative faculty (Aristotle 2016: 410b20-25), this is also present in animals, which exercise intermittently their sensory capacities. Humans, by contrast, exercise intermittently their noetic faculty, living their lives in a sensitive modality similar to those typical to animals for the rest of the time.

Building on this idea, Stiegler (2013) adopts the Deleuzian definition of *bêtise* to indicate the 'specifically human form of bestiality' (Deleuze 1994 [1968]: 150), that 'beastly or stupid tendency that was already thought in Aristotle as the regression of the intellective-sensational soul to the sensitive stage', and [that] 'contemporary industrial entropy' is designed to exploit (Stiegler 2011a [2004]: 134). This exploitation of regression is possible because, as sensibility in act, the noetic faculty finds its expression in logos: 'All sensibility in act becomes, for a noetic soul, the support of an expression. This expression (discernment, krinein, judgement, making-a-difference) is a logos – word or gesture: narration, poem, music, engraving, representation in all its forms, but also savoir-faire and savoir-vivre in general' (113). Stressing that the technical milieu mediates the passage to the act of the noetic faculty, that is, its actualisation or exercise, Stiegler highlights its function with regards to the intermittence of noesis. 'Education, attention-formation, culture and civilization all amount to systems and apparatuses whose aim is to struggle against this regression' (Stiegler 2019 [2016]: 226). As pharmaka, however, these systems and apparatuses can be wielded to condition behaviours and cause that regression towards bestiality that Stiegler critiques as artificial stupidity (2018a) and traces back to the weaponization of the technologies of thought characteristic of hyperindustrial capitalism.

This is the inescapable condition that comes with the curse of Prometheus: his liver being devoured during the day only to grow back during the night, an intermittence resonating with that of noetic souls, that 'always oscillate […] between progression (rise) and regression (relapse). In the language of Canguilhem, we must speak of noetic souls oscillating thus between two poles of illness and care and constituting what Simondon calls an indefinite dyad' (2018b: 8)[5]. It is in the first volume of *Qu'-appelle-t-on panser?* that Stiegler arrives then to describe the pharmakon as itself intermittently poison and cure and to speak of intermittences in a pharmacological sense (156-7), that is, of positive and negative intermittences with reference, on one side, to the technically induced regression and the electro-pharmaceutical abolition of intermittence also described by Jonathan Crary (2016: 55-59), and on the other, the necessity to counteract such drifts in the therapeutic attempt to recast those 'horizons of projections that prepare for bifurcations, that is to say, for possibilities and impossibilities of the future – in other words, promises' (Stiegler 2018b: 157).

The intermittence of life-functions discloses a constant regressive drift against which noetic, animal and plant life struggle in different ways. This idea is compatible with Erwin Schrödinger's

[5] All translation from this source are mine.

definition of life as orderliness: ‘Life seems to be orderly and lawful behaviour of matter, not based exclusively on its tendency to go over from order to disorder, but based on existing order that is kept up’ (Schrödinger 1992: 68). A complex pattern of matter and energy is then alive if this ‘does something’ to preserve its orderliness: all patters are kernels of order, and a rock is a pattern of matter and energy as well, but it resists entropy, the measure of the tendentially increasing disorder in a system, only thanks to its internal configuration. Schrödinger maintained that living beings have instead to actively fight against entropy: ‘How does the living organism avoid decay? The obvious answer is: By eating, drinking, breathing and (in the case of plants) assimilating. The technical term is metabolism. The Greek word (*μεταβάλλω*) means change or exchange’ (70). According to Schrödinger in fact, a living being cannot defeat death but

> only keep aloof from it […] by continually drawing from its environment negative entropy [...] What an organism feeds upon is negative entropy. Or, to put it less paradoxically, the essential thing in metabolism is that the organism succeeds in freeing itself from all the entropy it cannot help producing while alive. (71)

Life can consequently be understood as a set of behaviours aimed at a more or less dynamic struggle against entropy. If life is a form of order that tends to preserve itself by actively drawing and processing energy from its environment, instances of suspension of such activities like cryptobiosis, which minimise and slow down metabolic processing even without suspending it entirely, can still be instrumental to the preservation of organisms in adverse environmental conditions. Indeed, the exercise of the faculties through which entropy, in any of its forms, is staved off, cannot but be intermittent.

With the description of cryptobiosis as one of the manifestations of the ‘intermittence of life’ that we find on the organic stratum, we have obtained the last specification we needed to find a guideline in our search for digital life. While a form of life is an organisational pattern displayed by series of living entities in a relation of filiation, each of which is characterised by the possibility of replication with variation, a living entity is a complex pattern of matter and energy that self-sustains by performing some sort of metabolic process, i.e., the transformation and utilization of energy captured from its environment, or by entering cryptobiotic states. Understood in light of intermittence, viruses offer an interesting declination of the active fight life puts up to stave off entropy at the level of individuals and series or life forms. In the next section I will consider their characteristics and confront them with those of computer viruses, their digital counterpart.

General virality

Viruses are among the most abundant biological entities on the planet and are virtually present in every ecosystem (Edwards & Rohwer 2005; Lawrence et al. 2009). Defined by molecular biology only in the 1950s, however, viruses are intracellular obliged parasites, depending on and exploiting their host's metabolism to replicate: for this reason, they are generally considered as non-living and depicted as rogue genetic material. A complete virus particle consists only in a string of DNA (or RNA) protected by a protein coat (capsid). This state (virion) allows them to be transported from cell to cell, attach to their surfaces and penetrate their cytoplasm. The 'vector stage' ends when the virus injects its nucleic acid in a host cell and sheds its protein shell: 'Following the uncoating, the naked viral genome is utilized for gene expression and viral genome replication. Finally, when the viral proteins and viral genomes are accumulated, they are assembled to form a progeny virion particle and then released extracellularly' (Ryu 2017: 31).

Not being composed by cells, viruses do not fall within any of the three domains of life (Archaea, Bacteria, and Eucarya) currently defining the taxonomy of life on the basis of cell types (Woese et al. 1990). The hypothesis that viruses could have evolved from more traditional cellular organisms and consequently represent a fourth domain of life (Colson et al. 2012), has been recently contested by the discovery that a type of 'giant virus', Klosneuviruses, 'did not evolve from a cellular ancestor but rather are derived from a much smaller virus through extensive gain of host genes' (Schulz et al. 2017). Yet, the discovery that viruses are capable of evolution through horizontal gene transfer allows us to say that, since they evolve (Trifonov 2012: 649-650), viruses can be considered at least as a *life form*. This idea would add an important nuance to the depiction of viruses as 'organisms at the edge of life' proposed by Rybicki (1990):

> Do viruses belong to life? This is a classic question reflecting our blurry concept concerning life. Obviously, a virus is not a self-sustaining chemical system – e.g., no metabolism when outside a host cell; however, when you say it is not life, you may look back and feel that it is indeed something quite different from the non-life background. Here we can make it clearer: the "form" of a virus is capable of Darwinian evolution, thus being a life form; a virus itself, as an individual, does not constitute a living entity (Ma 2016: 2).

Putting aside our concerns with defining life forms exclusively in relation to Darwinian evolution, we can now add a revision to Ma's classification of viruses: from the point of view of individuals, in fact, viruses can be understood as 'intermittent' living entities. First, though, Ma's notion of 'self-sustainment' must be understood as the act of resisting entropy, and this does not necessarily involve metabolism: the vitrification of the cells that protects cryptobionts, or their total absence, can do just as well. Second, considering what we have seen with cryptobiosis, it is indeed possible that a living individual does not present any form of metabolic activity for part of its life cycle: 'Since viruses can survive for a very long time in the environment as a viral particle, especially when it is provided with a protein mantle, a virus can do without a cell for a very long time […] These are the so-called latent and persisting viruses' (Goudsmit 2004: 156). Cryptobionts reactivate their metabolism only when the right environmental conditions present themselves. For viruses, the right conditions to trigger metabolic activities is to infect a cell: sure, they do not possess the structure to metabolize, but 'life is a kind of behaviour, not a kind of stuff' (Boden 1996: 53), and they can exploit the structure of other cells to replicate, that is, preserve their existence as a form of life.

Viruses are then among the most extremes example of the intermittence of life within the organic stratum. In addition, if one turns to the digital sphere, they can also be considered as the first life form involved in that process of becoming-alive of computational technologies we are searching for. Analysing computer viruses to consider what they have in common with their biological counterpart, and assessing what changes of their biological expression once this specific form of life enters the digital stratum risks, reducing them to 'the same fixed terms conjured up in the metaphor in itself and does not provide any novel information concerning the intensive capacities of, for example, a specific class of software program' (Parikka & Sampson 2009: 4). As noted by media theorist Jussi Parikka, the presence of such an infectious and self-replicating rogue computer programs in cyberspace shows how 'virality proved to be a key organizational logic of the rising network culture' (Parikka 2007: 74). As I will show, this becoming-alive of digital technologies must be understood as a prelude to a more important fact, i.e. that 'media does not merely represent viral outbreaks but engages in a more complex tracking that uses a similar logic of contagion. The media as a contagious mechanism of exposure is also viral to a large extent, and the pace of media is telling in this regard' (81). After having considered the characteristics of digital viruses then, I will move to analyse the cross-strata dynamic of contagion or general virality, which is an abstract diagram that the organic stratum shares with the digital one, and that the latter adopts to support the affective propagation of its forms of expression.

Computer viruses originally appeared in sci-fi literature. The most iconic of them is probably *When HARLIE Was One*, by David Gerrold (1972), in which the author uses the word 'virus' to describe a self-replicating piece of software that infects other programs. The first scientific definitions of computer virus came only more than a decade later, and the most widely accepted of these has been provided in 1986 by Fred Cohen: 'viruses are programs that may attach themselves to other programs and cause them to become viruses as well' (Cohen 1986: 5). As 'segment[s] of machine code (typically 200-4000 bytes)' (Spafford 1995: 250), series of zeros and ones, computer viruses can be considered as material patterns: 'temporary set[s] of electrical and magnetic field changes in the memory or storage of computer systems' (260). When these patterns interact with their environment, i.e., when they are interpreted by the host machine, they reproduce themselves and deliver a payload. Computer viruses do then essentially three things: they infect a host machine (execution), they 'deliver their payload' (manipulation), and they spread (replication).

Artificial Life researchers Doyne Farmer and Aletta Belin (1991) and computer scientist and security expert Eugene H. Spafford (1990; 1995), have considered if these features are enough to define computer viruses as a form of Artificial Life. While the more known field of Artificial Intelligence studies the possibility and the models through which intelligent behaviours can emerge from computation then, Artificial Life focuses on the emergence of behaviours more generally associated with living organisms, producing simple artificial entities that share behavioural traits with them, and studying the way in which the interaction between these digital entities generates complexity.

Maintaining that digital viruses are 'one of many possible artificial life forms, selected for discussion because they have already emerged' (Farmer & Belin 1991: 821), Farmer and Belin propose their own list of life-functions and confront it with the behaviour of computer viruses. These properties are: self-reproduction, metabolism, functional interaction with the environment, stability under perturbations, insensitivity to small changes and the ability to evolve (818). As we have done above, we will focus on the first two of these properties, in which the following can easily be nested.

Regarding metabolism, Farmer and Belin highlight that 'The computer virus can direct the conversion of electrical energy into heat to change the composition of a material medium – it uses energy to preserve its form and to respond to stimuli from other parts of the computer (its environment)' (820). Cohen's definition of computer viruses mentions in fact a fundamental trait of computer viruses: they infect *programs*, not mere data. The difference between data stored onto a support and programs is that the first are sort of inert, while the second are executed. Execution, in computer language, is defined as the act of performing a set of instructions, that is, as the activation of a transformational pathway. When they are not executed, but just stored on a support like a floppy disk or an email not yet opened, we can say that computer viruses are in the digital equivalent of a cryptobiotic state. When exposed instead to a program that executes them, viruses can activate: as in the case of their biological counterparts, they need to parasite the transformative pathways of their hosts and exploit the energy flowing through them to replicate and deliver their payload. In other words, they 'make use of the electrical energy present in the computer to traverse their patterns of instructions and infect other programs' (Spafford 1990: 18).

The capacity to produce copies of themselves to infect other machines is one of computer viruses most evident characteristics. The fact that the agent of reproduction is not the virus itself, but its host, the computer, does not mean that viruses are not able to 'self-replicate': many are in fact the examples of reproductive processes that involve a medium of some sort, be it biotic or abiotic, like in the case of pollination, that can be carried out by insects, or necessitate the action of natural elements like wind or water, not to speak of artificial insemination and IVF. To this idea, Spafford adds that viruses are capable not only of reproducing themselves in exact copies, but also of producing and spreading an 'altered version of themselves' (18). One of the reasons why this is possible is because of polymorphic code. In his cultural history of computer viruses, Jussi Parikka describes this feature in the following terms:

> Polymorphus viruses were, in a way, intelligent viruses: they changed their appearance each time they infected a new object. Virus-specific scanners were able to identify programs by unique viral signatures, a form of digital fingerprint. Polymorph viruses were, however, shape shifters that encrypted the virus body differently with each injection. (Parikka 2007: 92)

Implemented as a defence mechanism against antiviruses, a polymorphic code causes random variations in the copies produced every time viruses infect a new host (Bontchev 1997: 134). While this feature signals the capacity to engage in reproduction with variation, Parikka highlights a problem with the interpretation of such properties as a signal of the evolutionary potential of computer viruses, reporting that,

> Although viruses had gained some degree of autonomy in environments that were not explicitly designed to foster them, thus showing capabilities of adaptation and emergen[t] behaviour […] Their evolutionary patterns had remained short and, in many ways, viruses continued to be very determined by the program code originally inserted into them, thus also being dependent on the programmers (Parikka 2007: 211-212).

This issue is related to the fact that polymorphic viruses do not change their basic code, 'The code remains essentially the same, but the *expression* is different, so that the same program is represented by a different sequence of bytes' (Harley et al. 2001: 10). This critical take with regards to the evolution of computer viruses recalls the position adopted by David Ackley in the ALife conference of 2000. As reported by John Johnston in *The Allure of Machinic Life*, Ackley draws a genetic comparison between source code and DNA and 'understands computer source code as genome, the software build process as embryological development, and the resulting executable binary as phenotype' (Johnston 2008: 268). If one accepts this overtly metaphorical position, which reduces again life to a kind of structure rather than a behaviour, polymorphism wouldn't lead to the digital equivalent of genetic variation but would merely alter the phenotype of computer viruses. In the case of biological viruses, phenotypical mutations 'can produce viruses with new antigenic determinants [and] Antigenically altered viruses may be able to cause disease in previously resistant or immune hosts' (Fleischmann 1996), hence simply expanding the infectivity of a given virus. *Mutatis mutandis*, the implementation of polymorphic code aims precisely at this expansion. However reasonable this argument may sound in rejecting the evolutionary capacity of computer viruses, though, Parikka highlights that the studies of computer viruses as forms of Artificial Life have always been limited by a neo-Darwinian understanding of evolution (Parikka 2007: 211), with its accent on competition and on the individuality of the units of evolution. Yet, there is another way to look at this issue and try to understand if digital viruses have some evolutionary potential: one can consider the stage and modality of evolution of computer viruses.

One can indeed take into account not only the evolution of a single lineage or even 'species' of virus, but that of their whole 'domain', that is, of viruses as technical objects. In other words, following Leroi-Gourhan's line of thought, viruses might be understood as evolving through the development of the technical tendency they express as particular concretisations of autonomously replicating pieces of code (Parikka 2007: 298-300; Johnston 2008: 22-48). The problem signalled by Parikka with classifying computer viruses as evolutionary forms of (artificial) life has to do with the impossibility, in computation, of random variation resulting from errors in the copy and the limited, phenotypical, type of variation provided by polymorphic code. Aware of this set of problems, Farmer and Belin invite to think about the evolution of culture and cultural objects in different terms, that is, as a Lamarckian rather than a Darwinian process (Farmer & Belin 1991: 20). While Darwinism acknowledges the random character of genetic variations and recognises the role of environmental forces in the selection of the most advantageous among such variations, consequently the most likely to be transmitted, Lamarckism draws a more direct relation between changing environmental conditions and the evolution of traits that are better adapted to them. In other words, for the theory of acquired inheritance generally referred to as Lamarckism, organisms sense the alteration in their environment, change themselves (for instance by developing thicker fur or a longer neck) and pass these traits to their offspring through their genes. While then, in the case of Darwinian evolution, variation takes place *through* the process of reproduction, according to this theory, it emerges within the lifespan of an individual, *before* reproduction. With the words of Steven Jay Gould, then 'Lamarckism holds that genetic variation originates *preferentially* [rather than randomly] in adaptive directions' (Gould 1980: 79). On this basis, Gould continues on maintaining that cultural (and technological) development proceeds as a form of Lamarckian evolution: 'Acquired characters are inherited in technology and culture. Lamarckian evolution is rapid and accumulative. It explains the cardinal difference between our past, purely biological mode of change, and our current, maddening acceleration toward something new and liberating – or toward the abyss' (83-4). Applying this idea to the case of computer viruses, Farmer and Belin understand the evolution of artificial life forms according through the same principle:

> With artificial life there is the potential for the control of the genome to be placed in the products of our technology, thus creating self-modifying, autonomous tools. As artificial life forms achieve higher levels of intelligence the ability to modify their own genomes will become increasingly more feasible. Assuming that artificial life forms become dominant in the far future, this transition to Lamarckian evolution of hardware will enact another major change in the global rate of evolution, comparable to the enormous acceleration that occurred with the advent of culture. The distinction between artificial and natural will disappear. (Farmer & Belin 1991: 835)

As we have seen above, for Simondon, technical tendencies run towards the implementation of an ever-increasing margin of indeterminacy. If, as technical objects, viruses actually evolve following a Lamarckian logic, that is, by implementing modifications not solely *selected by* a milieu, but also *in light of* an environment understood as a horizon of problems, the question of their evolutionary potential becomes related to their degree of indeterminacy. When it comes to software, the research and development in the field of Artificial Intelligence represents the forefront of this tendency, for it strives towards the realisation of machines that will be able to perceive their environment (be sensitive to a vast array of types of inputs) (Russell & Norvig 2010 [1995]: 34; 1005 – 1006), take action on the basis of those perceptions (chose between a vast array of possible conducts) (Albus 1991: 474) to carry on their goals (a vast array of possible tasks or states to be achieved) (Goertzel & Pennachin 2007: 73-74) and learn from their behaviours (systematising a vast array of data to analyse in a variety of possible ways) (Schank 1991: 40).

