FACULTY OF EDUCATION
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EDUCATION AND THE CYBERNETIC HYPOTHESIS

A synoptic View

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Abstract

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Aim:	Since the end of world war II, western nation states increasingly have moved toward post-national knowledge economy where supranational organizations shape national policy and knowledge has been rendered a commodity. According to writers collective Tiqqun, the underlying master-fiction in this move is one of cybernetic character: the privileging of concepts such as information, control, communication and feedback. They argue that the 'cybernetic hypothesis' has supplanted the 'liberal hypothesis'. The aim of this dissertation is to outline the effects of the 'cybernetic hypothesis' on education and educational scholarship.
Theory:	While Tiqqun can be said to continue in the theoretical tradition of Michael Foucault, this dissertation, in addition to Tiqqun, draws inspiration from Antonio Gramsci and his theory of cultural Hegemony. Especially so-called Neo-Gramscian theory which introduce an analytical sensitivity towards concepts such as globalization. This theoretical path affords the possibility to assemble a dialectics of totality, where the consciousness of a period can be coupled with the institutional and technological arrangements of said period.
Method:	Not to reproduce the cybernetic hypothesis, which promotes empirical methods in research, this dissertation draws inspiration from the synoptic method traditionally utilized within the humanities. The method has been chosen to force upon the work the activity of embodied thinking through the combination of platonic particulars into a synoptic whole.
Results:	The metaphor of information, the ontological basis of the 'cybernetic hypothesis', has rendered education a concerted effort to separate representations of human faculties in order to optimize the temporal and spatial efficiency of communication. Education, in this sense, is increasingly individualized and oriented toward optimal connectivity in order to secure a continual flow and management of information; a prerequisite for a cybernetic capitalism. This forms a set of critical problems for scholars in education which, it is argued, calls for serious consideration.

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"…No one knows who will live in this cage in the future, or whether at the end of this tremendous development entirely new prophets will arise, or there will be a great rebirth of old ideas and ideals, or, if neither, mechanized petrification, embellished with a sort of convulsive self-importance." Max Weber (1968 p. 124)

"You don't have to be a prophet to acknowledge that the modern sciences, in their installation within society, will not delay in being determined and piloted by the new basic science: cybernetics. This science corresponds to the determination of man as a being the essence of which is activity in the social sphere. It is, in effect the theory whose object is to take over all possible planning and organization of human labor." Martin Heidegger (1972 p. 58)

"Those who obey the logic of the net, and who understand that we are entering into a realm with new rules will have a keen advantage in the new economy." – Kevin Kelly (1998 p. 63)

Introduction

In the duration of his lifetime, American educationalist, pragmatist and communitarian John Dewey saw the expansion of railroads, factories and the telegraph. For him, they amounted to the engines of democratization – technologies that would "make the nation a neighborhood" and "break down the barriers of ignorance" (Quandt, 1970 p. 26, 30; Cook, 2006). Although tools and technology have been used to offload cognitive work for a substantial amount of time and more recently to augment labor in order to extract surplus value, cybernetic information technology – the computer, both as artefact and metaphor – seem to draw similar assessments in our times. The late computer scientist, cyberneticist and mathematician Seymour Papert, a continually recurring figure in discussions on the emancipatory qualities of computer literacy, align himself with the hopes and dreams of Dewey, but argues that it is only now, with the advent of the cybernetic apparatuses – digital computers capable of virtualization and simulation – that the technological base is of such capacity as to realize these progressive ideals (Robins & Webster, 1999). Papert, thus, placed his philosophy on computer-based education firmly within the modern tradition. Perhaps such spirited appraisals of computers can be attributed to the fact that they constitute the first technology that contains yet more technologies: the generalized character of their internal logic and interfacial purpose emblematizes the generalist and rational character previously only attributed to the conscious intellect of such elaborate structures as man. Perhaps it is merely a question of effective marketing. For the collective of writers that has been referred to as Tiqqun, once the title of their political journal, cybernetic apparatuses – computers – and, crucially, cybernetic thinking has superseded the very liberal hypothesis that Dewey saw realized in factories and train tracks. Thus, the 'cybernetic hypothesis', as Tiqqun refers to our current *épistémè*, is an entirely different beast all together. In encircling the consequences for education and educational scholarship, the following work extends the intellectual contributions offered by Tiqqun (2013).

The Greek word *kubernèsis* – the etymon of cybernetics – translates to "the act of piloting a vessel" or "steersman" and shares its root meaning with the Latin word *gubernator* ('governance'). Cybernetics, thusly, is named after the art of steering a ship which, in turn, were used to denote the art of governing a city-state in ancient Greece. Historically, cybernetics could perhaps best be understood as the science of managing and executing wars; an interdisciplinary synthesis of information sciences during the second world war (Eglash, 1998; Hayles, 1999). A more technical definition – and one of lesser drama – could be borrowed from Yuii Ivanovich Zhuravlev and Igor B. Gurevich: the "science of information management,

communication, and processing" (Zhuravlev & Gurevich, 2010 p. 1). The theory of cybernetics, then, is based on two principles, two dimensions: (1) the structure of information and its level of complexity and (2) the construction of physical representations of these informational structures in either digital syntax or analogue dynamics (Eglash, 1998). Mathematician and philosopher Norbert Wiener, who first formalized cybernetics, developed improved methods and machinery for determining the position of hostile aircrafts in order to raise the number of successful shots in the second world war under the oversight of the United States Department of Defense. A formula for prediction on incomplete information was, as will be discussed in more detail below, the practical outcome of his work, but also a very specific ontology of the human: what later would be called the *cyborg*. In a swift movement of thought, Wiener and the cyberneticists – "a handful of ordinary men mobilized by America during the Second world war", as Tiqqun refers to the pioneers of cybernetics (Tiqqun, 2013 p. 12) – escaped the conflict between mechanistic and vitalist explanations of both subjectivity and the object through the use of *information* and *system* as the governing metaphors. Wiener concluded that thinking the pilot and machinery (radar, stick and trigger) as parts of a *whole*; a holistic informational *system* throughout, self-regulating its way toward a concise *goal*, would yield better statistics for the allied forces through cybernetic feedback *control*. Although few speak explicitly about cybernetics today, its rhetorical logic kick-started the proliferation of digital computers, cognitive- and neuro science, artificial intelligence (AI), modern operations research, Systems analysis and thinking, 'spiritual management' and the technocultural ethos that seem to pervade most facets of society at our historical juncture (Edwards, 1996; Hayles, 1999; Turner, 2006; Lilienfield, 1978; Gonzalez, 2012; Webster & Robins, 1999; Barbrook & Cameron, 1996; Franklin, 2015).

These structural shifts afforded by cybernetics have not gone unnoticed outside the writings of Tiqqun. In his essay *Postscript on the Societies of Control* (1992), Deleuze approach a diagnosis of the contemporary as a time that seems to dispel much of the disciplinary reproach that previously had become discernable as the governing principles of power per the meditations of Michel Foucault and replaced with *control*. As factories were disassembled during the 1970's, the *school* as the principle site of disciplinary power – faced with the promises of perpetual (re-)training of the worker – quite simply lost its luster; over-shadowed as it was by the emancipatory promises of decentralization through the use of micro-processors and vast electronic networks. Post-disciplinary power, according to Deleuze, turns away from the clockworks, the barracks and the institutions of old; the terraces, the stage and the stack of guitar amplifiers. Societies of control breaks the dichotomous relationship between the *mass* and the *individual* and substitute with *samples*, data and the *'dividual'* – always reconfigurable through processes of informational *feedback* and programming (Franklin, 2015). Deleuze, in his essay, seem to seek a correspondence

between what Foucault (2008) had addressed in his lectures during the early 1980's (Foucault 2005, 2008). An emphatic correspondence between the birth of neoliberal *biopolitics*, the 'hermeneutics of the self' and Deleuze' own identification of the increasingly mobilizing thrust in computerized technologies. The *dividual* is not primarily a disciplined subject but rather something akin to a controlled vessel of information. The 'societies of control', Deleuze hints, are cybernetic in nature and fears not the entropy of muscular labour in the factory or the sabotaging of its heavy machinery but a jammed network of circulatory interior and the vessel coming to a critical halt; the baseline metaphor of capitalist societies – to paraphrase Luc Boltanski and Eve Chiapello, we might say 'the spirit' – had shifted from the ergodic *machine* to the metaphor of the informatic *computer*.

Marshall McLuhan was an early critic of the post-war technologies and the potential ramifications of communication unconstrained by time and space. Jean Baudrillard took it upon himself to critique his time in writings on simulation and hyper-reality. Stephen Ball has under a long time investigated the educational consequences of neoliberalism (2012; 2015) while Philip Mirowski has connected the dots between neoliberalism and cybernetic visions of the world (Mirowski, 2002). Others yet have made attempts to describe the period in its totality. In addition to Lyotard and his optimism (1984), we find a continuously developing group of theories, positions (Peters, Britez, & Bulut, 2009), that all can be seen to share the common goal of laying bare the rationalities of a third or fourth wave of capitalist domination. It has been called, among other things, the 'societies of control' (Deleuze, 1992), 'Empire' (Hardt & Negri, 2000), 'cognitive capitalism' (Moulier Boutang, 2011) 'technoculture' (Robins & Webster, 1999), 'cybernetic capitalism' (Peters, 2015) and, as alluded to above, the 'new spirit of capitalism' (Boltanski & Chiapello, 2005).

Of particular interest to this study, however, stands the 'Cybernetic Hypothesis', as proposed by Tiqqun (2013). Tiqqun could be seen as drawing both the arguments of Deleuze and Foucault to their logical conclusions as they argue that our current shared picture of the world is overwhelmingly cybernetic in its composition and subject matter – one of mathematics, biology and control; information. Out of the flailing liberalism of the 20th Century, shaken by global conflict and economic crises, from war-time research in the united states, through the war-fatigued and radicalized youth of Counter- and Cyberculture and the establishment of neoliberalism this new picture of the world emerged. In doing so, Tiqqun reminds us of how crucial *text as image* has been be for our understanding of the world, of ourselves and of our social relations. As the master-fiction of the 'liberal hypothesis', Tiqqun point to Mandeville's *The Fable of The Bees: or, Private Vices, Public Benefits*, published in 1714. In it, Mandeville lays out many of the basic

principles of liberalism. The private vices were the guarantor of the common good; the invisible hand makes its first appearance in the text. Tiqqun's main claim, then, is that since the middle of the twentieth century, the fable of Mandeville has been supplanted by the *oeuvre* of cyberneticists like Norbert Wiener, Karl Deutsch, Warren McCulloch, Gregory Bateson, Margaret Mead, Claude Shannon, Jay Forrester and John Von Neumann. The 'cybernetic hypothesis', Tiqqun claims, is the picture that is reflected back unto us when we try to understand what it is to enact ourselves and our social relations in the 'societies of control' (Deleuze, 1992; Tiqqun, 2013); Empire (Hardt & Negri, 2000). The following work, which specifically asks what it means to do educational research under these circumstances, is indeed situated within this tradition. A tradition that seeks to account for the broader brush-strokes in the history of the so called 'social question' as well as the current state of reason. In this way, the work takes the problem of the cybernetic hypothesis into serious consideration, together with some of the challenges that it poses to educational and educational research.

Method: approaching education and cybernetic hegemony

Education: state, God and Empire

Recent forms of education have in particular witnessed the introduction of internationally competitive and entrepreneurial subjects forcing a singular conception of education as preparation for joining economic competition. However, other historical conceptions of education certainly can be identified. Athenian and Babylonian education was implemented to form able statesmen while western education, from the middle ages, well into the 20th century, were predominantly arranged to imbue Christian morality amongst the wider populace. Depending on geographical location, this would amount to catholic moral duties toward the poor or protestant temperance of the soul (Thröler, 2005). With industrialization, urbanization and the coming of a 'proletariat', or 'fourth estate', in the wake of the French revolution and American independence, new educational problems arose. The discursive and material construction of the "social" as a sphere separate from the political state, and, subsequently, the emerging political and scientific problems of how to deal with and understand this new "social question" (Rodgers, 1998) can be traced to these times. The establishment of research universities during the 18th and 19th century can be situated within this historical problematic and it is within these universities that disciplines such as sociology – chiefly through the works of August Comte (1798-1857), Karl Marx (1818-1883), Max Weber (1864-1920) and Herbert Spencer (1820-1903) – took disciplinary form. These men are considered to be some of the prime formulators of the modern social sciences. all engaged with the newly appreciable qualities and dilemmas of the umbrella-like concept of the "social". Education as a social and *scientific* problem, too, came to the fore within this socio-political and scientific milieu (Tröhler, 2005).

While the consequences of industrialization and the French revolution in particular were seen as global in reach and consequence, the social sciences were indebted to the local revolutionary or counter-revolutionary milieus in which they were articulated. Karl Marx and Friedrich Engels, for instance, established their scientific socialism as an attack on the mysticism of French utopian socialism. All the while, the churches of Europe accrued their own responses to both to the problem of piousness and, increasingly so, the perceived dangers of anti-Christian sentiments prevalent in, for instance, scientific socialism. The newly instituted research universities, although assigned academic freedom 'on paper', still were tacitly expected to contribute to the articulation of national identity within the growing industrial economies of western civilization. The nationalist bias in otherwise "free" academic practice, and the ease with which it was formulated by the increasing number of social scholars at the time, Daniel Thröler (2005) argues, became

especially evident during the first world war. From a French horizon, Emile Durkheim focused his critique on German sociologist Werner Sombart while John Dewey, from his American perspective, attacked the entirety of German philosophy as the prerequisite for German aggression (Thröler, 2015). This narrative, it could be noted, would resurface after the second world war when composer John Cage – then affiliated with Black Mountain College, an experimental college indebted to the educational philosophy of John Dewey and a culturally influential site of social and artistic experimentation in the American post-war period – theorized that German authoritarianism could be seen as an extension of the rigidly structured sheet music of Ludwig Van Beethoven (Turner, 2015). During this period, western nation states, increasingly understood as 'mass societies', turned more distinctly toward to state-run 'mass education' and 'mass schooling'. The number of students enrolled at universities increased dramatically after the second world war, just as the gospel of education (Grubb & Lazerson, 2005) began to be rehearsed within governing bodies. The rigid disciplines of traditional academia began to be questioned, especially in the United states. This interdisciplinary turn, to a large extent driven by an anti-authoritarian and ecological ethos, were increasingly adopted at European universities during the 1970's (Sörlin in Sundberg, 2007).

Reports, often socially liberal/social democratic in ideology (Elfert, 2015), were commissioned to outline how education should be organized in order to assure the good and democratic life – the good citizen as a 'lifelong learner' – in a post-war and increasingly interconnected world. Education as a prophylactic for social division and the arbiter of social and material progress: instrument in the construction of a well-balanced and peaceful global society consisting of thriving nation states. To 'save' the flows of increasingly transnational communication from the threat of authoritarian thinking became, in short, a widely disseminated framework in dealing with the 'social question'. Coupled with a new understanding of propaganda as not merely an authoritarian negative, but a necessary positive in the management of society (Robins & Webster, 1999) and with the realization that the authoritarian and deviant potential of communism, fascism and Nazism lied dormant in each individual member of society became, then, increasingly more realized in practice. These ideals, as indicated in the beginning of this section, were later subsumed into the vocational and economic reconceptualization through the increasing dominance of economic supranational institutions such as the Organization for Economic Cooperation and Development (OECD) and the implementation of neoliberal politics and economics (spring, 2008).

As political economist Will Davies (2015a) has argued, the neoliberal dismantling of state socialism – and, one could also argue, the category of the *social* all together (Eyal, Szelenyi &

Townsley, 2003) – has curiously left us with forms of *social* institutions and activities with increasingly unclear connections with the traditional nation state and the practices of statistical planning that emblematized it. 'Social entrepreneurship', 'social marketing' and 'social media', here given as illustrative examples out of many available, are managerial in strategy and are primarily derived from business management (Davies, 2015a). For Davies, these conceptions of the 'social' can be interpreted either with skepticism or a teleologically tinted monocular. Are these new 'socials' derivatives of an advancing neoliberalism, or are they seeds of the socialism placed *within* Marx' conception of capitalist production? Judging the veracity or credibility in either of these interpretations is not of primary concern in the following work – although it should be noted that it leans toward the former. For Davies, the *search* for answers begins in the shift from state-centric 'socialist calculation' to the ever-increasing amounts of data and a broad availability of 'social analytics' ushered in by networked electronic computers. One potential *answer* to the question could be derived from the work of Alexander R. Galloway (2014a). The sheer amount of data – the ubiquitous paving of the *infobahn* – can nowadays be analyzed in fast and cost-effective ways. This "triumph of quantitative methods" (2014a p. 109), Galloway argues, is a nexus for a "methodological ecumenicalism" governed by quantitative and empirical reasoning that can be understood as thoroughly concomitant with the 'cybernetic hypothesis'.

