# Introduction

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*Catastrophe is the past coming apart.*
*Anastrophe is the future coming together.*
*— Land and Plant (1994)*

## The Reason of Trauma

One day, it will not be arbitrary to reframe twentieth century thought and its intelligent machines as a quest for the positive definition of error, abnormality, trauma, and catastrophe—a set of concepts that need to be understood in their cognitive, technological and political composition. It may be surprising for some to find out that Foucault's history of biopower and technologies of the self share common roots with cybernetics and its early error-friendly universal machines. Or to learn that the desiring machines, which "continually break down as they run, and in fact run only when they are not functioning properly" (Deleuze and Guattari 1983, 8), were in fact echoing research on war traumas and brain plasticity from the First World War. Across the history of computation (from early cybernetics to artificial intelligence and current algorithmic capitalism) both mainstream technology and critical responses to it have shared a common belief in the determinism and positivism of the *instrumental* or *technological rationality,* to use the formulations of the Frankfurt School (Horkheimer 1947; Marcuse 1964). Conversely, the aim of this anthology is to rediscover the role of error, trauma and catastrophe in the design of intelligent machines and the theory of augmented cognition. These are timely and urgent issues: the media hype of singularity occurring for artificial intelligence appears just to fodder a pedestrian catastrophism without providing a basic epistemic model to frame such an "intelligence explosion" (Chalmers 2010).

The definition of error had a fundamental role in the genesis of the Enlightenment as well. According to Bates (2002) both critics, such as the Frankfurt School, and defenders, like liberals and socialist revolutionaries, wrongly believed that the Enlightenment was just driven by plain confidence in reason. Instead, Bates stresses that the Age of Reason was obsessed with the constitution of error and considered human knowledge to be basically an *aberration.* Since the method of "truth is really parasitic on its supposed negation," Bates (2002, viii) suggests then that the Enlightenment in fact laid the groundwork for a modern epistemology of error. Therefore, critical theory's approach should be redirected toward its own postulates in order to inquire if the whole

history of instrumental reason—from the Age of Reason to the Age of Intelligent Machines—has actually concealed a deep and structural *errancy.*

These older concerns of the relation between technology and reason re-emerge today as concerns of the relation between computation and cognition. The current philosophical debate appears to be polarized between the positions of neomaterialism and neorationalism, that is between novel interpretations of Whitehead and Sellars, for instance, between those who side with the agency of technical objects, matter and affects and those who address the primacy of reason and its potential forms of autonomization.[1] The anthology cuts across these binaries by proposing, more modestly, that a distinction should be made between those philosophies that acknowledge a positive and constituent role for error, abnormality, pathology, trauma, and catastrophe on the one hand, and those who support a *flat ontology* without dynamic, self-organizing and constitutive ruptures on the other. No paradigm of cognition and computation (neomaterialist or neorationalist) can be assessed without the recognition of the *epistemic abnormal* and the role of noetic failure. Departing from the lesson of *the trauma of reason* instructed by the Frankfurt School, *the reason of trauma* must be rediscovered as the actual inner logic of the age of intelligent machines.

### The Pathology of Machines

With much akin to the turbulent underground that contributed to the computer revolution in the California of the 1970s, cybernetics was born out of a practice-based, error-friendly and social-friendly milieu, as Pickering (2010) recounts in his seminal book *The Cybernetic Brain*. Cybernetics is often perceived as an evolution of information theory and its predictable communication channels, but many cyberneticians of the first generation were actually trained in psychology and psychiatry. As Pickering reminds us, the idea of the cybernetic machine was shaped after the adaptive theory of the brain, according to which the function of the brain organ is not the *representation of* but the *adaptation to* the external environment. The canonical image of the organism struggling to adapt to its own *Umwelt* belongs of course to the history of evolutionary theory and beforehand, famously, to German *Naturphilosophie.* This historical note is not attached here to evoke a biomorphic substrate of information technologies in a vitalist fashion, but on the contrary to exhume the role of abstraction in the philosophies of life. Whether we are conscious of it or not, any machine is always a machine of cognition, a product of the human intellect and a component of the gears of extended cognition.[2]

1 For a general overview of this debate see Bryant et al. 2011. A main neorationalist reference is Brassier 2007. For a recent neomaterialist response see Shaviro 2014.