By taking polymorphism into consideration as a capacity for reproduction with variation, we could then assume that viruses are simply not smart enough yet, and that the meshing of polymorphism and sufficiently developed AI will unleash their evolutionary potential. In 2008, American computer scientist Steven Omohundro has identified the technical tendencies that AI could end up expressing with problematic results. Among these is the self-improvement representing the next stage of the evolution of deliberative systems. The latter, are those systems that select their curse of action evaluating their possible consequences against their goals. Self-improving systems, instead, 'make changes to themselves by deliberating about the effects of self-modifications' (Omohundro 2008: 5). The examples Omohundro provides are those of DeepBlue, the IBM chess-playing computer that notoriously won against world champion Garry Kasparov in 1996 and of a hypothetic self-improving chess machine. DeepBlue operated by brute-forcing its way towards the winning move:

chess is a game with a limited number of pieces, and each of them moves only in a specific way, thing which limits the number of ways the board can look after each turn. Being able to predict how the game might unfold generally leads to victory, and the capacities for calculation of DeepBlue allowed it to hold such an advantage against Kasparov. The other case, for which, at the time of writing, Omohundro did not yet have a concrete example, is best exemplified by the artificial intelligence deployed to play another board game, the Chinese Gō, in which the pieces don't move on the board but must be placed on it turn after turn and occupy one of its 361 possible positions. The difference between the two games is astounding: Chess is played on a 8x8 board, each game lasts an average of 80 moves and the total number of possible moves in a game is 10^{123}; Gō, instead, is played on a 19x19 board. Every game is around 150 moves long, with 250 moves possible on average at every turn, and a total number of possible moves of 10^{360}. There is no way one can brute force one's way to winning a Gō game, 'Given this virtually illimitable complexity, go is, much more than chess, about recognizing patterns that arise when clutches of stones surround empty spaces' (Koch 2016). Yet, in 2016, AlphaGo, an artificial intelligence software developed by a company later acquired by Google, became the first computer program to beat a Gō master. Years before, Omohundro explained how this has been possible:

> Initially, the rules […] and the goal of becoming a good player would be supplied to the system in a formal language such as first order predicate logic. Using simple theorem proving, the system would try to achieve the specified goal by simulating games and studying them for regularities […] As its knowledge grew, it would begin doing "meta-search", looking for theorems to prove about the game and discovering useful concepts […] Using this new knowledge it would redesign its position representation and its strategy for learning from the game simulations. It would develop abstractions similar to those of human grandmasters and reach superhuman performance (Omohundro 2008: 4)

As later acknowledged by the American computer scientist, AlphaGo succeeded in its task (Omohundro & Mirghafori 2018), precisely through this model. In its more recent variants, the same artificial intelligence developed by Google's DeepMind has already been put to work in other contexts, which are arguably even more complex than a Gō game (Simonite 2017; 2019). One can ask what prevents this kind of software from engaging with the development of computer viruses. Indeed, software researchers have highlighted the creation, already in the early 1990s of 'virus kits' and 'polymorphic engines'. The first are non-viral programmes that automatise the generation of potentially always different viruses, while a polymorphic engine 'is not a virus as such, but code that can be added to *any* virus in order to make it polymorphic [i.e.] re-form the viral code on each new infestation' (Harley et al 2001: 130-131). The possibility that the development of advanced artificial intelligence could, in the future, converge with software of this type and bring about viral code with the capacity to go undetected and, replication after replication, actually evolve as a digital life form thus seems already likely.

Conceiving computer viruses as technical objects and their evolution in terms of technical tendency broadens our perspective on the specific type of life pertaining to digital technologies. Adopting an even broader perspective on virality and its digital implementation will allow us to close the circle between the processes of becoming-algorithmic of human life and becoming alive of digital technologies, and to show how virality can be understood as a behavioural pattern not only replicated within the digital sphere after its biological instantiation, but a wider, cross-strata trait involving patterns replicated across the psychosphere as well, that is, in the domain of human consciousness. As highlighted by Parikka, indeed, 'viruses and worms are perhaps not anomalous objects of digital dirt; they reveal characteristics of a specific digital ecology and actually can provide an essential viewpoint on our network culture' (Parikka 2007: 215). In the next section, I will show how the digital stratum appropriates virality well beyond computer viruses, and adopts it to spread its forms of expression, that is, the suggestions structuring its homeomorphic interfaces.

Virtual contagion

In his 2012 book, *Virality*, Tony Sampson proposes an abstract diagram of contagion inspired by a connection of Gabriel Tarde's sociology with Deleuze and Guattari's ontology.

The most interesting idea of Tarde's sociology for a general theory of contagion consists in the fact that, for the French sociologist, 'everything is a society, […] every phenomenon is a social fact' (Tarde 1895: 58)[6]. In line with the realist perspective I have adopted so far, that avoids essentialist descriptions of reality to focus on the immanent processes from which forms and identities emerge (DeLanda 2002: XIII), and as already suggested in a brief passage of *Mille Plateaux* (Deleuze & Guattari 1987: 218-219), Sampson suggests that this tenet of Tarde's thought should be understood as a claim that all things, from atoms to markets to individuals and communities, are but the collection of the virtual points composing their multiplicities (Sampson 2012: 8). To understand what this means, one must remember that reality is not adequately described by merely listing the actual properties of the objects that might be cut out of it. Appropriate descriptions must include also those traits that, not being manifested at the moment of observation, are nevertheless real. The fact that ice cubes melt rapidly if taken out of the freezer, for instance, is part of their identity, and this tendency is one of the many traits forming the virtual field of affordances of what we call an ice cube, that is, the reservoir

[6] All translation from this source are mine.

of possibilities, real though not actual, that an object has to change, or those properties that will manifest exclusively if the object acts or is acted upon by other things. As we have seen in the first chapter, objects can then be described by mapping their tendencies and capacities. Every way in which a system can change can be portrayed by a line on its diagram, with every point on such a line indicating a variable condition of the system. If one considers temperature and time, tracing the changes in these two connected variables would yield a vector that describes the behaviour of a melting ice cube degree after degree and minute by minute. Combined together, the variable points describing to the many characteristics of the system can generate patterns that portray specific states, as the decreasing volume of the ice cube, and can be used to trace vectors that signal specific tendencies of the system, as the liquid state towards which ice cubes tend.

Every significant transformation in the trajectories of change of a complex system is indicated by a singularity, that is, a mathematical point in its virtual field of affordances that corresponds to a pivotal point of change (bifurcation) in a system's behaviour or a state towards which its development is directed in the long term (attractor). It is important to remember that singularities are actualised only given the right conditions: complex systems are indeed open, and their singularities are consequently relational, they depict the possibilities that a system has of changing as a result of its capacity to affect and be affected by what surrounds it. Thus portrayed, every actual entity can then be described as a society, as Tarde does, and more specifically as a society of singularities, that is, as the sets of connective nodes among open, interacting systems, the virtual points of contact indicating the possible effects of the circulation of affects between and within them.

A good example of what this means can be drawn from the street corner experiment carried on by the social psychologist Stanley Milgram in the late 1960s (50-52; Milgram & al. 1969). A person walks down the street, minding her own business. At a street corner, she encounters a group of people looking at the sky or at the buildings above them. As the passer-by sees them, there is a good chance that she stops her walk and looks up as well. The occurrence of such an 'automatic' reaction would indicate a circulation of affects between two multiplicities: the crowd has acted upon the passer-by and she has in turn been acted upon by the crowd. The interaction would then trigger a bifurcation in the behaviour of the passer-by, actualising a singularity that changes the course of her action and, with it, all sorts of variables coordinated to her behaviour: her walk stops, she loses her train of thought, her gaze shifts from the sidewalk she was looking at but not really seeing to the crowd, and focusses on the sky above. One could even say that she's not a passer-by anymore, but part of the crowd. Milgram found out that the threshold at which this singularity actualises a change in the behaviour of the system-passer-by is directly connected to the density of the crowd: 'While 4% of passersby stopped alongside a single individual looking up, 40% of passersby stopped alongside a stimulus crowd of 15’ (80). The singularity changing the behaviour of the passerby is therefore connected to the singularity of the crowd, the point corresponding to the density beyond which the crowd exerts a power of capture over the attention of passersby.

Back to Tarde, then, the idea that everything is a society means not only that every entity is the expression of a virtual multiplicity characterised by several singularities, but that these singularities are essentially points of contact, coordinates of connection, relational triggers for the actualisation of significant changes. In his book, Sampson notes indeed how ‘Tarde’s social is not concerned with the individual person or its collective representation but rather with the networks or relational flows that spread out and connect everything to everything else. To be sure, Tarde’s contagion theory is all about flows or vibratory events’ (Sampson 2012: 7). In other words, instead of molar aggregates, Tarde is interested in the relation between the singularities of distinct but interweaved virtual fields of affordances and considers them as the spreading channels for contagious affects (Deleuze & Guattari 1980: 218-219). From this point of view, the social interaction involved in Milgram’s experiment takes place within the virtual field populated by the capacities of related multiplicities to affect and be affected, the set of interweaved singularities that can be found *between* the crowd and the passerby, and consists in the circulation of an affective and eventually transformative flow between the two. Since it acquires a new member, the multiplicity of the crowd is not less altered that that of the passerby, in a phenomenon that replicates the creative involution of the orchid and the wasp we have seen above (Sampson 2012: 45-46). Interested in the preindividual network through which molecular influences spread, Tarde developed then a theory of contagion – *cum* (together) + *tangere* (to touch) – to illustrate the way in which affective transmissions circulate, and behavioural changes follow the actualisation of the singularities affected or ‘infected’.

The second fundamental point of Tarde’s ‘microsociology’ (Deleuze & Guattari 1987: 218) will help to shed light on the idea that virtual contagions can give rise to viral transmissions. As suggested by Sampson, Tarde ascribed the emergence of social wholes to ‘a principally accidental repetitive succession of desire’ (Sampson 2012: 18). For the French sociologist, desire is in fact what circulates between singularities. This notion refers to two types of attraction: first, it indicates the basic drives towards the preservation of organic life, both at the individual level and at that of life forms, that connect metabolic needs and reproductive impulses to the behaviours and objects that could satisfy them. The other class of desires has instead a social origin, when this term is understood in its molar sense as indicating an emergent layer of complexity that exerts downwards causation over the microsociological layer of basic desires and converts or overcodes it: ‘This is how, for example, biological desires for nutrition, food, sex, entertainment, and amusement are appropriated, expressed, and transmitted in assemblages of social inventions, including consumer food products, religious rituals, games, novels, and the theatre' (25). Both these desires ensue and propagate intermittently: 'all our desires are intermittent and periodic' (Tarde 1902: 149), but they come and recede in either periodic or aperiodic waves. While the first type of desire triggers the intermittently active power of life-functions, their social appropriation, expression and transmission, and the shift from periodicity to aperiodicity this entails disclose the possibility for all sorts of manipulation and suspension of that intermittence we have seen life presenting in different forms, and at different degrees of complexity (148). Both types of desire tend in fact to constitute repetitive behaviours but, before inducing the formation of habits, the second originates as a shared fantasy (Sampson 2012: 12). This detail makes the second type of desire particularly susceptible to capture by socio-political or economic power formations and their design: indeed, as highlighted by Sampson,

> This process is appropriated by capitalism, promoting the formation of new habits to sustain itself. In Tarde's reckoning, there is no separation between biological desires and social desires; rather there is a process whereby the first becomes translated into the second, which can, when encountered and copied, take on a vital and contaminating force of its own (12).

The intermittence of desire, its relation to the formation of habits and their role in the abstract model of viral contagion I am describing are connected to the third fundamental element of Tarde's microsociology: his understanding of repetition. The possibility, so nicely concretised by Sampson's work, to connect Tarde's conception with the realist ontology of Deleuze and Guattari appears particularly clear in relation to this this point: virtual fields of affordances can be diagrammed because they map recurrent behaviours of complex systems. As highlighted by DeLanda, in fact, 'multiplicities specify the structure of spaces of possibilities, spaces which, in turn, explain the regularities exhibited by morphogenetic processes' (DeLanda 2002: 3). Tarde is interested in the infinitesimally minute repetitions observed in the recurrent patterns of natural events, from the periodic movement of cosmic bodies to the repetitive chemical reactions marking metabolic cycles, growth, and reproduction, and understands these phenomena as the regular actualisation of specific singularities. Consequently, the French sociologist refers to undulation or periodic movements as the repetitions typical of physical systems, to heredity as the repetition typical of life forms and to imitation as the type of repetition characteristic of the social sphere (Tarde 1898: 22).

As mating and feeding are behavioural patterns replicated generation after generation independently of their representations, what keeps (molar and actual) societies together is, for Tarde, a form of imitation that does not involve ideas or beliefs but underlines them as the affective associations between the (virtual and molecular) singularities of separate multiplicities (Sampson 2012: 19). Understanding these processes as repetitions conform to precedents, the sociologist maintains that ‘among the continuum of variation experienced in social environments, there are repetitions of events that imitatively reproduce the cause point to point’ (21). As we will see in more depth in the next chapter, for instance, the formations schools of fish maintain while swimming, or the shapes flocks of birds draw in the sky do not follow from any plan or agreement: rather, these social patterns actualise shared energetic economies that emerge from a coordination of virtual fields of affordances in relation to their environment. In other words, basic social behaviours of these types emerge as shared entropy management strategies from which every individual of the group can in principle benefit: this is a form of coordination of the first type of desires identified by Tarde, and manifests within groups as a result of a propagation. The spatial array of flocking birds improves the aerodynamic efficiency of (most of) the individuals that are part of the group, and schooling patterns help fishes to save some energy while swimming. The advantageous effects of this behaviour spread by proximity, so that a fish swimming in the immediate vicinities of a school will be drawn to join the formation by a molecular effect. As stressed by Sampson, when applied to human societies the same diagram can map ‘flows of contaminating influence and persuasive mood settings, all of which are transmitted through mostly unconscious topologies of social relation’ (6), that is, on the basis of an ‘imitative propensity’ Tarde attributes to singularities, regardless of their degree of complexity.

To illustrate Tarde’s diagram of contagion, then, Sampson describes molecular social fields as crossed by an ‘imitative ray’:

> The imitative ray comprises of affecting (and affected) noncognitive associations, interferences and collisions that spread outward, contaminating feelings and moods before influencing thoughts, beliefs and actions […] the imitative ray does not travel *between* (inter) individual persons; rather, it moves *below* (infra) the cognitive awareness of social association. (19-20)

In a move Sampson articulates beyond the scope of Tarde’s theory, his book connects the microsociology of contagion to neuromarketing as the generative matrix of imitative rays that today serve ‘corporate and political agencies to effectively prime the public mood and guide accidental contagions’ (116) and exploit the shifting topology of homeomorphic digital interfaces to support the propagation of the suggestions produced by the digital stratum.

The example of the co-optation of imitative rays adopted by Sampson is a feature of the recommendation system adopted by Amazon, but at work also behind the interfaces of other platforms delivering suggestions or Kuleshov machines like YouTube and Twitter. Amazon destratifies users’ interactions with the platform, be they searches or purchases. Analysing the data it captures, the platform produces dividual profiles that help it trace tendencies before any points on their vectors manifest as actual behaviours of the users to which it will propose suggestions:

> Amazon encourages shoppers to create wish lists, matching desirable purchases to comparable products and maximizing imitation–suggestibility by drawing attention to others who also share similar obsessions. Amazon is typical of a new business model of the network age Thrift describes as having the capacity to "catch" the nearby desire of someone just like us […] Indeed, the methods used to predict, measure, and exploit imitative rays are becoming ever more complex and neurologically invasive. (58)

Suggestions that have the form of 'Customers who bought this item also bought…' mobilise the abstract model of viral contagion conceived by Tarde to enhance the power of the forms of expression produced by the loops of the stratum. 'Neuromarketers not only map the contagions themselves but delve into the constituents of the imitative rays of the consumer: the semiconscious flows of feeling and affect and their subsequent emotional, neurological, and physiological responses' (60).

In his work on the role of the brain in political identification, George Lakoff highlights how 98% of cognitive processing takes place below the threshold of awareness, automatically and out of our control. This 'is what our brains are doing that we cannot see or hear. It is called the cognitive unconscious, and the scientific evidence for its existence and for many of its properties is overwhelming' (Lakoff 2009: 9). However, an interesting issue with regards to the control of such processes has to do with one of their physiological sources. Among the mechanisms underlying this from of cognition are in fact what neuroscientist Antonio Damasio calls somatic markers: sensations 'marking' or automatically associated to a piece of information received. Damasio suggests that, in the case of a subject presented with a choice, before a conscious evaluation of costs and benefits of a specific conduct, a somatic marker can force 'attention on the negative outcome to which a given action may lead, and [function] as an automated alarm signal which […] When a positive somatic marker is juxtaposed instead, it becomes a beacon of incentive' (Damasio 2004 [1994]: 173-174). In his work, Lakoff highlights how somatic markers can be triggered at will through the manipulation of a symbolic environment:

> emotional content can be bound to a narrative, yielding a melodrama – a narrative with heightened emotional content. You feel fear when the heroine is threatened, and satisfaction or joy when the hero rescues her. The same is true of political experience that has a narrative structure […] The circuitry characterizing winning for your hero is neurally bound to dopaminergic circuitry, which produces positive feelings when activated. Narratives and frames are not just brain structures with intellectual content, but rather with integrated intellectual-emotional content. (Lakoff 2009: 28)

In this way, somatic markers can be purposefully triggered to provoke nonconscious reactions that, while weighing on deliberation, leave the user with the impression of operating autonomous selections among engineered choice landscapes. If the symbolic manipulation of somatic markers thus sounds similar to Manfred Clines's *Sentics* – the practice of administering cycles of emotional stimulation to space travelers/cyborgs in order to suppress aggressivity and replace it with docility (Gray 1995: 38) –, it is because it works according to the same principles. The artisanal cyborg is the hybrid subject of the suggestions produced by the digital stratum, and these suggestions propagate virally among populations as the molecular flows of virtual contagions leading to the emergence of desired behaviours. To go back to Sampson's work then, 'Tarde's diagram comprises mostly unconscious flows of desire, passion, and imitative radiations of muscular as well as cerebral activities' (Sampson 2012: 35) and the social spheres emerge from the networking of virtual singularities whose actualisation can change the behaviour of complex systems. Contemporary capitalism and digitally mediated consensus politics exploit the magnetizing effect of affective contagions and the viral power of social imitation, devising imitative rays and homeomorphic 'epidemiological spaces' (29) to capitalise on human suggestibility:

> in a network age, when there is a concerted effort to guide the precious attention of the consumer to the increasingly fragmented sprawl of commercially networked media messages and political propaganda, appeals to a relatively small percentage of cognitive thought is fast becoming a waste of resources. As the neuromarketers and experience designers perfectly understand, to grab attention, it is better to focus resources on the neurological unconscious. (42)

This abstract model of virality stresses how the connection between imitation and suggestion is central to the emergence of artisanal cyborgs, whose process of subjectification is steered through the analysis of tendencies and a purposeful stimulation of capacities in a post-hylomorphic model of power that relies on the emergence of desired behaviours as the actualisation of specific possibilities to exert its control over individuals and collectives.

Yet, the collective dimension of human life is not only the scene of the circulation of viral suggestions, but becomes, against the background of metropolitan environments, another field from which the stratum can extract the tendencies and capacities. This is the less glamorized aspect of the smart city paradigm, that the next chapter will describe as the implementation of the digital stratum at the urban level to offer a more complete picture of the levels of complexity at which the stratum operates. In the next sections, I will address this topic by starting from the emergence of collective behaviours in living beings. I will suggest that these behaviours are connected to the partial exosomatisation of energy processing operations and the development of strategies for the shared management of entropy. I will show how this complex emergent behaviour underlies the constitution of urban environments, the managing of flows of energy, waste and people within them, and how the stratum plugs its biofeedback mechanism in its structure to destratify and direct the flows crossing such environments, identifying tendencies and capacities of social groups to steer them towards desired directions. This passage will be crucial to move towards the conclusion of this work, that will focus on flows of money and the capitalist extraction of value from the relation that the digital stratum establishes with virtual fields of affordances.

Chapter 7: Structures of Mitigation

In the previous two chapters, I have considered the impact of digital technologies on the biological and anthropomorphic strata. It is important to stress again that the three strata highlighted by Deleuze and Guattari cannot be separated by hard and fast cuts: as the biological stratum is necessary for the anthropomorphic one to emerge, and the physico-chemical stratum is necessary for both, the processes emerging in one stratum influence those of the others. To continue my stratoanalysis of the digital, I will now focus on the relationship between the digital stratum and the physico-chemical one. In this chapter and the following one, however, this stratum will be considered in relation to the processes that aim at the preservation of stable physico-chemical states in living individuals and groups.

My definition of the relations between life and the digital has so far been informed by the distinction, proposed by Wentao Ma (2016) between *living individuals* and *forms of life*, the vertical series shaped by evolutionary mechanisms. In this chapter, I will look instead at a phenomenon of emergence related to the synchronic association of living individuals, bound together to form the coherent multiplicities that can be named *living systems*. Every system can be considered as a specific energetic regime, and living systems are, as we have seen, those complex patterns of matter and energy that engage in a more or less active fight against entropy. Since energetic efficiency is a key trait of fitness, this fight tends to optimise its myriad mechanisms through the evolutionary histories of living forms. One of the ways in which this fight can be articulated consists in the association of living beings with the purpose of sharing energetic economies to lessen the stress that energy processing puts on individuals and channelling entropic drifts. This behaviour has been selected in various species and in some cases it involves the active production of what I will call *structures of mitigation*, concrete patterns in the organisations of matter that modulate the possible oscillation in the fluxes of afferent energy and reduce the energy expenditure of the individuals composing the system. After introducing this phenomenon, the chapter will consider the city as the biggest and the most complex technical object humans have created for that purpose. The city functions as a structure of mitigation that, not being an organism in itself, but the material support for a living system, takes upon itself part of the active fight against entropy.