The debate raises concerns for any social scientist. Regardless of methodological position and disciplinary location: what do we mean with our shared conceptions of the 'social' and what consequences can it have for what we mean with 'education' and 'learning' when we claim ourselves to be the interrogators of it? And what consequences for method might lie dormant, or perhaps plainly visible, in these shifting assignments of meaning? Especially seeing as the foundations of method, in many cases, where conceived during a different time, a time when capital had no explicit claim on the apparatuses of knowledge production. The situation, it would seem, has thoroughly changed through the emergence of a cybernetic mode of capitalism with increasingly global reach: the post-fordist 'knowledge economy' (Boltanski & Chiapello, 2005), a cybernetic turn with a *systems management* approach to curriculum and educational reform (Michel, 2016; Watson & Watson, 2013; Apple, 2004), cybernetic theories of economics (Mirowski, 2002) and the cybernetic agents that populate it (Hayles, 2005; Tiqqun, 2013; Peters, 2015). Following Michael Hardt and Antonio Negri (2000), it becomes evident that we are in transition from imperialist politics and culture engineered by the modern nation-state, to an emergent and postmodern 'Empire'. A globalized form of government, connected through supranational bodies of '*monarchist'* (World Trade Organization, International Monetary Fund. OECD etc.), '*oligarchic'* (multinational corporations) and '*democratic'* (World Health Organization, NGO's, United Nations etc.) institutions and organizations: science, knowledge,

affect and communication are the "powers that constitute our anthropological virtuality and are deployed on the surfaces of Empire", Hardt and Negri argue (2000 p. 365).

A critical approach

To situate education within the ideological field of post-national and informatic politics – attempt to comprehend education through the lens of the 'cybernetic hypothesis' – it is important to have a functional delineation of what is meant by the concept of 'education'. Within the critical fold of the twentieth and twenty-first century social science – from where this work draws inspiration – the traditional approaches toward a critique of educational institutions and the social relations it produces has dedicated much attention to the reproduction of inequality while the so called 'postmodern' strains of critical theory is enamored with the rejection of any analysis that approach society as totality. In addition to this divide, attempts to bridge them together into a coherent project have also been made (see for example Bidet, 2016). For structural-Marxist thinkers, the Althusserian concept of ideological state apparatuses (ISA) has been readily utilized to unearth the reproduction of class-based differentiation and oppression. For figures like Pierre Bourdieu and Jean-Claude Passeron, the university emerge as 'symbolic violence' in where the assignment and reproduction of social habitus within the social field take place. As Maxime Ouellet and Éric Martin point out (2018), these approaches certainly are relevant and could provide a productive reduction of distance between the critic and her object of critique. But they are also ahistorical insofar as they are insensitive to the transformations of capitalist arrangements which, by proxy, leaves them unable to approach the 'positive' university; the university as a site to reflect critically on itself and within a public and political sphere. Thus, they afford limited guidance in situating education as social practice within the acutely contemporary. For postmodern theorists of the university, such as Jean-Françoise Lyotard, another set of difficulties emerge. The argued demise of 'grand narratives' deny critique its traditionally dialectical foundation. While critical theory can be used to approach capitalist domination over academic knowledge production, it falls short precisely because of the postmodern condition; there is no totality to point your critique at when the images of computers and cybernetic systems displace any metaphysics of universal truths (Lyotard, 1984). What is left for the critical scholar is neither to allude to reason nor to universal truth, but to engage in linguistic games of resistance and the continuing insistence on particularity. It would seem that in attempt to approach the cultural totality in which education manifests itself today, we need to look elsewhere. While Tiqqun are sympathetic to Lyotard's propositions in some respects – perhaps especially concerning the emphasis on mediating technologies and the technological as subsuming the superstructure – they deviate in terms of ethics. In stressing the

provisional character of the Cybernetic Hypothesis, they open up for a dialectic critique of a totality that can either be transcended or destroyed.

Education, Michael W. Apple (2004) points out, is, in the last analysis, inseparable from the forms of consciousness concomitant with the institutional arrangements of advanced industrial economies. It follows that scholars of education need to be attentive to any shifts in these arrangements, theorize their qualities, histories, effects and develop critiques of the common-sense perceptions ushered in by them (Daza, 2013). Therein lies both the challenge for educational scholarship tomorrow and, as will be argued, the relevance of this work today. For if we follow Michael W. Apple, it is also true that the education of educational scholars and educational science itself, in the last analysis, is inseparable from the forms of consciousness concomitant with arrangements of advanced industrial economies. The aim here, then, is to point a categorial critique against a cultural hegemony that Tiqqun refers to as the 'Cybernetic Hypothesis'; something that affects the categories of thought and social practices as determined *by* social totality. This puts us squarely in the realm of Antonio Gramsci and his theory on cultural hegemony.

With inspiration from neo-Gramscian perspectives (Cox, 1987) the interrelations between hegemonic subjectivities and the institutions, forms of consciousness and modes of production can be brought forth; it becomes possible to appreciate the provisional character while at the same time acknowledge that education, in the last analysis, is the dissemination and reinforcement of a provisional totality through the continual reinvestment in arrangements that is articulated and implemented in mutuality. In terms of education, to lead populations from ignorance to mutually desired states of being in Empire. Modern education, then, can be seen as deliberate social arrangements implemented to transmit knowledge and moral aptitudes that are perceived as answers to the 'Social question' as it is posed by the epistemic order of the present. A broader and less historically constrained delineation could be this: education can be seen as encompassing (1) the articulation of deficiencies within populations or subset of populations, (2) the design of interventions that can remedy these deficiencies. What constitutes education is thus both a historical and political question of mobilization. The arrangements shift with the perceived needs, problems and deficiencies which uncompromisingly situate education within a field of tension, a field of power relations and a struggle over hegemony. One clear tension ca be identified between the remnants of the traditional and imperialistic nation-state and the fulfillment of Empire.

Escaping methodological nationalism(s)

A related debate about the circumstances for methodology has emerged among social scientists (Chernilo, 2011). They ask how we should understand the 'nation state' at this historical stage and, perhaps more importantly, how we can avoid the dangers of what they call 'methodological nationalism'; the realization that the historical parallels between modernity and social science are many by the number and that this would put all social scientists at the risk of presupposing the nation state as a necessary – 'natural' – representation of organized society (Savage, 2017). Many scholars today attempt to counter this by moving beyond what they perceive as outdated and insufficient theoretical concepts when trying to grapple, 'methodologically and 'empirically', with questions of policy. To approach the objects and interests of science with abstractions like 'state', 'government' and 'bureaucracy' is deemed too reductionist and puts the scholar at the risk of thinking with, and within, this 'methodological nationalism'. The processes of policy, likewise, is increasingly identified as difficult to capture with concepts such as 'cycles', 'transfer' and 'implementation' (Savage, 2017) when the enactment of policy is performed within new institutional arrangements marked by globalization and, it could be added, so-called 'big data' methodologies in where data emerge autonomously on the behest of algorithms (Clough et al., 2015). Instead, many look toward non-representational theory (Thrift, 2007) and specifically the genealogically Deleuzian concept of 'assemblages' as a way forward. Assemblages, Deleuze (together with Guattari) points out, are always 'passional' in that they in part consist of desires and social ideals and, in part, the less abstract such as energy and matter (Deleuze & Guattari, 1987). From this standpoint we can see policy-assemblages as apart from individual humans, living their own lives and take use of other humans in other contexts. It allows us to look beyond capitalism reduced to its economic and social moments: the practice of "human exceptionalism" (Haraway, 2008). A highly parallel debate, specifically within the field of education, has brought attention to economic and social changes from a distinctly historical perspective, rather than the more traditional comparative one. Martin Carnoy and Diana Rhoten (2002) has drawn our attention to how globalization – however contested as term both in its totalizing pretentions and its differing facets (such as economic, social, cultural, judicial or technological) – brings forth new empirical and theoretical challenges that traditional comparative approaches need to address. They need, though, to be addressed thoughtfully.

While Deleuze' insistence on situating assemblages of technology in the social milieus in which they were construed will be adhered to henceforth, the discourses of 'assemblages', 'networks' and 'rhizomatic' knowledge-production, so heavily associated with Deleuze, are easily appropriated by the discourse of 'freedom', 'flexibility' and 'progress' enmeshed with the radical

claims of postmodern and cybernetic restructuring. The fundamentally Marxist approach in Deleuze' thinking on technology, perhaps especially evident in his essay *Postscripts on the Societies of Control* (Deleuze, 1992), is, then, often lost to the benefit of aspects that de-emphasize that very foundation. The seemingly anarchic and voluntarist quality of 'the network' lends itself easily to an unreflective optimism regarding the emancipatory qualities of 'post-fordist' and cybernetic modes of capitalist organization (Lyotard could be understood as the victim of this optimism, according to Ouellet & Martin, 2018). In science and scholarship, human agency, then, quite easily disperses into a diagrammatic whole that we tend to forget is governed by the current protocols of *method*. Galloway (2014b) refers to this phenomenon as 'the reticular fallacy', where the falseness lies in the belief that the abolishment of centralized and vertical management releases us from power all together; overlooking the fact that management and control can take an unlimited number of structural forms (Galloway, 2012). For Galloway, *Interface* and *protocol* (2002) are analytical tools that helps us understand power in a post-fordist period. Drawing from Fredric Jameson's concept of 'cognitive mapping' (Wark, 2017), The *interface* reinstates mediation as the guiding principle of communication in the space that we call internet and constitute a movement away from technological devices as mere objects of human manipulation and mediated communication as the Socratic notion of writing on the souls of one another. Interface reintroduces the computer, in all of its different forms, as a *practice* with an ethical dimension; it provides a pattern of structured movements within the diagrammatic whole. *Protocol*, on the other hand, refers quite simply to the actual protocols that govern the computerized networks: for example, the internet and the world wide web. The formal codes of conduct, the code, the algorithms and the grammatical principles of programming languages are all susceptible to literary and ideological criticism according to Galloway. In preparation for this work, as a way to resist both dominant methodological regimes of the cybernetic hypothesis and the 'reticular fallacy', a deliberate choice has been made regarding the terms of phrasing that, to a certain extent, is inspired by this way of approaching power, media, technology and subjectification and, hence, avoids scientific method in any strict sense, turning instead to the hermeneutic and theorizing task of, roughly, assemble claims.

We have spoken here about cybernetics and what could be called cybernetization of society (Berman, 1986). But we are probably more familiar with it by the name of 'Digitalization': the promises of democratization through Information- and communication Technologies (ICTs), automation, the omnipresence of digital technologies in our lives and the conversion of information into a computer-readable format. It has become a common-sense phrase that tries to capture a major shift in society that usually, by way of folk definition, entails the act of converting the analog to the digital. It is however unclear in which way 'digitalization' is an exhaustive

description of what is being spoken of or enacted. 'Digitality', after all, is all about distinction. Whether it is between good and evil or the base-ten positional numeral system, most western philosophy can be described, in the last analysis, as *digital* (Galloway, 2014c). A simple remark that would extend our digital transformation to a period of at least four thousand years. The explanatory value of such a concept is, at least in this context, debatable: in Tiqqun's account, 'digitalization' amounts to the political branch of the 'cybernetic hypothesis' (Tiqqun, 2013). Morris Berman, in his article *The Cybernetic Dream of The Twenty-first Century* (1986), proposed that we call it 'cybernetizisation', which he described as a historical dynamic enacted in three layers. (1) The abstract philosophical layer of systems theory, holistic thinking, complexity and neo-spiritualism, (2) The professional disciplinary layer in where psychology, ecology and biology embrace the metaphor of *information* and, lastly, (3) the 'grass-roots' layer where we find the personal computer and video games as consumer goods and apparatuses of subjectification (Berman, 1986). Berman's proposal stands here as a bridge between the popular use of 'digitalization' and the choice of phrasing in this work.

The concept of 'cybernation' is borrowed from a report written by Donald N. Michaels (1962) and commissioned by the Center for the Study of Democratic Institutions published in 1962. Its full title reads *Cybernation: the silent conquest.* The report weighs the advantages and disadvantages of the advent of cybernetic *automation*; the title is a rather playful combination of 'cybernetics' and 'automation'. As the reader might have noticed, *cybernation* can be taken both as a process of change and a political body of law and soil – here as the electronic networks and apparatuses, social or otherwise. It draws attention to the fact that cybernation, in establishing just that; [the] cybernation, might render the point of traditional nation states almost entirely moot (or at least decimated to rhetorical tools; aesthetics), while at the same time operate as an engine of subjectification according to its dominant passions, desires and designs. It also draws attention to the specifically 'cybernetic' in the consciousness and the institutional arrangements of advanced industrial economies (Tiqqun, 2013; Hayles, 1999; Galloway, 2014a; Franklin, 2015; Peters, 2015), and therefore underscoring that beyond cultural theories – such as postmodernism – lies the dialectics of technology and the scientific concepts that together shape the consciousness of a period (Galison, 2001).

The attentive reader might want to intervene here and ask: is this not merely 'Empire' – the consolidation of traditional nation states into a truly global form of hegemonic imperialism – as theorized by Hardt and Negri (2000)? To that question the answer must be both "yes" and "no". It is 'Empire' in the sense that we here speak of a political architecture where the nation state has lost political significance primarily due to substantial changes in both the commodity and the

production of it. Tiqqun, however, speak of 'the cybernetic hypothesis' as the police-like *thinking of* 'Empire'. This *thinking* is precisely what is to be examined in the following work. 'Empire' has been created as legal body, yes. The 'cybernetic hypothesis' is put forward as the framework for knowledge, reason and the arbiter of meaning *in* Empire *as culture:* cybernation. The open question is where education is left in this arrangement.

In conclusion: to be cautious about 'methodological nationalism' is her taken to be a two-fold challenge. Not only should we, in the first step, attempt to avoid approaching the traditional nation state as a natural phenomenon unearthed by the peace-treaties of Osnabrück, Münster and Westphalen. The treaties of cybernetics and the dissemination of them, too, here as a second step, should be approached as lacking an essence of necessity and natural character. The lack of an empirically oriented method in this work is just that: an attempt to escape – to the extent that it is possible – both the problem of methodological nationalism and methodological cyber-nationalism, as well as the positivist ethos that characterize them both. Instead, inspiration has been sought in another tradition of research and scholarship: the synoptic method of the humanities.

Reintroducing a method: Particulars and 'wholes'

The dialectical mind, Plato insisted, is the synoptic mind; It is a 'whole' the platonic philosopher aims to systematize, with the help of his synoptic method; to mimic the *unity*, intelligibility and eunomic beauty inherent in the cosmology of ancient Greece (beck, 1939; Von Wright, 1988). The ur-synoptist will admit that there very well could reside conflicts and irreducible differences within this 'whole', but the act of "seeing together" – as is the etymological root of the word – still maintained a privileged position in Plato's thought on the act of interpreting reality and the intellectual tools of abstraction required for that activity. For Ludwig Wittgenstein, Synoptic *analysis* is concerned with the world as it is and, more importantly, *how* it is that the world is as it is rather than *why* (Kaplan, 2000). This position, that the world is as it is, and that scholarship should concern itself with the *how*, has imbued great inspiration on this study.

While Plato saw the 'whole' as a methodological endpoint for the philosopher engulfed in the dialectical thought of Antiquity, gestalt psychologist during the first half of the 20th century laid the groundworks for a diagrammatic 'whole', assembled by human psychology, and they took at least some of their inspiration from the technological marvels of that time. One of the founders, Max Wertheimer, reportedly, hastily abandoned a planned vacation for laboratory work when a

fast-moving train triggered his clinical imagination: the individual sections of the train, the carriages and the locomotive, blended together and formed for Wertheimer something of great significance: a gestalt. Gestalt psychology would eventually find a public audience when coupled with motion pictures; the new and exciting media around the beginning of the 20th century (Fancher, 1996). Still-frames turned into *apparent movement;* the *parts*, here conceptualized as anchor points for the sensory devices of man, ensures the ability to perceive *gestalten*, objects beyond their discrete parts and experience their more 'poetic' qualities and emergent 'wholeness'.

The whole, they said in reference to Aristotle, are other than the sum of the parts. This widely disseminated trope is often modified to include a "greater" sum instead of the "difference" present in the (semi-)original incarnation regularly attributed to Kurt Koffka. The reasoning behind this modification, one can only venture, lies in the popularized versions tendency to lead ones' thoughts into the realm of the otherworldly – the realm from which objects obtain their ideal state of beauty and poetic grace, rather than abstract difference. It strips the quote of ambiguity, appeals to an elementarist position where the whole is already inherent in the parts (Beck, 1939) and thereby, presumably, constitute a much more enticing claim for those who see themselves as seekers of essence and enlightenment. Wholeness nowadays, is regularly categorized under 'holism', a term commonly attributed to philosopher, military leader and prime minister of the Union of South Africa Jan Smuts, and placed in contrast to the reductionist stance of 'atomism' (Von Wright, 1988). Gestalt theory, so very interested in explicating 'wholes' on their own merit, would became one building block for the mathematicians and engineers, anthropologists and psychologist, who articulated the cybernetic way of thinking. During the 1940's and -50's, the computer scientist, mathematicians and engineers of Massachusetts Institute of Technology (MIT) and Stanford wrestled with gestaltist thought in their laboratory work with radars and analog computers (Heims, 1991). The eye, they hypothesized, is, perhaps, not so much about 'seeing', as it is 'sensing motion and shape'. This hypothesis formed one epistemological foundation for the sensory devices they devised both as part of the effort during the second world war and during years that followed. A cybernetic psychology took form that, in balancing *gestalt* psychology and psychoanalysis managed to be stated in materialist terms (Franklin, 2015). This 'holism' of the computer age would, as indicated above, develop and shift shape, although still tightly connected to the ongoing development of computers and artificial intelligence, even after the second world war (Turner, 2006; Capra, 1995).