2 The concepts of organism, structure and system had a very promiscuous family life throughout the twentieth century. In this anthology they are considered *symbolic and*

French philosophers and American cyberneticians did not welcome the parallelism between organisms and machines with the same enthusiasm. In his influential lecture "Machine and Organism" Canguilhem stated that a machine, unlike an organism, cannot display pathological behaviors as it is not adaptive. An organism becomes mentally ill as it has the ability to self-organize and repair itself, whereas the machine's components have fixed goals that cannot be repurposed.[3] There is no machine pathology as such, also on the basis that "a machine cannot replace another machine," concluded Canguilhem (1947, 109). Nonetheless Bates has noted that the early "cyberneticists were intensely interested in pathological break-downs [and] Wiener claimed that certain psychological instabilities had rather precise technical analogues" (Bates 2014, 33). The adaptive response of the machine was often discussed by early cyberneticians in terms of error, shock and catastrophe. Even the central notion of homeostasis was originally conceived by the physiologist Walter Cannon (who introduced it in cybernetics) as the organism's reaction to a situation of emergency, when the body switch to the state of *flight or fight* (Bates 2014, 44). At the center of the early cybernetic paradigm, catastrophe could be found as its forgotten operative kernel.

### The Catastrophic Brain

Across the thought of the twentieth century the saga of the *instrumentalization of reason* was paralleled by the less famous lineage of the *instrumentalization of catastrophe*, that was most likely the former's actual epistemic engine. The model of catastrophe in cybernetics and even the catastrophe theory in mathematics (since Thom 1975) happened to be both inspired by the intuitions of the neurologist Kurt Goldstein, who curiously was also the main influence behind Canguilhem's lecture "Machine and Organism."[4] Goldstein is found at the confluence of crucial tendencies of the twentieth century neurology and philosophy and his thought is briefly presented here to cast a different light on the evolution of augmented intelligence.

Goldstein was not an esoteric figure in the scientific and intellectual circles of Berlin. He was the head of the neurology station at the Moabit hospital when, in 1934, he was arrested by the Gestapo and expelled from Germany. While in exile in Amsterdam, in only five weeks, he dictated and published his seminal monograph *Der Aufbau des Organismus* (literally: the "structure"

*logic forms* rather than ontological ones.

3 Canguilhem's 1947 lecture had a profound influence on the French post-structuralism, including Foucault and Simondon. The famous passage on the desiring machines "that continually break down as they run" (Deleuze and Guattari 1983, 8) is also a reference to this debate. Deleuze and Guattari's notion of the desiring machine proved afterward to be a very successful one, but at the cost of severing more profound ties with the domain of the machines of cognition.

4 On the legacy of Goldstein see Harrington 1996, Bates 2014, Pasquinelli 2014 and 2015.

or "construction" of the organism). Goldstein's clinical research started with the study of brain injuries in WWI soldiers and intellectually it was influenced by German Idealism and *Lebensphilosophie*. With the Gestalt school and his cousin Ernst Cassirer, he shared a sophisticated theory of the *symbolic forms* (from mathematics to mythology) whose creation is a key faculty of the human mind. Goldstein was an extremely significant inspiration also for Merleau-Ponty (1942) and Canguilhem (1943). Foucault (1954) himself opened his first book with a critique of Goldstein's definitions of mental illness discussing the notions of abstraction, abnormality, and milieu.

It is essential to note that Goldstein (1934) posits trauma and catastrophe as operative functions of the brain and not simply as reactions to external accidents. Goldstein makes no distinction between ordered behavior and unordered behavior, between health and pathology—being any normal or abnormal response expression of the same adaptive antagonism to the environment. Goldstein's organic normativity of the brain appears to be more sophisticated than the simple idea of neuroplasticity: the brain is not just able to self-repair after a damage, but it is also able to self-organize "slight catastrophic reactions" (Goldstein 1934, 227) in order to equalize and augment itself. The brain is then in a permanent and constitutive state of *active trauma*. Within this model of cognitive normativity, more importantly, the successful elaboration of traumas and catastrophes always implies the production of *new norms* and *abstract forms of behavior*. Abstraction is the outcome of the antagonism with the environment and an embryonic trauma can be found at the center of any new abstraction.