Alongside the construction of these structures, the interactions taking place within social systems, that is, within sets of individuals and their relations, give rise to the emergence of cultural and economic layers of complexity that articulate various forms of exosomatic energy managing processes. These layers, which I will call the suprasystem, shape the fight against entropy taken up by living systems by imposing on them, designed forms of order, and via the manipulation of structures of mitigation. The first part of this chapter will focus on the relation between (social) subsystems and (cultural-economic) suprasystems and define the role of structures of mitigation in the partial exteriorisation and collective orientation of afferent energy and entropic flows. The second part will look at the relation between these structures and computation, projecting the relation between the digital and the virtual onto the urban scale. Indeed, as per many other products of exosomatisation, the city is becoming enmeshed with digital technologies. The consequences of this process for the relation between technology and living systems will be addressed by looking at the implications of the rhetoric of the smart city, and by relating it to the notions of hygiene (Gille, D. 1986) and security (Foucault 2009 [2004]), the suprasystemic paradigms previously shaping structures of mitigation and directing the social subsystem.

Extended processing

Living individuals are complex systems that fight entropy by extracting and processing energy from their environments (Odling-Smee et al. 2003: 168). Since this energy must be harnessed, transferred, spent sparingly and possibly stored to withstand shifting environmental conditions, like scarcity of resources and competition, energetic efficiency represents a key fitness trait. Regardless of the level of complexity, habitat and morphological traits of a species, social behaviours relate to the energetic economy of the individuals involved. The overall energetic economy of an individual is often seen as revolving around its metabolism, the set of concatenated mechanical and chemical operations supporting the fight against entropy by converting material and energetic elements cut-out from the milieu into specifically formatted energy units that can be spent to run life functions. Part of the processes composing the energetic economy of living beings can be externalised, and indeed must be externalised in order to be shared. This evidence is well described by American physiologist Scott Turner:

> By structurally modifying the environment […] organisms manipulate and adaptively modify the ways energy and matter flow through the environment. In so doing, they modify the ways energy and matter flow through them. Thus, an animal's physiological functions is comprised really of two physiologies: the conventionally defined "internal physiology", governed by structures and devices inside the integumentary boundary of the organism, and an "external physiology", which results from adaptive modifications of the environment. (Turner 2000: 6)

Examples of this can be found in the behaviours of eusocial insects and in the forms of social thermoregulation displayed by some species (Heinrich 2015: 447-509), but the phenomenon is evident already in 'basic colonial growth (e.g., that of budding yeast) and the evolution of complex multicellular life [as they constitute behaviours] accompanied by enhanced growth efficiency and several energetic advantages' (Kempes et al. 2014: 208). Collective behaviours have been selected because they assume the function of managing part of the processes composing the energetic economy of organisms, easing the stress that the interaction with the environment puts on individuals (Markham & Gesquiere 2017: 1). Marine unicellular algae of the types *Hydrodictyon* or *Caulerpa*, for example, aggregate in specific patterns that 'manipulate the local flow of water, enhancing exposure to nutrients and provide enhanced protection from potential predators' (Weinstock 2010: 105). Similarly, the spatial array of flocking birds improves aerodynamic efficiency, and the swimming patterns of ducklings or schools of fish help the individuals to save energy during movements, as well as offering an analogous form of protection from predators (Fish 1995; Weimerskirch et al. 2001). 'The word "structure" may be used to designate the sum of these relations and relationships', Deleuze and Guattari write (Deleuze & Guattari 1987 [1980]: 41). If so, these social behaviours can be considered as constituting structures of mitigation.

In the cases just considered, these structures consist of the patterns emerging from the spontaneous coordination of movements and bodies in space. The constitution of structures of mitigation ranges however from the collective adoption of spatial arrays, or forms *in* space, to the constitution of concrete structures, or the in-formation *of* space, obtained through the organisation of organic and inorganic matter in species-specific and environment-dependent patterns. Synchronic relations can indeed be established also between individuals of different species and kingdoms, and between biotic and abiotic elements of different scales. In more complex cases, the social managing of energy flowing through a living system can involve other species and/or the organisation of inorganic matter, and shapes collective behaviours through their mediation. Biologists John Odling-Smee, Kevin Laland and Marcus Feldman highlight that, since organisms must actively fight against entropy, 'they are compelled to modify their local environments by niche construction to some degree' (Odling-Smee et al. 2003: 209), that is, while drawing material from their environment to extract the energy they need to preserve the form of order they are an expression of, living beings depletes their milieus and discard within them the wastes produced by metabolic processes (168), locally accelerating the entropic drift these spaces are subject to. However, 'Because niche-constructing organisms work in open systems, they can […] drive some selected components of their environments in both thermodynamic directions, by either locally increasing or locally decreasing entropy levels' (190). A fascinating case of the latter is represented by the constitution of artifacts:

> neither biotic nor conventionally abiotic, but intermediate between the two […] Like organisms, artifacts demonstrate negative rather than positive entropy because they are usually quite highly organized: yet, unlike organisms, they have no ability to defend their own organization nor to prevent their own dissipation. Artifacts are therefore likely to demand repetitive niche construction from organisms to maintain them. (190)

Noting that artifacts can modify selective pressure on the organisms that partake in their construction and upkeep, benefiting from their effects (44), Odling-Smee, Laland and Feldman allow us to understand structures of mitigation as one specific type of artifact and, as such, as a particular declination of niche construction operated through the organisation of an ecosystem's abiotic – and in some cases also biotic – components.

The collective dynamics that lead to the formation of structures of mitigation have been selected because specific arrangements of matter can regulate the flux of energy necessary for the survival of individuals and lessen the stress some life functions exert on the members of a living system, without themselves being organisms or having a metabolism. The structures that support forms of the collective management of energy, and which have the function of limiting the fluctuations of the external environment, like changes in temperature and the availability of resources, can indeed function as actual processors of materials, exteriorising processes relative to the transformation of energy or its extraction. Termites of the species *Macrotermes*, for example, 'cultivate' (Mueller et al. 2005) a species of fungus to which they assign the function of metabolising the materials from which they will then retrieve energy. 'The principal food source for the termites is leaves, but they cannot digest cellulose directly. Fungus can […] so they are "planted" on the chewed fragments of leaves that the termites have brought into the nest', process the material and allow the termites to feed on it (Weinstock 2010: 135). This example shows how niche construction can, in some cases, be related to the partial exteriorisation of digestive and metabolic processes. In the case of human behaviour, techniques play a significant role within this framework: the use of fire for cooking, for example, exteriorised part of the digestive and metabolic activities of early hominids (Wrangham 2009: 40). Cooking transforms matter so that some of the metabolic conversions necessary for extracting energy from it are carried out by an element external to the individual. Humans have evolved around this exteriorised function, losing the digestive and chewing capabilities of primates. From this crucial event in our evolutionary history derives, however, the fact that energy must be spent in taking care of the fire, by gathering the materials to fuel the flame, for instance. This highlights two fundamental characteristics of structures of mitigation: the first is that the structure has an energetic economy of its own (fires needs to be alimented, and artifacts need maintenance); the second regards the broader effects of structures of mitigation on the behaviours of the organisms they host.

To address the latter, Australian philosopher of science Peter Godfrey-Smith (2011) suggests that the development of cooperative behaviours among living entities interacting in a group 'may lead to the appearance of a series of adaptation that suppress lower-level competition' (75). For him, cooperative behaviours may consequently have a de-Darwinizing (76) effect on the individuals composing a social whole, by attenuating some of the selective pressure exerted over them. This is observable, for instance, in 'some key adaptations on the road to complex multicellularity [that] have the effect of moving collective entities towards paradigm status as Darwinian individuals [while] The lower-level entities are partially "de-Darwinized" by the transition process' (77). In other words, while emerging wholes take on selective pressure as living entities with their own, separate virtual field of affordance, they partially free their elements from the selective pressure they would be subject to in other conditions. The passage to multicellularity offers an example of this phenomenon. While individual cells would compete for resources, their status as elements of an emerging whole, manifested down the evolutionary line towards multicellular organisms, is characterised by the absence of this competition, which is instead present at the level of the emerging individual. It is now the multicellular organism they have evolved into that will fight for its own survival in a competitive environment located on a superior level of complexity. Taking inspiration from Godfrey-Smith (67), Daniel Dennett adds that culture is one such instance of de-Darwinising emerging layers of complexity. '[H]uman culture started out profoundly Darwinian […] and then gradually de-Darwinized, becoming ever more […] capable of top-down organization, ever more efficient in its ways of searching Design Space' (Dennett 2017: 148). According to this logic, exosomatisation constitutes spaces that alleviate the selection pressure 'external' environments would exert over exorganisms living within a techno-cultural milieu. In relation to the top-down organisation potential Dennet hints at with regards to culture, in a recent discussion with Bernard Stiegler, British philosopher Gerald Moore proposes the notion of re-Darwinisation. In a move anticipated in a certain, rudimentary sense by J.C. Smuts in his *Holism and Evolution* (Smuts 1927: 222), who maintained that organic wholes become themselves agents of selection (192), Moore traces the connection between the ideas of Godfrey-Smith and Dennett, and suggests that 'de-Darwinization is a reversible process, where the suspension of selection pressures can also give rise to new forms of culture that heighten selection pressures' (Moore & Stiegler 2020: 164). As we have seen above, structures of mitigation have energetic requirements of their own. Just as a fire needs to be fed, artifacts need maintenance. While dispensing individuals with some of the pressure exerted by the energy managing processes, the partial exteriorisation of metabolic operations requires them to spend energy *on* the structure of mitigation, rechannelling their entropic drifts.

The amount of work necessary to satisfy the structure of mitigation's own energetic requirements is not simply deducible from the sum of the energetic needs of the individuals from which it emerges, but disproportionate to the actual necessities of the subsystem's elements: hunting and eating is one thing: hunting, hoarding, tending to the structure that stores nutrients by preserving its variable properties, organising the distribution of nutrients among individuals etc., is another thing entirely. While lessening the energetic stress on the living system regarding matters of survival then, this disproportion invests it with a form of stress of another nature, whose rationale is organisational and its principle purely economic. Such a conversion leads to the development of new forms of selective pressure exerted on the social (sub)system, as the downwards causation exerted by an emerging economic suprasystem that regulates the behaviours of the individuals and imposes over them the constraints to which they must conform in order to survive as part of the living system.

Bees store honey to consume it in case of shortage of other resources. Hoarding allows the group to survive seasonal or accidental fluctuations in the afferent flows of energy and materials. Besides of motor coordination, this behaviour requires a storage structure, and beehives provide such material support, at the same time allowing and mediating also the regulation of energy dispersion. The conservation of the temperature of individuals, including precious newborns and the queen, within the ideal range for their survival is indeed of crucial importance for the colony. While in the colder months, individuals might cluster around the queen and shiver in order to radiate towards her their temperature and guarantee her survival, in other occasions, 'heating' bees crawl into cells intentionally left empty and, remaining immobile for long periods of time, disperse the heat accumulated in their thoracic muscles during flight, raising the temperature of the hive. The latter can alternatively be cooled down through fanning, or even by being sprayed with water (Kleinhenz 2003; Bernardinelli et al. 2004: 59). Lessening the metabolic stress of maintain optimal bodily temperatures then, structures of mitigation like the hive work as homeostatic systems. Faced with the variability of environmental conditions, organisms tend 'to decrease stress and avoid death' (Sandler & Tsitolovsky 2017: 540) by preserving their homeostasis: a stable physico-chemical state originally described in the work of Claude Bernard on the internal milieu of living beings (Bernard 1974 [1878]), and later formalised by American physiologist Walter Bradford Cannon (1929). The preservation of this physiological state of efficiency is the goal of chemical systems of regulations, and can drive mechanical action in the environment: this tendency expresses through a series of coordinated processes that, in response to perturbations, act to re-establish the range in which certain variables should fall in a functioning body. As Cannon highlights, in fact, 'when that system is not functioning the same stresses – cold, lack of oxygen, low blood sugar, loss of blood – which had no considerable influence on normal animals, became ominous for continued existence' (Cannon 1935: 6). Individual homeostasis can be partially exteriorised through the formation of structures of mitigation. The social formations supporting individual homeostasis, however, constitute in turn an emerging homeostatic system at a superior level of complexity. The processes that attenuate the metabolic stress of individuals composing living systems are also deployed to preserve their material support. If flying in formation improves the aerodynamics of individual birds by lessening the metabolic stress connected to flying, they still have to make adjustments to their individual route in order to prevent a dispersion of the formation. The coordination of the series of processes preserving individuals' internal homeostasis thus becomes the exosomatic homeostasis of the structure of mitigation itself, the homeostasis of the colony or of the group: it becomes social. Living individuals relate to the social formation in which they take part as the chemical and mechanical agents preserving the homeostasis of the structure of mitigation supporting their shared energy management processes.

The fact that structures of mitigation work as homeostatic systems, though, does not mean that societies can be treated as organisms. Social homeostasis is often related to the concept of superorganism and, since there is no synchronisation of energy managing functions without some sort of external structure, this often leads us to speak of both societies and structures of mitigation like cities as if they were organisms This superposition is, however, quite problematic. Canguilhem described the fundamental difference between organisms and societies in the essay 'The Problem of Regulation in the Organism and in Society' (2012 [1955]), in which the 'very old, still unresolved problem […] of the relations between the life of the organism and the life of a society' (67) is debated precisely from the point of view of homeostasis and of the criteria of regulation. In the essay, Canguilhem maintains that there is no difference between the existence of living individuals and the 'rule or norm' guiding their survival (70), while this difference defines human societies and must be taken in consideration. 'In brief, the ideal of the organism here is clear to everyone – it is the organism itself […] in the order of the organism, we commonly see the whole world debate the nature of the bad [mal] and no one debate the ideal of the good' (70). In the case of human societies, instead, this 'ideal state' is contentious, and the interventions needed to re-establish some sort of functional state, which is not equivalent to a physiological optimum, are debatable. It is indeed precisely on matters of 'illness' that organic descriptions of society unveil their political significance: 'what dominates the comparison of the organism to a society is the idea of social medication, the idea of social therapeutics, the idea of remedies for social ills' (70). While people might often agree on the diagnosis of the illnesses of society, they regularly disagree on the remedies and the possible approaches to these problems, 'so what appears to some as a remedy appears to others as a state worse than the illness itself, precisely because of the fact that *the life of a society does not inhere in society itself*' (76).

While the remaining pages of the essay do not expand much on this line, Canguilhem's wording allows us to describe the emergence of social formations in terms of different levels of complexity. From this perspective, society is a (sub)system composed by a set of individuals and their relations and characterised by a tendency to share energy management processes in order to lessen the stress these put on individuals. The distribution of such processes is possible thanks to their partial exteriorisation, that causes the emergence of a suprasystem at the level on which these processes are administered, the behaviour of individuals moulded and social homeostasis is maintained. Exorganisms support the emergence and the functioning of the suprasystem through webs of technical objects. As a cultural reality, the suprasystem emerging from their coordination is consequently regulated by historically developed paradigms: being more than the sum of its parts like every emergent layer of reality, the rules composing these paradigms are not the simple sum of individuals' needs. The articulation of the relation between subsystem and suprasystem is indeed renewed and enforced through politics, which, according to Canguilhem, represents 'a type of apparatus that is not inherent in social life as such […] a historical acquisition, a tool that a certain society gave itself' (76). The kind of social homeostasis that human suprasystems tends to preserve is thus historically determined and hybrid, for it results from the stacking of techno-political solutions and practices imposing an order on the subsystem and regulating its variations. In Canguilhem's words, 'being neither an individual nor a species, but a being of ambiguous genus, [society] is as much a machine as it is a living thing; not being its own end, it simply represents a means, it is a tool' (77), and as such, it has the purpose of alleviating individuals' stress by arranging collective energy management operations, while evolving just as technical objects would.

In his recent work, Antonio Damasio reflects on this topic, suggesting that 'Governance has precisely the same goal as homeostasis […] Homeostasis counters thermodynamic decay. Effective governance counters the decay that comes from uncoordinated human actions and from human conflicts' (Damasio 2019: 68). In his latest book, *The Strange Order of Things*, he depicts the evolution of these sociocultural homeostatic system in more detail:

> cultural instruments first developed in relation to the homeostatic needs of individuals and of groups as small as nuclear families and tribes. […] Within wider human circles, cultural groups, countries, even geopolitical blocs, often operate as individual organisms, not as parts of one larger organism, subject to a single homeostatic control. Each uses the respective homeostatic controls to defend the interests of its organism. Cultural homeostasis is merely a work in progress often undermined by periods of adversity. (Damasio 2018: §1¶51)

There are a few problematic points with this use of the notion of homeostasis to describe cultural realities. First, Damasio falls prey to the same biomorphic language I have criticized above, lacking an understanding of the hybrid nature of suprasystemic homeostasis. Being mediated by material structures of mitigation, suprasystemic homeostasis is administered at a different rhythm than it would in nuclear families or tribal settings, precisely because of the technical nature of urban structures of mitigation: the passage between the homeostasis of small groups and that structuring life at the level of the city or of the State does not preserve the same features of the organisms that compose these realities because it involves processes of emergence and of exosomatisation. What matters, for us, is to highlight the technical nature of the suprasystem and the mediated relation between this and the life of the subsystem. Key to mapping this relation is understanding the detachment between the two layers of complexity, which, aggravated by the parallax effect we have seen masking alternatively the components or the emergent entity, their sets of tendencies and capacities like basic desires, allows for the self-preservation of the suprasystem, for its own homeostasis to be enforced at the expense of the subsystem: just see the effects that austerity policies have had on low-income classes. By describing the subsystemic effects of suprasystemic homeostasis as the horizontal conflict between groups, Damasio also flattens a problem that is clearly vertical. The solution to the problem as he describes it would be to constitute a global 'organism', a utopianism for which we should not have patience today, especially since it is being concretised through the totalising power of capital and big tech. Considering cultural products as part of broad social homeostatic systems, Damasio adds that economic systems are 'an example of such [a] regulatory mechanism' although, 'in keeping with the position we assign them as components of less than perfect sociocultural homeostatic devices, they are quite open to malfunction' (Damasio & Damasio 2016: 128). But suprasystemic homeostatic devices are not 'prone to malfunction' as Damasio suggests: they work perfectly, for some, and at the expense of others. The emergence of the suprasystem and the development of directing paradigms that shape the structure of mitigation causes a separation between what Canguilhem distinguished as the normal and the normative. 'Man feels in good health […] only when he feels more than normal - that is, adapted to the environment and its demands - but normative, capable of following new norms of life' (Canguilhem 1991 [1966]: 200). Yet, suprasystemic homeostasis is collocated at an emerging level of complexity, that evolves in the same fashion as technical objects do and is in a relation of parallax with the subsystem. This aspect of their relation causes the 'illness' of the subsystem as a living system, because the suprasystem takes over the capacity to organise life by structuring its material support, the structure of mitigation, and organises life to preserve its own homeostasis: 'The sick living being is normalized in well-defined conditions of existence and has lost his normative capacity, the capacity to establish other norms in other conditions' (183). Managing the shared energy processing of the subsystem and developing an energetic economy and a homeostasis of its own, the suprasystem becomes the layer that, through the manipulation of the structure of mitigation 'norms' its milieu. The issue of illness becomes twofold. Subsystemic malaise (widespread depression, addiction epidemics, violence etc.) derives from the loss of normative capacity at the suprasystemic level, where illness appears as stagnation, that is as stasis instead of constant growth or political agitation that more directly threatens the status of the suprasystem.