The following work deals with the educational consequences of cybernetic reformulation of the cultural totality and in doing so draws inspiration from the synoptic method insofar as it seeks to unify through the re-combination of platonic *particulars*; different kinds of texts that deals with

such disparate subjects as the history and philosophy of science, science and technology studies (STS), media, literature and education in order to unearth the metaphysics of a particular and provisional point in time: the "cybernetic hypothesis" (Tiqqun, 2013). It will be an exercise in what scholars in the humanities has described as 'discipline-hopping' – albeit in this case, with a springboard situated in education. This approach will in all fairness be regarded as somewhat traditional in the departments of The History of Ideas, Literature or, particularly, Philosophy. But this intended 'hopping', which involves the drawing of inspiration and evocation of sources from a range of fields and disciplines to weave together arguments and claims about curriculum, education and the possibilities of educational scholarship under the hegemonies of the present, is in some estimations of rising importance. A certain amount of eclecticism is after all, as Michael Hardt and Kathi Weeks (2000) point out in their introduction to *The Jameson Reader*, necessary when producing primary work on these matters solely because of the intricacy of cerebral, global, socio-technical, techno-scientific and bio-technical assemblages and the adamantly 'digital' and 'big' *ethos* that characterize both the production and reproduction of knowledge in our times. But it is also a way to resist the position of the 'capturer' in the thinking of Karl Deutsch (see below), busy with the management of information, and force upon the work the act of thinking; that endangered species in educational science (Daza, 2013). A question posed by Catherine Malabou (2009) might afford some temporary soberness: "what should we do, so that consciousness of the brain does not purely and simply coincide with the spirit of capitalism?". If we interpret that question as a challenge to the scientism and managerial ethos that pervades educational science under the statutory control and methodological diagrams of Cybernation, then the critical character, the avoidance of 'methodological nationalism', and the deliberate use of a synoptic method in this work could be considered a counter-move.

This chapter has addressed the methodological choices in the following work, while also situating it within a tradition of inquiry that is marked by philosophical conviction, literary eclecticism, continual attempts to create a distance between the normalized, decrease the distance to the object of inquiry and the particular approach utilized: here, what together is taken to be a critical position. To approach any topic, including mine, implies sentient or inanimate bodies, movement, a starting point, and an attempt to engage; the reduction of distance. The instinct might very well be to 'catch them all', but any reasonable assessment of corporeal capacity and allotted timeframes must necessarily end in a demarcation between what is to be included and what is to be excluded: an approach. In order to produce a synoptic view of greatest possible width and breadth, however, both works produced by cyberneticists, historians of cyberneticists and critics of cybernetics has been used in this exploratory process of 'assembling'. But any demarcation will also, uncompromisingly, throw analysis in a distinct direction while at the same time obscure what

could have been engaged if a different path would have been taken. It is by that token acknowledged that the following confrontation – understood as limited in composition, ocular width, sensitivity to light and granular detail – could have taken the shape of a different whole if it had drawn from a wildly or slightly differing corpus of literature – it would have given the work a different tone, character and result.

In conclusion, the aim was to identify – with the help of the synoptic method – where previous scholarship on the cultural and political consequences of is relevant to the field of education and, on the basis of identifications, discuss the relevance of Tiqqun's claim for both existing and future educational research and scholarship. In this way, the work could be read both as an invitation and challenge to the community of educational scholars to engage with the consequences of the cybernetic hypothesis. With the assumption that the 'cybernetic hypothesis', as put forth by Tiqqun (2013), is in place, I will take my departure in three research questions that will guide the process: (1) **what are the constituent elements in the "cybernetic hypothesis" that are relevant to education**, (2) **what is education within the cybernetic imaginative** and (3) **what, then, are the consequences for educational scholarship?** The following chapter addresses the first question in a direction that draws mainly from historical perspectives on cybernetics while the subsequent chapter, more explicitly, engage in the act of 'seeing as a whole': assembling a synoptic view that takes into account the history of cybernetics in conjunction with education and educational scholarship. The last and concluding chapter provides summarizing remarks.

The maneuvers and positions of cybernetic thought

One of the principal contributions of Italian radical theorist Antonio Gramsci was his distinction between two modalities of warfare: the “war of maneuver” and “war of position”. The former denotes the popular definition by which two identifiable armies collide in armed conflict. Victories are won, and defeats are suffered on a battlefield; governmental and territorial power is manifestly gained and lost. The latter, instead, denotes a warfare that withdraws from such discernibility and rests on the mobilization of the entirety of (modern) society in order to remain continuously victorious. From this distinction Gramsci drew his understanding of culture, identified the importance of culture understood as struggle and it was on the basis of this identification that he developed his widely recognized concept of ‘cultural hegemony’. A concept which according to Gramsci amounts to a ‘positional war’ within the modern social apparatus (Gramsci, 1971). Outlining a history of electronic computers, As Paul N. Edwards (1996) points out, would be a difficult endeavor if one left war out of the story. The same could be said for the implementation of information and communications technologies (ICT’s) in education which, at least since the late 1980’s, has been the subject of increasing investment and, one might add, celebration. Policies and strategies has been implemented which are part of a much broader economic and ideological agenda that is heavily indebted to the ideals of globalization and neoliberalism: a modernization that is argued inevitable and necessary when attempting to meet the demands of the future ‘knowledge society’ (Moltó Egea, 2014).

It remains, of course, unknown how Gramsci, a political prisoner of Mussolini’s fascist Italy, a contemporary with the Russian Revolution and a devote internationalist would have interpreted our times. He died in 1937. But the historical trajectory of cybernetics, which is the focus of this chapter, can be grounded neatly within both of Gramsci’s conceptions of warfare. It stretches from a set of rather isolated techno-scientific and political practices during the second world war, to a technology of government (Tiqqun, 2013) that rests firmly on the rhetorical logic of cybernetics. This “Gramscian” periodization will guide the disposition of this chapter. But seeing as the history of cybernetics has been dissected in exhaustive ways by others, the following account will be in summary and instead focus on particulars that has relevance for education. In addition, focus will lay on which directions cybernetics have ‘traveled’ to our present times and, one might add, how it has laid claim to the future while at the same time not suspend what Thomas Kuhn identified as one of the problems of scientific thought: it’s inability or reluctance to stay aware of its own history (Kuhn, 1970).

The following summary draws, then, heavily, but not exclusively, on the works of Peter Galison (1994; 1999; 2001), Paul N. Edwards (1985; 1996), Joshua Heims (1991), Katherine N. Hayles (1999; 2005), Seb Franklin (2015) and Fred Turner (2006; 2015). These works have practically become standards within the subgenres of social science and humanities that preoccupy themselves with the tension between technology, culture and politics. Edwards and Galison have spent many years investigating the circumstances in which cybernetics came to be and how it developed during the first and most formative years. Galison, coming from philosophy of science, has sought out the ontological presuppositions of cybernetics while Edwards, with a background in Science and Technology Studies (STS), has outlined the emergence and significance of the digital computer (which, as we shall see, is heavily intertwined with the history of cybernetic thinking) both as object and metaphor. Heims focused on how cybernetics came to meld with the social sciences during the decades following the second world war as a science of prediction and planning; management. Turners work outlines where the first wave of cybernetics coalesced with the growing counterculture during The Sixties and transformed into a rather distinct and politically more radical *second wave* of cybernetics within the burgeoning countercultures of Californian station and the emerging 'digital utopianism' of libertarian *Cyberculture*. Hayles has traced the formation of a informationalist 'posthuman' in cybernetic thought during the second half of the twentieth century and relates that to literature, her field of inquiry. A field she shares with Seb Franklin who has outlined the cultural logic of 'control' and the cybernetic foundations for that very logic.

In maneuver: the triangulation of enemies, language and learners

Computers: shifting politics in American academia

The practice of devising ballistic trajectory tables, used to calibrate canons and machine guns to increase their precision and raise the number of successful shots, has a strikingly long and bloody history. It dates back at least to the wars fought by Venetian armies and the Venetian government's sponsorship of Galilei Galileo as the principal mathematician of their wars (Berman, 1981). Norbert Wiener, who later would christen cybernetics and formalize many of the principal tenets within the tradition, began his military research career during the first world war devising similar kinds of tables. By the standards of the time, he would have been called a 'computer' – 'computing' was yet to denote the work of machines (Edwards, 1996; Mirowski, 2002). As the technological sophistication of war increased from the first to the second world war, especially in the growing maneuverability and speed of fighter airplanes, so did the demand on

the tables that gave anti-aircraft guns not just its destructive power, but also a level of precision (Edwards, 1996). Guns and launchers, as a response, were increasingly equipped with analog electronic computers and radars to make faster and more complex estimations of future positions of enemy aircraft and imbue a level of control over the cascades of shells that ideally would destroy them. The involvement of the scientific community thus increased substantially during the second world war.

This, a reminder, as Ian Hacking (1986) has pointed out, that if one disregard weapons of mass destruction, it is the delivery systems and strategies of weapons that require the bulk of research and development – not the bombs and bullets in themselves. It is on that note worth noting that a substantial amount of military attention and funding also were funneled into the development of effective ways of training soldiers (Noble, 1989) and the production manuals for successful management of populations in besieged territory (Heims, 1991). Educators and experimental psychologist devised a number of methods and technologies predicated on 'behavioral objectives' – thus foreshadowing the Competence Movement and post-war Human Resource Management (HRM) – and both developed and utilized audiovisual tools such as instructional film, simulation and training devices. In fact, a large number of educational equipment and methods, some of them still used today, as Douglas D. Noble (1989) points out, saw the light of day during both these and later efforts to reduce the training-time to a minimum while maintaining a balance between under- and overtraining. Noble lists "overhead projectors, language laboratories, instructional films, instructional television, teaching machines, computer-assisted and computer-managed instruction, and videodisk applications" as prominent examples of educational equipment devised during the period while "programmed instruction, instructional design, criterion-referenced testing, individualized instructional packages, the "systems" approach to educational administration, simulation software, skill taxonomies, behavioral objectives, the mastery learning model and intelligent tutoring systems" constitute examples of models and methods for educational practice and administration (Noble, 1989 p. 275). During the post-war period, efforts, paradoxically, intensified within military organizational bodies such as the Air Force's RAND Corporation and System Development Corporation (SDC), the Army's Human Resources Research Office (HumRRo), Air Force Personnel and Training Research Center (AFPTRC) and the Navy Personnel Research and Development Center (NPDRC). Additionally, an "enormous body of psychological literature on learning and training" (Neumann, 1979, p. 86) was generated on the behest of military funding agencies like the Air Force Office of Scientific Research (AFOSR), the Army Research Institute (ARI), the Office of Naval Research (ONR) and the Defense Advanced Research Projects Agency (DARPA, formerly ARPA). The application of proto-cybernetic methodology was, in this respect, not confined to the development of

computerized weapons- and radar-systems. These were but aspects of the mobilization of scientist and engineers during the period.

American research universities became heavily involved in military operations through the coordination of Vannevar Bush who, as professor at Massachusetts Institute of Technology (MIT), had built one of the largest analog computers up until that point. The protection of Britain through the Lend-Lease act, he insisted, could only be upheld through the close cooperation between the scientific community and the military (Edwards, 1996). In 1940, the National Defense Research Committee (NDRC) – renamed the Office of Scientific Research and Development (OSRD) one year later as the United States had formally entered the war – were instituted to oversee this project. During the following period of five years, they allocated $540 million dollars to private contractors, laboratories and, chiefly, research universities while also establishing a rather substantial and diverse array of actors working toward a shared goal: devise military equipment of high sophistication and improve military strategy, management and training (Edwards, 1996; Turner, 2006; Franklin, 2015; Noble, 1989). Here, the development of electronic computers, and eventually the micro-processor, ended up on the receiving end of both substantial interest and ample funding from the United States government and continues to do so until this day (Edwards, 1996; Turner, 2006). But it would also reconfigure relationships between the state, the university and private contractors in a way that is still felt today.

While the bureaucratic apparatus of war-time research grew heavily on the macro-level, the high demand of ever more sophisticated technologies drove these actors together in new ways on the micro-level. New interdisciplinary alliances where forged and the relationship between public and private, social and natural sciences became indistinct and took on a more entrepreneurial *ethos* (Etzkowitz, 2002). In these collaborations, new ways of speaking and thinking began to take shape both in reference to organizational principles and concrete innovation of technological equipment, human psychology and educational practice. To visualize and explain across disciplinary boundaries and hierarchical layers, new and not rarely jargon-laden linguistic tools, a computational metaphor, and hardware were constructed with which scientist could delve into fields in which they lacked formal accreditation: proto-cybernetics and systems thinking/analysis (Franklin, 2015). This is where American academia more generally began shifting paradigms (Mirowski, 2002) as it was detached from previous conceptions of American science: a science conceived as apolitical in terms of its relations with the external (Leslie, 1993). The subsequent dissemination of the technologies, conceptions of administrative rationality and human psychology into public schools, Noble hastes to remind, is not the consequence of some "pentagon conspiracy". Rather, the result of researchers looking for ways to expand the opportunities for

funding and laboratory space; public administrators attempting to improve and modernize public education and commercial interests in search for opportunities to exploit education markets (Noble, 1989). Educational research, thus, in the middle of the historical ground zero of what Etzkowitz later has referred to as the (non-linear) triple-helix mode of knowledge production. An organizational arrangement where academia, increasingly, are taking over the role of the military in innovation-processes also involving government and industry in complex networks of inter-communication. Other ways of conceptualizing these processes and approaches to post-war knowledge production include the more linear theories of 'mode 2' knowledge production (Nowotny, Scott & Gibbons, 2001) and national systems of innovation (Lundvall, 1992). At the center of this collaborative network of professionals stood the highly influential Radiation Laboratory (RadLab) at Massachusetts Institute of technology (MIT) where Norbert Wiener now held position (Etzkowitz, 2002; Turner, 2006).

Proto-cybernetics

As the United States formally entered the second world war, Wiener, together with engineer Julian Bigelow, became involved in the building of what they called a 'predictor'. They aimed to mathematically calculate the probable position of an enemy airplane and it was for them, as Turner (2006) has phrased it, "down to a choice". Either reduce the target to a (psychological) *human* or *mechanical* opponent. Wiener and Bigelow privileged the latter and conceptualized the enemy pilot and his airplane as a servo-mechanical system – the distinction between the human and the non-human here unescapably blurred. Thus, the 'AntiAircraft (AA) Predictor', which could predict the seemingly erratic, non-linear, patterns of enemy movement, were devised. The errors made by pilots and gunner alike, and the corrections they did as a response to these errors, were understood as a 'negative feedback' and thus made available for computational calculation (Wiener, 1956). It was, as previously mentioned, a formula for prediction and control on incomplete information; conceptualizing the enemy pilots as black-box feedback systems with electro-physiological character and forecast the movements of those characters with servomechanisms that operated autonomously on feedback. It is worth mentioning that Wiener here provided a starkly different idea about the enemy combatant than the prevailing one amongst soldiers and commanders of the war in which the Japanese opposition in particular were seen as savage barbarians that should be defeated as you would vermin (Galison, 1994).

Wiener, however, already at this early stage, saw that there were possibilities to generalize even further. As both Galison (1994) and Edwards (1996) have shown, it didn't take long for Wiener

to realize that the logic of the 'AA predictor' – the hybridization of man and machine into a "man/machine system" – could be extended to encompass not only the minds of enemy pilots, but also the pilots of the Allied forces and human beings in general – eventually even society as a whole. The prerequisite for this line of thinking came through the metaphor of *information* (Tiqqun, 2013), in turn afforded by Claud Shannon's version of Information Theory (Terranova, 2016) which became highly influential within the milieu of military research at the time and played a substantial part in the subsequent formalization of cybernetics.

In the relationship between the gun operator and the 'AA predictor', Wiener, together with Bigelow, saw the manifestations of a fluid and flat, non-hierarchical, organizational *system* of circular informational flows, in where human and autonomous technological systems collaborated effectively, improving the capabilities of each other toward the obtainment of a shared and common goal without the need of hierarchical lines of command. They were self-regulating systems of information and if the world – human beings included – were understood as informational feedback systems, then they could be observed, managed and controlled without the use of the traditionally strict organizational hierarchies. Together with physiologist Arthuro Rosenblueth, Wiener and Bigelow wrote a paper, *Behavior, Purpose and Teleology*, where they outlined how biological systems behave purposefully in just the same way as the mechanical/bio-mechanical 'AA Predictor' did (Rosenblueth, Wiener & Bigelow, 1943). It is worth noting that in the 'AA predictor', they saw the very form of organizational structure that they themselves were enacting at MIT during the war: the highly innovative, urgent, well-funded, collaborative and, in most aspects, self-regulated work performed within the OSRD program seemed to parallel the teleological behavior of their machine through bottom-up processes of decision-making (Turner, 2006).