This core of intuitions that influenced the early cybernetics could be extended, more in general, also to the age of intelligent machines. Since a strong distinction between machines and the brain is nowadays less of a concern, cognition is perceived as extended and its definition incorporates external functions and partial objects of different sorts. The technologies of augmented intelligence could be understood therefore as a *catastrophic process* continuously adapting to its environment rather than as a linear process of instrumental rationality. Open to the outside, whether autonomous or semi-autonomous, machines keep on extending human traumas.

### The Human Mask of Artificial Intelligence

The recognition of a catastrophic process at the center of cognition also demands a new analytics of power and cognitive capitalism. In contrast, the current hype surrounding the risks of artificial intelligence merely appears to be repeating a grotesque catastrophism, which is more typical of Hollywood

movies.[5] This anthology attempts to ground a different angle also on this debate, where a definition of "intelligence" still remains an open problem. From a philosophical point of view, human intelligence is in itself always artificial, as it engenders novel dimensions of cognition. Conversely, the design of artificial intelligence is still a product of the human intellect and therefore a form of its augmentation. For this reason the title of the anthology refers, more modestly, to the notion of augmented intelligence—to remind us of a post-human legacy between the human and the machine that is yet problematic to sever (despite the fact that machines manifest different degrees of autonomous agency).

There are at least three troublesome issues in the current narrative on the singularity of artificial intelligence: first, the expectation of anthropomorphic behavior from machine intelligence (i.e., the anthropocentric fallacy); second, the picture of a smooth exponential growth of machines' cognitive skills (i.e., the bootstrapping fallacy); third, the idea of a virtuous unification of machine intelligence (i.e., the singularity fallacy). Regarding the anthropocentric fallacy, Benjamin Bratton's essay in the present anthology takes up the image of the Big Machine coming to wipe out mankind, which is basically an anthropomorphic projection, attributing to machines what are features specific to animals, such as predator instincts. Chris Eliasmith takes on the bootstrapping fallacy by proposing a more empirical chronology for the evolutions of artificial minds that is based on progressive stages (such as "autonomous navigation," "better than human perception," etc.), according to which "it seems highly unlikely that there will be anything analogous to a mathematical singularity" (Eliasmith 2015, 13). Similarly, Bruce Sterling is convinced that the unification and synchronization of different intelligent technologies will happen to be very chaotic:

> We do not have Artificial Intelligence today, but we do have other stuff like computer vision systems, robotic abilities to move around, gripper systems. We have bits and pieces of the grand idea, but those pieces are big industries. They do not fit together to form one super thing. Siri can talk, but she cannot grip things. There are machines that grip and manipulate, but they do not talk. [...] There will not be a Singularity. (Sterling 2015)

In general, the catastrophism and utopianism that are cultivated around artificial intelligence are both the antithesis of that *ready-to-trauma logic* that have been detected at the beginning of the history of intelligent machines. This issue points to an epistemic and political gap of the current age yet to be resolved.

5 See for instance Elon Musk's statement in October 2014 declaring AI the most serious threat to the survival of the human race (Gibbs 2014).

### Alleys of Your Mind

The anthology proposes to reframe and discuss the *reason of trauma* and the notion of augmentation from the early cybernetics to the age of artificial intelligence touching also the current debates in neuroscience and the philosophy of mind. The keyword entry at the end of the book provides a historical account of the notion of augmented intelligence starting from the definition given by Douglas Engelbart (1962) and following the evolution of both the technological and political axes, that cannot be easily separated.