The impossibility of modelling cities or societies onto organisms resides also in the specific type of evolution of human suprasystems and of the structures that support them. While in fact 'a society bears some resemblance to what is organic, since it is a collectivity of living beings' (2012: 76), suprasystems and technically mediated structures of mitigation evolve with the rapid and accumulative character of Lamarckian acquired inheritance (Gould 1980: 83-84). Combined to the difference in complexity and to the parallax effect that we have seen developing between two layers of emergence, such differences in pace allow for the progressive detachment of the suprasystem's energetic economy from the individuals' energetic necessities. While the suprasystem is the engine operating the conversion of what Tarde identified as desires of the first type into desires of the second type (Tarde 1902: 114), that is, of the basic drives towards the preservation of organic life into desires that have a social origin, it does so only by developing its own set of 'desires' that aim at the preservation of its own stability. In the next section, I will describe how human social systems preserve their own homeostasis.

Urban moulds

The 'heart of the city', its 'green lungs' and tarmacked 'arteries' are figures of speech that the vocabulary of urban planners draws from animal physiology. In the fields of architecture and design, cities are often considered analogous to living organisms (Wright 1970), huge artifacts equipped with a metabolism of their own. This point of view testifies the constant oscillation between mechanomorphic and biomorphic descriptions of the world: nature is portrayed as a machine and machines are portrayed as living beings in an endless circulation of functional analogies. A more appropriate description, though one that is not based on the programme of mechanisation I set out in the first chapter, should fall right in the middle of these two poles. Cities must be described as technical objects but also, in their co-evolutionary relation to the individuals that inhabit them, as complex systems constituting the material supports for the shared processing of energy flows. Such an approach to the city must consequently be ecological rather than organic: only a hybrid ecology, an ecology of intersecting *machinic phyla* could help study the complex interactions between biotic and abiotic elements, and at the same time also account for the transformations and circulation of energy flows and material units among living communities. It is within this framework that one can read Clause Lévi-Strauss's description of the city in *Tristes Tropiques*:

> The city […] stands at the point where Nature and artifice meet. A city is a congregation of animals whose biological history is enclosed within its boundaries; and yet every conscious and rational act on the part of these creatures helps to shape the city's eventual character […] the city has elements at once of biological procreation, organic evolution, and aesthetic creation. It is both natural object and a thing to be cultivated; individual and group; something lived and something dreamed; it is the human invention, par excellence. (Lévi-Strauss 1961 [1955]: 127)

My view differs from the description of this passage only with regard to the capacity of 'every conscious and rational act' to shape the city. The causal power of the components over the features of the whole and the correlated downwards causation of the suprasystem over the subsystem must indeed be considered while bearing in mind that, because of the progressive detachment of the suprasystem's energetic economy from the individuals' energetic necessities, and the difference in rhythms between the evolution of technical systems, suprasystems and subsystemic relations, the suprasystem tends to pursue its self-reinforcement. To do so, it often structures functional spaces that impose specific forms of organisation on the subsystem. In other words, the suprasystem and the structure of mitigation supporting it impose downwards pressure on individuals and their relations, and tend to work as moulds: the modalities in which this downwards causal effect operates determines the space the subsystem has to, in turn, re-shape the suprasystem. One is either shaped or crushed by a mould, and the suprasystem enforces a regime of selection over the living matter composing the subsystem by conforming its capacities to a standard or, in alternative, removing those capacities altogether.

Progressively detatching itself from the needs of the subsystem, the suprasystem essentially exploits it to guarantee its own preservation. Today, we are inhabiting structures of mitigation whose historical forms have evolved not only to 'accommodate' a growing number of individuals, but to support the constantly intensifying energetic demand of the suprasystem. The historical complexification of the relation between these two levels, a social subsystem and an economic-cultural suprasystem has reached a tipping point with industrialization and the technoscape it has produced to manage the sharing of energy management processes. At their current stage of complexification, urban structures of mitigation have to deal with a great amount of variables, and new techniques to support their manipulation allow the city to become an interface between the voracity of a capital-driven suprasystem, and its subsystem, constituted by the individuals and their relations. The design of the city is indeed always already captured by the paradigms directing the suprasystem and by its formulas: as we will see, hygiene, security, and smartness represent in fact as many 'rules or norms' – to hint back at Canguilhem – that structure the urban environment in order to alter the internal relations of the subsystem and to impose a functional order on it.

Designed, directed and employed to implement these formulas in the life of society, the city is not an organism, but the technical support for a living system. As such, it must be understood both as a structure of mitigation and as the complex of constraints that reinforce the new regimes of selection imposed on the subsystem as a consequence of the mutation of the technoscape that characterises it. The form of the city as a mould is not *directed* then by 'every conscious and rational act' of the individuals inhabiting it, but rather *enforced* and *kept in place* by every *non-conscious* and *non-rational* act diffused according to a purely economic rationale, through regimes of signs and the contagious propagation of operational patterns. As a structure of mitigation, a city works as an enveloping object (Simondon 2018).

The starting point of the argument with which Simondon defines this notion is that 'Man does not always communicate with others or with things directly' (22)[7]. In other words, every form of horizontal relation relies on some sort of medium. In the case of human communication, their material supports constitute both the medium and the series of constraints that contribute to shape the relations between individuals. These relations are influenced by the milieu, that 'is itself an object because it intervenes in the phenomenon'(24). The form of structures of imposes a distribution of subsystemic elements. With the example of enveloping object he proposes, Simondon focusses precisely on the distribution of the elements within the structure that hosts them:

> For example, in education, talking around a table does not create the same relationships that take place […] in an amphitheater. Talking around a table "democratises" relationships. The class of thirty, used for a course, leaves a lot of room […] for the teacher, and allows him to be autocratic. The amphitheater, with its amplification equipment, immobilizes the teacher but gives a certain freedom to the students. (22)

This example is precious because it points at the node between circulation, distribution and individuation. In education, different arrangements of the classroom affect the processes of individuation of the students in different ways: being taught around a table has different developmental effects compared to being taught in a more traditional way. The way in which matter, energy or information circulate among the elements of the system contributes to their individuation, and the way in which these are distributed shapes the way in which they have access to the flows circulating within the system.

[7] All translation from this source are mine.

If we follow Simondon's argument on the enveloping object then, we can maintain that it is inherent to the technologies of mediation, and to the structures of mitigation that they compose, to constitute political and behavioural divisions. However, while the division of labour in honeybees is related to functional features of the individuals composing the subsystem, the differences imposed by the suprasystem on social life are modelled by the formulas shaping the modern structures of mitigation.

Hygiene

The success of human structures of mitigation in relation to the variability of the environment usually causes an increase in the system's density. This factor is parallel to a general complexification of the system: proxies like organs of political representation and money start mediating the widening gap between the subsystem (society) and the suprasystem (economy, bureaucracy…). One of the pivotal changes provoked by the industrial revolution regards the explosion of population growth, which thereafter became exponential. This striking growth in population was accompanied by the increasing concentration of people in urban centres, where work and resources were more available. As a consequence of this, the city of the 19th century started to be organised in response to the growing problem of public health. The structure of mitigation adjusted to alleviate another form of stress, this time endogenous, afflicting the living system it supports. In the face of this crisis, the organic conception of the city has allowed to link urban dysfunctions to 'the sickness of the urban body' (Gille, D. 1986: 228). However, these disfunctions are thought in relation to purposes that are already more than simple mitigation and impose an order on the subsystem to preserve suprasystemic homeostasis.

As described by Didier Gille, hygiene is a principle of discrimination, a form of digitization that inscribes patterns in the material structures of the enveloping objects to organise the circulation of individuals and resources. Inscribing designed circulatory pathways, the suprasystem produces boundaries that will be imposed on life and ultimately mould it. Starting from this principle then, 'The territory will be partitioned into ever more restricted zones. Highways built around the borders of "problem neighborhoods" already form invisible walls closing off those areas from the middle-class subdivisions' (The Invisible Committee 2009 [2007]: 27). The architecture of the city reinforces the social structure imposed on the subsystem and the class divisions that in other animal systems are connected to anatomical differences, while here are grounded purely on financial discrimination and enforced through forced cultural and economic exclusion.

The key aim of the hygienic re-structuring of 19th century structures of mitigation is then to fight what Gille calls 'stagnation': 'Since the city is suffering from confusion and stasis, what is indistinct must be differentiated and what is stagnant must be put into "circulation"' (Gille, D. 1986: 228). According to the principle of hygiene, the concentration of population provoked by the intensification of the flow of energy in the urban centres and the potential development of illnesses that this entails are connected to the structure of mitigation and its effects as an enveloping object, that is, to its capacity to structure the relations of the objects it hosts. 'All crowded establishments in the city are invitations to typhus, one of the many reasons that such establishments (barracks, prisons, workers' housing, etc.) should be moved to the edge of the city, where conditions of isolation and ventilation would guarantee both their security and that of the city' (229).

This is one of the principles of distribution of the city of the 19th century, and constitutes the material context in which the technologies of power described by Foucault appear. Except for the school, in fact, whose value is also symbolic and has to be showed in plain sight, prisons, hospitals and factories are usually relegated to the outskirts of cities: 'From this perspective, working-class neighbourhoods are especially dangerous. The crowded conditions and confusion in which workers live, eat, sleep and sometimes work, as well as the moral chaos these entail, generate or focus' (229). Working-class 'problem' neighbourhoods represent a danger for the architecture of the suprasystem, and they have to be well 'defined' in the double sense of 'delimited' and 'differentiated'. Circulation has therefore to be managed in the city and pathways/boundaries have to be articulated among these sites, the centre, and the factories.

In the case of hygiene, equating the city to an organism has made it possible to treat urban environments as living beings, and to model them on the ideal of a healthy organism. The solution to the illnesses of the city, however, has not been thought to reside in the structure of the suprasystem, but in the architecture of the structure of mitigation, and the density of the subsystem is dealt with not considering the economic conditions that generate it, but only the material structure by which it is supported. This structure is thus organized in separate areas between which circulation channels are inscribed after being designed with the purpose of serving at the same time as boundaries: 'The installation of a network of "circulation" is a fundamental stage in modern urban surgery […] this network delineates the boundaries of the circumscribed and separated islets' (231).

In a passage that is worth quoting at length, then, Gille describes the ideal prerequisites for the emergence of Foucauldian disciplinary societies and the structures that support them.

> [T]he city has finally discovered its intrinsic nature: it was because it was a body that it was sick, that it was not really a city; and it is because it is finally an organism that its eternal truth is revealed. An organism is a supposedly living being whose meaning nevertheless can be entirely reduced to the structure that accounts for it, whose organs are actualizations

> of abstract functions, whose essential finality is the preservation […] of its structure […] Thus the city will be composed of a series of clearly differentiated functional organs and of a series of 'circulatory' organs that allow for their communication. The hygienist movement derives its impact from the strength of this model. (239)

Echoing Deleuze and Guattari's concept of the body without organs, this description points to the idea that the organic understanding of urban environments and the process of in-formation of urban structures of mitigation this directs, 'make the organs' to the subsystemic body. Through this process, the relations between topography and topology, map and territory, start to be exploited as channels through which power is exerted on society. In relation to this suprasystemic undoing of the social body, to its striation and transformation in an organism, it might be interesting to highlight that, in his original formulation of the notion of body without organs, Artaud had already identified automation as the key concept of this model: 'When you will have made him a body without organs, // then you will have delivered him from all his *automatic reactions*' (Artaud 1976: 571). Striating the social body through the mould of the structure of mitigation installs automatisms within the subsystem through a thorough limitation of the capacities of its elements in relation to affluent flows of matter/energy and the monetary proxies that articulate their circulation. For instance, the status of one's neighbourhood has been found to have a higher impact on the development of compulsive gambling than other features like race, gender, or age (Barnes et al. 2013). Engineered economic constraints push low-waged people to live in deprived inner-city or suburban neighbourhoods, and these areas have the highest number of gambling venues (Davies 2021). This exposes less well-off individuals to the risk of becoming gambling addicts, with all the psychological and behavioural automatisms related to such addiction.

The control of space, the imposition of an order that fosters the automatisation of an endless circulation regulated by financial rhythms, further expands the gap between subsystem and suprasystem, making the structure of mitigation the interface for the development of discipline and the primary organ for the imposition of designed regimes of selection. In the next sections I will outline the evolution of the other formulas that shape the urban structure of mitigation, the relation between Foucauldian discipline, Deleuzian control and spatiality (both Euclidean and Riemannian), and how they shape the material structure of the city in the age of its 'smartification'.

Plugging in the city

As we have seen, structures of mitigation have energetic economies of their own, the maintenance of which is imposed, through different forms of downwards causation, on the components of the sublevel: living individuals and their relations. While releasing environmental pressure, the emerging whole acts as an additional agent of selection and as a source of organisational discrimination projected on the subsystem, usually causing the structure to be maintained by one class of individuals and be managed by another. For Richard Wrangham, for instance, the adoption of cooking with fire, that is, the partial exosomatisation of metabolic processes and the possibility to share its benefits between individuals of a community, has caused the modern sexual division of labour by separating men, who hunt, from women, who gather (Wrangham 2009: 129-146). The behaviour of the individuals composing the subsystem is determined by a regime of signs, that is, by the set of codes and order-words that, through the incorporeal effects these produce, influence subsystemic relations. The mandibular pheromone emitted by a queen bee, for instance, establishes a semiochemical regime that influences social behaviour in both short- and long-term, determining subsystemic relations of mating to the point of limiting the development of the reproductive system of worker bees, as well as directing the upkeep of the structure of mitigation and the circulation within it (Slessor et al. 2005).

Configuring the physical structures that support the channelling or arrest of flows of people, miasmas, the circulation of diseases, litter and sewage, but also the spreading of potentially explosive dissent and social unrest, the hygienist paradigm has accompanied urban design since the dawn of industrialisation. A clear implementation of this design strategy can be appreciated with the Haussmanisation of Paris (Harvey 2003a: 102-112). As we have seen, the hygienist paradigm operates in accordance with the principles of disciplinary societies, hylomorphically imposing forms with precise functions, moulding urban layouts to conform to the broader technology of domination described by Foucault. Implementing the metaphorical conception of the city as an organism, this type of codification allows for the domination of the subsystem to be framed as therapeutic, or as a cure for the illnesses of society (Canguilhem 2012: 70).

In the following pages, I will argue that the digital stratum impacts on social life through the production of a new strategy for the constitution and management of urban structures of mitigation that, instead of treating cities as organisms, destratifies them into *bodies without organs.* As anticipated above with Artaud's verses, in fact, to perceive the city as a body without organs, to destratify it and reach the layer of virtuality that composes its phase space, equates to exposing its 'automatic reactions' both to the fluctuations of the environment and to suprasystemic pressure, allowing for their dynamic mapping and their consequent modulation. The digital stratum plugs into the urban environment its internal and external feedback loops, allowing destratified urban flows to circulate between its form of content and substance of expression, while the city is clasped between its sensorium and its form of expression, its set of alloplastic suggestions, as between the hammer and the anvil. Before dealing with the paradigm of smartness directing this relation, though, we must collocate it on the evolutionary line that connects hylomorphic and morphodynamic technologies of power. To do this, I will consider some of the most diffused ideas regarding the rhetoric of the smart city and introduce the paradigm of security, whose importance for the development of the paradigm of smartness has largely been ignored.

The author of a pamphlet explicitly titled *Against the smart city* (2013), American urbanist Adam Greenfield connects his most recent definition of digitally enhanced urban environments to the paradigm of the Internet of Things, or IoT. This refers more or less to every possible implementation of digital perception and networked calculation within physical objects, be they of everyday use or embedded, often to the point of disappearing, in the background of contemporary life. Such smartification of ordinary objects is perpetrated at every scale, from the dimension of portable and wearable devices like smartphones and fitness trackers to the microscopic size of implantable bioreceptors (Tu & al. 2019) used for the monitoring and enhancement of the body and praised by the transhumanist ideologues of the quantified self (More & Vita-More 2013); to the slightly bigger scale of domotics, the domestic implementation of calculation covering the computational management of appliances and multimedia while serving the commercial needs of the customers-inhabitants; to entire urban environments. The smartification of the city embodies a more general tendency, 'driven by the desire to achieve a more *efficient* use of space, energy and other resources. If the ambition beneath the instrumentation of the body is a nominal self-mastery, and that of home convenience, the ambition at the heart of the smart city is nothing other than *control*' (Greenfield 2018: 48). The form of control to which Greenfield alludes in this passage relies on the incorporation of the streetscape in the sensory layer of the digital stratum (48-49). Apart from CCTV cameras, whose deterrent function requires also their visibility, the sensors connecting the city to the digital stratum are not meant to be seen and, working in the background, effectively disappear into it. The sensory layer of the digital stratum has the function of recognizing features and events in order to inoculate their destratified, binary translation into its loops. In fact, the forms of content and the substances of expression of the sensitive city will then manage the layout of the infrastructures that support a variety of flows, from traffic lights, barriers and retractable bollards, to water and electricity distribution channels, sewerage and irrigation or, more simply, to signal to the community when parking spaces are available or to the municipality when recycling bins are ready for collection (50).

Buried under concrete, protected by opaque glass globes, silently crunching numbers and timetables behind turnstiles or ticket machines, these sensors are complemented by other systems, like CCTV 'with advanced capabilities like face-detection and -recognition and gaze tracking' (50). Being perceived by the public as more directly personal instruments of control, these systems raise privacy concerns, often confirmed by analyses that indicate the flaws and biases implicit in their design (Singer & Metz 2019; Grother & al. 2019) and installation, as in the cases of face recognition algorithms not being able accurately to recognise black people (Simonite 2019) or of automated license-plate readers being mainly deployed in poor neighbourhoods (Mass & Gillula 2015). To these ethical, rather than merely technical problems, one must add the series of vulnerabilities highlighted by British geographers Rob Kitchin and Martin Dodge (2019). Among these issues, the authors highlight the loss of individual civic responsibility, offloaded onto the automatic systems that manage the city for its inhabitants, the outsourcing of public services to digital technology firms, ready to step in where economically challenged municipalities in search of cheap fixes for the deterioration of the sector (Grabar 2016) and the general hackability of systems connected to exploitable networks (Ng 2018). These issues are connected to the episodic need to patch bugs and glitches and to the obsolescence of systems that need updating, just like any other piece of digital technology, to face new urban conditions and environmental or economic challenges. According to a business strategy nowadays extremely widespread, obsolescence could be planned in smart cities by its programmers, or be affected by other events that risk short-circuiting the control a municipality has on the system and the data it has processed (Greenfield 2018: 61).

This series of threats to citizens' rights, the issue of the ownership of the data that the city collects from their behaviours and the possibility these could inform social sorting mechanisms are only some of the most superficial consequences of the paradigm of smartness. As highlighted by urbanist Maroš Krivý, in fact, the rhetoric of the smart city signals a global tendency to the re-structuring of how power is grafted onto collective life: 'the SC is foremost an entrepreneurial myth having little to do with how actually existing urbanisation unfolds. While this would be a fair point, I want to suggest that the virtual state of an always deferred potentiality is the SC's fundamental mode of existence' (Krivý 2018: 10). This passage stresses a fundamental element for my understanding of the rhetoric of the smart city as a framework for the implementation of control.

Yet, critics tend to describe the digital enhancement of urban structures against the background of a more or less dissimulated conception of the city as an organism (the city 'sees' (Amin & Thrift 2017), has a sensitive skin (Bratton 2017), a metabolism, a brain etc.), flattening domination by digital means over hylomorphic conceptions of power. Moreover, focussing on borders and topographical discriminations, most critics end up looking at the city as a protean set-production matrix instead of as a complex system, consequently focussing on the city as a design problem rather than as an entity whose nonlinear morphodynamics results from the continuous variation of digitally enhanced forces of transformation. In other words, critics see the issue of smart cities form the point of view of organogenesis, while instead, the paradigm of smartness understands the structure of mitigation as a body without organs, whose 'fundamental mode of existence', as highlighted by Krivý, is the virtual dimension. Before turning to this aspect, though, one must understand how it has mostly gone overlooked by critics.

