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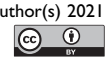
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Network concepts in social theory: Foucault and cybernetics

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Abstract
Network concepts are omnipresent in contemporary diagnoses (network society), management practices (network governance), social science methods (network analysis) and theories (network theory). Instigating a critical analysis of network concepts, this article explores the sources and relevance of networks in Foucault's social theory. I argue that via Foucault we can trace network concepts back to cybernetics, a research programme that initiated a shift from 'being' to 'doing' and developed a new theory of regulation based on connectivity and codes, communication and circulation. This insight contributes to two debates: Firstly, it highlights a neglected influence on Foucault's theory that travelled from cybernetics via structuralism and Canguilhem into his concept of power. Secondly, it suggests that network society and governance are neither a product of neoliberalism nor of technological artefacts, such as the Internet. They rather resulted from a distinct tradition of cybernetically inspired theories and practices.

Keywords
Cybernetics, Foucault, neoliberalism, network society, power

For some time now, network concepts have been soaring in social theory and practice. In *The New Spirit of Capitalism*, Boltanski and Chiapello (2005) famously argued that capitalism has been inspired by a new set of ideas and justifications revolving around an ideal of connectivity and networking. However, the economy is not the only sphere to observe the rise of network concepts. Governance theories have turned to 'network

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governance' as a new form of public management that would respond to the failures of new public management as well as it would be more powerful in managing the rising level of diversity and complexity (Bevir, 2010; Kooiman, 2013). Moreover, even societies in general have recently been described as 'network society' (Barney, 2013; Castells, 2009), while a variety of theories and methods in the social sciences have adopted network approaches, ranging from policy-related governance research to the critical approaches of governmentality studies, and from quantitative analysis to philosophical reasoning (Scott, 2011).

The breadth and force of this development indicate that network concepts are at the bottom of a broader paradigm shift that interprets and shapes the social world in terms of connectivity. Despite suggestions by Boltanski and Chiapello, critical social analysis has barely started to interrogate the epistemology and history of network concepts. At the same time, network heuristics, the diagnoses of a 'network society' and the normative appraisal of network governance gained even more momentum as the development of big data technologies accelerated in recent years (Healy, 2015). Understanding the history and consequences of network concepts, therefore, seems even more pressing. In this article, I want to propose a starting point for this endeavour by historicizing Michel Foucault's use of network concepts.

The article, thus, does not attempt to deliver a full-fledged account of 'the network paradigm', neither in descriptive nor in explanatory terms. Rather, it chooses a case study to explore some paths that further research might follow to understand how network arguments diffused, transforming social theories and practices. Here, analysing Foucault's work is a good starting point, because his conceptual innovations have developed a massive impact, disseminating the network perspective into a vast range of social, political and cultural inquiry. My main argument is that via Foucault we can trace network concepts back to cybernetics, a research context that unfolded a new conceptual and argumentative apparatus revolving around networks and systems, codes and circulation, diagrams and strategies in order to found a theory of regulation that is applicable to animals, machines and societies alike.

The case study will contribute to two lines of research. *On the one hand*, historicizing Foucault's use of network concepts sheds new light on his work. Common inquiries into his inspirations are predominantly primed by a philosophical perspective that stresses the influences of Nietzsche, Heidegger and other philosophers. While I do not neglect those influences, the philosophical contextualization overlooks the tremendous impact from a different intellectual context, that is, information theory and cybernetics. *On the other hand*, this inquiry will contribute to a critical conceptual history of network approaches, and – in the long run – to an analysis of the historical and political formation of our 'network society'. In this regard, Boltanski and Chiapello (2005, pp. 132, 201–202) argued that the 'new spirit of capitalism' cannot be explained by referring to the rise of neoliberalism, but their methodology of analysing business manuals also prevents them from systematically tracing the origins of the 'network polis' formation. Here, the following case study enhances our state of knowledge significantly.

First, uncovering the roots of network concepts in cybernetic reasoning contributes to answering their question as to the origins of the network polis in capitalism, enabling us to trace the paths network concepts took when traveling from cybernetics into other

theories. Second, locating the roots of network concepts in cybernetics also strengthens Boltanski's and Chiapello's claim that analysing neoliberalism is insufficient to explain current trends in economics and politics. And finally, by showing that Foucault was able to describe the society as a network in the 1970s, the case study also questions the common narrative that the network society is a result of the Internet and the advance of micro-electronics following the 1980s and 1990s. My findings rather suggest that network concepts in social theory and network technologies are two related but different results of cybernetic ideas that only later started to lend each other plausibility.