Cybernetic fears

Wiener, however, did not only see his construct as a force for good. He was also sensitive to the potential threat of cybernetic apparatuses taking control over processes that, to his mind, should be in the hands of man; methodological individualism seemed threatened by what later has been called "Methodological cyborgism" by economist Philip Mirowski (2002, p 441). The computational metaphor of cybernetics; the diffusion of man and machine in the abstraction of the organism as principally a device for sensory function, data analysis and the direction of action brought forward a fear of the domination of machine over man. Wiener disliked the potential of industrial automation to the extent that he at least on one occasion, personally, advised union leaders on effective ways of resistance (Turner, 2016), which is, perhaps, revealing of a politically

conscious side to Wiener that is often overlooked (Franklin, 2015) but not forgotten (see for example Heims, 1980). What prevailed as a true source of moral good for Wiener was the model for social organization as theoretically perfect systems of information. Systems that adjusts its behavior when interfaced with negative feedback and thereby able to maintain and be manipulated into a desired state of homeostasis.

After the war, Wiener published two best-selling books that would formalize cybernetics into a coherent proposition, deliberately distance his works from the horrors of war and – in keeping with the narrative of Tiqqun (2013) – come to supplant the liberal tract of Mandeville. First, *Cybernetics: or, Control and Communication in the Animal and the Machine* (Wiener, 1948) in which he intellectually connects cybernetics to both the binary logic of Gottfried Wilhelm Leibniz and the self-regulating mechanism of James Clerk Maxwell. From physiology, Wiener incorporated the concept of *homeostasis* and used it to describe desirable states of social systems. *Feedback* were derived from control engineering and afforded complimentary concepts such as 'memory', 'learning' and 'purpose' (Turner, 2006). Now, cybernetics were properly christened. It was described as 'the study of messages as a means to control machines and society'. Society, and its social institutions, here understood as constituent systems of bio-technical character – patterns of information surrounded by noise. Systems that through responses to negative feedback could maintain a state of homeostasis. The television, Wiener theorized at this point, stood as a 'radar' for the entirety of civil society. Later, the more accessible *The Human Use of Human Beings: Cybernetics and Society* (Wiener, 1954) were published and the mechanical and biological thus merged in front of a substantial audience of both academic and non-academic creed while Wiener stressed his humanist convictions. To appreciate how Cybernetics went from a rhetoric concerned with servomechanical apparatuses of war and intuitions about its significance for social organization and control to become a social force of significance, we have to de-center Norbert Wiener and outline the scientific, cultural and political circumstances in which cybernetic thought gained wide-spread traction during the years following the second world war.

From proto-cybernetics to articulation

After the war, and after the publication of Wiener's popularly accessible books on cybernetics, the ideas were widely disseminated and thus made available for embrace, modification and development. Perhaps especially at large-scale military research facilities such as the SAGE air defense system that rested heavily on the systems theory of cybernetics (Turner, 2006). This proto-cybernetics can, up until this point be understood as operating within the confines of an ongoing 'war of maneuver', while at the same time begin to exhort cultural influence within the

microcosm of war-time research. It afforded those involved what Sociologist of science Geoffrey Bowker, in direct reference to cybernetics, has described as the 'the triangulation effect'. An "extravagant argument" affords legitimacy which can be reciprocally shared through triangulation, allowing others to operate within the legitimizing field of that very 'extravagant argument'. This language would provide a powerful methodology in 'smoothing out' the discontinuities between different actors with wildly different professional backgrounds (Bowker, 1993). The inter- or meta-disciplinary language of cybernetics gave a suitable methodology for computer scientists, anthropologists, psychologists, administrators, designers, engineers and politicians – the scientific entrepreneurs active under the umbrella of OSRD – to devise the most effective and sophisticated apparatuses, artefacts and strategies for war against a common enemy Other, often eschewing the distinction between the mechanical and the living in the process, or see to it that they were made.

These geographically and culturally "American" escapes and solidifications into a holistic vision of *information* provided a means to settle the philosophical and political debates of the time and did not go unnoticed outside of the US. As Bernard Dionysius Geoghegan (2011) has shown, it was even celebrated. French anthropologist and structuralist Claude Lévi-Strauss saw in the developments of these technologies of prediction and communication a grand reconciliation between the intuitions of both the savage and the civilized mind. The informational world – the world as a series of patterned signals and signs available for our processual interpretation (for westerners, through the use of cybernetic apparatuses) – gave access to the principles that the savage heuristically had used all along. The world as a network of probabilities, where the structuralist notion of language could be scaled-up to visualize "forms of social phenomena" (Lévi-Strauss, 1951), have them mathematized and used for prediction and as technologies for the liberation of man. Although it won't be explored further here, it is worth mentioning that there are others who have studied particularly the French reception of cybernetics (see for example Geoghan, 2011; Johnson, 2014; Franklin, 2015; Lafontaine, 2016) and been able to show that there were in fact a sizeable number of French academics that embraced cybernetics at an early stage. Andrew Pickering, in a similar fashion, has written extensively on British formulations of Cybernetic thought (Pickering, 1995, 2010). As have John Biggart (1998) on physician and psychiatrist Alexander Bogdanov, who represented a less state-centric fraction than the Leninists within early Russian bolshevism, who's theories are repeatedly understood as a precursor to systems analysis which would later be paralleled in American cybernetics and become a cornerstone concept in the biologically underpinned General Systems Theory of Ludwig Von Bertalanffy (Lilienfield, 1978; Zhuravlev & Gurevich, 2010).

Into position: planning for peace

The coming of social cybernetics

The war had ended and left in its wake highly sophisticated technological innovations that captured the imagination of many and were integral to the national identity of many Americans during the years following the war (Heims, 1991). But the prospect of Soviet intervention had also become a substantial part of American life and would become institutionalized as the Cold war began in 1947. Society, it was felt, needed to be defended against the foreign forces that threatened to annihilate it or imbue it with a machine of socialist, bureaucratic terror (Turner, 2006; 2015). The conservative response with an ideology of anti-communism, gave a *carte blanche* in the vilification of university workers accused of carrying communist sympathies (Hodgson, 1976). This while liberals busied themselves with constructing and develop new sets of political ideas that could withstand the threat of European fascism and Soviet communism (Heims, 1991; Turner, 2015).

At the same time, the liberal rationale of enlightenment and the industrial revolution was under pressure both culturally and politically. The prolonged period of armed global conflict and the Bolshevik revolution of 1917, had severely destabilized the positivist stance and the liberal conception of the 'individual' were fractured in the trenches of continental Europe and on the islands of the Pacific Ocean (Tiqqun, 2013). In fact, the whole idea of the 'enlightened man' was turned on its head during the first half of the 20th century. To build a great society were not possible, it became increasingly clear to the intellectuals of the time, if one solely were to depend upon free flows of information in conjunction with the good will that rests in people's hearts. To build the Great Society, as political writer Walter Lippmann already had alluded to in the Lippmann-Dewey debates decades before, one needed to engage in scientific management and use new technologies of analysis which could improve the thrust and character of social management on the macro-level (Lippmann, 1922). The omnicompetent conception of man, according to Lippmann, was a figment of the imagination and he instead proposed the "manufacture of consent" (p. 364). Propaganda were, then, re-contextualized from its previous connotations of sovereignty (Adolf Hitler, it was later widely argued, rose to power through the effective use of mass-media) into something integral to social control both within the modern nation state and through transnational federations; a technology to solve the inconsistencies found in conceptualizing the citizen as a thoroughly rational actor and the increasing complexity of society that, according to Lippmann and later Edward Bernays (1928), rendered it humanly unmanageable (Robins & Webster, 1999). The "laws" of pre-war liberal humanism and capitalism were, in short, increasingly understood as ill-equipped to protect the "Social" from entropic

dissemination of corrupt information. Liberalism and the psychology of the enlightened man, it seemed to many, not least to Wiener himself (Hayles, 1999), needed reconfiguration and ultimately saving (Tiqqun, 2013; Mirowski, 2002; Heims, 1991). The growing problems of *information* and communication left, then, empty spaces for the 'cybernetic hypothesis' to fill (Tiqqun, 2013) with statistical planning and forecasting and eventually computerized 'expert systems' – mimicking, broadening, amplifying and, not least, reconstitute the objectives for the specialized social researcher toward large-scale data analysis. The techno-scientific expansion under the OSRD had given military leaders and politicians the foundations for a dream of wars without soldiers, social scientist hopes of more powerful methods for quantification and prediction while industry leaders saw the potential to replace bodily work with machines: the automation of democratic society had become a widely shared goal (Green, 1999).

This gave rise to what Fred Turner (2015) has described as a 'democratic surround', in where liberal democratic *competence* were to be awakened or instilled in the masses through, amongst other things, free-form musical compositions and suggestive art shows depicting anthropological sceneries that would transcend the transmission-form of pedagogical instruction and instead, through immersion, trigger interpretive faculties associated with a self-regulating democratic disposition. New bottom-up conceptions of communication were sought. Information, Norbert Wiener argued, perhaps inspired by the exiled German social theorists and artists, is always contaminated with the extravagant claims of marketers and eschewed by the monopolistic tendencies within the mass media (Tiqqun, 2013). The morale of Nazi Germany, seen as conformist and brittle, were to be met with a flexible and strong morale that involved the 'whole' person. The masses, in short, lacked an insulating set of skills and competencies; scientific ways of thinking and acting (Faure et al, 1972). Competencies that, if present, could turn human beings immune to communist and fascist ways of thinking. "*The world was sick, and the ills from which it was suffering were mainly due to the perversion of man, his inability to live at peace with himself*", said psychiatrist and the first general director of the World Health Organization (WHO) George Brock Chisholm. He saw to it that his close friend John Rawlings Rees, a founding member of the Tavistock Institute which also employed Kurt Lewin who developed his 'action research' there (Flood, 2010), became the first president of the World Federation for Mental Health (WFMH). The WFHM gathered an international and interdisciplinary group of experts that, amongst others, included anthropologist Margaret Mead, whom we'll return to below. The federation initially received funding from UNESCO in the development and dissemination of their program of uncorrupted communication and information and transparency in both inter- and intrapersonal relations through the fusing of psychiatry and social science (Brody, 2014). The federations motto was even taken directly from the constitution of UNESCO: "Since wars begin

in the minds of men, it is in the minds of men that the defence of peace must be constructed" (Heims, 1991).

Joshua Heims (1991) situate what he calls 'the cybernetic group' in this tradition where social science would receive a substantial increase in government funding to construct a resilient, scientific and, principally, liberal social order and citizen (Heims, 1991). It is within this political, cultural and scientific milieu cybernetics became a language for an *avant-garde* of scientists and social scholars during the decade that would follow. This chiefly, but not exclusively, in the context of a set of highly influential conferences organized by the medical director of the Josiah Macy Jr. Foundation, Frank Freemont-smith, a devote liberal (Edwards, 1996; Heims, 1991). Freemont-smith had already been involved in the prehistory of cybernetics through connections within the neurophysiological community and the work of Walter Cannon, who's popular fame perhaps best can attributed to his thesis on flight or fight responses, rather than his work on homeostasis, in where Freemont-Smith once had played a part (Heims, 1991).

The Macy Conferences

The social potential that Freemont-Smith and others identified in cybernetics is at the center of Joshua Heims work on the Macy Conferences. In his book, titled *The Cybernetics Group* (1991), he outlined not only how Cybernetics evolved within this context, but also how cybernetics where negotiated with the aim of turning it into a proper meta-discipline; into something relevant within the social sciences more in general. Heims points out three particulars of special interest in relation to the so-called Macy Conferences and the development of a socio-cybernetics within them. Sociology were at the time heavily inspired by the functionalist conservatism of Talcott Parsons and his emphasis on hierarchy, equilibrium and continuity. Cultural Anthropologists were engulfed in the methodologically relativistic observation and classification of small and culturally closed systems of community, ideally threatened with extinction. Clinical psychology was typically focused on the individual, mainly with a Freudian bent, while academic psychology leaned heavily on behaviorist assumptions or more mechanist understandings of cognition (Heims, 1991; Franklin, 2015). The Macy conferences brought together people that came from all of these traditions, in addition to the mathematicians and engineers that had worked with them side-by-side, during the war. The conference was arranged with the goal of devising a socio-cybernetics that, with the use of *social feedback* as the paradigmatic concept, could afford scientific methods for the control of societies and a general science concerning the human mind and its functions (Heims, 1991; Turner, 2006; Tiqqun, 2013); a social theory of everything that, it was hoped, could be beneficial in the recalibration of a world in disarray. The management of

smaller social units, and thereby maintain *homeostasis* on a larger scale, was deemed more beneficial in the protection against communist thought than the large-scale planning of centralized bureaucratic apparatuses utilized by the enemy, and thus more in line with sentiments that characterized the US during the cold war (Turner, 2015). The anti-authoritarian emphasis was also visible in the proceedings themselves. The conferences focused not on the presentations of finished papers, but on highly inter-disciplinary discussions based on unfinished works that the conferees brought with them (Hayles, 1999), thus mimicking the working conditions Wiener *et consorts* had developed or been injected into during the second world war.

Hayles (1999) has identified three areas where the conferees invested the better part of their attention in order to reach that goal. The first area of interest was the further development of the theoretical construction of information. The second, to incorporate that developed theory of information into an understanding of human neural structures as consisting of flows of information and, lastly, the third area of interest, to construct apparatuses and concepts of translation that could turn the flows of information into observable operations and therefore something "real" (Hayles, 1999, p 50) that can be proven "true" or "false"; premonitions of the establishment of, amongst other things, the cognitive sciences (Heims, 1991). For our purposes, Seb Franklins account, although it shares many entry points with Hayles, is perhaps a better fit. He emphasizes that during the first meetings, as is evident in the transcripts (Franklin, 2015; Heims, 1991), it was still unclear in which ways cybernetics, still oriented toward biological and mechanical hardware, were applicable to the study of social groups and by extension society as a whole. The question revolved around the possibilities of – and the ethical justifications for – prediction and statistical forecasting of social behavior. Early on, cyberneticists, although clearly interested in it, failed to provide a viable way of model forecasting that could account for long periods of time. The scale was smaller than that, and accounted only for more or less immediate events, such as the positions of enemy aircraft or, as exemplified by Rosenblueth, Wiener and Bigelow (1943), the difference between an amoeba simply following the source of its chemical reaction or a cat, extrapolating the future position of the pray that it hunts.

The question of how to both ethically and scientifically transpose cybernetic feedback control to social science centered around two major positions: the *diagnostic* interpretation of Gregory Bateson and the Game Theory of John Von Neumann. The latter saw in the game of poker a microcosm of human behavior that in its competitive nature could be modelled, rendered digital and subjected to experimental forecasting. A perceived ruthlessness that fared ill with both Bateson and Wiener who saw the emphasis on personal gain and growth in Von Neumann's robot-like human as standing in direct opposition to their preferred emphasis on control for the sake of

social *homeostasis*. Anthropologists Gregory Bateson, who was a recurring guest at the conferences and the informal leader of the group of panelists that came from the non-physical sciences, and Margaret Mead, equally, if not more, established anthropologist, were actively encouraged by Wiener who was set on expanding cybernetics into a "world picture" (Galison, 1994). For Wiener, and other cyberneticists, the world consists not of the soul-infused monads of Gottfried Wilhelm von Leibniz – a philosophy that Wiener by own admission where highly influenced by – but by the communication between nodes in a mesh-like structure, interacting through the input and output of messages; black-box automatons with internals unavailable to the Other but through the analysis of the inputs and outputs that passes through them. This world also included human beings and their psychology which, up until this point, were confined to the operations of Rosenblueth, Wiener and Bigelow (1943).

Hayles (1999) outline how a psychology were negotiated during the Macy conferences by pointing our attention to the conflict between psychiatrist Lawrence Kubie and neurophysiologist Warren McCulloch. The former was sympathetic to the Freudian psychoanalysis that was dominating American psychology at the time, the latter, adamant that it was mere mystifications and that psychology best could be understood with the help of mechanist assumptions. Kubie, though, were heavily outnumbered at the Macy Conferences. Bateson, for instance, approached psychoanalysis with suspicion on the basis of the fixation with consciousness he identified in Freudian thinking, while others receded to the dismissive position of McCulloch. At the same time, Both Bateson and Wiener, as mentioned, expressed hesitation when confronted with questions of the extent to which game theory, in conjunction with cybernetics, were acceptable as both a scientific and ethical proposition. While McCulloch, on the basis of his reduction of consciousness to a complex of discrete states, expounded the idea that computers, in theory, were able to have emotions, John Von Neumann, who was recognized within the cybernetic group for his work on information theory, automata and viruses as information processing entities questioned if such a complex system as the human nervous system would ever be susceptible to that level of control (Kay, 1995).

The computationalist foundation in Cybernetic thinking made for a rather open playing-field in determining a proper vocabulary in terms of human psychology, but the stakes were high. An account for psychological phenomena were vital in both developing and diffusing Cybernetics (Heims, 1991); some sort of final compromise had to be had, in order to produce a cybernetic psychology proper. Kubie, with the endorsement of Wiener, went on to publish an article where he persistently stuck to the idea of having a consciousness and a corresponding unconsciousness within the Cybernetic paradigm. The unconsciousness, in his article, were reformulated into

something that was akin to the neurons that McCulloch and computational neuroscientist and logician Walter Pitts had presented. The switches of Kubie's unconscious were not governed by intensities of energy, but discrete states – on or off – by which measurement were turned obsolete. This erasure of materiality and privileging of information was of central importance during the Macy Conferences. Already at the first meeting, Von Neumann and Wiener argued that this was the way to approach the cybernetic man-machine equation (Hayles, 1999).