Segmentarity of the Stack

A good example of how the problems highlighted above can affect otherwise very detailed descriptions of the smart city's workings can be found in the work of American sociologist and design theorist Benjamin Bratton. The merit of Bratton's major work, *The Stack* (2015) is to have proposed a detailed map of the technical network that concretely supports the digital stratum. This is distributed through a multi-layered structure composed by various hardware and software systems that operate in concert and at different scales: 'infrastructures at the continental scale, pervasive computing at the urban scale and ambient interfaces at the perceptual scale' (3-4).

The physical architecture upon which the digital stratum rests is described by Bratton as the global 'megastructure', which he names 'the Stack', and depicts as already so deeply embedded in the contemporary socio-economic panorama and so powerful both as a tool for thinking and as an actual 'thinking tool', to qualify as the new engine in the process of re-designing the world. The stack is composed of six layers: *Earth*, from which materials necessary to craft infrastructures and designs are extracted; *Cloud*, which includes online platforms and the physical hardware necessary for these to work; the layer of the *City*, which I will describe in due course; an *Address* layer that comprises the protocols attributing unique 'addresses' to points of access to the network and devices in order to allow for their connection; the *Interface* layer, encompassing the software membranes that through sensory stimuli put users in dialogue with the *Cloud* layer; lastly, the *User* layer. Bratton describes the C*ity* layer as comprising a network of megacities, whose spaces are delimited and organised according to 'architectural and informational partitions' (369). While the physical apparatuses constituting the *Cloud* layer are usually inaccessible to the general public, cities are the concrete expression of the omnipresence of the infrastructure of the Stack and envelop definite geographical areas in which its power is exerted. This power rests, for Bratton, on a variety of borders, passageways and passcodes through which the Stack 'opens up and closes off urban spaces to different Users in different ways, allowing different City morphologies for some than it does for others, and in doing so, it generates and automates visceral first-person experiences of platform sovereignty, whether invited to do so or not' (148).

Bratton's description of the relation between urban spaces and digital technologies focusses almost exclusively on the fact that, as a technology of power, the smart city operates as a filtering matrix through a shifting array of gates allowing or blocking the circulation of individuals (or better, of the destratified traits persons are parsed through) and the consequent formation of spatial or social subsets according to specific attributes. These traits are captured by a range of sensors that feed into the first loop of the digital stratum, informing its alloplastic output so that, in the city layer of the Stack, 'anyone's self-directed movements through open and closed spaces [can be] governed in advance at every interfacial point of passage, as built up parametrically through filtering gateways, point-of-purchase identity verification, and the local geography of entertainment' (157). Such spaces generate 'different geometries, [and] accumulate to realize different kinds of geopolitical effects' (23). Bratton's megacities are consequently partitioned by shifting sets delimited through 'Lines [that] are linked, folded, and looped [to] become a frame, keeping things in or out, but like all other frames, they also present a certain section of the world and put it on display' (24). In this way, Bratton describes the borders of the maps produced by the Stack: 'Its geography is not only the allocation of lines, but is a squaring of the line into frames and a multiplication of frames into grids' (37). Describing the smart city in these terms, and therefore depicting what he explicitly labels a 'less modern way of being urban than we assume' (165), Bratton's account reveals a limited understanding of Foucault's possible contribution to the topic, reducing the description of power exerted through the smartification of urban environments to a disciplinary matrix. Conceiving smart urbanism in terms of 'enclosure and mobility' (166), Bratton focusses on the urban morphology of 'reversible partitions' to show, with good reason, how urban environments are exposed to multiple new sovereignties. In doing so, however, he describes a form of power that is still exerted through partitioning instead of a form of domination obtained through the subtle modulation of actual and virtual flows alike, be they analogue or digital. *The Stack* is preoccupied with a form of power that segments space rather than tracing the vectors through which life expresses itself dynamically.

Despite his references to Deleuze's 'Post-scriptum' (174), Bratton's conception of the power exerted through the smart city remains then essentially disciplinary and understands the organisation of life as the design of moulds and evaluation of stages, instead of conceiving digital domination as the modulation of vital processes. This, however, is justifiably supported by Deleuze's own reference to barriers that regulate the movement of the citizens (Deleuze 1995: 182). Following this imagery in his description, Bratton addresses the digitally enhanced urbanscape as the space of connection between re-definable subsets that can be allowed or suspended, reducing the complexity of the open urban system to a matter of set theory. It is only in relation to these borders that Bratton alludes in fact to the government of flows, 'flow of capital, flow of risk' and more in general to the smart city as a mechanism grafted on flows of all sorts, but without defining their modulation, in its functioning and effects, nor taking into account the ontological character of these risks, as allowed by a more attentive reading of Foucault's work (Bratton 2015: 289).

That of *The Stack* is then a segmentary description of what is instead played on continuous flows and performed as a process. What is instead important to highlight in the rhetoric of the smart city, though, is not limited to the regulation of circulation through the design of reactive access points or gates. When it is exerted through the weaponization of the digital stratum, in fact, power must be understood as the capacity to manipulate virtual fields of affordances and modulate the lines that compose their phase spaces. This modality of domination is not just about governing possibilities through a segmentation of flows, but also about *programming* them, limiting capacities and crafting tendencies to graft onto urban life: in this sense, also in urban environments, the exploitation of freedom and choice engineering become the rule. For this reason, we need to understand how the stratum is plugged in the virtual field of urban environments and what part these play in the process of transversal emergence generating the subject of control.

Security

Sécurité, Territoire, Population is the title of a course that Foucault gave at the Collège de France in 1978 (Foucault 2009 [2004]). In these lectures, the philosopher describes a technology of power distinct from discipline that takes populations as its object and aims at governing not only the sphere of the actual, but that of the probable. This aspect constitutes a fundamental difference from disciplinary regimes, which are concerned with an administration of the present and the design of the future through the conditioning of behaviours and, in the cases in which these defy the pre-established norm, their eventual correction. Through its attention for populations rather than individual bodies, the paradigm of security unlocks instead the immaterial realm of the supra-individual as an object of domination, offering the capacity to govern a dimension of reality that is defined in terms of probabilities and as such does not necessarily correspond to the actual dimension, or the stratified plane of organization that Deleuze and Guattari pair with the 'immanent virtual field subtending morphogenetic processes' (Bonta & Protevi 2004: 124). The notion of population can be defined through the words of historical sociologist Bruce Curtis:

> As an object of knowledge, population is primarily a statistical artefact. The establishment of practical equivalences means that population is connected to the law of large numbers, which causes individual variation to disappear in favour of regularity. In its developed

> forms, population is bound up with the calculus of probabilities. Population makes it possible to identify regularities, to discover "things which hold together," and such things may be both analytic tools and objects of intervention […] (Curtis 2002: 508-509)

A good way to understand the workings of this technology of power is through an example provided by Foucault and connected to the issue of hygiene I have considered above: the regulation of contagions. In the Middle Ages, the exclusion of the lepers from social life was enforced as part of a binary separation established between the healthy and the sick, and operated through the regimes of signs governing the subsystem (Foucault 2009 [2004]: 9). While the strategy adopted throughout the Middle Ages rests on a simple logic of discrimination then, the approach adopted between the 16th and the 17th centuries to face the black plague consisted in a more thorough regulation of the social subsystem through a surveillance apparatus and, more importantly, via the architecture of the structure of mitigation. This architecture organises circulation channels and designates basins where flows are allowed to slow down and produce stagnation away from the classes that administer the suprasystem, geographically kept out of the danger of contamination (Gille, D. 1986: 229), so that 'We can say that this is a disciplinary type of system' (Foucault 2007 [1976]: 19).

Over the 18th century, however, a new model started to be implemented to deal with the smallpox epidemics, that consisted in provoking a contained contagion to trigger an immune response:

> what was remarkable with variolization, and more especially with variolization than with vaccination, is that it did not try to prevent smallpox so much as provoke it in inoculated individuals, but under conditions such that nullification of the disease could take place at the same time as this vaccination, which thus did not result in a total and complete disease. With the support of this kind of first small, artificially inoculated disease, one could prevent other possible attacks of smallpox. (59)

Describing the technique of variolisation, Foucault points at a way to control the flow of infection by experimentally actualising the possibility that one could catch the virus, which would consequently manifest into a less severe form, leaving the subject alive and immunised. I have mentioned that experimentation is necessary to the outlining of the phase space of a phenomenon (DeLanda 2002: 22) and, in this case, we can see that an intervention in the field of possibilities, the experimental and controlled actualisation of the capacity of a system or of a body, can reduce the uncertainty related to its virtual dimension and lead to a desired outcome. In terms that deviate from ours, but that still share the same Deleuzo-Bergsonian distinction between the virtual and the actual, Franco Berardi claims that 'The field of possibility is not infinite because the possible is limited by the inscribed impossibilities of the present. Nevertheless, it is plural, a field of bifurcations. When facing an alternative between different possibilities, the organism enters into vibration, then proceeds making a choice that corresponds to its potency' (Berardi 2019: 1). Variolisation, as the process that brings about immunisation, constitutes an intervention on the virtual field of affordances of the patient's body, an operation that, by producing an 'impossibility', which consists in the fortification of the immune system against a virus, purposefully shapes the virtual dimension of that body. Moving beyond the terminology adopted by Berardi then, who calls *potency* the energy involved in the actualisation of a possibility, we can understand the strategy described by Foucault as the invention of a technology of power that intentionally acts on the virtual dimension of bodies in order to shape it and condition the actualisation of desired states of things. In other terms, a form of power that acts upon the set of real though not actual possibilities a body has to change, and selects which one among these will concretise, and how.

Through the example of epidemics, Foucault describes then the overcoming of the paradigm of hygiene highlighting the necessity of adopting different approaches in relation to distinct transmission patterns and states of evolution of both social system and structure of mitigation. With regards to transmission patterns, for instance, leprosy and the plague differ because, if extensive contact is necessary for the first to spread, so much that it was initially thought that skin contact could have been the vector of transmission, in the case of leprosy, the disease could profit from a greater range of channels of transmission as various as insects, excrement and surfaces previously touched by infected individuals. These differences correspond to the production of two distinct responses, the simple binary that commands the exclusion of the leper, or the organisation of urban environments to channel the vectors of infection away from wealthy areas. The high contagion rate of smallpox, mixed with its slow spreading and the possibility of gaining lasting immunity, instead made it possible to control its virtual vector of transmission: until symptoms manifest, in fact, virtually everybody might carry the pathogen. These three strategies can be classified under the two categories of simple prevention and engaged regulation, the difference between the two reflecting how the two paradigms relate to space.

Echoing the issue of segmentarity I have highlighted in relation to Bratton's work, Foucault maintains in fact that discipline can be defined as *centripetal*, because it functions

> to the extent that it isolates a space, that it determines a segment. Discipline concentrates, focuses, and encloses. The first action of discipline is in fact to circumscribe a space in which its power and the mechanisms of its power will function fully and without limit. […] It isolates, it concentrates, it encloses, it is protectionist, and it focuses essentially on action on the market or on the space of the market and what surrounds it. (Foucault 2009 [2004]: 44-45)

Spatial structures manipulated by this paradigm are fashioned as rigid guides conceived to force a desired result. In this context, the application of the disciplinary paradigm over a structure of mitigation implements in the urban environment apparatuses of surveillance and the instruments for the correction of eventual deviances from the pre-established norm set up according to the code of law. Security measures, on the other hand, are described as *centrifugal*:

> New elements are constantly being integrated: production, psychology, behavior, the ways of doing things of producers, buyers, consumers, importers, and exporters, and the world market. Security therefore involves organizing, or anyway allowing the development of ever-wider circuits. (45)

The paradigm of security can expand its horizons of domination to respond to changes in the economies of the structure of mitigation it governs. With this capacity to adapt to the unforeseen, this paradigm can account for emergent phenomena and represents a first attempt at engineering and controlling complexity instead of a renovated effort to reduce it. Differently from discipline, then, security does not organise the structure of mitigation in order to conform the events taking place within it to a rigid model, an ab-solute criterion, entirely preventing certain things from happening. Security instead allows things to occur and, by observing their development, establishes an optimal ratio at which their intensity or extent is tolerable. In short, the paradigm of security recognizes that there could be something to gain, if not simply something to spare, in this more nuanced regulation of the economy of urban flows. Indeed, Foucault stresses that:

> So you can see that a completely different technique is emerging that is not getting subjects to obey the sovereign's will, but having a hold on things that seem far removed from the population, but which, through calculation, analysis, and reflection, one knows can really have an effect on it. (72)

While discipline is deployed to prevent conducts that do not conform to the desired models, in order to produce desired effects, security lets things happen but regulates their connection with related events and processes. Events allowed by this strategy must fall within the framework of what is deemed to be acceptable, which is dependent on calculation and kept open to possible refashioning. It is acceptable, for example, to inoculate the smallpox in a selected number of individuals, allowing the virus to spread, but only in a controlled environment and quantity, so that, by introducing more immunized individuals in the city, the contagion will progressively lose its dangerousness. The calculation of an average becomes then the form of normalisation proper to the paradigm of security, which doesn't simply understand space as a passive matter to organise, but conceives the urban milieu as the field or medium in which events will, nevertheless, circulate (20-21). Security must not be confused with disciplinary surveillance: security has not individuals or bodies as direct targets, but populations and masses, and instead of looking at individual behaviours in relation to a norm, it looks at the larger causal chains that involve, or can involve the structure of mitigation. Despite its use as a deterrent, punishment arrives always too late, but security allows events to occur to regulate their *effects* on a broader and more abstract scale. Its flexible processes of normalisation operate on the likelihood that specific events happen; on the probability that these can be too detrimental; and on the basis of a calculation of the risks related to the circulation of this or that flow. As anticipated above, this means that, if discipline focusses on the actual, present state of the life it organises in view of a desired effect, operating within the paradigm of security, 'One will therefore work not only on natural givens, but also on quantities that can be relatively, but never wholly reduced, and, since they can never be nullified, one works on probabilities […] one works on the future' (19-20). Consequently, the urbanscape has to be conceived as open to change and in view of the future, a dimension that is not as directly malleable as the present nor as easily measurable as the actual or a past state of things.

In its interest in fostering the self-regulation of a flow through a gentle manipulation of coordinated circumstances then, security differs from discipline also with regards to the way in which it actually shapes the structure of mitigation: 'These mechanisms do not tend to a nullification of phenomena in the form of the prohibition, "you will not do this," nor even, "this will not happen," but in the form of a progressive self-cancellation of phenomena by the phenomena themselves' (66). Operating through an exploitation, formatting and programming of freedom, security qualifies as a morphodynamic instead of hylomorphic technology of power: that is, instead of moulding desired behaviours to conform to an ideal form, it leaves them to unfold and gently steers them in the most advantageous direction. The key points that Foucault's theory of security provides for an understanding of the rhetoric of smartness are therefore twofold: first, security is not interested in individuals and discrete conducts, but in the supra-individual level of populations and in a general economy of circulation; secondly, it does not limit freedom, but exploits it to inform the means of calculation used to modify correlated aspects of reality in order to foster the autonomous development of desired outcomes. These elements are crucial to understanding the use of digital technologies as a tool for domination and the perspective from which this form of power is exerted. The shift of focus from individual bodies to supra-individual processes and from the actual to the virtual dimension underpinning the success of biofeedback control cannot in fact be fully understood without passing through the paradigm of security.

Cyborg Urbanism

Highlighting the importance of the paradigm of security to contextualise the smart city discourse, however, does not suffice to explain the 'intrinsic flexibility of governing through code' (Klauser & al.

2014: 872). The paradigm of smartness must be understood as a tendency towards which ideals of domination are moving, with the smart city as the terrain in which most clearly we can see the process of cyborg-crafting operating at the scale of living systems. The form of power enabled by the digital stratum crafts artisanal cyborgs out of dividual profiles, by operating cut-up cartographies with the phase spaces of its users. These users are at the same time the parsed object of the digital's perceptive layer, constituting its substance of content, and the targets of its forms of expression navigating through its homeomorphic interfaces.

The digital stratum has a double impact on the city. On the one hand, the cityscape assumes a new dimension because the stratum smoothens the Euclidean topography of the urban space in the Riemannian cyberspace overlapping it, allowing for a correlation of data points in which interrelated but not necessarily contiguous events are destratified. On the other, the analytical capacities of the computational expose the ontological dimension of the virtual as an object of governmentality. In order to assess the potential of the smart city as an instrument of domination, one must understand how these two elements interface and how the cyborg-crafting process works at the level of populations. In other words, having mapped the stages of moulding and monitoring as the operations of discipline and security, and having pointed out that the latter paves the way for the operation characteristic of control as described by Deleuze's 'Post-scriptum', we must now ask what exactly gets modulated, that is, altered morphodyamically in the urban environment.

An important difference between the technologies of power I have described above is related to the way in which they address uncertainty. Disciplinary power tries to eliminate it through constriction and surveillance, while both security and control encourage events to unfold relatively freely. These allow the indeterminate to manifest within certain limits, so that its developments can inform future action over specific eventualities, which is to say, their curbing or amplification, that will be obtained through the regulation of interconnected factors. Building on this approach, the most interesting aspect of computational tools of domination is that these do not simply gain control of the flows in themselves but aim at dominating the emergent social behaviours whose phase spaces border with that of these flows. Criticizing what I have referred to as an organic conception of the city, London-based architect Wolf Mangelsdorf introduces a notion I find quite useful to describe the peculiarity of the smart city paradigm:

> The design of urban infrastructure has for decades been driven by a notion of technical efficiency determined by simple equations of flow. Number of cars at a given speed determines the width of roads, and pedestrian flows generated by key attractors – stadia or railway stations for instance – result in route layout, width and surface design with little notion of the spatial qualities generated; spaces are separated according to their usage […] There are some fundamental flaws in this approach. The focus on primary measurable flows, which results in a city based on a technical notion of infrastructure, negates any

> aspect of the informal meta-flows that depend on not being predicted, predictable or designed, but are emergent, allowing for human activity, change and adaptability. (Mangelsdorf 2013: 95)

What Mangelsdorf refers to as 'meta-flows' consists essentially in the results of a transformation of a flow into another and constitutes part of an emergent layer that the author identifies as a metasystem of secondary, emergent flows. Let us now shift away from an approach that looks at urban infrastructure and governs flows of energy, people, information and waste through the direct manipulation of the gates and channels devised for their circulation within a structure of mitigation. Moving towards an ecological and holistic understanding of how these flows interact with one another, allows us to comprehend that not all the flows can be planned in advance or directly regulated through interventions on the infrastructural layer of the city. Some of them are crucial for a neoliberal organisation of nature, but can only be encouraged, followed in their development and gently modulated. The idea is that the design of specific infrastructures supporting primary flows, as stations channelling the circulation of commuters, can be connected to a wider urban ecology whose emergent characteristics germinate from the relation between these flows and their surroundings: a flow of commuters can easily branch off into flows of pub goers, shoppers or minor flows of drug-dealing. The emergence of these flows depends on the interaction between the primary flow and the infrastructure. For this reason, control acts on urban ecologies more than on urban infrastructures: it reaches, in short, the farthest point from the disciplinary paradigm, while at the same time expanding the scope of surveillance mechanisms towards the larger dominion of the virtual field of affordances of a complex urban ecology.