The article proceeds in three steps, first unravelling the cybernetic resources for network concepts, then tracing their trajectory to Foucault's work and, finally, discussing their application in Foucault's network concept of power. Hence, in the first section, I start by explaining the context, concepts and arguments of cybernetics. In the second section, I present some references to this cybernetic context in Foucault's early texts and identify mediators who might have brought cybernetic reasoning to Foucault. In the third section, I use the cybernetic concepts from the first section as a heuristic to demonstrate its systematic application in Foucault's concept of power. I close the article by locating my findings in a broader context of the 'conceptual-cum-political change' (Ball et al., 1989, p. 3) that is the rise of network ideas.

Resources: The cybernetics debate

What was cybernetics?

Cybernetics has recently been rediscovered in debates on big data and digitalization (e.g. Helbing et al., 2017). In these debates, as in the social sciences, the meaning of 'cybernetics' is still linked to the debate on technocracy that made cybernetics a buzz word in the 1950s and 1960s. This debate, however, did not deal with cybernetic research but with post-war politics. After World War II, the state attempted to organize social cohesion and modernization by rational techniques of planning and steering (Seefried, 2014). In search for better techniques, state agencies and private foundations also funded cybernetic research, as they saw potential for a general theory of 'communication and control' (Wiener, 1948). The political goal of rationalizing government by technical means spurred a public debate, in which 'cybernetics' became the signifier for a research programme believing in the optimization and rationalization of societies through data and machines.

Strangely, this understanding of cybernetics was shared by proponents and critics of rationalization in the technocracy debate. Proponents were strongly influenced by a rational choice approach to modelling the future as developed by the RAND Corporation (Seefried, 2014). They aimed for a so-called modern style of government that relies on rational decision-making by technical procedures (e.g. Helmer, 1966). Critical positions, on the other hand, argued that a rule of technicians and technique would result in a loss of democratic and human sovereignty. Critics, such as Jürgen Habermas (1987, p. 118), cautioned against the 'cybernetic dream of the instinct-like self-stabilization of societies'. Yet, both sides agreed that 'cybernetics' stood for a rationalized stream of

information and faster processing that – for better or for worse – would affect decision-making.

In contrast to its public label, cybernetics attempted something completely different according to many cyberneticians, as studies in the history of cybernetics have demonstrated (e.g. Dupuy, 2000; Hayles, 1999; Heims, 1993; Kline, 2015; Pickering, 2009). This leads to the methodological problem that, in the worst case, a text criticizes cybernetics while applying cybernetic concepts. It is therefore necessary to decentre the technocratic reading of cybernetics that continues to affect contemporary accounts of it.

For one, cybernetics discussed communication and control *in a much broader range of areas*, rather concentrating on mathematics, quantum theory, neurophysiology, psychology or linguistics than on political decision-making. This transdisciplinary approach was a precondition for cybernetics' long-lasting impact (Kline, 2015). Of course, Norbert Wiener who coined the term 'cybernetics' was initially inspired by modernist ideas of feasibility and generalization, as he intended to create a *universal* framework for regulation in animals (including human beings), machines and, to a certain degree, societies. Moreover, its transdisciplinarity also opened cybernetics to aspirations of rational choice modelling or mechanical engineering. Cyberneticians, however, dissociated themselves early on from these perspectives. In their view, cybernetics aimed for the opposite: it attempted a *general critique of mechanical steering and rationalization* by replacing linear models with the complexity and circularity of interdependent feedback loops.

Already at the Macy conferences, a seminal series of 10 events that provided a forum for early cybernetics, two camps began to form (Dupuy, 2000, pp. 119–123). One camp consisted of scientists such as Leonard Savage who had a close relationship to positivism, utilitarian ideas of behaviour and linear models of communication. In the other camp were 'core' cyberneticians such as Warren McCulloch, Gregory Bateson and Heinz von Foerster, who initiated and organized the conferences. They criticized the hierarchical order of preferences behind rational choice reasoning, arguing that the main discovery of cybernetics lays in conceptualizing circular, heterarchical information processes and the emergent eigen-behaviour of complex systems (Bateson, 1987, p. 452; McCulloch, 1945; von Foerster, 1977). Linear and rationalist models would, thus, simply miss the central ideas of cybernetics.

This hunch of many cyberneticians had two main consequences. On the one hand, and as early as in the mid-1950s, significant parts of information theory and game theory rejected a connection to cybernetics, which denied to conceive of information problems in terms of effective transmission of a fixed message (Geoghegan & Peters, 2014; von Foerster & Pörksen, 2001, p. 97). On the other hand, a group of cyberneticians including Bateson and von Foerster concluded that early cybernetic concepts, although interested in non-linear dynamics beyond rationalism, still provided too many opportunities to build linear, rationalist models. To prevent this misunderstanding, they refined cybernetic concepts by performing a reflexive turn, creating 'second-order cybernetics' (Foerster, 1974; Hayles, 1999, pp. 73–75, 131; Scott, 2004).