Cybernetics, Homeostasis and social science

As Henry Etzkowitz, (1993) points out, the attempts of the conferees to establish cybernetics as paradigmatic new meta-discipline would fail. Cybernetics as a discipline would primarily merge into computer science, Artificial Intelligence-research, development of neural nets (artificial representations of animal brains in where learning is understood as the task-based progressive improvement of performance) and visualization. Cybernetics became a semi-pronounced guiding methodology within disciplines of primarily naturalistic character and not the inter-disciplinary and distinct body of knowledge it initially was hoped to become (Etzkowitz, 1993; Mirowski, 2002). Cybernetics would, then, primarily come to inform a more general comprehension of *information* as the stuff of reality and systems of informational patterns, biological or otherwise, as the object of enquiry. With the discursive constructs of cybernetics as a philosophy, legitimacy could be gained within a multitude of scientific disciplines – including social science – and transform them into what Donna Haraway later has called the 'cyborg disciplines' (Haraway, 1991, 1997).

The social sciences have always been interested in data. Even haunted by it, as Patricia Ticineto Clough, Karen Gregory, Benjamin Haber, and R. Joshua Scannell (2015) phrase it while referencing Jacques Derrida. The cybernetic or 'datalogical' (Clough et al, 2015) turn that has manifested itself in social science in the post-war era are but an intensification of the hunt through an increase in speed in processing of said data and the cybernetic move from the biophysical to the informational as the governing metaphor. Katherine N. Hayles, in her book *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature and Informatics* (1999) stipulates three distinct periods with differing emphasizes within the cybernetic tradition: *homeostasis* (1945-1960) *reflexivity* (1960-1980) and *virtuality* (1980-). The period of *Homeostasis*, when overlaying the periodization of Hayles with that of Clough et al. (2015), is one of positivism and scientism: social science as a productive agent in the predictive, rather than archeological, practices of the state. Cybernetics, in short, took proper form in a political climate that made the United States

highly susceptible to the Cybernetic emphasis on *control;* the displacement of history through information *systems* as guiding concept in social analysis and, most importantly, planning (Clough et al., 2015). In modeling and thus valorizing cognition and social behavior, cybernetic methodologies – systems analysis in particular – were already deemed as useful tools in the scientific management of minds and machines both for corporations and state. It is, for instance, worth mentioning that cybernetics as a model for organization and inquiry were under development at institutions like the Air Force's RAND Corporation, which not only embraced these new ways of thinking the man/machine system and the control that it afforded, but also exhorted substantial influence on public policy not only in the United States (Turner, 2006; Jardini, 2000; Franklin, 2015), but also in Great Britain (Thomas, 2015) France (Hecht, 2000) and Sweden (Kaijser & Tiberg, 2000).

The sentiments of the time are made strikingly visible in the work of Cyberneticist and political scientist Karl Deutsch who, in his book *The Nerves of Government* (1966), laid out a rather clear case for a cybernetic society which bears striking resemblance to our current historical juncture. While we tend to ascribe the abandonment of 'the sovereign' as the true source of power to thinkers like Michael Foucault, Deutsch saw the allure in similar propositions. Deutsch, in his book *The Nerves of Government* found just that in the cybernetic fascination with techno-biological confluence. Deutsch conceptualized government as the rational coordination of all information and decisions that flow through, in his words, the "nervous system" of the social body. For Deutsch, this totalizing rationalization of government rested on three principles: the *capturing* of the information produced within the social body; the *handling* of this information and, perhaps most importantly, a *proximity* to the subjects that produce the information and decisions that is to be handled. Tiqqun (2013) describes this very example as the production of a visible instantiation of the 'invisible hand'– a visibility that renders cybernetic management both a paradigmatic event and a technique of government; a bio-politics managed through cybernetic systems of technology. First, the social body is re-conceptualized as system or network of cybernetic qualities, then, later, melded with capital in where it derives its power through the rational delivery of information and decisions within Empire (Tiqqun, 2013; Hardt & Negri, 2000).

The systems approach to planning and forecasting In the Swedish context, Kaijser and Tiberg argue, no longer employ special divisions in corporations and public agencies as used to be the case, instead the practices and structures of thought has been incorporated into new academic disciplines and computer software where it continues to imbue influence on organizations and

institutions perhaps particularly through the work of supranational organizations such as OECD (Michel, 2016).

Further into position: administration, environmentalism and personal computers

Toward reflexivity

For Bateson, who had worked for the U.S. Office of Strategic Services during the second world war and, at the time, already an established anthropologist and theoretician of learning, the circular causality within the homeostatic systems of black-box messengers were of great intellectual significance, but particularly the couplings that bind them together. Bateson, together with Mead, thus placed an anthropological gaze upon the cybernetic picture of the world. For Bateson – who had made a habit of presenting his clinical work bereft of empirical data, thus giving it a more philosophic vernacular – cybernetics brings out man not in solipsistic terms (a recurrent criticism according to Clough et al., 2015), but still as something that breaks down the barrier between subject and object through the abolition of the object all together. The world as we know it is construed by our sensory perception and is therefore unavailable to us except through the internal metaphor of the self; we are nothing but our own personal epistemologies, Bateson would later exclaim (Hayles, 1999). The outer world is only accessible to the inner world through the internal construction of a world equally diverse and complex as the external; the balance and continuity of complexity constitute the organization of the self, thus the internal and the external is rendered as one coherent and functional system. Cybernetics, as a theoretical basis for the social sciences, were, in Bateson's understanding of it, centered around anthropological diagnosis; feedback as a means for communities to remain stable and the further development of a psychological theory of learning that could explain the individuals within those communities (Heims, 1991; Franklin, 2015). Within these tensions, a consciousness marked by programmability emerged. In the computer and the automata, as is perhaps most visible in Ron W. Ashby's *An introduction to cybernetics* (Ashby, 1956) and John Von Neumann's *General and Logical Theory of Automata* (Von Neumann, 1951), the cyberneticists found an idealized metaphor for not only the individual learner but for communities, organizations and society as *readable* black-boxes which outputs could be altered through feedback control – much in line with what Walter Lippmann had sought a couple of decades earlier.

The cybernetics put forward by Wiener and Claude Shannon during the conferences emphasized information as object; they approached information in terms of what it is, and where in that sense congruent with the post-war social science of, as mentioned, Talcott Parsons (Clough et al., 2015).

Social systems can, in this first order of cybernetics, be approached through statistical analysis, as if the dualism of method and object of study are ontologically separated and that subsystems are reasonably stable. A rivalling conception of information, that of Donald MacKay, whom for Hayles (1999) represent a more British perspective on cybernetics of the time, approached information as contextual and therefore more in line with the reflexive turn that cybernetics would take during the initial years of the 1960's. Even Bateson, who would become somewhat of a father figure for a new generation of cyberneticists, would foreshadow such tendencies when he provisionally managed to convince his peers in the circle around the Macy Conferences that reflexivity, once stripped of its psychoanalytical deadweight, were a viable proposition to incorporate into cybernetic thought (Franklin, 2015). But only if the prevailing realism within the cybernetics group received substantial interrogation. The Batesonian intuition that internal states are mere metaphors for the states of the exterior needed to be empirically evidenced in order to be acceptable within the 'cybernetics group'; cybernetics, according to Wiener, needed to be mathematical or else it would be nothing (Hayles, 1999). This brings us to the next phase in Hayles (1999) periodization: *reflexivity* and self-organization. A period in which cybernetics and systems theory, more broadly, would be explored, modified and adapted in a range of fields and spheres in order to gain acceptance as a theory of everything while at the same time obscure the 'datalogical' foundations of cybernetic thought (Clough et al. 2015).

Reflexivity: Second-order cybernetics

While the emphasis on homeostasis in early cybernetics did provide a holistic vision informatics and the suppression of materiality (Hayles, 1999), the political climate of social 'containment' during the cold war provided the cultural foundations for a social and intellectual style of atomistic managerialism still indebted to Euclidian mathematics: linearity (Eglash, 1998). Social behavior understood as within a closed system, separate from the outside and attributed regularities in the interconnections within the system afforded the possibilities of modelling human behavior and have it scaled up to the level of statistical populations (Cough, 2015). The solidification of the family unit during the 1950's and 1960's; the emotional austerity and self-sufficiency of that period, were the hallmarks of a culture attempting to cope with the threat of nuclear annihilation and communist hegemony (Turner, 2006). For the younger generation, increasingly frustrated with the order of things, this rigid atomism emblematized the root cause of their despair; discrete social units pre-occupied with what they were tasked. Physiological cogs in a closed system of bureaucracy and 'expert systems', unable to register that everything was connected; everything was weaved together in informational patterns of emergent qualities: non-linearity. The lack of

reflexivity in the traditional cybernetics obscured the notion that a miniscule event in the periphery could reverberate through the entire fabric of the open and chaotic whole (Turner, 2006; Eglash, 1998). This new take on cybernetics would inspire social researchers to explore their own take on reflexivity: acknowledge their own presence in the field of inquiry and in doing so highlight the fleeting connections between cybernetic thought and sociology (Clough et al., 2015).

As the link between first-order cybernetics, still, to some extent, burdened with Cartesian dualism, and second-order cybernetics, in where the (human) observer were included in the observed system – thus forming a 'cybernetics of cybernetics' – stands Heinz Von Foerster. Von Foerster emigrated to the united states after serving as a scientist on the German side in the second world war. Through the courtesy of Warren McCulloch, he not only became a recurring guest with the Cybernetics Group, but also the editor of their transcripts. At the beginning of the 1960's the homeostatic vision of man and machine, as a clearly delineated mechanism, largely unaffected by its environment, were increasingly displaced by explorations of reflexivity and analogies of self-organization – thoughts that Von Foerster and others borrowed from the systems biology of Ludwig von Bertalanffy. First-order cybernetics saw the system as a whole consisting of parts which implied a hierarchy both within the whole and between different wholes, as parts, in a larger system. Von Foerster, instead, proposed that systems could be viewed as parts in a complex and multipolar *network* of relationships that are situated within an *environment*.

Of crucial importance to the work carried out by Von Foerster stood the constructivist epistemology of Humberto Maturana. Maturana, together with other luminaries from the Cybernetics Group, had earlier performed experiments on frogs in order to better understand visual perception (Lettvin, Maturana, McCulloch & Pitts, 1959). They, in effect, turned the frog into a cybernetic assembly – a circuit – by connecting microelectrodes to its visual cortex, thus enabling them to transmit signals through the brain and measure the output. They established that the frog not so much "saw" a representation of reality as *constructed*, in a species-specific way, the visual stimuli it was bombarded with. Large objects, for instance, triggered no immediately measurable effect while something small, representing for instance a fly, triggered massive responses. The epistemologically constructivist ramifications of this observation became the main object of interest for Maturana, while others within the team of researchers chose to remain with their realist assumptions concerning perception (Hayles, 1999). Maturana, however, now together with neuroscientist Francisco Varela, persisted and eventually presented the then groundbreaking work *Autopoiesis and Cognition: The Realization of the Living* (1980), in where cognition, the actions of the nervous system, were presented as circulatory; a self-organization of the species-specific internal. The anthropocentric notion that human perception establishes a causal link

between the actual reality and the perceived where cast aside and an elaborate project of establishing a new vocabulary that could properly capture the consequences of this 'casting aside' were to become the main object of interest for not only Maturana, but a range of second-order cyberneticist and systems theorists during the following period. For them, it was of the highest priority to depart from traditional cybernetics through correction: include the observer in the feedback-loops of the system – the observer as a self-observer (Clough et al., 2015). This correction would gain cultural thrust as the growing youth culture of The Sixties appropriated cybernetic thought.

Cybernetic hopes: inventing the future

The predominantly white, middle-class countercultural movement of The Sixties, according to Turner, responded to the political turmoil of the cold war in two distinct ways. On the one hand, the so called New Left that went out to rally disenfranchised voters in the south, formed new political parties and protested the Vietnam war – the civil rights movement. On the other, a shift inward toward consciousness, spiritualism, fiction and, eventually, psychedelics. The later would provide the archetypical aesthetic of the counterculture as perceived by the broader public, not least as they went on to depart from their predominantly middle-class suburban background and formed rural communes where different forms of social organization, small in scale and connected through shared technologies and beliefs, were explored and preached as the solution to the rigidness of the reigning culture of 'containment' and agonistic politics. Turner, in distinguishing between the New Left which in large part accepted the traditional political format of liberal democracy, and the "hippies" that in this way forcefully escaped mainstream society, refers to the latter as the New Communalist Movement. A movement that channeled their libertarian leanings through the lenses of second-order cybernetics and systems sciences, thus seeking to correct not only the compartmentalized state of a rigid political order but counter the newly realized threat of environmental and ecological disaster (Turner, 2006). The reciprocity between the New Communalist Movement and scientists are highlighted by Ron Eglash (1998) who not only points out that Kenneth Boulding, cyberneticist and economist, regularly held organizing meetings for the Students for a Democratic Society (SDS) in his own home, but also that the scientific embrace of the then new Chaos Theory can be seen as a 'turn' in cybernetic thought toward the natural, spiritual and holistic.

This holistic vision, perhaps best described in Charles Reich's book *The Greening of America* would supplant two preceding forms of consciousness – the agricultural (Consciousness I) and

the industrial-bureaucratic (Consciousness II) – with a consciousness that stressed organicist 'togetherness' and honesty instead of authority and thus afford humans the possibility to return into a more truthful and humane era of spiritual prosperity where class struggle could be transcended or even be revealed as a false premise to begin with: a consciousness of wholeness (Consciousness III) (Reich in Turner, 2006). The intrapersonal recalibration of a generation would usher in a higher level of inter- and intrapersonal relations; new minds that could form the basis of communities in equilibrium with the human psyche and nature: 'Ecotopia' (Callenbach, 1981). For the New Communalists, cybernetics, and the systems theory of theoretical biologist Ludwig von Bertalanffy, afforded an ideology that represented these ideals of anti-bureaucratic struggle and a turn to mediated inter-connectedness and ecological awareness (Turner, 2006). It afforded a blue-print for liberation based on the emergent qualities of complex bio-social systems and computation, a rational dogma for emancipation, and an Utopian thought figure by which everything could be accounted for (Lilienfield, 1978; Turner, 2006). The social world, not as chains and hierarchies of command, but self-regulating horizontal loops and flows of information that, if allowed a certain amount of self-determination, the assumption went, usher in something akin to the Age of Aquarius (Ferguson, 1980). An illustrative, albeit extreme, example can be found in the case of the Principia Cybernetica Project. Apart from being one of the first ever 'webpages', it is also an organization that, through the stewardship of cognitive scientist Cliff Joslyn, computer scientist Valentin Turchin and cyberneticist Francis Heylighen, drew together other cyberneticist and systems thinkers in an attempt to further the cause of cybernetics and, specifically, an evolutionary and radically emergent interpretation of it. Systems, to them, were evolutionary constructed through self-organization and Darwinian principles of natural selection. The internet, then, conceptualized as the physical representation of the rhizomatic connections between informational vessels: a 'world brain' in development.

Of central importance in this new vision of holistic post-politics were not only a shared theory of the world, but tools; technology. Herbert Marcuse, the highly regarded "guru" of the American New Left, underscored the emancipatory qualities of the science and technology he had decried as the vehicles of the Holocaust only a decade earlier (Filippone, 2009). Marshall McLuhan inspired a thinking that put the new technologies as the enabler of a truly democratic and free communication between the citizens of the world (Barbrook & Cameron, 1996). French molecular biologist and futurist joël de Rosnay saw in systems theory and the second-order cybernetics the science and symbolic technology to arrive at an encompassing view of the complexities of nature, society and man. De Rosnay, in his book *The Macroscope: A new World Scientific System* (1979), phrased it in no uncertain terms:

> "The eco-society is decentralized, communitarian, and participatory. Individual responsibility and initiative really exist in it. The eco-society rests on the plurality of ideas about life, life styles and behaviors in life. The consequence of this is that equality and justice make progress. But also, there is an upheaval in habits, ways of thinking, and morals. Mankind has invented a different kind of life, in a balanced society, having understood that maintaining a state of balance is more of a delicate process than maintaining a state of continual growth is. Thanks to a new vision, a new logic of complementarity, and new values, the people of eco-society have invented an economic doctrine, a political science, a sociology, a technology, and a psychology of the state of controlled equilibrium." (de Rosnay, 1979 p. 87)

One of the most famous instantiations of these techno-infused and environmentally aware expressions are, however, the 1972 report *The Limits to Growth* (Meadows et al., 1972) which used methods from Jay Forrester's Systems Dynamics to simulate exponential growth in world populations and economy. The report, commissioned by The Club of Rome and financed by the Volkswagen Foundation, made it clear that the discrepancy between growth and the finite resources provided by earth should raise serious concerns for everyone. While the methods used by the team behind the report later would be widely criticized (the insufficient amount of data specifically), it became enormously popular, reinforcing the already growing environmentalist movement and elevate ecological issues in public discourse. The Systems Dynamics approach is described as a way to 'invent the future' through modelling the world, and is today, along with other systems approaches, mainly utilized by organizations such as OECD (OECD, 2017) in order to devise recommendations for economic sustainability and change-management for decision-makers and managers in the public sector. And while the proponents of this environmentalist take on cybernetics and systems thinking were inspired by a return to nature in their calls for a new ecologically aware psychology and politics, it all rested on the computing powers afforded by new and evermore advanced computer systems.