Foucault describes the urban milieu as a collection of 'natural' and 'artificial' givens (Foucault 2009: 21). This idea invites an understanding of the city in its hybridity, where designed and spontaneous elements interact to produce emergent effects that must be integrated in a fuller description of urban ecologies. The city must therefore be conceived as composed by two sets of elements. On one side one must consider spontaneously occurring events, or primary flows like human circulation, flows of capital, water, energy, CO_2 and other waste cycles. These are largely channelled by infrastructures, and increasingly approached in their virtual dimension, first in terms of risk and probability through the paradigm of security, and then in the form of dividual tendencies and capacities revealed by the analytic loop at the centre of the digital stratum. To these data points clustered around dividual patterns, one must add the elements of design epitomising the various forms of intervention designed to regulate primary flows and the eventualities directly related to their oscillations. This ecological conception paves the way for an understanding of smart city rhetoric as a form of 'cyborg urbanism', to be conceived in the light of the transversal emergent subject of control I have described above through the figure of the artisanal cyborg. Channelled primary flows generate emergent behaviours on a meta-level of secondary flows, which are the directions in which life spontaneously develops around the channelling infrastructures that shape the structure of mitigation. These secondary flows, these emergent mass behaviours, constitute the urban matter the stratum is interested in capturing and parsing in order to gain control of the virtual field through which these lines run. The passage from the paradigm of security to that of computational control, then, does not simply consist in an automatization of the management of gates and circulation channels, nor in an enhancement of the capacity to calculate risks and probability. More importantly, the shift between these two paradigms involves instead the definitive switch between an understanding of the city as an organism, composed by infrastructures positioned *in view of* primary flows to harvest, direct or get rid of, to the city as a body without organs, a morphodynamical control of structures of mitigation as structures of modulation and not only a regulation of actual flows through infrastructures, but also of a crafting of meta-flows, emergent behaviours whose traits can be selected through cut-up cartographic interventions.

This makes of the smart city the ideal product of a cyborg-urbanism. Architect and Harvard School of Design professor Antoine Picon has been using the concept of cyborg-city to describe the integration of computationally enhanced urban infrastructure and living systems:

> In an essay entitled 'La Ville territoire des cyborgs' ('The City as Cyborg Territory'), I suggested in 1998 that the cyborg could represent for the city of today – a city that is both ever more spread out and suffused by digital networks – the equivalent of what the figure of the ideal man represented for the Renaissance city: a fiction allowing a better understanding of some aspects of the logic that makes up the urban environment, together with the profound nature of individual experience that is supposed to correspond to it. (Picon 2015: 79)

The problem with Picon's description, though, is that he conceives the cyborg as a modular, homeostatic construct rather than constantly modulated result of a process of emergence. Reflecting on the hybrid character of urban ecosystems in terms akin to Stiegler's idea of exosomatisation, Cambridge geographer and urbanist Matthew Gandy stresses instead that the relation constituting the cyborg blurs the elements related, defining the cyborg-city 'as a post-metabolic city in which the exchange of information has supplanted the role of material exchange to become the dominant dynamic behind the shaping of urban space' (Gandy 2005: 35). Although this idea is significantly closer to my conception of the smart city, I must add to Gandy's words that the product of such a post-metabolic cyborg-city, understood as a body without organs instead of as an organism, is the cyborg-population that inhabits it and not only the refashioning of its physical structure.

While the experimentation of variolisation was carried with regards to only one dimension of the urban multiplicity, in fact, through the array of sensors beaming dividual features to the coordinated network of analysis that constitutes supra-individual profiles of mass behaviour, the paradigm of smartness can assess a more complex phase space of urban environments, which are then read by the stratum as bodies without organs: immanent, destratified planes hosting the circulation of virtual flows. Conceiving the urban structure of mitigation as the exact opposite of an organism, then, the digital stratum plugged in to the fabric of the city can manipulate the conditions of its 'artificial givens' to direct not only primary but also emergent flows in the formation of transversal emergent effects on the scale of population, constituting a cyborg-citizenry on top and around the artisanal cyborg user I have described above. If Deleuze and Guattari stressed that 'Staying stratified-organized, signified, subjected is not the worst that can happen; the worst that can happen is if you throw the strata into demented or suicidal collapse, which brings them back down on us heavier than ever' (Deleuze & Guattari 1987 [1980]: 161), then, the paradigm of smartness represents one of the most dangerous projects involving the digital stratum. This project consists in engineering the spontaneous emergence of behaviours by intervening on the modulation of the virtual flows involved in these processes. The phenomenon of homelessness could be a good example of the application of the digital stratum to urban environments. The movement of homeless people from one place to another is indeed an emergent, secondary flow of people circulating within urban environments, a consequence of the re-Darwinizing selective pressures imposed by the economic suprasystem. Homeless people move constantly from the streets to emergency shelters, transitional houses and vice versa and, while cities are not designed for these flows, some components of the urban landscape are explicitly deployed to keep the homeless population away from the economic centres, that is, to keep these flows moving (Savicic & Savic 2013). Homeless individuals might seek admission in more than one transitional house, if these start meeting full capacity. The discourse around the possible 'optimisation' and 'regulation' of these flows through the deployment of algorithms is already taking place on the margins of the discussions around the smart cities, where it often adopts the language of 'risk management' and 'preventive' assistance (Khayyatkhoshnevis et al. 2020: 190-191). While we will probably see the effects of this rhetoric over such a vulnerable, expanding population over the next decades, before concluding this chapter it is important to highlight two elements, stressed by the French post-anarchist collective *Comité Invisible*. First, that 'One never maps a territory that one doesn't contemplate appropriating' (The Invisible Committee 2015 [2014]: 105), which means that the power of computational analysis of tendencies and capacities of living systems is practiced in order to expand the scope of domination to the virtual field. Secondly, that

> cybernetized capitalism does practice an ontology, and hence an anthropology […] cybernetics is producing its own humanity. A transparent humanity, emptied out by the very flows that traverse it, electrified by information, attached to the world by an ever-

> growing quantity of apparatuses. A humanity that's inseparable from its technological environment because it is constituted, and thus driven, by that. (110-111)

This ontology is not circumscribed to the actual dimension, but is increasingly virtual, and this humanity is a cyborg-humanity, paradoxically emergent and crafted at the same time. These two points converge in the rhetoric of the smart city, whose mission consists in an expansion of the paradigm of security, insofar as, ‘The question of cybernetic government is not only, as in the era of political economy, to anticipate in order to plan the action to take, but also to act directly upon the virtual, to structure the possibilities’ (113).

Moving beyond the organic conception of structures of mitigation and towards an understanding of the city as a body without organs, the urban milieu is in course of mutating in a structure of modulation, whose goal is the crafting of cyborg populations as the collective incarnation of the *nouveaux monstre* Deleuze alluded at in the ‘Post-scriptum’ (1995: 178). Control is a form of power grounded on freedom, and acting as a background force that shapes complex hybrid ecologies and the conducts taking place within them before these become actual.

Chapter 8: Phase-space Capitalism

My work is informed by a simple premise: as we shape them, our tools have the power to shape us too. By exteriorising cognitive operations into blackboxed digital tools and employing them to enhance our capacities, we are ending up thinking through them and becoming increasingly dependent on their configuration. Today, these tools permeate our environments and mediate most of our interactions, often serving political and economic interests to the detriment of noetic life. In the previous chapters, I have pointed at recommendation algorithms and homeomorphic interfaces, in addition to the paradigm of the smart city and the phenomenon of virality, as some of the key elements of a new technology of power underpinning the morphodynamic modality of domination that, after Deleuze and Burroughs, I call control. Rather than imposing strict rules on the behaviours of individuals, control plugs designed algorithmic processes into spontaneous processes of emergence, to nudge their development.

To understand the scope of digital control and map its implications, my work has then asked, 'how are digital technologies grafted onto human life?' and 'how do machines perceive and change the world?'. I have provided an answer to these questions by integrating digital technologies within a broader processual understanding of reality that I have outlined in chapters 1, 2 and 3. Against this background, which shows how things come to be and accounts for the virtual dimension of their tendencies and capacities, in chapters 3 and 4, I have developed a descriptive method that I call Stratoanalysis, and applied it to study how digital technologies are impacting the physicochemical, the organic and the anthropological registers of reality and altering their most typical processes of emergence. Chapters 5, 6 and 7 have looked at the relationship between life and the digital respectively from the point of view of life forms, living individuals and living systems, that is: chapter 5 has looked at the process of humanisation *qua* technicisation and at the becoming-algorithmic of human life as the modality of individuation preceding the constitution of the artisanal cyborg; chapter 6 has instead looked at an existing life form whose most characteristic traits are replicated by digital technologies, a becoming-alive of digital technologies, and considered how its behavioural pattern gets reinvented by its digital transmutation as the spreading pattern of viral suggestions; chapter 7, instead, has looked at the emergence of collective living systems and described how digital technologies manipulate the spontaneous emergence of flows within them as well.

The relation between the digital and life expresses through a biofeedback loop by which the stratum perceives interactions with its sensorium, analyses them to uncover virtual patterns and produces suggestions that will guide further interactions. The result of this process is the emergence of the artisanal cyborg, the subject of algorithmic control whose behaviour is modulated through the processes of destratification, dividualisation and suggestion, which transform the correlation between the behaviour of multiple users into causation.

To define destratification, I have considered how continuous flows of matter and energy are constantly segmented by transformative systems. The operations performed by these systems give rise to the spontaneous emergence of discrete entities, but also, in a progressively limited number of cases, to instances of perceptual digitisation and of linguistic grammatisation. Building one on top of the other across different layers of complexity, all these processes underlie the production of the particular type of cuts operated by the digital stratum, that we named digitalisation and I have described as the destratifying operation that sets off the biofeedback loop of control. Let us recap through a quick example: say you are thirsty. Turning on the tap in the kitchen allows a flow of water to fall in the sink and run through a drainage system. When you put a glass under the tap, its volume will operate a cut in the now unimpeded flow of water. Drinking out of the glass, you then swallow smaller amounts of liquid, performing another cut in the flow of water you now pour in your mouth. A sip of water moves down your throat and gastrointestinal tract and is eventually absorbed via osmosis. By that point, the original flow of water is parsed into molecules. The glass, your throat and the walls of your gastrointestinal tract operate different types of cuts on the flow of water, performing what I have defined as flow-cuts. Perceptive systems like eyesight work in the same fashion, cutting flows of energy and matter according to their degree of complexity and internal arrangement. Like every other perceptive systems, also digital sensors perform cuts over the flows of energy and matter they are designed to perceive.

While the notion of flow-cut describes how bits of matter and energy are delimited and extracted from *continua* of movements or transformations, the history of grammatisation illustrates how discrete quanta, inscribed on mnemotechnical supports, can be re-connected according to pre-codified rules. Flows of voiced sounds, for instance, can be parsed and translated into discrete graphical units whose emergent configuration and use consolidate through the development of technical supports like dictionaries and grammars. Similarly, when the digital stratum performs flow-cuts, it translates parsed flows of matter and energy in the standardised elements of the binary language, reducing the complexity of the movements or surfaces it captures to expose their grammes to a separate field of concatenation. This allows the stratum to reconnect digital grammes according to its own rules: while a grammar codifies the spontaneous use of a language into the guidelines one needs to follow in order to participate in the exchange of meaningful enunciates, the digital stratum imposes a more sophisticated connection between destratified grammes.

First, the stratum destratifies the behaviour of multiple users in relation to analogous categories of content. Then, analytic processes that take place over vast, supra-individual collections of data, recognise recurrent patterns in the behaviours of users that share features as: similar age, chronology, geographic location etc. These behavioural patterns are employed to constitute dividual profiles as supra-personal, abstract models of the tendencies and capacities of individual users. Here is where the relation between the digital and the virtual starts to become apparent, for the latter is the dimension of the possible, the sphere of the real, yet not necessarily actualized affordances of individuals and collectives. Complexity theorists call phase space the diagram composed by these tendencies and capacities: a map of possibilities that will become actual only given the right conditions. Rather than a destratified individual, that is, the individual as it is perceived by the eyes of the machine, the dividual is a supra-personal technical entity, a patchwork, a cluster of non-contiguous, destratified individual interactions whose analysis produces glimpses of individual phase spaces that the stratum uses to inform the output of its biofeedback loop.

Suggestions populate then homeomorphic interfaces, and push, say, the users of a platform, towards the specific type of content that recommendation algorithms have flagged as the most likely to drive more engagement and activity through the platform. In doing so, recommendation algorithms tend to collapse the vast array of possible uses of a platform onto one specific virtual tendency identified through the process of dividualisation. Transforming correlation into causation by latching on a possible chain of correlated pieces of activity and driving action towards content of the same type, the stratum engenders the emergence of what I've called the artisanal cyborg.

In this way, and through a few other tricks, the biofeedback loops of control weaponise the relation between the digital and the virtual to establish a new regime of domination. Control fosters a becoming-algorithmic of human life, both individual and collective, in a movement that is mirrored by a becoming-alive of digital technologies, exemplified by the digitalisation of viral life and digital contagions. These contribute to the becoming-algorithmic of human life through the circulation of affects that feed into the emergence of the artisanal cyborg, the modulated result of the cybernetic project of control that one can encounter at the level of individual users and at the centre of the logic of cyborg urbanism.

With this chapter, I will complete my description of the impact of the digital on the economy of human social systems. Above, I have suggested that living beings can associate to articulate shared energetic economies, reducing the stress imposed on individuals by their relations with the environment through a transposition of physico-chemical operations onto collective bodies. In the case of humans, the sharing of energy processing is coordinated through exchanges within symbolic regimes, and hinges on the production of structures of mitigation, the physical supports of collective bodies. These are homeostasis-preserving devices that contribute to the modulation of possibly critical oscillations in the flows of matter and energy crossing social systems, for instance by providing storage capacities, efficient circulation routes, and supporting a reduction of individual energy expenditure in the face of environmental pressure and metabolic needs. To this end, however, structures of mitigation partially displace individual energy expenditure towards the upkeep of the economic-cultural suprasystems we have seen emerging from the interactions taking place at the level of the social (sub)system. While organising the structure of mitigation, the suprasystem exerts over it forms of downwards causation that can be expressed in terms of its re-Darwinization: a refashioning of the selective pressure endured by the individuals composing the subsystem.

As showed in chapter 5, the regimes of signs that govern the relation between the suprasystem and the subsystem couple with the technoscapes on which they are inscribed to mediate the passage to the act of the intermittent noetic faculty. The digital stratum must now be understood as the latest technology devised to suspend the intermittence of noetic life. As I will show in this chapter, in fact, this form of intermittence is suspended thanks to the captivating suggestions that keep feeding the dopaminergic circuitry of our brains, hooking the sympathetic nervous system to performing cognitive work beyond the threshold that separates noesis and bêtise.

In the next pages, I will extend my description of the mechanisms and criteria of resource allocation, in order to understand how social modalities of distribution and accumulation of energy have been reconfigured by the implementation of computation. As I will show, the digital stratum has not only been adopted as a tool for governing the configuration of structures of mitigation and, ultimately, controlling the emergence of meta-flows within them, but it has also triggered a new mutation of capitalism, understood in its triple character of a modality of organisation of nature, a logic of accumulation and a social relation that fosters the suspension of intermittence.

The digital frontier of accumulation

In its classic, industrial setting, capital accumulates through the production and collection of surplus-value (Marx 1981: 251). For Marx, this is a variable resulting from the articulation of the process of production. Crystallising all the energy spent for its production (182-184), a commodity (974) is an object meant to be exchanged on the market (126). Commodities are sold for the original money invested in all the aspects of their production (raw matter, wages, machinery etc.), plus a profit, that is, the form assumed by surplus value in the context of exchange. The extent of surplus value is tied to the degree of exploitation of labour power and is influenced by the pressure exerted on the production process by the market: in a competitive setting, in fact, capitalists are compelled to sell their goods at a lower price compared to others and risk being forced close to selling a commodity at cost price, or even below it. The rate of profit can however be increased by introducing machinery, or by altering the conditions of work (as we will see, only temporarily and up to a certain point). For instance, by lengthening the workday well beyond the time necessary for workers to produce the amount of goods whose sale would cover the cost of their wages (necessary labour), the capitalist employs the workers to produce goods from the sale of which they don't have to subtract their labour cost (surplus labour) (340-341). Since the workday can be prolonged only up to a certain point without leading to drastic drops in workers' efficiency and the inability to reproduce their labour-power, capitalists increase productivity by introducing machines into the process (dead labour) and employing fewer workers (living labour), so as to minimise expense while maximising the commodity output of the process and consequently the rate of profit (Fraser & Wilde 2011: 197). Nevertheless, since the tension between the need and strategies to accumulate surplus-value and the various pressures that tend to lower the rate of profit is never fully resolved, capitalism is characterised by chronic contradictions and prone to crises of different type, magnitude and geographical extent. As highlighted by David Harvey, though, these 'Crises are essential to the reproduction of capitalism. It is in the course of crises that the instabilities of capitalism are confronted, reshaped and re-engineered to create a new version of what capitalism is about' (Harvey 2014: ix).

One of the fundamental contradictions of capitalism is connected to its employment of technology. While technological innovations promise to favour the endless growth to which capitalists aspire, their implementation generates instead an important contrary effect, commonly understood as the tendency of the rate of profit to fall (Marx 1992: 318-319). This is a trend involving labour power as variable capital, i.e., the money spent on wages, and constant capital, particularly in the form of the cost of machinery. By relentlessly innovating to secure short-term advantages on competitors, the ratio between variable capital and constant capital tends to shift in favour of the latter. While capitalists tend to spend increasingly more money on their machines, they soon realise that these cannot be exploited to produce any surplus value, for if production could be completely automated, in the long run they would end up selling commodities at the price of production, and could not accumulate surplus value other than by raising prices over that limit, consequently risking being undercut by other firms. Since for Marx only workers' labour can create new value in the finished commodity, the more variable capital is overtaken by constant capital in a productive system, the lower the surplus value that can be extracted by exploiting the workers, the lower the rates of profit. As a logic presupposing the possibility of endless accumulation, capitalism admits no limits, but conceives contradictions as obstacles to be sidestepped and devises counteractive measures that can delay their consequences (Harvey 2014: 107). Some of the strategies for an inversion of the tendency of the rate of profit to fall are aimed at increasing the rate of exploitation, for instance by expanding the quantity of surplus labour and consequently working hours despite the principle that automation should progressively free time from work; aim at capitalizing on exchange, by exporting commodities on markets where they can be sold for higher prices; and attempt to lower the cost of production by extracting raw materials or buying labour power where these are cheaper.

In its double character of a logic of accumulation and social relation, capitalism can be framed as the emerging code applied not only to social subsystems, but also mediating the integration between the suprasystem, the subsystem and structures of mitigation *with* their environments. For this reason, the definition proposed by Jason Moore allows us to expand our descriptive framework: 'capitalism is more than an "economic" system, and even more than a social system. Capitalism is a way of organizing nature' (Moore 2015: 78). Ignoring their interdependence, 'traditional' capitalist ideology posits nature and civilization as independent spheres, choosing to disregard the historicity of nature itself, co-determined by human activities, to consider it as an endlessly renewable reservoir of energy and work. On this basis, capitalism develops worldviews that consider nature as the passive receptacle of codes imposed through a process of con-formation with the requirements of the hegemonic logic of accumulation. This is what Moore calls 'capitalism's correspondence project', a tendency

> through which capital seeks to remake reality in its own image, and according to its own rhythms. Agricultural landscapes become exhausted because capital must extract unpaid work faster than agro-ecological relations can reproduce themselves. Working classes become exhausted because capital must extract surplus labor as fast as possible. (235)

Elaborating on this tendency as the production of worldviews that periodically clash with the limits of reality, Moore describes capitalism as a cyclical movement for which accumulation, given the tendency of the rate of profit to decline over time and the unescapable depletion of natural resources, may realistically continue only if capitalists find new frontiers, that is, new systems and/or conditions in which the mechanism of accumulation can be plugged in. These frontiers consist in those fields in which it is possible to appropriate any of the four aspects of what Moore calls 'Cheap Nature', namely cheap energy, raw materials, food and labour-power (17). In order to support the capitalist logic of accumulation, cheap nature must be found in (or reduced to) a quantity or state allowing for the rate of energy returned on the capital invested (for their integration in exploitative cycles) to remain high. This framework allows us to understand how value is *co-produced* by human and non-human natures and how appropriation counts for capitalism just as much, if not even more, than exploitation:

> Early capitalism excelled at this: developing technologies and knowledges unusually well-suited to identifying, coding, and rationalizing Cheap Natures. Here the new way of seeing the world – inaugurated by the emergence of Renaissance perspective – decisively conditioned a new organizing technics for the capitalist world-ecology, manifesting in the cartographic-shipbuilding revolution of early modernity, from the Portolan maps and caravels to Mercator globes and galleons, and much beyond. (70)

The technological aspect of this dynamics is of crucial importance, and Moore's insight on capitalism's self-renovation tactics point indeed to its origin in European mercantilism and the vast fortunes it has amassed by profiting of trading in scarce product made accessible by a plethora of techno-scientific innovations. With the words of David Harvey, this process entails 'taking land, say, enclosing it, and expelling a resident population to create a landless proletariat, and then releasing the land into the privatised mainstream of capital accumulation' (Harvey 2003b: 149). According to this general feature, every era of capitalism can be considered as being inaugurated through a new 'imperialism':

> Finally, the possibility of renewed capital accumulation, in a particular sector or for capital as a whole, depends upon finding new frontiers of appropriation. New production complexes emerge. Not coincidentally, every new era of capitalism begins with a "new imperialism" and a new industrialization. (Moore 2015: 101)

One of these new frontiers has been disclosed by the pursuing of financial means of accumulation, a 'perpetual accumulation of capital at an exponential rate by way of an exponential creation of money' (Harvey 2005: 233). Thanks to the higher profitability of financial exchanges over the increasing costs of extraction and production (Moore 2015: 149), financialisaton has allowed a shift from the hegemony of the M-C-M' archetype to that of the M-M' model of capital accumulation (103; Marx 1981: 256-257), with speculation being preferred over investments in constant capital and productivity in response to the need to 'keep in liquid form a growing proportion of […] incoming cash flow' (Arrighi 2010: 372) in the face of a progressive embitterment of competition. Backed up by the computational capacity to perceive and intervene on the tendencies and capacities of markets, financial capitalism exerts its codification power over the *puissance* of economic systems (Bonta & Protevi 2004: 129-130), shifting its focus away from a form-imposing regulation of natural rhythms of reproduction, of the behaviours of the workers, of markets themselves, to a new modality of domination based on the capacity to detect, predict, modulate and invest on their affordances.