Second-order cybernetics argued that first-order cybernetics observed systems without adequately considering that the observer is also part of a system. This would force cyberneticians to apply their concepts of circular self-regulation to their own

observations (Clarke, 2009, p. 36). Observing systems are both conditioned by their position in the network of systems and self-regulatory as they create their behaviour through their own recursive processes. Therefore, they also produce their own perception of the world and any observing system could be observed from another observing system, starting an infinite recursive process of observing observers and their blind spots. In other words, second-order cybernetics radicalized ideas of circularity, reflexivity and complexity already encapsulated in first-order cybernetics.

Let us briefly explore main conceptual ideas of first- and second-order cybernetics. This introduction into cybernetic concepts further decentres the technocratic reading and generates a heuristic that I will use to analyse Foucault. It focuses on two main developments of cybernetics: (a) the invention of a *new set of concepts* that allowed to reject ontological perspectives for an operational approach and (b) the *remodelling of 'governance'* from linear and hierarchical models to circular and reflexive self-regulation that prefers difference over identity and continuity.

Networks and systems: 'Doing' rather than 'being'

Cybernetics received much attention because it offended post-war humanism by rejecting the strict dichotomy of human beings and machines. In so doing, cybernetics imagined itself to be a fourth revolution following Copernicus, Darwin and Freud in dethroning the human subject (Hagner, 2008, pp. 38–39). Behind this rhetorical verve, however, stood an epistemological critique of modern societies. In particular, cybernetics targeted the 'simplistic' and 'reductionist' models of modern science that prevailed in Newtonian mechanics and ontological reasoning (Ashby, 1956, p. 5; another example is Ackoff, 1979). As both rely on essentialist distinctions of subjects and objects or life and machines, they generate an 'under-complex' understanding of the world. They simplify the 'real' diversity of possibilities by isolating variables and construing linear causalities, thus explaining the world with insufficient models of stimulus and response, cause and effect, or motivation and action (Ashby, 1956, pp. 5, 121–126; von Foerster, 1984).

Cyberneticians believed that this 'old' world view increasingly fails to grasp the growing complexity of the world. Therefore, they called for a new way of thinking, a 'new world view' (e.g. Ackoff, 1979, p. 96). The polemic call for a new mind-set that follows from the narrative of rising complexity survives in Foucault's writings (e.g. Foucault, 1994, IV, p. 108) and in nowadays rhetoric of network theory and network governance (e.g. Eggers, 2008, p. 28; Raworth, 2017). To overcome the 'old', 'insufficient' models, early cybernetician W. Ross Ashby (1956, p. 1) already proclaimed a revolutionary shift towards an operational epistemology that disposes of the ontology inherent in humanism and mechanics by switching the attention from *what to how* and from *essence to doing*: 'Cybernetics [. . .] does not ask "what *is* this thing?" but "*what does it do*?"' (original emphasis).

For developing this operational approach, cyberneticians invented a range of concepts that are abstract enough to deal with *any* assembly of elements and to model *how* these elements may *connect* to do something (Beer, 1959, 1967, pp. 9–10). Presenting 'connectivity' as the core idea of cybernetics, Stafford Beer once advanced five models of

connectivity in a single paragraph – machines, systems, networks, diagram and electric circuits:

> A machine is a system, a set of points joined together by certain specified relationships. Therefore we may set up as its model a simple *network*. [. . .] The lines by which these dots are connected reveal the possible modes in which the system can operate. [. . .] A schematic diagram [. . .] can obviously be drawn [. . .]. This diagram will bear a marked resemblance to any representation of an electric circuit. (Beer, 1967, p. 95, original emphasis)

Beer's explanation illustrates that cybernetics defined a *set of models* to conceptualize connectivity, in which one model is used to explain another model, creating a paradigm to describe reality: an assembly of elements is like a system, is like a network, is like a diagram and so on. In that manner, the apparatus of cybernetics encompasses graphical models (flow charts, diagrams, esp. circuit diagrams), material models (machines and computers), conceptual models (network, system) and mathematical models (matrices).[1] Finally, and despite their critique of rational choice theory, cyberneticians adopted the model of games, strategy and tactics, because it enabled them to describe connectivity and complexity from the perspective of actors without conceptualizing them in humanistic terms (Dupuy, 2000, pp. 61–62).