Two threads: toward a stable postmodernism

In this way, two different approaches to the concept of feedback co-existed in the post-war period. Historian George P. Richardson (1991) describes the first as the 'servomechanical thread', in where machine and human constitute systems that lends itself to be optimized for efficiency and stable operation. A first-order cybernetics that, according to David Colander and Harry Landreth (2007), can be seen as a continuation of Keynesianism and the doctrines of rationalization and partitioning that were derived from it. The second thread encompasses the ideologies that would enthrall sections of the younger generation during The Sixties and the 1970's (Turner, 2006),

Californian tech-entrepreneurs (Barbrook & Cameron, 1996), free market advocates (Mirowski, 2002) and later so called postmodern theorists (Clough, 2015). Fred Turner, in his book *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network and the Rise of Digital Utopianism* (2006), puts forth a historical tracing of how these sentiments were acted upon and, indeed, amplified through the popularization of personal computers during the latter half of the 1960's, the advent of Arpanet (a precursors to the internet) and, eventually, the World Wide Web (seen as the physical representation of anarchic flows of information; nature) during the 1980's. And, finally, the appropriation of this countercultural/Cybercultural sentiments within the political and managerial establishment. The 'cybernetic governance thread' – second-order cybernetics – in where equilibrium through the free and chaotic exchange of information between actors within the system-network took precedence, were negotiated during the entire post-war period but, according to Michael French (1997), only gained dominance through the restructuring of the global economy during the 1970's. The division between the two threads were however never of a particularly detrimental character (Lilienfield, 1978) – they merely explored different paths within the same cybernetic tradition. The insistence of reflexivity in second-order cybernetics obscures, according to clough et al. (2015), the fact that they both draw inspiration from the same thermodynamic system as a point of underlying reference. The first, engaged in the transposition of living beings *into machines* and thereby master the "future" of life and society. The second, to imitate the autopoietic living in machines; autonomous robotics, artificial intelligence and technologies for the imitation, automation, augmentation and transcendence of human thought (Tiqqun, 2013; Richardson, 1991) in order to solve problems and arrive at decisions through emergent, computationally augmented knowledge-production, bottom-up management and networks of innovation.

In position: global governance and cybernetic capitalism

One complex thread: Utopian technoculture and the virtual plane

A critical investigation of the Social, or aspects of it, would, at this time, most likely take its historical departure in the fordist crisis during the latter half of the 1970's and the subsequent restructuring of public institutions according to neoliberal insistence on *laissez-faire* liberalism after an expansive period of social-democratic/social liberal welfarism and large-scale planning. This analysis, while historically accurate, obscures the fact that neoliberal conceptions of the market differ substantially from the traditional one. As both Mirowski (2002; 2013) and Tiqqun (2013) points out, neoliberal thinking is infused with and ultimately shaped by cybernetic thought.

Tiqqun, by the logic of their totalizing argument, goes as far as to state that neoliberalism should be approached as the economic branch *of* cybernetics. The computer metaphor, according to Mirowski (2002), can thus be readily discerned within economic theory of the 20th century. The basis of the arguments of Mirowski (2002) and Tiqqun (2013) can be traced to Hayek's article *the use of Knowledge in society* (Hayek, 1945), in where he prefigured the rise of the 'knowledge economy' and the fall of modern reason through a conceptualization of the market as a cybernetic system of communication (Ouellet & Martin, 2018). This cybernetic and neoliberal epistemology excludes the possibility to know enough about other economic agents to conceive of a successful state-run planning operation while the [cybernetic] market provides a far superior and natural form of mediation of information and, it is argued, knowledge. This was the basis of his critique of socialism and this is how knowledge and information become a commodity; a commodity that affords the possibility to reduce chaos and complexity into a temporarily stable form. This is also how knowledge no longer can be conceived of as a 'public good' on its own terms; the totality, as something knowable, lies well beyond anyone but the market itself (Ouellet & Martin, 2018). For further insights into the historical affinities between cybernetics, systems theory and early neo-classical economic thought, Petrus Simons article *Hayek's concept of orders in relation to technicism and neo-liberalism (2016)* provides an excellent primer while Philip Mirowski's monograph *Machine Dreams: Economics Becomes a Cyborg Science* (2002) is uncompromising in detail and scope.

While Hayek, for obvious reasons, would have drawn his metaphoric from the technologies available to him, the two threads of cybernetics, first- and second-order cybernetics, would by the end of the 1980's coalesce. The coalescing of these two threads is perhaps best illustrated in developments in machine learning and through the works of cognitive scientist and pioneer researcher in artificial intelligence, neural nets and machine learning Marvin Minsky. During the span of his career, he had embraced a number of paradigms. Both digital Euclidian linearity and the analogue non-linearity of the Chaos Theory that had emblematized much of the 1970's. In 1988 however, as the Washington Consensus were prescribed, and the internet became publicly and commercially accessible, Minsky, along with others in the field, argued that a synthesis between these two was the proper way forward: The *analogue* neural net was to be governed by *digital* algorithms. At the same time, neural nets began to be understood against a backdrop of Harmony Theory, in where the neural net were conceptualized as functioning by a harmonizing balance of competition and cooperation (Eglash, 1998). A cultural consequence of the network-metaphor is the 'open' architecture and culture that it promotes (Galloway, 2005). A network – while constrained by digital protocols that govern the basic rules of engagement between nodes – can be accessed from anywhere: it has no starting point, no end. Large swaths of it can be taken

out of operation without affecting the integrity of the network as a whole. As the network were firmly established as the governing metaphor in cybernetic thinking and digital technology became increasingly commonplace in every-day life, an ethic of networked openness, democracy and progressivism took form. Andy Cameron and Richard Barbrook, in their well-cited essay *The Californian ideology* (1996), has outlined how the coming-together between the new communalists, computer hobbyists, hackers, state funded military researchers, systems theorists and artisans, all indebted to differing strands of cybernetic thinking, contributed to the establishment of an ideology that presented an enticing proposition for the right-wing political establishment of both Europe and the United States: digital utopianism.

The software and business models invented by young entrepreneurs of the San Francisco Bay area sparked a renewed fascination with the social and economic potential of so-called 'new technologies'. While the United States government and the European Union overlooked the possibilities to deregulate the new information and communication technologies (Flyverbom, 2011; Barbrook & Cameron, 1996; see also Turner, 2006) in order to stimulate these markets, the United Nations deemed Information Technology as a means to fight poverty; they all acknowledged the transformative potential in the entrepreneurial *ethos* that the 'neo-bohemians' of San Francisco had developed amongst themselves during the economic and cultural expansion the of hi-tech industries of Californian station (Turner, 2006). The libertarian leanings (Winner, 1997) of the 'Californian ideology' favors a Lockean notion of self as property (Selwyn, 2013) and, thus, fared well within the blend of neo-conservative and neo-liberal politics that increasingly dominated the period. The introduction of 'variable' or 'human' capital, for instance, coupled with computational systems of management of that very capital and the extraction of surplus value from it, opened, seen in this light, up for the possibility of an exponential growth of minds, rather than the exploitation of natural resources much in the same way as Artificial Intelligence researchers hoped that self-organizing neural nets, governed by digital algorithms, would evolve. The pooling of cognitive resources into a techno-organismic vision of a global society is, in neoliberal terms, beneficial not only for the economy in the short term, but for its future evolution all together: the invisible hand will take care of the environment since the economy *is* nature. Economist Michael Rothschild's best-selling book *Bionomics: The Inevitability of Capitalism* (Rothschild, 1990) constitutes a revealing case in point. Rothschild was deeply involved in the first techno-utopian wave of Silicon Valley (Turner, 2006) and in his book argued that capitalism is the biologically given way for humans to do economy. Consequentially, being for or against capitalism – based on its status as natural phenomenon – is, according to Rothschild, a perfectly suitable way to waste one's time. For the evolutionary cyberneticists specifically, it could literally provide us with an additional set of chromosomes; Increase the biological complexity of our entire

species and make us intellectually gifted enough to abstain from war and ecological mass-destruction through such futile activities as agonistic politics: maintaining social equilibrium, while still advance the human genome and technological innovation. Aside from such extravagant ways of thinking, the digital utopianism of the 'virtual classes' (Kroker & Weinstein, 1994) and their goal of designing a new modernity proved very powerful indeed (Barbrook & Cameron, 1996).

In the epoch the *virtual,* to conclude our use of Hayles (1999) periodization, or the age of "digital reason", as Michael A. Peters (2015) refers to the same period – our period, the establishment of the internet and open platforms, architecture, and networks – a virtual plane of integration and accumulation of data – affords a scalability that paradoxically manages to hold and maintain the opposing forces of decentralization and monopoly as is currently manifested in the dominance of commercial agents such as Google, Facebook and Amazon (Peters, 2017). The 'art of government', by which this plane if integration and accumulation is reproduced, has been described as a move from 'planning' (decision-making) and 'administration' (policy-making) toward 'governance' (problem-solving) (Enroth, 2014). While governance on the regional and national level is mainly described in terms of policy-networks engaged with social and logistic 'problem-solving', so-called 'global governance' is paradoxically described as the absence of global hierarchy but also equivalent to a world government or a 'hegemonic bloc' (Sellar & Lingard, 2013) in its functionality: systemically address the problems that arises from such forms of government – be it terrorism, ecological disaster, increasingly volatile financial markets or failing educational systems – through technological innovation.

In the position of postmodern peace

For Tiqqun (2013), there is little doubt that the 'cybernetic hypothesis' must be understood as the technological and theoretical results and continuation of war, the strategic objectives being a maintained level of both stability and control and they underscore that the internet should be seen as the most powerful weapon in the arsenal (yet). Just like the American highway-system, designed and built to form a decentralized tool for internal mobilization of material, the Internet would provide sustained communicative lines of command during military attack. But while war and conflict might have been the unconscious of cybernetic thought and its application during the second world war and the subsequent cold war, it is now driven by global and financialized economic competition and techno-utopianism: a 'cybernetic capitalism' (Peters, 2015). Now, embedded in information and communication technologies, the internet provides the backbone

for financial and commercial globalization as well as for new forms of social activity and control; the strategic management of consumers as 'assets'; the informational trail left by each individual node in the network – information about information – can be exploited as a source of revenue (Tiqqun, 2013).

The 'cybernetic hypothesis', then, began at the nexus of operations research, information theory and communications during the 1940's, it was amplified by the substantial acceleration in production of the hardware and software – information technology – that it helped to facilitate into being in the first place. The metaphor of information, as a result, has become ubiquitously manifested in our everyday lives as the citizens of Cybernation. The information society (Machlup, 1962); knowledge economy (Drucker, 1969); the post-industrial society (Bell, 1973); the information economy (Tiqqun, 2013): Cybernation. Data can now be abstracted from the networked Social in effective and non-intrusive ways and through generalized representations be 'fed back' in a commodified format, thus forming the entire economy into a feedback-loop. The 'social', at first understood as a thermodynamic and biological systems, and later, as developments in Artificial Intelligence-research solidified the neural net as the ruling metaphor in the development of machine learning: a network. Both, however, susceptible to entropic degradation through its very constitution: the decomposition of information flows. For Tiqqun (2013), the matter of cybernetic psychology can be summarized with the hollowing out of the individual, turning into an optimized site of social feedback, a local point of connection in an endless feedback-circuit precisely to avoid corruption of information and the jamming of flows. Not the liberal project of separating the individual from traditional bonds, but the cybernetic project of reconstructing social bonds through communication and cognitive conceptions of human thinking. The subsequent appropriation of cybernetics into a language of social equilibrium and emancipation from hierarchical structures afforded the hypothesis of cybernetics a veneer of peace and decentralized authority: cybernetics – once the language of technicians of war – now presents itself as the peace-keeping and democratic *lingua franca* of a global ecology of mediated communication, financialized capital, holistic harmony, social management, networks, and the regulation of our self-sufficient and entrepreneurial selves (Tiqqun, 2013). In answering Paul Virilio's rhetorical question: "By the way, who invented peace?" (2012, p 23), we could then very well say that the (re-)invention of peace, at this historical impasse, can be attributed to the deliberate establishment of Cybernation and in doing so reinforce Virilio's tacit observation that peace tends to carry a fixed and stable meaning of neutrality.

Education and scholarship in Cybernation

Education, has long been an activity pre-occupied with a culture of the *self*. Tina Besley and Michael Peters (2006), drawing on Michael Foucault, points out that since establishment of 20th century psychology, a secularized form of self-regulated 'inspection' has manifested itself as the dominant form of socially supplied techniques of self-constitution. It is contrasted with the 'self-examination' of ancient Greece and the 'confessional' practices of Christianity. Consider, in this light, the consecutive turn from humanistic *'bildung'* and Fordist 'qualifications' to the post-fordist concept of 'competence' as championed by the Human Resource Management (HRM) movement and later turned to public policy through, amongst others, OECD (2005). While competence has proven hard to operationalize, one key aspect that separates it from both *bildung* and qualification is the inclusion of a propensity, a will to act and engage with challenges that are new and contextual (Illeris, 2013). This post-fordist arrangement of subjectification, one that includes emotional dispositions, can not only be seen as a humanistic turn toward the 'whole child' or the 'whole worker' (McGuire, Cross, & O'Donnell, 2005), but also as a way to alleviate the risk of insurgencies in both education and the workplace in times of precarious and tumultuous conditions (Robins & Webster, 1999) afforded by the construction of a new modernity. This 'future' that we are asked to participate in casts its shadow upon the present, and it seems that the leadership of cybernation – to paraphrase Massimo D'Azeglio – has the terrain charted and is now at the stage of imbuing a national identity upon its utensils.

The pains of an immense transition from Cartesian epistemology and Newtonian physics to a future of uncertainty – Cybernation – can then prove to be chaotic and land you in need of therapeutic intervention. Both vertigo and resistance have, though, been anticipated and prepared for in an era that has turned from statistical planning to a mathematics of probability and chaos governed with the help of digital algorithms. An era that is indebted to a cybernetic understanding of the human mind and favor the cognitively flexible knowledge-worker – the worker that does not fear the new environments chartered by the cartographers of Cybernation. Margaret Wheatley, a highly successful management consultant who utilizes holistic, spiritual and cybernetic metaphors in here extensive writing on Organizational Change Management, is an illustrative example of this anticipation and an equally illustrative example of the progressivist *ethos* evident in the cybernetic hypothesis. Wheatley employs a spiritual and poetic vernacular in an attempt to console the fretting worker of the post-fordist 'learning organization'. In the vast *chaos* that surrounds patterned systems or networks of information, she reminds her readers, lies the secret world of ordered beauty that we still struggle to codify. *If you only could remain a little while my friend*, and she writes: "participation, seriously done, is a way out from the uncertainties and

ghostly qualities of this non-objective world we live in" (Wheatley in Gonzalez, 2015). Eglash (1998), in his attempt to outline the conjunctions between cybernetic paradigms and American youth culture, points out that latest and current iteration of cybernetic thought are concomitant with New Age thinking – something that can be picked up in the writings of Margaret Wheatley (Gonzalez, 2015).

This particular category of 'self-help literature', oriented exclusively toward the field of human resource management, is only one strand of a much broader field of such literature that has gained increasing readership under neoliberalism, as Sam Binkley (2014) has pointed out. Happiness and affirmations, in fact, has become an industry on its own (Davies, 2015b). James Reveley, in a number of articles (2013; 2014; 2015; 2016), points out that similar interventions are carried out in education through what he refers to as 'positive education'. Reveley, for instance, invokes Max Weber's concept of 'elective affinities' when he argues that such a relationship exists between the newly founded field of Positive Psychology (Seligman, Csikszentmihalyi & Fowler, 2000) and a cognitive mode of capitalism (Moulier Boutang, 2011). Proponents champion 'mindfulness', 'curiosity' and 'psychological flexibility' as technologies of the self, touted as the instruments of self-fulfillment and preparation for a successful career and, indeed, life. Similar messages of affirmative character can be found in the continually growing number of books that opine for a paradigm-shift in how we organize and understand education and construct the learning subject in the 21st century.

Douglas Thomas, associate professor at the Annenberg School for Communication, and John Seely Brown, researcher in organizational studies and member at the board of Amazon, argue, in their bestselling book *A new Culture of Learning: Cultivating the Imagination for a World of Constant Change* (2011), that passion-driven learning takes place throughout life, and that traditional education is detrimental to people's ability to imagine and fantasize by not recognizing these informal and non-formal learning processes as legitimate. They go on to argue that technological development and adaption, at this stage, is of such high pace and sophistication that there really are no historical bodies of knowledge worth transmitting through traditional conceptions of formal education. Instead they urge us, much like Margaret Wheatley does, to accept 'change' as a continuously evolving array of opportunities and to 'learn' how to reap the benefits of a culture committed to and, in their view, dependent upon life-long learning and technological innovation (Thomas & Brown, 2011). Discipline and rote, then, is to be decommissioned and replaced with something that can prepare future generations to both 'act in' and, perhaps more importantly, 'enact' a future of constant change through innovation and action. To choose otherwise might put you at risk of having no future at all.