David Harvey defines neoliberalism as the economic philosophy based on the idea that 'human well-being can best be advanced by liberating individual entrepreneurial freedoms and skills […] strong private property rights, free markets and free trade' (Harvey 2005: 2). Since the 1970s, neoliberal theory has progressively reduced state intervention in the globalised economy, extending the incidence and scope of market transactions to incorporate 'all human action into the domain of the market' (3). This practice generates a context in which the value of assets can change drastically not simply because it follows variations in manufacture costs or because of the scarcity of a given raw material, but because the relation between supply and demand can fluctuate rapidly on the basis of perceived risks or rewards, potentially generating sharp falls in the demand of a given commodity and/or apparently unjustified crazes for the purchase of specific assets. These factors make financial markets proverbially unstable and reveal the intimacy of the field of finance with the sphere of risk assessment, which, as we have seen in the previous chapter, does not fall in the domain of the actual but, essentially mapping tendencies and capacities of complex systems, discloses a new virtual frontier that since the 1980s has been integrated in the logic of capitalism. Yet, the virtual frontier of financial markets, with their tendencies and capacities, does not hold any new cheap natures. Rather, neoliberalism relies on the necessary input of new fiat money through quantitative easing, indefinitely postponing a more profound crisis that, instead of being overcome, has more recently caused a further, significant mutation in the capitalist logic of accumulation.

Because of the growing difficulty in finding ever new frontiers, in order to overcome the problems related to the tendency of the rate of profit to fall, capitalism's expansion cannot simply continue by moving goods and raw materials from one place to another in the attempt to make a profit on those markets in which some goods are more expensive (as in the case of the spice trade), but must eventually include the active retrieval, or even the production of new cheaps – 'labor-power, food, energy, and raw materials' (Moore 2015: 73) –, and create new markets to exchange them on. As we will see, the resources at the centre of the liaison between the digital stratum and capitalism can be created through a process of elaboration operating over interactions, and collected as 'worthless waste: leftovers lying around for the taking' (Zuboff 2019: 90). In this regard, McKenzie Wark suggests that the need for capitalism to overcome crises has already led capitalists to rely on

> more and more abstract forms of commodification, reaching from land to labor to information […] Commodification now means not the appearance of a world of things but the appearance of a world of information about things, including information about every possible future state of those things that can be extrapolated from a quantitative modelling of information extracted from the flux of the state of things, more or less in real time. (Wark 2019: 14-15)

While Harvey speaks about accumulation by dispossession then, implying if not the previous individual ownership of a resource, at least its previous qualification as commons (Harvey 2003b: 137-182), in the case of the connection of the digital stratum to the latest cycles of capitalist accumulation, we need instead to think about the active production of a new 'abstract' frontier and of a new cheap nature. On this basis, we can then describe the liaison between digital technologies and capitalism as the progressive production, appropriation and capitalisation of a new abstract frontier: cyberspace.

Considering these three operations together allows us to understand the emergence of a new mutation of capitalism, and, maybe, also to speculate on its future directions.

Since the 1980s, the capitalisation of information has become the centre of a growing portion of economic activities. The valorisation of information inaugurates a stage in the development of the hegemonic logic of capital accumulation in which value begins to be extracted from information about information, that is, for instance, from an understanding of the tendencies of the price of financial assets to rise or fall. As a consequence, the circulation of information becomes a more fruitful source of value extraction than productive activity, which is still exposed to the limitations connected, for example, to the impossibility to indefinitely lower the cost of variable capital. The overall volume of value extracted by trading in information, whose price is set by the markets in relation to a perception of the tendencies of assets' value, soon trumps that of trading in material goods. The financial frontier of capitalism constitutes a more rapid and apparently unlimited nexus of accumulation that is freed from the rhythms of reproduction of natural resources and variable capital, and which abandons the logic of Moore's correspondence project to favour the imposition of a more general standardising codification: information can be extracted from everything, and everything can be commodified.

Emerging as the target of a new imperialism, in which cycles of accumulation count on obtaining as much information as possible in order to be able to extract value from an ever-vaster abstract frontier, the infosphere discloses the possibility of controlling social relations through the same approach:

> while after the crisis of 1929 they constructed an information system upon economic activity in order to serve regulation – this was the objective of all the planning – the economy after the crisis of 1973 made the process of social self-regulation dependent on the valorization of information. (Tiqqun 2020 [2001]: 59)

In response to this regulatory necessity, cybernetics started to reveal its great potential as a subtle instrument of government, for it describes economic and social systems as teleological mechanisms, that is, as systems moving in relation to a goal, be it the preservation a steady state, as in the case of homeostasis, or the attainment of a state of development, which can well be selected and ascribed to the system from outside. On the basis of this modality of description, cybernetics allows for intervention in the course of the development of the systems it diagrams, as well as into their behaviours and the environmental features determining them, in order to correct their development towards a desired direction. The concrete application of this worldview necessitates a great amount of energy and active monitoring to eliminate uncertainty in social and economic systems, and this can be provided by recurring to automation, on one side, while, on the other, by developing an effective tactic for the implementation of the system of control into the fabric of everyday life.

The implementation of control

The conditions of control described in Deleuze's 'Post-scriptum' (1995 [1990]) rest on the progressive dismantling of social relations emblematized by Margaret Thatcher's 1987 declaration of the inexistence of society, and through which local subsystems have been stripped of their capacity to actively re-shape their suprasystemic unity. In a world reduced to a collection of connected individuals, everybody gets together to work, consume meals and media, that is, marketing and propaganda. Actors necessitate information to devise lines of conduct in their environments. The opening of the borders of human life beyond local communities has to be guided through information as well, but this might be complex to retrieve from the collection of heterogeneous voices of the social system and is therefore more efficiently distributed downwards, from dedicated organs of the suprasystem: taxation, general social coordination in war efforts and the integration in a national electorate or in a supra-national workforce represent some of the reasons why this information, whose goal consists essentially in preserving suprasystemic organisation over a disciplined subsystem, is distributed by the suprasystem. Media play the role of filtering this information, structuring a regime of signs that, determining the information available to actors, shapes their conducts in compliance with the interests of dominant groups. Linked by the same technical supports, marketing and propaganda are aimed at shaping behaviours to minimise the uncertainty in both markets and social settings. If understood as such, the contemporary history of media can be framed as a progression towards the closure of a cybernetic control loop first around the public and after around platform users.

For instance, the demand for specific products can be raised by influencing their degree of perceived necessity in the eyes of consumers. In order to do this, however, the attention of potential customers must be reached and captured through wide-reaching media devised with the aid of persuasion techniques that have a history of their own. In *The Attention Merchants* (Wu 2017), Columbia Law School professor Tim Wu traces the rise of the advertising business model back to the United States and the mid-19th century, when the growing interest of business in the possibilities offered by advertisement was met by the need for newspapers to increase their revenues and the ensuing coincidence of interests started to alter the focus of the newspaper industry, setting the precedent for a trend that will, in differing degrees, affect every other medium over the following century. According to Wu, this shift is epitomised by Benjamin Day's newspaper, the *New York Sun*. From its foundation in 1839, the newspaper was devised as an attention-capturing platform that, while making spaces available for advertisers to buy, managed to present itself as appealing to a vast number of readers because of its low price, made possible by advertising revenue and because of the nature of its news, whose trivial character stimulated the voyeuristic tendencies shared by potential customers. During its first year, the *New York Sun* became the most read newspaper in New York. This episode is crucial to understand the development of today's economic hegemonies over web 2.0. With its focus on crime news and other highly entertaining topics, Day's newspaper appealed to a vast basin of readers, hiding behind its claim of democratising information an attention-grabbing mechanism designed with the sole purpose of maximising sales. With the growing role of advertisement in relation to media generating a market in which ad space and attention are the two main resources in circulation, the need to influence customers tied itself to the circulation of information just as much as political propaganda did around the 20th century global conflicts. At the same time, this business model ends up shifting the purpose of the medium, transforming it into a platform.

Despite focussing on the relation between digital platforms and capitalism, which started to form towards the beginning of the 21st century, Nick Srnicek proposes a suitable definition of platforms in general. They are: 'infrastructures that enable two or more groups to interact. They therefore position themselves as intermediaries that bring together different users: customers, advertisers, service providers, producers, suppliers and even physical objects' (Srnicek 2017: 13). This definition can easily be applied to Benjamin Day's newspaper and indicates, in the liaison between media and industry constituted through advertisement, the inauguration of the 'platform capitalism' analysed by Srnicek onto a market in which ad spaces are priced on the basis of the presumed effectiveness of the attention-grabbing mechanisms that characterise the platform, and are rented out as doorways to the attention of possible customers. After the becoming-platform of media, therefollows the expansion of the 'attention economy' through which the advertising industry became a crucial part of the capitalist system, where what is sold is the possibility of influencing potential customers, and what is bought is their volatile attention.

Soon, trading in attention starts to be generally understood as necessary to keep the machine of capitalism going. As highlighted by Yves Citton, however,

> Attention, which is always particular, only becomes a currency (Währung) – which may be exchanged on a market, accumulated as capital and invested according to the logics of finance – thanks to a translation operation which homogenizes and standardizes it so that it can enter into a system of equivalence. This operation is carried out by the various measuring devices involved in any kind of rating: print runs for hard-copy periodicals, ticket sales at the cinema, monitoring of radio and television audiences, visit counts on the internet. (Citton 2017 [2014]: 53)

Since investing in the tendencies of stock values to rise or fall amounts to a gamble, investing in advertisement remains a generally risky business. It is not given in advance that purchasing ad space will produce more sales, or guarantee an edge over competition through the aesthetic constitution of a brand. The operation mentioned by Citton, accounting for the value of attention-grabbing mechanisms by measuring different features of a media platform, must be understood as an attempt to reduce the uncertainty in the market of attention. However, ratings always come *after*, say, the release of an issue of a newspaper, and always *before* new investments, frustrating attempts to reduce uncertainty with the seemingly unsurmountable gaps between analysis of previous data and prediction of future possibilities. It is specifically in relation to this difficulty in the reduction of uncertainty that digital technologies have stepped in, in the attempt to turn this linear, intermittent connection between the advertiser and the potential customer, the past and the future, into a more continuous cybernetic loop.

The circulation of advertisements, and their integration into everyday life, are facilitated by flooding structures of mitigation with access points to the web and amplified by the availability of addictive portable devices capable of delivering location-aware suggestions in real time. By design, these deliver dopamine doses through push notifications and lure users in the neuromodulating phantasmagoria of homeomorphic interfaces, so that the advertising economy extends an almost inescapable grip onto human life by attaching attention-grasping machines directly onto the human body with the purpose of filling all residual '*environmental attention gaps*' (40). Taking advantage of the moments in which the attention threshold of individuals is lower, suggestions penetrate the time off work, already progressively colonised by capital and transformed into leisure time, the time of unnecessary although compulsive consumption, a conquest often accepted as part of the series of coping mechanisms developed by individuals to try and escape the psychological and emotional fatigue late capitalism exposes them to. This strategy complements the tendency towards an artificial suspension of intermittence in the life of individuals, that 'bioderegulation' (Brennan 2003: 33) allowing for the machinery of post-industrial capitalism to work incessantly through the 'generalized inscription of human life into duration without breaks, defined by a principle of continuous functioning' (Crary 2014: 8) that Jonathan Crary ascribes to late capitalism and its correspondence project. In these conditions, value is extracted from the unintentional work performed by the users hooked to their devices, in the continuous time of modulation and within an environment designed for the 'breakdown of cognitive control' (20) propaedeutic to its hijacking.

While conveniently granting free and free-of-charge access to their user-oriented services, today's hegemonic web-based companies, and especially those fully falling into the sphere of service economy, have mastered the tenants of the rising attention economy and developed those of the advertisement industry by exploiting the plastic relation between habits and habitats thanks, on one side, to the easy implementation of environmental design on the web, and on the other, to the design of interfaces, devices and hand gestures. The swift design of both habits and habitats has been informed by the capacity of digital platforms to gather information on the usage of their services. In her *The Age of Surveillance Capitalism*, Shoshana Zuboff devotes particular attention to the case of Google, which she characterizes as being 'to surveillance capitalism what the Ford Motor Company and General Motors were to mass-production-based managerial capitalism' (Zuboff 2019: 63). With its Search service, the platform has managed to striate the portion of the web more readily available to users by ordering pages on the basis of its Pagerank algorithm, and to trump any other search engine, controlling over 92% of market share as of the time of writing (Statcounter 2020). Zuboff stresses the reasons for the success of the platform:

> Google's engineers soon grasped that the continuous flows of collateral behavioural data could turn the search engine into a recursive learning system that constantly improved search results and spurred product innovations such as spell check, translation and voice recognition. (Zuboff 2019: 67-68)

According to the author, however, in the aftermath of the bust of the dot-com bubble in April 2000 (Ironman 2010), Google began to understand the economic potential of the increasing amount of behavioural data collected. Zuboff's book is unfortunately weakened by her positive attitude towards the possibility of an 'advocacy-oriented' capitalism – that is, not solely oriented to the accumulation of profit –, which, she argues, been discarded mainly because of the external pressures of the market. This has pushed Google to reinvest what the author names, in an undoubtedly effective formulation already anticipated by Bratton (2015: 48; 137-8), *behavioural surplus*, in the transformation cycle that constitutes the loops of the digital stratum. In yet another evolution caused by a crisis, the model of accumulation developed by Google consists in feeding the behavioural surplus collected by its search engine into the training of predictive algorithms that forecast with ever increasing accuracy the inclinations or tendencies of the users, and consequently inform the production of 'smart' advertisement, to shape portions of homeomorphic interfaces loaned to investors.

The analysis of a substantial number of individual behaviours prepares the production of supraindividual profiles, which in turn are used to classify further interactions that can be as minimal as a new access with the same credentials or from the same geographical location. The result of the cycle consists in the automatic manipulation, according to the principle of smooth cyberspatiality and through the implementation of a set of suggestions, of the digital environment in which such new interactions will take place. These suggestions, usually understood in the form of ads but notably informing any content proposed to the user as possibly interesting, connect the loops of the stratum to the cycles of capitalist accumulation. This form of algorithmically-directed environmental design is the direct result of an investment of the surplus value accumulated by firms into the market for attention and aims at profiting from the uncertainty-reduction power of the digital stratum to increase the sales of services or products. These operations, conducted on the basis of the automatically-generated knowledge of what users are inclined to buy, when and even at what price, prepare the production and the capitalisation of users' phase spaces, of the digital diagrams of their tendencies and capacities drafted in relation to products or ideas.

In this complex panorama of loops and connections, the idea of proposed content can seem at first a harmlessly convenient feature for the user. The problem that lies behind automated suggestions, however, is double. On one side, dwelling on the space of a platform shaped by the loops of the stratum fosters standardisation by engineering the choices between alternatives that are not really different, and do not allow for real novelty to emerge from heterogeneity; on the other side, and because of the first problem, self-reinforcing content bubbles start to form around the dividualised user, not allowing them to perceive as readily accessible anything other than contents conforming to the tendency originally grasped by the machine. A consequence of this has to do with the fact that attention must be kept active, say, on a platform like YouTube, in order to maximise the exposure of users to advertisements, and therefore the overall revenues of the website. In another instance of the elimination of the prospect of intermittence, this is done by suggesting to the user more and more seductive titles and thumbnails, or by varying the schedule of rewards through an administration of dopamine via push notifications, likes and comments. As highlighted by American author Nir Eyal, 'variability increases activity in the nucleus accumbens and spikes levels of the neurotransmitter dopamine, driving our hungry search for reward' (Eyal 2014: §4¶2). On one hand, this strategy is the choice of content producers in a competitive online market of free-to-consume content, where value and the race to monetisation are determined by the ability to elicit views and garner likes. But it equally doubles as a way to increase engagement for the platform. Since the portion of the smooth cyberspace in which the user is caught tends to become a protean echo chamber, tendencies and interests are pushed to the extreme and, in the absence of any alternative, dividualised users end up living a possibly radicalising milieu (Roose 2019).

While the digital economy is a second-order system of circulation of value in which a capital gets invested to increase sales, the great investments that Google and Amazon have poured into perfecting the digital stratum's loops have made it so that these firms have rapidly gained hegemonic positions over cyberspace, becoming, thanks to nothing more than advertising revenue, the most valuable companies on the stock market (Zuboff 2019: 162). The constitution of digital platforms available to businesses of every sort has generated the conditions for which if a company wants to achieve all its market potential, it *must* do it by advertising online. Taking place against the background of the globalisation of commerce, the anthropological mutation caused by the informatisation of society has allowed individuals to have immediate access to a global network of consumption, and not only as consumers. While the miniaturisation of devices allows a capillary diffusion of portable gateways to this Riemannian cyberspace of endless entertainment, the addictogenic design of platforms and interfaces triggers the compulsive behaviours developed, in relation to this technology, to cope with the general misery of daily life under capitalism. As individuals spend more and more time in cyberspace, the design of homeomorphic interfaces, the ancestral need for social validation and the electronic stimulation of desires discloses the doors of influenceability. This is how the digital stratum is plugged into the logic of accumulation of capitalism, collecting behavioural data, producing dividuals, informing the administration of suggestions through which the chemistry of neuromodulation causes the emergence of artisanal cyborgs.

Facebook is arguably one of the most powerful avatars of the digital stratum. In September 2021, The Wall Street Journal has published a series of reports based on more than 10.000 internal documents leaked by a former employee, Frances Haugen (The Facebook Files 2021). The so-called Facebook papers confirm that the company is aware of the harms its algorithms cause to individuals and communities, but choses to ignore them (Danner 2021), prioritising revenue over preventing fake news from going viral (De Vynck et al. 2021), minimising polarisation and curbing recommendation-fuelled radicalisation (Riley 2021). Despite numerous proposals, the company does not improve its platforms because intervening on the problems flagged by its own staff would curb engagement and revenue growth (Merrill & Oremus 2021).

The key concepts that illustrate the functioning of the digital stratum can be safely mapped onto the practices adopted by Facebook: take the mechanism behind the platform's news feed. When a user posts something, other users can mark it with their reactions. Reactions that express emotions through emojis contribute to rank a post higher in the recommendation chart, so that the more a post is outrageous, the more likely it is to be recommended. Liking or resharing a piece of content is a clear indication, for recommendation algorithms, of the likelihood that similar posts will keep the user engaged: here, users are dividualised, a phase space of their tendencies is drafted and one of their affordances is reinforced through suggestions populating the homeomorphic interface of the platform. The posts shared by verified accounts are also ranked higher than normal users' and, being more prone to be recommended and reshared, generate waves of virality because other users, whose parasympathetic system has been hooked on likes, will emulate that type of content and share more of that type of information.