The first part "From Cybertrauma to Singularity" follows the technopolitical composition from cybernetics during the Second World War to the recent debates on artificial intelligence today. Ana Teixeira Pinto focuses on the moment where cybernetics emerges out of the conflation of behaviorism and engineering during the war years. Teixeira Pinto recounts the influence of behaviorism on wartime cybernetics and the employment of animals (like pigeons) in the design of oddly functional ballistic machinery. War experiments were also the breeding ground upon which the mathematical notion of information was systematized, she reminds us. At odds with such a determinism (or probably just the other side of it), Teixeira Pinto unveils the hidden animism of cybernetics: "the debate concerning the similarities and differences between living tissue and electronic circuitry also gave rise to darker man-machine fantasies: zombies, living dolls, robots, brain washing, and hypnotism" (31). In conclusion, Teixeira Pinto stresses that the way cybernetics treats "action" and "reaction" as an integrated equation was extrapolated into a political and economic ideology (neoliberalism), which denies social conflict, while the tradition of dialectical materialism has always maintained an unresolved antagonism at the center of politics. Anticipating an argument of the following essay, she encapsulates her analysis in a dramatic way: "cybernetic feedback is dialectics without the possibility of communism" (33).

Adrian Lahoud measures the limits of the cybernetic ideals of the 1970s against the background of Salvador Allende's Chile, where the Cybersyn project was developed by the British cybernetician Stafford Beer in order to help manage the national economy. Cybersyn represented an experimental alliance between the idea of equilibrium in cybernetics and social equity in socialism. Lahoud remarks that any cybernetic system is surely defined by its *Umwelt* of sensors and information feedbacks, but more importantly by its *blind spots*. "Where is one to draw the line, that difficult threshold between the calculable and the incalculable, the field of vision and the blind spot?" (46) asks Lahoud in a question that could be addressed also to current digital studies. The blind spot for Allende's cybernetic socialism happened to be Pinochet's coup on 11 September 1973. Of course Cybersyn was never designed to halt a putsch and Pinochet indeed represented a set of forces that was exceeding the equilibrium field of cybersocialism. Any technology may happen to be colonized and,

at the end, Lahoud follows the taming of cybernetic equilibrium within the deep structure of neoliberalism.

Orit Halpern writes in memory of the filmmaker Haroun Farocki. In his *Serious Games* (2011) multi-screen installation, the viewer is immersed in 3D simulations of war scenarios, which are used by the US Army for both military training and the treatment of post-traumatic stress disorder. On one screen, young soldiers learn how to drive tanks and shoot targets in Iraq and Afghanistan; on the other, veterans are treated for war traumas like the loss of a friend in combat. The repeated reenactment of a traumatic event with virtual reality is used to gradually heal the original shock and sever the mnemonic relation with pain. This therapeutic practice dates back to Freud's time, but here the therapist is replaced by a fully immersive interface. As Halpern remarks: "[T]rauma here is not created from a world external to the system, but actually generated, preemptively, from within the channel between the screens and the nervous system" (54). Halpern retraces the genealogy of such military software to the Architecture Machine Group at MIT, where in the 1980s the "Demo or Die" adage was born. Aside from warfare tactics, these new immersive interfaces were also tested in the context of racial conflicts, like in the controversial Hessdorfer Experiment in Boston. Halpern describes a world already beyond psychoanalysis, where cognition and computation collapse into each other on the political horizon of video simulation.

Benjamin Bratton contests the anthropocentric fallacy of the current hype and alarmism around the risks of artificial intelligence, according to which hostile behaviors are expected from future intelligent technologies. Scientists and entrepreneurs, Stephen Hawking and Elon Musk among them, have recently been trying to warn the world, with Musk even declaring artificial intelligence to be the most serious threat to the survival of the human race. Bratton discusses different aspects of the anthropocentric fallacy moving from the first instance of the "imitation game" between the human and the machine, that is the test conceived by Alan Turing in 1950. There are two main issues in the anthropocentric fallacy. First of all, human intelligence is not always the model for the design of machine intelligence. Bratton argues that "biomorphic imitation is not how we design complex technology. Airplanes do not fly like birds fly" (74), for example. Second, if machine logic is not biomorphic, how can we speculate that machines will develop instincts of predation and destruction similar to animals and humans? In a sort of planetary species-specific FOMO[6] syndrome, Bratton suggests wittily that probably our biggest fear is to be completely ignored rather than annihilated by artificial intelligence. Reversing the mimicry game, Bratton concludes that AI "will have less to do with humans

6 Fear of missing out: the feeling (usually amplified by social media) that others might be having rewarding or interesting experiences from which one is absent.

teaching machines how to think than with machines teaching humans a fuller and truer range of what thinking can be" (72).