The sentiment of Thomas and Seely Brown, as summarized above, can be said to echo the constructivist learning theory of Humbert Maturana and Francisco Varela in that it equates social and technological change with learning while also inject 'survival' – the foundational psychological drive for said change – as the ultimate goal. To learn, according to Maturana and Varela (1992), is a simultaneous process in where networked systems, the 'mind/body system' of the learner and an 'environment-system' change toward a mutual 'fit', thus forming an integrated learning system (Murray, 2006). The teacher, in the cosmos of Maturana and Varela, is unable to 'input' anything *into* the pupils or students, only communicate through facilitation which hopefully awakens the will for 'survival' in the learner: establish connections to the histories of the self and the drive to maintain a state of cognitive stability. But if the fit between the mind/body system and a particular *environment* – introduced by the teacher or some other mind/body system – proves incomprehensible to the learner, he or she might 'depart'; escape into thought or physically relocate. Managing human resources, human assets, then, could be seen as the continual task of keeping human beings from 'departing' or disconnect, imbue a level of self-regulation in the cybernetic grid and thus remain in a state of effective communication. The post-fordist 'learning economy' rests, according to Lundvall and Johnson (1994), on the proliferation of information technology that makes it more cost-effective to extract data, the 'flexibilisation' of a self-regulating worker (or 'learner', the distinction would seem to be under pressure) which decreases the cost of fast and recurrent changes in production and a strong emphasis on systems and networks of innovation as means to achieve economically sustainable cash flows in an increasingly volatile and fast-paced marketplace. Under these circumstances, the contents of Management are increasingly oriented toward the establishment of regimes in where interactive *learning* can be *facilitated*. The same could be said for more formal forms of education (Robins & Webster, 1999). This will be explored in the following chapter.

Networked education

The modern project, here reduced to the Marxist concept of 'primitive accumulation' which constitutes the knowledge production that afforded the enclosure of agrarian populations into a proletarian state and the fordist period of scientific management and nationalized universities, rested, in large part, on a discourse of linear and stage-driven development. The post-fordist project of 'knowledge economy', however, is subjugated by a postmodern, non-linear and 'networked' discursive conception of development in where education has an important part to fill (Peters & Besley, 2006). While this has transformed education, both comprehensive, secondary, higher and vocational, in a myriad of ways, its effects on higher education has been

substantial both in terms of the actual education of students but also through the emerging industry of student debt-management and university branding on a global market of educational goods and services (Peters, 2015). The growing importance of education reflects, in large part, the growing trust in so-called New Growth Theory where economic growth is generated through improved of input/output-tables; technological change and innovation (Peters & Besley, 2006). While 'primitive accumulation' by no means should be understood as surpassed according to Nick Dyer-Whitford (2011), he nevertheless introduces the concept of 'futuristic accumulation' in order to better capture the extraction of surplus value from knowledge and the 'enclosure' of it through judicial regimes such as patents and property rights rather than the expropriation of territory and the exploitation of thermodynamic labor. The university, Dyer-Whitford maintains, has been recast in the mold of the scientific mobilization during the second world war and the following period of binary power-balance between the United States and Soviet Russia: the fluid networks of private and public actors as was discussed above (see also Etzkowitz, 2002; 2003a; 2003b). These practices – inherited from the second world war as they are – makes it perfectly natural to engage in social research within cross-sector collaborations, such as those describe by Etzkowitz as triple-helix partnerships where regional, private and academic agents participate in development programs and engage in problem-solving together.

While the consequences have been substantial, one key problem for formal education in general, William R. Watson and Sunnie Lee Watson maintains, is that it still isn't networked *enough* (Watson & Watson, 2013; Watson, Watson & Reigeluth, 2008). The autonomy and disconnectedness render education unable, and perhaps even resistant, to adapt to the changing demands put in place by a fast-changing 'knowledge economy' where focus, in their view, should be on universal education, rather than mass education, and research initiatives that can advance the economy. For education to maintain its relevance, the latest modes of systems thinking needs to be applied so the transformation of change processes can lead educational institutions from an 'organization for learning' into a 'learning organization'. This would force upon educational systems a culture of growth and the effective management of change by which it could meet the needs of a society in flux and uphold the 'social contract' on which its legitimacy rests. For Watson and Watson, technology will play an important part in this much needed transformation. They state that educational technologist has the competence to design effective instruction and provide a more learner-centered pedagogy through technological innovation and thus are well suited to lead and facilitate continual processes of systemic change.

While it might seem perfectly natural to speak of 'educational systems' today, the scientific use of the concept is, according to Alain Michel (2016), a rather recent phenomenon. In France, for

instance, the first public use can be traced to the end of the 1980's. In this scientific iteration, it denotes a set of parts that through diverse interrelations manifest a system capable of reaction to its environment and concerted actions toward goals. These parts can be mapped and defined mathematically in order to define new goals, procedures and operations that are increasingly more effective. The systems view on education, according to Béla Bánáthy (1968), is "common sense by design" (p. 16) because it begins with the question of what education is *for*. Design, in this case, is the deliberate re-engineering of the educational system – its *organ*-ization – with a keen sensitivity to changes in the larger system (society), in which the educational system is situated – the 'suprasystem' which inputs personnel, pupils and material resources. In this input/output conception of education, the long-term sustainment of the lower-level system, in dependent upon re-engineering in accordance with feedback provided by the suprasystem: the rejection *or* acceptance of the output of education to the suprasystem. While this techno-scientific and functionalist view on educational administration and management lends itself easily to criticism (see for example Apple, 2004), it has seen increased popularity in proportion to its invocation of a 'networked' nomenclature that inherently favors self-regulation and decentralization (Michel, 2016; see also OECD, 2017; Fullan, 2006; Senge, 2000; Lundahl & Öquist; 2002). Alain Michel (2016) underscores this when he traces three general conception of the 'systems view' on education in were the first could be summarized with 'management', 'administration and 'planning', the second with 'steering' and 'control' while the third and more recent is more aligned with the widespread turn toward 'governance' 'leadership', 'norms', 'recommendations' and both binding and non-binding regulations in a decentralized and goal-oriented system of organization (see also Giddens, 1999). This rise in popularity could, then, be traced onto to the ideological developments within the cybernetic hypothesis itself: the progressive move from servomechanical metaphors to those of cellular automata, emergent networks, self-organization and neoliberal autopoietic markets.

As education is rendered an automaton within the systemic grid and in constant adaptation through feedback-loops, it is both discursively and materially *closed off* as an internal organ in the superorganism that is society; put in an environment that bombards it with information and chaotic change. To know everything about this chaotic and exterior environment, or rather, this *future state* of the cybernetic suprasystem, renders the concept of history moot (Foucault, 2008). In the sheer speed of things, the only question there really is time for is a digital one: does it work or not? The Systems analyst becomes, then, concerned with the immediate *environments*; the systems analyst has to observe the world of the present in order to successfully stimulate "innovation of innovation" (Morton in Ericson, 1972 p. 442) within the 'learning organization' and makes sure that it does not stagnate or decompose in the ecology of the social circuitry. To

be a systems analyst, then, is to occupy the much sought-after position of 'brain' – or rather the algorithmic 'metacognition' – of the social organism (Lilienfield, 1978; Tiqqun, 2013). To reflect critically on the wider public and political sphere in which the university is grounded – once the ideals of the university as *institution* indebted to concepts such *bildung* – is here replaced with the veneer and grain of the *organization* (Ouellet & Martin, 2018) Aligning an organization, personal or otherwise, with a projected *future state* does away with the need of historical dynamisms (Foucault, 2008) to the benefit of continual *development* and *change*: the intensified production of evolution and cybernetic futures. Thinking, thusly, on behest of the computational conception of the cerebral, has succumbed to the position of the proletariat (Stiegler, 2010): thinking has been connected to the circuits of capital. "We are left with nothing but the expansion of the present", as Kevin Robins and Frank Webster has put it (1999 p. 237).

Alvin Toffler, early roadside management prophet of the *infobahn*, said of this modularism, that it seeks to "…lend whole structures greater permanence at the cost of making their substructures less permanent" (Toffler cited in Ericson, 1972 p. 438). Education, in this light, becomes the process of continuously engineer systems and its agents in accordance with the fluctuations of the suprasystem and thus afford the suprasystem a state of equilibrium. Education as a disembodied activity set on carrying out actions that increases the chances of survival in a state of flux. A certain amount of *heterostasis*, here taken to be the confusing task of thinking like a sensory device attuned to the flickering of headlights, seems, then, only obvious when *homeostasis* of capital flow is to be maintained. Thus, the hopes put forth by Richard F. Ericson (1972) in his article *Visions of Cybernetic organizations*, in where he argues for a turn from "naïve", unnatural and misery-laden conceptions of management and administration ('control', 'order') toward a Taoist-inspired and enlightened 'leadership' of 'restoration' toward a natural order of equilibrium and harmony could be taken as fulfilled. Erickson sees this primarily as an emancipatory form of management in where the human being, and the organization in which the human being is a part, is freed through the naturalized imperatives of design, general systems theory and cybernetic methods of analysis and forecasting.

The move toward 'governance' in education has been sustained an amplified by the increasing influence on educational bodies from the setting of international standards established by supranational organizations like the European Union, OECD and the World Bank (Michel, 2016) who all acknowledge that long-term economic growth is dependent upon a systemic analysis of probable future states and risk analysis on the suprasystemic level and the subsequent recalibration of lower-level systems in accordance with these analyses (Rhydderch, 2016; OECD, 2017). To uphold a suitable level of natural complexity (a level of complexity that matches the

increasing complexity of the exterior) becomes the grounds for a regime of performative growth where a partly algorithmic, partly visionary leadership articulate what should be recognized as performance. Jerome Bruner, once one of the pioneers in cognitive psychology and later prominent educator, noted that the ‘cognitive revolution’, when looking back, perhaps best could be understood as "a response to the demands of the 'post-industrial revolution'" (Bruner, 1983 p 62).The psychology of the organization – the psychology of networked education – is equally applicable to the individual agents of that system: the teachers, students and pupils that are subjected to formal education. These agents, too, has been made discursively and materially accessible for systems analysis and improved efficiency in Cybernation.

The cognitive revolution: artificial Intelligence and human slowness

Positioning the soldier *between* automated and, most crucially, *known* systems of technology begged the question “what kind of machine have we placed in the middle?” (Edwards, 1985 p. 42). Psychology during this period, according to Edwards (1985), became a cybernetic psychology; a militarized psychology of mechanistic foundations and oriented almost exclusively toward human performance. Already in 1949, the training director at the Systems Research Laboratory (a division of RAND corporation) Alan Newell devised a radar simulator that allowed recruits to exercise radar operation without the use of manual calculation. Newell then, according to McCorduck (1979), began to envision human operators as ‘information processing systems’ that operated much in the same way as the machinery he had built. On the basis of his observations, Newell, together with Herbert A. Simon, who studied decision-making (later renamed ‘problem-solving”) in industrial organizations and systems analysis at RAND, developed a psychological theory founded on the assumption that a human brain is a control system that combines the activities of receptors and effectors: a computer. They argued that if one could simulate that particular process with the help of a computer, one could claim that the human brain is properly understood. While they first called it “cognitive simulation”, it would later come to be known as the now ubiquitous “Artificial Intelligence”. The research was then still, to a large extent, funded by the military who saw three principal gains to be had with the continuation of developments in both educational technologies/methodologies and artificial intelligence: (1) the construction of fully automated weapons, (2) accelerated learning processes in military training and (3) the amplification of human intelligence as a function within systems of man/machine assemblages (Noble, 1989). These assumptions would later come to inform the field of cognitive psychology through the works of George Miller together with his team (Miller, Galanter & Pribram, 1960) and Ulric Neisser (1967) respectively. Artificial intelligence, cognitive

psychology and, by extension, the cognitive sciences share in these events a common history and by the end of the 1980's, the success of cognitive psychology, according to Knapp (1986), had rendered it almost entirely synonymous with psychology in the main. The cognitive turn was also a way to criticize the reigning behaviorism and the closing in of the mind that was attributed to it. Ways of thinking – strategies of thinking – became an important piece in the puzzle in the development of a typically American way of thinking. A way of thinking that were seen as antithetical to the authoritarian thinking of communism and fascism. In waging a war against behaviorism, the cognitive scientist construed a more normative position of thinking; a universal psychology that privileged creativity over instinct and were, to some extent, independent of the environment. As Jamie Cohen-Cole (2005) has shown, the image of the human mind they produced were derived reflexively; the image mirrored their own self-image as cognitive scientists and excluded other forms of 'humanness', turning them into the pathologies of the non- or sub-human.

By the end of the 1970's, research in both educational technology and artificial intelligence had reached a plateau where further developments seemed distant given the still dominant behaviorist approach to learning in educational technology and the difficulties researchers in AI had met with mapping human behavior in real-life situations. Simon (1983) expressed frustration with the human learning process: "Human learning is horribly slow. It takes decades for human beings to learn anything" (p. 26) and went on to decry the fact that there is no copy-function in human beings, as there are in computers: "When one computer has learned it, they've all learned it – in principle... Only one computer would have to learn; not everyone would have to go to school" (p. 35). That knowledge continually presents itself as domain-specific proved to be one of the main obstacles in constructing learning machines; while highly sophisticated in one area of expertise, machines faced difficulties in applying said expertise within other domains. A broader and more generic approach were needed (Noble, 1989; Edwards, 2006) thus a more distinct explanation of learning and instruction were sought. By the mid 1970's, when the aforementioned problems began to be discussed openly, researchers in AI increasingly moved away from building digital 'expert systems' and instead began to use 'learning' as a radically different approach in engineering Artificial Intelligence (Noble, 1989); a return to the organic automata of previous generations of cybernetic theory as was the case With Marvin Minsky as discussed above. 'Learning', increasingly the emblem of AI, were excepted to yield better outcomes in regard to identifying domain-independent invariants in processes of training human beings and would eventually lead to the development of a new AI paradigm of 'machine learning' and the establishment of cognitive psychology. This while educational technologists looked toward the

cognitive sciences as a means to transcend the limitations of the behaviorist black-boxing of the learning subject.

While cognitive science had been foreshadowed under previous decades, by 1980, when it emerged as field proper, it was presented as exclusively interested in 'the artificial' (Simon, 1980). The human mind was to be viewed as something contingent and accessible for re-design – a mental material to be worked on much in the same way as the computers that were taught how to learn within the new paradigm of 'machine learning'. Artificial intelligence research had increasingly moved away from building expert-systems packed with stored memory, to software that could learn how to learn. Roy Pea (1985) speaks here of a unification of educational technology and the cognitive sciences. A mutual recognition of the common interest in the attainment of a functional and more complete understanding (i.e. physical representation) of intellectual development and, most importantly, *learning* within the structures of information.

This symbiosis, then, extends, according to Noble (1989), into classrooms through the implementation of machines for 'intellectual augmentation'. One prime example of this form of cognitive engineering, one that emphasize a symbiotic relationship between pupil and machine, and one that is still highly relevant today (Parikka, 2014), is the use of "Microworld Learning Environments" which are said to afford pupils of younger age powerful ideas through the use of computers and, particularly, educational programming languages such as LOGO (Papert, 1980). For Papert, who wanted to reinvigorate the cybernetic tradition through education saw little reason not to have school children learn the basics of cybernetic thought: build artificial intelligence and become cybernetic systems designers and thus usher in a new episteme of what he called "managed vagueness" (Papert, 1993 p. 85), an entrepreneurial approach to engineering in an economy increasingly reliant of technological change. While these particular interventions soon would prove ineffective in relation to the purported benefits (Dudley-Marling and Owston, 1988; Leron, 1985), the ideas have resurfaced in conjunction with increased demands for the 'digitalization' of education, initiatives such as 'computational thinking' (Wing, 2006) and within the Makerspace movement (Kjällander, Åkerfeldt, Mannila & Parnes, 2018). While the dissemination of computer hard- and software has received a considerable attention and the ideological underpinnings of these interventions has received substantial criticism (see for example Selwyn, 2013; 2014), others has gone almost unnoticed. Nevertheless, these are technologies that share space with hardware and software, extends them in a mutual reinforcement through the implementation of digital tools in schools and universities. One such educational technology is the use of *feedback*.

Feedback

Peter Senge (1990), noted systems scientist and senior lecturer at the MIT Sloan School of Management, laments the fact that feedback, too often, is reduced to a common-sense conception of: "…give me some feedback" (1990, p. 75) while, according to Senge, the concept is of much higher sophistication within the cybernetic imaginative. Otto Mayr (1986) reminds us that during antiquity and the Islamic 'golden age', self-regulated feedback-mechanisms were commonplace and regularly found in the form of liquid-based regulators that could afford somewhat precise temporal indications through the use of water. During the middle ages, and the baroque, the technology was virtually lost and replaced, most notably, with the user-regulated and for the time, highly emblematic clock, it would take centuries and, according to Mayr, the establishment of British liberalism before the self-regulated feedback-device would resurface. Mayr (1986) further argues that the invention and application of the steam-engine *'governor'* – a device responsible for maintaining preferable amounts of pressure in the steam-cisterns so vitally important for the industrialization – marked the definitive return of the feedback-mechanism and metaphor in western culture. Furthermore, that it was rationalized and made appreciable alongside such rhetorical standards as "dynamic equilibrium" and "supply and demand". Thus, the re-emergence of feedback was well-adjusted to the liberal attitude and conception of 'order' in the socio-intellectual and technological ethos of British industrialization (Mayr, 1986; Galison, 1994). Senge's point gains some further clarity when one of the key texts of the cybernetic enterprise is re-consulted. For Rosenblueth, Wiener and Bigelow (1943) the guitar amplifier illustrates *positive* feedback where the output, true to sign, is reintroduced to the input – unaltered, uncorrected. *Negative* feedback, on the other hand, is used in a more restricted sense and introduces the concept of goal-oriented behavior of teleological qualities (think here of the 'survival' of Maturana and Varela) to the already existing concept of *feedback*. In this iteration, feedback denotes input *altered* by the output; the goal-oriented *system* continually adapts in reference to its own output. This, as we have seen above, was the lesson learned from the AA predictor that Wiener and Bigelow devised. This, as we also have seen above, is true both for biological organisms and the electronic apparatuses theorized and produced during the early years of cybernetics (Richardson 1991, Galison 1994; Hayles, 2005) and reintroduced through the convergence of educational technology, cognitive psychology and machine learning.