The case of Carol Smith is particularly relevant. In summer 2019, a Facebook researcher set up a fake account with this name, drawing the profile of a North Carolina conservative woman with interests in Christianity, parenting and political news. The account was made to follow Fox News and president Trump. Within 48 hours from the account going live, Facebook recommended the 'test user' to join pages dedicated to QAnon, the far-right conspiracy theory movement guided by the cryptic messages of the anonymous Q, a mysterious individual said to have intelligence on the government. Covering the Leaks, Nbc News reports that 'Within one week, Smith's feed was full of groups and pages that had violated Facebook's own rules, including those against hate speech and disinformation' (Zadrozny 2021). The mechanism behind this instance of radicalisation has been documented to lie behind several culture-defining events since at least 2016: from the election of Donald Trump (Rosenberg et al. 2018), the result of the Brexit referendum in the UK (Cadwalladr 2017), to the Capitol Riots (Wong 2020) and the viral wave of no-vax hysteria (O'Sullivan et al. 2021). A philosophy of technology aware of the relation between the digital and the virtual must therefore extract the core processes through which such novel technology of power is expressed, producing diagrams that will allow us to identify future embodiments of biofeedback control and help devising resistance strategies against the manipulation of virtual fields of affordances.

Conclusion: abstract work

As with previously developed systems of accumulation, the hegemonic position digital platforms have gained over the global market benefits the 'emerging ruling class of our time' (Wark 2004: ¶20), which McKenzie Wark calls the vectorialist class. This controls the vectors through which information circulates, patterns are extracted, and phase spaces are drafted and monetised through the administration of neuromodulation and homeomorphic interfaces. This class has been rapidly brought to power by plugging the digital stratum into more traditional logics of accumulation, profiting beyond imagination from their connection. In line with a definition of capitalism as a logic of accumulation through dispossession, Wark opposes the vectorialist class to a new dispossessed class of producers of information, which she names the *hacker* class. According to this model, land, factories and platforms qualify as the three portions of structures of mitigation whose organisation is structured by a suprasystem in which the landowners, the owners of the means of production and the owners of the vectors follow one another in the exploitation of, respectively, the farmers, the workers and the producers of information, and dominate the previously-formed dominant classes (Wark 2019: 46-47).

While I believe Wark's refashioning of the classic Marxist categories to be an important move in the direction of an accurate description of the liaison between the stratum and capitalism as a modality of organisation of life, I consider it equally important to move away from the idea of the *hacker class* as the conscious producer of new information. With this notion, in fact, Wark points to the creative power of abstraction of certain groups of individuals (2004: ¶72) which, in her more recent work, she defines as

> everyone who produces new information out of old information, and not just people who code for a living. Part of the struggle of our time is to see a *common class interest* in all kinds of information making, whether in the sciences, technology, media, culture, or art. What we all have in common is producing new information but not owning the means to realize its value. (2019: 14)

Wark maintains that the hacker class *produces* new information. For me, however, this conception seems reductive: first, because it appears to rest on a reification of information and second, because it restricts its 'production' to human activity. The limits of this classification for our description are made even more explicit by Wark's further specification: 'what is "new" information? It is whatever intellectual property law recognises as new' (43). Here, I deem important to step away from the creative sphere of human production and incorporate non-human phenomena and unreflective behaviours among the pattern-generating events from which platforms are able to extract value. The category of the exploited class should consequently be extended to include any destratified phenomenon from which meaningful patterns can be extracted and elaborated for profit, and only within this set, a group of online platforms users that unwittingly produces 'information exhaust' or 'digital breadcrumbs' (Zuboff 2019: 90). Google Maps, for instance, provides information on traffic by tracking moving devices and analysing their speed. Combined with historical data on the average time it takes to complete a specific route, the system offers suggestions on the best paths to move from a point to another. Arguably, the speed at which devices move on the road does not depend on any 'productive' activity nor can be classified as an exclusively human phenomenon, but should rather be considered as an emerging effect involving human and non-human factors alike, which renders inadequate existing frameworks of intellectual property, because it is not the product of intellect. Congestions in the flow of traffic occur when the urban channels for its circulation are smaller than the volume they should convey at a given moment. Here, the conditions of the street, the weather or stochastic events like accidents and road works trigger an emerging effect in a complex system. Maps collect value for Google by selling ad spaces to local businesses, whose presence will be highlighted on the re-stratified version of the analogue territory presented by the interface, and by selling the service to other companies like Uber (Franek 2019; Schaal 2019). As a consequence, the revenue Google harnesses from Maps has not simply been generated by human activity, but by the analysis of a supraindividual phase space circumscribed to a section of the city and composed by tendencies and capacities relative to the speed, directions and volumes of the destratified flows that cross it.

This example allows us to consider an additional idea through which the dominated class has been described. In a brief 2005 article, Franco Berardi defines 'Cognitariat [as] the social corporeality of cognitive labour' (Berardi 2005: 57). While his position might still appear too anthropocentric, Berardi points at the changes the digital revolution entails for character of work: 'What does it mean to work today? Work is tending to assume a uniform physical character: we sit down in front of a screen, move our fingers on the keyboard and type. But at the same time, work is a lot more diversified in the contents it elaborates' (57). Today, this 'elaboration' must not be interpreted necessarily as the development of something original, but understood more generally in terms of 'processing'. Staring at its screen, the cognitive labourer is at the same time processing suggestions and being processed, as a behavioural matrix, by the loops of the stratum. Here, Jonathan Crary's work adds something important in pointing out that the collapse of the separation between work time and leisure time is produced also through the monetisation of attention:

> A temporal alignment of the individual with the functioning of markets, two centuries in developing, has made irrelevant distinctions between work and non-work time, between public and private, between everyday life and organized institutional milieus. Under these conditions, the relentless financialization of previously autonomous spheres of social activity continues unchecked. (Crary 2014: 74)

Producing behavioural patterns that fuel the accumulation of capital perpetrated by the platforms, the processing of online resources by the users becomes a form of unsuspecting work: while all types of work is homogenised by computation then, all types of activities perceived by the stratum become work. This expansion of the basin of work exploited by the stratum does not stop here though. With the words of Jason Moore, in fact,

> Marx's observation that large-scale industry is a mechanism for turning "blood into capital" was no mere polemic. It was a means of highlighting that the capital-relation transforms the work/energy of all natures into a […] crystallization of wealth and power: value. Work/energy helps us to rethink capitalism as a set of relations through which the capacity to do work – by human and extra-human natures – is transformed into value […] "Work/energy" (or potential work/energy) may be capitalized – as in commodified labor-power via the cash nexus – or it may be appropriated via non-economic means, as in the work of a river, waterfall, forest, or some forms of social reproduction. (Moore 2015: 14)

If we understand it as proposed by Moore, the notion of work should be abstracted from the forms of human production and considered as the energy investment over platforms' contents, which is tapped into by the destratifying sensorium of the stratum and leads to a production of value for those who control them. Work of all sorts can be appropriated by the digital stratum as the actualisation of tendencies and capacities whose supraindividual diagramming conduces to the production of valuable dividuals. Since its position of power is obtained through the capture of patterns from not necessarily task-oriented energy expenditures, but from energetic expenditure in general, as we have seen with Moore, the vectorialist class can consider every sort of behaviour or events to 'work' for itself.

Cognitive labour is surely part of the business model, but eventually it will not even be the most fundamental one: the cyborg urbanist rhetoric of smart cities, for instance, already levels the cognitariat to every other meaningful event. Perhaps we should then start speaking about work in the sense that physics attributes to this word, instead of labour, to point at the object of the latest type of abstraction capitalism benefits from. Nature 'works', machines 'work', relationships 'work' by producing emerging patterns that can form dividuals and that do not necessarily result from the cognitive labour of an individual, as it is the case of relations of proximity or age. For this reason, it is reductive to counterpose a hacker class (that implies a will and creativity) or a cognitariat (that implies cognition and scope) to the vectorialist class. Indeed, this is the class that has managed to put to work the totality of what is given as a process: if there has ever been an 'outside' of the circuit of commodification, the loop is consequently closing.

The basin of value-production and work-abstraction should consequently be expanded to virtually every phenomenon that can be sensed by the surface of the stratum. This does not involve any cognition but has direct effects on lives of all sorts. When in 2018, The West Virginia Legislature proposed the implementation of Go365, an app requiring public employees to wear activity trackers, the dividualisation process informing the risk-reduction logic of health-insurance companies did not depend on any cognitive activity, but relied simply on the physical work registered by the accelerometer in the devices (McAlevey 2018). What we are essentially looking at, then, is the capitalisation of individual, collective and non-human phase spaces, and their manipulation for commercial purposes. If both the discourses of Wark and Berardi sound still too anthropocentric, it is because the vectorialist class is not exploiting only the 'psychic and desiring dimension of post-industrial societies' (Berardi 2005: 57), but every multiplicity it manages to plug into the stratum.

For this reason, it is worth looking at Bratton's idea of non-human users as a posthuman attempt to highlight the extension of the stratum's reach. Forecasting the 'death of the user', Bratton claims that, 'As the existential incorporation of information into the *User*-subject works to consolidate and then explode its humanist register, it does so by placing the biological materiality of the human subject onto a common plane with other actors and events' (Bratton 2015: 271). Advocating for the need of a perspectival shift analogous to the abandonment of geocentrism, Bratton argues that the default critical stance towards digital technologies that revolves around some sort of 'high-tech Vitruvian Man, radiating waves of "desire" and "needs" […] always sited at the centre of his technical cosmos' (272), should be redirected towards the assessment of 'posthuman users' (271) as the class of beings from which the vectorialists abstract behavioural patterns and extract value. Beyond the relation of platform 'use', however, lays the passive condition of being perceived by the sensorium of the stratum, in view of which what the vectorialsts exploit becomes the posthuman basin of abstract work. While abstract labour can then be defined as 'an extortion of time, without regard for its quality, without relation to the specific and concrete utility of the objects it creates' (Berardi 2005: 58), the posthuman basin of abstract work must be considered as the locus of a destratification through which all those nonhuman actual behaviours whose analysis can spin the loops of the stratum are configured as a new cheap.

Conceiving the latest phase capitalism in terms of opposition between producers and accumulators is then probably obsolete, and even keeping the human at the centre of critique might not be the best position to organise a critique of the system that exploits human and non-human multiplicities alike. By mapping supra-individual phase spaces thanks to the systematisation of multiple interactions with the sensory layer of the stratum, the analysis of dividuals informs interventions in the virtual field of affordances of individual and collectives and allows us to shape their behaviours in relation to specific products or services. The commodification of predictions is then at the centre of the liaison between the digital stratum and the logic of accumulation of postindustrial capitalism, a nexus devised to extract value from the dividualisation of multiplicities. Ultimately, though, the relation between the stratum and the basin of abstract work it appropriates and exploits, cutting across previously distinct specializations and time frames, the individual-crowd difference, and the animate-inanimate divide, remains a particular application of a new declination of power: 'today's capitalism should be called the information economy. Information has become wealth to be extracted and accumulated, transforming capitalism into a simply auxiliary of cybernetics' (Tiqqun 2020 [2001]: 59). While the stratum enables the renewal of the capitalist logic of accumulation beyond its recurrent crises and supports the new class structure it shapes, it exerts indeed its own modality of domination over life: 'As a science of society, cybernetics was intended to invent a kind of social regulation that would leave behind the macro-institutions of State and Market, preferring to work through micro-mechanisms of control' (51). Dopamine-charged suggestions may then serve capital very well, but the Kuleshov machine activated through the automatic manipulation of homeomorphic interfaces and the enveloping effects of cyborg urbanism constitute instruments of power that can be harvested for a variety of political ends and be applied in contexts detached from capital interests.

The new form of domination afforded by the digital stratum works on the virtual field of affordances of individual and collective bodies, modulating human and non-human multiplicities alike and conferring a new political role on the virtual dimension of their real yet not actual tendencies and capacities. The virtual as the reservoir of possibility to change one's own life through movements of deterritorialization, as the experimental field of possible bifurcations and lines of flight understood as 'vectors of freedom' from particular assemblages (Bonta & Protevi 2004: 107) becomes the field of biofeedback control, where dividual phase spaces are mapped and lines of flight intercepted and bent into the logic of cut-out cartography. Resulting from the stratum as a pattern of emergence, artisanal cyborgs are thus not necessarily human-machine assemblages but, more generally, virtual-digital hybrids, that is, alive (in the sense in which we have seen life described by Deleuze's 'L'Immanence: une vie…' (Deleuze 2006a [2003]), i.e., undetermined, immanent *puissance* of self-organisation) *and* crafted, i.e., cybernetically modulated towards desired emergent behaviours.

My stratoanalysis of the digital has proposed an investigation of power relations, in this case of the relation between the *pouvoir* exerted through the loops of destratification, dividualisation and suggestions and the *puissance* of dynamical systems, that is the capacities of bodies to affect and be affected, and their tendencies to change in relation to determinate environmental conditions. I have highlighted how the type of power to which we are subject has changed from being primarily exercised according to an hylomorphic model (the imposition of an ideal form over a sterilised matter) to a morphodynamic one (the modulation of processes of individuation, that is, the crafting of phenomena of emergence). Accordingly, the relation of domination established between the digital and the virtual does not simply impose restrictions nor commands obliged conducts, but focusses on the engineering of choice by means of the Kuleshov machine assembling the landscapes of reality that homeomorphic interfaces present to the users and the automation of will through constant stimulation and neuromodulation, ultimately crafting futures by controlling their hybrid processes of emergence. The digital stratum operates in fact at the intersection between the spontaneous and the designed or the emergent and the crafted by means of its feedback loops. From this shift derives the transformation of the thus far hegemonic model of capitalism, that has mutated from the appropriative/exploitative character of early mercantilist and industrial age to the speculative *modus operandi* typical of finance, to the predictive model of digital capitalism. Consequently, also the class composition has changed: the industrial-age configuration of a society divided, within the circuits of capital, between factory owners and workers has given space to a more fragmented class structure shaped by financialisation, the decadence of public institutions and the open labour market. British economist Guy Standing (2011) describes the new distribution as constituted by an absurdly wealthy elite, removed from society and secured against justice by its wealth (22); a 'salariat', composed by those lucky enough to still be in stable, full-time employment, with all the benefits this comports; the class of those who have skills to sell, and that by selling them for a high income and enjoy 'a project-oriented existence in which they move from one short-term project to another' (15); the decimated, increasingly disintegrated working class, that has lost its 'sense of social solidarity' (8) under the blows of the predatory search for new frontiers of cheap labour and the tacit support of the state for practices like offshoring and outsourcing; and the precariat, the class characterised by 'flexible' labour, always on the verge of falling within the lumpen proletariat, but whose ranks are growing because global economic systems require an increasing amount of people to have temporary, underpaid, zero-benefits jobs (9). Both in their digital, exploded form, and in their corporeal one, the individuals composing all these classes are carefully kept at the same time in a state of *connection*, by falling in the same supraindividual category of consumers or possible voters, and *disjunction*, separated by distinct echo chambers or information bubbles. While depriving the lowest classes of the bargaining power digital instruments could provide them across the world, these instrumentalise their misery to feed any political or economic interest that keeps the loops of the stratum rolling, at the same time controlling their performances, opinions, education, and state of health. This is possible because of the asymmetry between a vectorial class and the posthuman basin from which work is extracted: every nonhuman phase space that the digital stratum can dividualise, that is, destratify through its sensorium and use to produce supraindividual maps of tendencies and capacities, will indeed inform its administration of forms of expression. When these are suggestions, one witnesses the intermittent emergence artisanal cyborgs as the new political subjects; when these are features of the structures of mitigation, one can appreciate the manipulation of social life produced through cyborg urbanism.

The development of the digital stratum has transformed the connection between life and computation in a relation of domination articulated between the digital and the virtual. This produces emergent phenomena whose character can be manipulated in advance and, as emerging, these phenomena can spread while being perceived as spontaneous and even 'natural'. While capitalism has arguably entered its final crisis (Streeck 2016: 56-59), kept alive as it is by injection of fiat money, one must acknowledge the mutated character of power that capitalism's last frontier – the virtual dimension of affordances to monetise and manipulate – is materialising. For this reason, my work has considered the multifaceted impact of the digital stratum on life. It has moved from the level of individuals, where this contact is expressed through the processes of destratification, dividualisation and suggestion, and reached the level of life forms, where the relation between the digital and the virtual is expressed on one side by the digitalisation of viral life expressed by digital viruses (becoming-alive of digital technologies) and digital contagions, while converging, on the other side, with the hybrid evolution of exorganisms and the cybernetic project of the modulated cyborg (becoming-algorithmic of human life), that concretises the biofeedback model of control by supplanting the ideal of mechanisation of the living and its auxiliary disciplinary apparatuses. By manipulating the machinic phylum and shaping the hybridity of exorganismic life, the relation of domination established between the digital and the virtual manifests then at the level of users and as cyborg urbanism, and connects urban structures of mitigation to the power of the digital stratum.

In order to understand how this power might be contrasted, the study of these processes must lead to the formulation of new political frameworks meant to keep the future open. As highlighted by the anarchist collective Tiqqun, the cybernetic hypothesis underlying the digital stratum, sets out 'the politics of the "end of politics." It represents at the same time both a paradigm and a technique of government' (Tiqqun 2020 [2001]: 30). The development of practices meant to safeguard the inscrutability of self-organisation processes, to jam the loops of control and protect the spontaneity of the emergence of alternative forms of life passes then through these questions: How does one escape control, when this seems the spontaneous state emerging with 'one's own' choices? How to we defend what one still doesn't know about oneself, but would like to discover, how do we protect what escapes *our* view? How to defend the unpredictable and the spontaneous character of immanent life? How to scale up these solutions to the collective? In the years to come, we will have to learn how to contrast the minimisation of uncertainty with its maximisation, the optimisation of the circulation of digital contagions, manufactured second-order desires and suggestions, with a routine jamming of the channels of communication and destratification. We will have to learn how to contrast the piercing gaze of the stratum's sensorium and the transparency it induces with a renovated sense of opacity, that moves beyond the rhetoric of privacy, emptied out by supra-individual dividualisation and cyborg urbanism (Brunton & Nissenbaum 2015: 8; 13; 15; 28; 35). We will have to imagine how to contrast the principles of 'following' and 'tracking' with the exercise of 'nullibicity', the becoming-imperceptible (Žukauskaitė 2015: 66; Braidotti 2006: 153-154) in the eyes of a machine that often necessitates locative germs to synthesise and employ effective dividuals, and learn how to articulate one's own intermittence in relation to the stratum's hysterical rhythms of compulsive connection. We will have to understand how to contrast the model of programmed obsolescence, the synthetic excitement for the novelty of cool gadgets and more seductive interfaces and the appealing social gratifications related to the 'participative' web 2.0, with a renovated taste for low-fi, web-1.0-type hypoaddictive designs and slow fruition (De Decker 2019). We will have to familiarise ourselves with producing noise to cover over our bifurcations, with practices that disturb dividualisation through false traces; articulate movements of sabotage and withdrawal, short-circuits and disconnections (Tiqqun 2020 [2001]: 136). And just as industrial workers have to withdraw their labour, we shall have to withdraw our virtual fields, suspend our connections to the Kuleshov machine of the digital stratum.

As Deleuze highlighted in the 'Post-scriptum', faced with the power of the digital stratum and its seemingly unescapable biofeedback loops, 'It's not a question of worrying or of hoping for the best', Deleuze writes in his 'Post-scriptum', 'but of finding new weapons' (Deleuze 1995 [1990]: 178). Before looking out for new weapons, though, one must identify the right field to defend, where to set the battle: my work has proposed some of its coordinates. I hope others will follow.

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