In the second part of the anthology "Cognition between Augmentation and Automation," Michael Wheeler introduces the hypothesis of extended cognition (ExC) that has a pivotal role in the discussion on Augmented Intelligence. According to ExC the brain need not retain all the information it is given. Instead, it only needs to remember the path to the place where information is stored. Thus, in the ecology of the brain, the abstract link to the location of information appears to be more important than the memory of content itself. Where such an abstract link starts and ends is a critical issue for ExC, as thinking is also the ability to incorporate external objects as parts of the very logic of thinking: pen and paper, for instance, are helpful in solving mathematical problems that otherwise would be impossible to solve in one's head. The current age of smartphones, pervasive computing, and search engines happens to exemplify such an external human memory on a massive scale. Wheeler explores the idea in relation, first, to the education of children in an increasingly wired, wireless and networked world; second, to the experience of space and thinking in spaces designed with "intelligent architecture " (99 ff.). In a Ballardian moment, Wheeler asks if those buildings are themselves an extension of human cognition and realization of the inhabitants' thoughts!

The hypothesis of ExC makes possible an alternative approach to the thesis of cognitive alienation and libidinal impoverishment that few authors attribute to the information overload of the current media age.[7] Following the ExC hypothesis, it could be postulated that the human mind readjusts itself to the traumas of new media, for instance, by producing a new cognitive mapping of the technological *Umwelt*. In the ExC model, the brain is flexible enough to capture any new external object, or better, just its functions. In this way ExC introduces a fascinating definition of intelligence too: Intelligence is not the capacity to remember all knowledge in detail but to make connections between fragments of knowledge that are not completely known. A basic definition of trauma can be formulated within the ExC paradigm: Trauma is not produced by a vivid content or energetic shock, but by the inability to abstract from that memory, that is the inability to transform a given experience into an abstract link of memory.

The cultural implications of cognitive exteriorization and the malaises allegedly caused by new technologies are also the starting point of Jon Lindblom's essay. Drawing on Mark Fisher's book *Capitalist Realism,* Lindblom reminds us that current psychopathologies are induced by capitalist competition and exploitation rather than digital technologies in themselves: Neoliberalism

7 See the critique of semio-capitalism in Berardi 2009, the cognitive impoverishment allegedly caused by Google in Carr 2008 or the notion of grammatization in Stiegler 2010.

is restructuring the nervous system as much as new media do. Lindblom reverses Adorno and Horkheimer's account of the pathologies of instrumental rationality by following Ray Brassier's critique: The trauma produced by science in the human perception of nature should be considered as the starting point for philosophy, rather than as a pathology which philosophy is supposed to heal. Lindblom discusses then the modern hiatus between the *manifest image of man* and *scientific image of man* as framed by Wilfrid Sellars. Instead of accommodating the scientific view of the world to everyday life's experience, as the Frankfurt School may suggest, Lindblom seconds Sellars' idea of the *stereoscopic integration* of the two. As a further instance of cognitive dissonance, Lindblom includes the gap between perception of the self and neural correlates in the formulation given by the neurophilosopher Thomas Metzinger. Following Metzinger's ethical program, Lindblom finally advocates for a political and intellectual project to re-appropriate the most advance technical resources of NBIC (nanotechnology, biotechnology, information technology, and cognitive science) in order to re-orient "mankind towards the wonders of boundless exteriority" (111).

Luciana Parisi presents high frequency trading as an example of an *all-machine phase transition* of computation that already exceeds the response and decision time of humans. Parisi argues that computation is generating a mode of thought that is autonomous from organic intelligence and the canonical critique of instrumental rationality must be updated accordingly. Parisi finds an endogenous limit to computational rationality in the notion of the incomputable, or the Omega number discovered by the mathematician Gregory Chaitin. Taken this intrinsic randomness of computation into account, the critique of instrumental rationality needs to be revised: Parisi remarks that the incomputable should not be understood "as an error within the system, or a glitch within the coding structure" (134), but rather as a structural and constitutive part of computation. Parisi believes that "algorithmic automation coincides with a mode of thought, in which incomputable or randomness have become intelligible, calculable but not necessarily totalizable by technocapitalism" (136). The more technocapitalism computes, the more randomness is created and the more chaos is embedded within the system.