Feedback, in this sense, is a way to continuously provide pupils and students with stimulus in the form of 'information' on how they have positioned themselves in relation to the content of the course. This seems to be the general consensus in the quite substantial corpus of research that specifically deals with the development of *effective* feedback in educational settings (for a succinct introduction, see for example Hattie & Timperley, 2007). This research – in many cases

packaged under the banner of 'assessment for learning' and vignetted by the language of 'systems engineering' – is commonly summarized with the words of Paul Black and Dylan Wiliam (whom, being the fathers of the trope 'Assessment for learning', arguably are the leaders of the educational feedback-industry). They see in 'assessment for learning' the potential to fulfil: *"…The need to move away from an idea of learning as transmission of knowledge and towards more learner-centred education that emphasises, above all, self-regulation."* (Black & Wiliam, 2010, p. 1).

Self-regulated learning, as Ernst D. Thoutenhoofd and Annie Pirrie (2015) has pointed out, is most commonly conceptualized as the optimization of behavior as it relates to predefined tasks and thusly heavily oriented toward the individual, rather than the social context in which learning takes place. Education takes here the form of the psychologist's laboratory or the workshop of the engineer; the cognitive scientist. A laboratory in where the pupil or student, in its individual intellectual development toward an increasingly more complex biological system-state, needs to be engineered toward effective self-regulation and self-monitored learning in order to survive in an increasingly more technically augmented world. Educational psychologists Lauren Resnick and Ann Johnson phrase it bluntly but succinct: "children must be taught to *routinely* monitor themselves for bugs" (Resnick & Johnson, 1988, p. 152).

A host of books, courses, conventions and derivative research has surfaced in the wake of the foundational works of the field. They all share the general aim of improving teachers' skills in extracting, analyzing and codifying *information* and, on many occasions, underscore how incremental this is not only for the singular pupil, but also for the cultural, economic and historical transition from the factory-form of organizing education to a personalized, decentralized and non-authoritarian design of instruction and assessment, thus improving the output of educational systems. A shifting focus of supranational organizations toward the promotion of *'assessment for learning'* and its cousin '*formative assessment'* as a means to improve individual member states' ability to compete in a globalized knowledge-economy seems to sanction the proliferation of feedback discourse in both compulsory- and higher education (Hénard & Roseveare, 2012). The tendency, it could also be noted, is amplified by the proliferation of digital 'Learning Management Systems', that can afford a multitude of educational stakeholders the ability to surveil, keep track and mediate informational feedback in real-time through the use of social media-like features and data-driven 'learning analytics' for automated 'personalization' of pace, content and objectives as well as real-time re-engineering of the educational design for individual learners and thus prepare pupils and students to think in line with the 'humanness' promoted by the cognitive paradigm.

Cybernetic pedagogies

While Thomas and Seely Brown (2011), so enthusiastic about their new culture of learning, seek to de-emphasize the role of formal education in our times of knowledge intensive economies, others are not as enthusiastic. Gert Biesta, Dutch professor of education, is a staunch critic of what he refers to as 'learnification'. The language of education, Biesta maintains, has been overtaken, reduced, to the language of ´learning´ to the detriment of, for instance, 'teaching'. Thus, education is continually deprived of a broader discussion on its teleological foundation and, consequentially, its social and material conditions while also reconfigured into something that is taking place on the individual level. Biesta attributes these changes, firstly, to a postmodern influence in where constructivist ideals have been used to question the validity of a previous conception of education, molded in the hierarchical logic of the modern nation state. Secondly, the neoliberal turn that stresses individual responsibility and accountability for the accruement of 'human capital' and, thirdly, the proliferation of information technology (IT) as a readily available source of vast amounts of *information*. While it is easy to sympathize with Biesta's critique and generally agree with his argument concerning the historical underpinnings, it is here contended that the argument could be elaborated, extended, to encompass cybernetic systems thought and the continual reproduction of Cybernation as an analytically important element in the critique of the now widespread privileging of 'learning' in educational management. For the fervor with which proponents of a 'learning'-paradigm encourage a positive attitude toward 'learning', 'change' and a 'future', coupled with the deliberate attempts to discredit skeptics (Webster & Robins, 1999) and draw up a poetics of 'smooth transition' from industrial society (Gonzalez, 2015), seem to suggest that it is so.

In connecting the ways researchers within Artificial Intelligence (AI) conceptualize the minimum of behavioral traits needed for an AI to interact with its surround, Katherine N. Hayles (2005) has traced out how the informational knowledge-conception of the *posthuman* impose itself onto our understandings of the world and ourselves. The distinction between embodied knowledge and an ether-like representation of ever-present flows of information brought forward by the emergence and dissemination of cybernetics, as Hayles has identified, has left us almost entirely swimming under the reign of the latter. 'Learnification', seen from this perspective can be seen as the application of psychological principles and rhetoric borrowed from the cognitive scientists and engineers of artificial intelligence and machine learning as a way to 'open up' educational processes for technological and cognitivist interventions carried out and over-seen by a range of stakeholders (Noble, 1989) in order to improve both spatial and temporal efficiency of the cognitive apparatus – a reversed form of AI engineering (Pea, 1985) that is predicated on the need to change how we conceptualize learning in the post-fordist reproduction of 'cybernetic

capitalism' (Peters, 2017). *Sensing* the informational surround, and then cognition only as a preparatory step toward *action* (Hayles, 1999; 2005).

The 'interface' of the learner, on the other hand, takes the shape of the strategized self-leader of the technologized and compartmentalized organizational self which, paradoxically, also makes it reasonable to speak of, to romanticize and design medicalized interventions that targets the 'whole child' (see for example Lund, 2010). Education, then, turns to emotional and cognitive engineering to insure both the survival of individual learners in a world that is made chaotic by the very principles that underline cybernetic education and the continual reproduction of Cybernation as social and economic order. To speak with Tiqqun, we can then say that cybernetic education is concerned with the separation of cognitive representations of the mind and the re-configuration of these representations for the sake of optimized flows of information and communication: "the first bringing death, the second mimicking life." (Tiqqun, 2013 p. 14). 'Learnification', in short, can be here be taken as the reproduction of the cybernetic hypothesis.

Thinking, thinking critique

The university, and perhaps especially faculties of education, has become an important function in this *'systems engineering'* of educational bodies, described as highly *complex* entities, both on the local, national and supranational level (Nowotny, 2005; Apple, 2004). Economic globalization and technological jingoism, following this line of reasoning, has transformed education to a scientistic endeavor where doing, not thinking (Daza, 2013), takes precedence through the discourse of 'Best Practices', 'evidence' and technological solutions to social dilemmas perceived as non-ideological exactly because of the technological discourse that surrounds them (Daza, 2013; Hyslop-Margison & Naseem, 2007). This 'closing in' of the 'social' toward a technical system of extraction, management and presentation, one hastes to remind, is in historical parallel with the proletarisation of university workers; the entrepreneurial turn in academic organization (Etzkowitz, 2003a) and the associated administrative regimes of grants, publication metrics, scholarships and re-training (Aronowitz, 2001). Social scientists, now but *engineers* of the continually increasing level of complexity in socio-technical systems, are pressured into a position where the authoritative voice in conversation with governmental power (in whatever shape or form) is diminished and, at the same time, cast as a valuable source of borrowed legitimacy in both the national and supranational production of, amongst other things, competitive educational services and goods. It is affecting what questions are being asked and what informs the methodological choices made in search for answers while calls for critique, new forms of

critique, the activity of introspection, hermeneutics, and the formulation of alternative forms of collectivity remain increasingly unanswered by the community of educational scholars (Apple, 2004).

Critique in the age of social media, as Anders Johansson (2016) point out, might be something that is mediated through us, rather than the product of our own making; the algorithms of Facebook and Twitter, platforms Johansson takes as examples, are but "machines that produce *critique*" (p. 126, own translation). Digitally indexed archives of data that provides improved empirical exactness and extends or displaces the capabilities of the individual researcher in identifying emergent qualities in vast amounts of text in a matter of seconds or minutes (Moretti, 2013); the power of computing flattens the distinction between qualitative and quantitative work, rendering its 'artificial' (as in 'artificial intelligence') moniker limiting in analytical thrust (Clough et al., 2015) – the autonomy with which it operates, its adaptability, affords it a highly cost-effective form of 'creativity". This, according to Stephen Best and Sharon Marcus (2009), amounts to a de-skilling of scholars, a "minimization of agency' as deep knowledge in a particular field or close familiarity with a literary corpus is replaced with the proficient use of tools and reduced by the affordances inherent in them.

To think about education is increasingly to think with the help of, and through, the regeneration of Empire: to fall victim to a methodological *cybernationalism*; the escape from methodological *nationalism* might easily become the celebration of Cybernation through choices in outlook and method. Consider the example of mining for Big Data, the latest generation of cybernetic methodology. The advent of so-called 'Big Data' methodologies, according to Farnam Jahanian (2013), head of the National Science Foundation directorate for Computer and Information Science and Engineering (CISE), constitute a shift of paradigmatic proportions in the production of knowledge. Others share his enthusiasm and adds yet another layer of self-importance when they allude to the inherent and unbiased truth embedded in these numbers (as shown by Williamson, 2017). The shift takes us from hypothesis-driven to data-driven inquiry where the use of *analytics* – the real-time harvesting of data to be computationally analyzed, visualized and used for predictive models on which theories can be tested – increasingly takes precedence. Analytics are used both in business and science in order improve decision-making and, according to French philosopher of technology Bernard Stiegler, equipped by such common-sense thrust that it might prove just as instrumental to our understanding of knowledge as did writing during antiquity (Stiegler, 2014). Langdon winner, it could be worth pondering, might be right in his observation that we tend to accept massive change in our lives when the source of change is continually attributed to a techno-scientific community rather than to the traditional political

sphere (Winner, 1980). While common-sense thrust might prove to be one important pre-condition, the very real momentum of big-data methodologies comes from the reconfiguration of social science, or rather, the 'dissasembling' and 'distribution' of it to the spatial and temporal spaces of capital, as Clough et al. (2015) argues in relation to recent changes in sociology. Thus, even if one were to engage with computational big-data methodologies, one would soon find oneself in direct competition with some of the largest corporations in history (Galloway, 2014a) – corporations that use the very same methods but for exclusively commercial ends and with far greater social impact. Furthermore, to pursue these same computational methodologies is, as Alexander Galloway points out, "to follow a trend toward normalization with the dominant rather than of differentiation from it" (p. 127). To think with computers and, we might add, to think *like* a computer, then, boils down to a choice – in this case, between resistance and acceptance. The choice is made even more difficult when considering the discourse of emancipation that is common to Cybernation: the 'democratization' of networked media, the 'creativity' of cognitive and technologically augmented labour, the flattening of organizational hierarchies and the 'solving' of pressing 'problems'. Tiqqun, however, maintains that the 'cybernetic hypothesis' is beyond choices or critique and that we instead need to defeat it through induced panic and guerilla tactics (2013). A sentiment they can be said to share with Kevin Robins and Frank Webster (1999) who have made attempts to resuscitate luddism as way to resist the fetishizing of technology and the mobilization of capital that underscores it in these times of *technoculture*.

Concluding remarks

The ‘cyborg sciences’, as Philip Mirowski (2002) points out, did not grow from spontaneous circumstances; they were consciously *made*. Although it is striking how often the systems theorists and cyberneticists allude to themselves as the pioneers of a scientific revolution, the prospectors of a new paradigm of peace and tranquil togetherness: the patrons, painters, and, perhaps mainly, *writers* of a new image of the world and life, they are, in equal measures, the *readers* of the natural-social world. For it is scripture in the most basic sense that is at the foundation of the hypothesis. Lily E. Kay invokes Jacques Derrida in a critique of the information metaphor as it is used in molecular biology and contends, with the help of Derrida’s writings on ‘logocentrism’, that cybernetics and information theory is the absolute high-point of a ‘logocentric’ view of the world. The information metaphor, so imperative to the entire cybernetic project, is ingrained in the very fabric of life through the reinterpretation of the biophysical ‘protein’ in molecular biology into the informational double-helix string of DNA: the basis of life turned to a coded language – physical representations of information that is reducible, in the last analysis, to binary statements. Cybernetics, in this way, solidify the digital binary and excludes the creation of new differences; the generation of novel meaning. Consider the ‘Turing test’ devised by Alan Turing as the definitive method in distinguishing if a computer is intelligent or not. This is a basic operationalization. It either works, or it does not. That is the presupposed nature of the experiment, its digital bias in the attainment of scientific answers, and it entirely removes the question of ‘intelligence’ from philosophical speculation (Hayles, 2005). We could very well add ‘learning’ and ‘education’ to that proposition. The cell nucleus approached as an informational control system; the human being approached as an informational control system; the organization approached as an informational control system; society approached as an informational control system and the globe approached as an informational control systems not only obscures any conceivable distinctions previously in place to delineate in new ways – it also begs the question “who wrote the language by which the control system maintains its integrity and purpose?”. Here, according to Kay, a circularity emerges in where cybernetics both write and read the world. The scientific endeavor, thus, a machine from which there are no clear escape: the writing does the writing.

With the help of the synoptic method, a method chosen to escape the empiricist and scientistic regimes of the ‘cybernetic hypothesis’ as proposed by Tiqqun (2013), The aim was to identify where previous scholarship on the cultural and political consequences of cybernetics is relevant to the field of education and, on the basis of these findings, argue for the relevance of Tiqqun’s claim for future educational research and scholarship. The synoptic view that has been assembled

reveals education, in a post-fordist society, as, at least in part, infused with cybernetic thought and reconfigured both on the macro- and micro-level to *fit* into a cybernetic image of the world; a 'hegemonic bloc' preoccupied with information, biology and mathematics. Education, then, has, become the project of fulfilling the techno-utopian promises of post-fordist arrangements of labor and conceptions of the commodity: harnessing the human intelligence of both human, machine and organizations in such a way as to make the most effective use *of technology* (Zuboff, 1988), thus re-generate the cybernetic hypothesis through the continual improvement of input/output tables. This attempt to build a new Modernity, and the many problems that separates students, teachers, school administrators, local politicians and educational scholars from the attainment of that condition, it has also been illuminated, are increasingly articulated by global and local networks in where cross-sector partnerships and collaborations, which include academia, are touted as the very form of not the path forward, onward, toward a new age, but the expansion of the present order understood as a new age not yet properly unearthed. This continual and circular process requires the maximization of informational throughput in both individuals and organizations, thus forming the grounds for modular educational subject both in the school, the university and in the workplace. A 'learner' that is both emotionally and cognitively dispositioned to *self-regulate* in accordance with the 'instrumental progressivism' (Robins & Webster, 1999) of Cybernation: being a locus for feedback.

To conclude, let us return to Morris Berman and his article *The Cybernetic Dream of The Twenty-first Century* (1986) in which he argued that the cybernetic dynamic is enacted in three layers. (1) The abstract philosophical layer of systems theory, holistic thinking, complexity and neo-spiritualism, (2) The professional disciplinary layer in where psychology, ecology and biology embrace the metaphor of *information* and, lastly, (3) the 'grass-roots' layer where we find the personal computer and video games as consumer goods and apparatuses of subjectification (Berman, 1986). While we could add to these layers global governance, social media and big-data, Berman, already in 1986, would seem to have had a rather clear picture of how things are unfolding and the ramifications thereof. Berman quoted at length:

> "In our eagerness to reject the mechanistic science of the last 300 years, we need to be wary of what we are replacing it with. The thing to as of any new philosophical statement, any extension of computer hardware into school, universities of therapists' offices, and of any new toys such as Pac-Man or Apple II, is only this: Does it take me into the things I fear most and wish to avoid, or does it enable me to shut out the environment, ignore politics, remain unaware of my dream life, my sexuality, and my relations with other people, or does it shove these into my face and teach me how to live with them and through them? If

> the answer is the latter, the I suggest to you that we are on the right track. If the former, then it is my guess, as Merleau-Ponty says, that we a sinking into a sleep from which, in the name of enlightenment itself, there will be no easy awakening." (Berman, 1986 p. 46)

Berman's challenge bear relevance still today, thirty years later, and could be directed directly at scholars of education: is this a modernity one wishes to normalize and a form of nationalism one wishes to identify with?

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