Reza Negarestani aims to reinforce the alliance between mind functionalism and computationalism that was formalized by Alan Turing in his historical essay "Computing Machinery and Intelligence" (1950). Functionalism is the view that the mind can be described in terms of its activities, rather than as a given object or ineffable entity, and its history can be traced back to Plato, the Stoics, Kant, and Hegel. Computationalism is the view that neural states can be described also algorithmically and its history passes through scholastic logicians, the project of *mathesis universalis* until the revolution of modern computation. Negarestani stresses that "the functionalist *and* computational

account of the mind is a program for the actual realization of the mind outside of its natural habitat" (145). Negarestani concludes by recording the trauma caused by the computational constructability of the *inhuman* for the galaxy of humanism: "What used to be called the human has now evolved beyond recognition. Narcissus can no longer see or anticipate his own image in the mirror" (154).

Ben Woodard discusses the notion of *bootstrapping,* or that mental capacities and cognitive processes are capable of self-augmentation.[8] He moves from a basic definition of self-reflexivity that is found in German Idealism: "Thinking about thinking can change our thinking" (158). Woodard defines the augmentation of intellect in spatial and navigational terms rather than in a qualitative way, as "augmentation is neither a more, nor a better, but an elsewhere" (158). Augmentation is always a process of alienation of the mind from itself, and Woodard illustrates the ontology of bootstrapping also with time-travel paradoxes from science fiction. This philosophy of augmentation is directly tied to the philosophy of the future that has recently emerged in the neorationalist and accelerationist circles. In the words of Negarestani quoted by Woodard: "Destiny expresses the reality of time as always in excess of and asymmetrical to origin; in fact, as catastrophic to it" (164).

In the third part "The Materialism of the Social Brain," Charles Wolfe and Catherine Malabou submit, respectively, a critique of the transcendental readings of the social brain in philosophy and trauma in psychoanalysis. "Is the brain somehow inherently a utopian topos?" asks Wolfe. Against old reactions that opposed the "authenticity of political theory and praxis to the dangerous naturalism of cognitive science," Wolfe records the rise of a new interest in the idea of the social brain. Wolfe refers to a tradition that, via Spinoza, crossed the Soviet neuropsychology of Lev Vygotsky and re-emerged, under completely different circumstances, in the debate on the general intellect by Italian *operaismo* in the early 1990s. Wolfe himself advocates the idea of the *cultured brain* by Vygotsky: "Brains are culturally sedimented; permeated in their material architecture by our culture, history and social organization, and this sedimentation is itself reflected in cortical architecture" (177). In Vygotsky, the brain is augmented *from within* by innervating external relations. Interestingly, here, the idea of extended cognition is turned outside in to become a sort of *encephalized sociality*.

In a similar way, Catherine Malabou argues against the impermeability of Freudian and Lacanian psychoanalysis to the historical, social, and physical contingencies of trauma. In the response to Zizek's review of her book *The New Wounded*, Malabou stresses the cognitive dead-end for philosophy (as

8 See also the notion of bootstrapping by Engelbart 1962 in the keyword entry "Augmented Intelligence" at the end of the book.

much as for politics) that is represented by the conservative Lacanian ditto: *trauma has always already occurred*. Malabou criticizes the idea that external traumas have to be related the subject's psychic history and cannot engender, on the opposite, a novel and alien dimension of subjectivity. Her book *The New Wounded* already attempted to draw a "general theory of trauma" by dissolving the distinction between brain lesions and "sociopolitical traumas" (2007: 10).

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*A final mention goes to the title of the book: Alleys of Your Mind was originally a track released by the Afro-Futurist band Cybotron in 1981, which will be later recognized as the first track of the techno genre. It is a tribute to a generation and a movement that always showed curiosity for alien states of mind.*

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