As the adoption of game-theoretical metaphors illustrates, the different models have their own strengths and weaknesses. While the concept of a system is very abstract, allowing for an application to any arbitrary assembly of elements, networks and diagrams are much more intelligible in describing the idea of connectivity. Because of that, they also help to understand two general epistemological premises of cybernetic modelling. *First*, there is a *multiplicity of interdependent relationships that condition each other*. The opportunities of an element a to connect with another element b are influenced by the connections among the elements c, d and e, as well as the chosen 'strategy' of element a will influence the opportunities of the elements c, d and e. *Secondly*, the complexity is even higher as there is also *a relationship between actualized and potential connections*. The diagram, for instance, demonstrates that some connecting lines between the elements are active in each moment, whereas others are inactive but could have been chosen or might be chosen at a different point in time. What we can observe, therefore, is neither the essence of a thing nor the identity of a person, but only one possibility actualized at given moment.

Here lies a radical consequence of shifting the attention from essence to doing, which was finally explicated by second-order cybernetics: Systems or networks only exist *in doing*, in processing, in reproducing their elements and their relations in real-time (e.g. Maturana & Varela, 1980). Exploring these processes of ordering, cybernetics adopted the concepts of emergence and evolution. 'Emergence' means that some pattern appears as the elements in a network relate to each other. This emergent order and its possibilities are not intended; they are simply an *effect* of simultaneous coordination in the network. Yet, as the relations reproduce themselves in response to changes in the network and in its environment, the pattern of the network *transforms* – which is called 'evolution'. In contrast to stable identities that develop coherently over time, emergence and evolution

are erratic, unintentional and irreducible to former formations. Second-order cybernetics thus undermined modern theories of identity and linear history alike.

A new concept of 'governance': Circularity, self-regulation, diversity

In line with their categorical rejection of Newtonian mechanics and ontological philosophy, cybernetics also came to refuse linear-causal and mechanistic concepts of steering, in particular hierarchical forms of organization, command-and-control approaches and central planning. Cybernetics thought of those models of regulation as 'primitive' and 'naïve' (Beer, 1967, p. 21), because they are based on a reductionist idea of causality and imply that systems can be steered intentionally and hierarchically. While this critique targeted the models of modern science (not political decision-making), some cyberneticians argued that the 'old' rationality also yields insufficient concepts of government and power. According to Beer (1967, p. 21), for instance, those concepts still dominate post-war societies and simply identify control with coercion. In either case, cyberneticians believed that in refusing such simplistic models cybernetics would offer a new, more accurate understanding of control.

The cybernetic concept of control (or regulation) entertains two fundamental shifts. On the one hand, it maintains that *regulation is a universal and ubiquitous phenomenon*. While there are no systems (and no societies) without regulation, regulation rarely takes the form of coercion or linear causality. This is because complex systems are 'highly differentiated', which prevents them from being easily steered from a control centre. Rather, the interdependent elements in a network regulate themselves via mutual influence. Each element in a system is shaped by connecting processes and, at the same time, it shapes those processes by redirecting the flow of communication. In other words, cybernetics argued that regulation is but the name for the *circular processes of communication and coordination* (Beer, 1959).

To model circularity, early cyberneticians introduced the term 'feedback' (Rosenblueth et al., 1943). It described that a system uses its output as its input. Early cybernetics started from observing systems that minimize the difference of its actual output to a specified goal (negative feedback). This focus on quasi-teleological or purposive mechanisms of goal-attainment, however, soon was criticized. First, Ashby argued that complex 'homeostatic' systems would randomly seek *their own viable patterns*, rather than to orient towards a given goal (Kline, 2015, pp. 52–53). Then, second-order cybernetics developed this thought even further by arguing that input and output are not even objective terms. Instead, what counts as input is determined by the processes *inside* the system: 'an organism does not receive "information" as something transmitted to it, rather, as a circularly organised system it interprets perturbations as being informative' (Scott, 2004, p. 1369).

This conceptual clarification radicalized cybernetics' idea of *control as self-organization*. First-order approaches already argued that the elements of the networks regulate themselves by their own 'language' (Beer, 1959, p. 5) or 'codes' (Ashby, 1956, p. 140). To generate resonance inside a system, you must connect to those codes rather than to exercise command. But second-order cybernetics was even more rigid. According to them, the environment of a system is only 'noise' until the systems selects on which

turbulences in the stream of noise it is going to act (Clarke, 2009; von Foerster, 1984). *Because* there are so many connections and co-dependencies in a network (and in a network of networks), systems are completely self-organized. Complexity and self-organization go hand in hand.

It is obvious by now that these 'governance' concepts are descriptive *and* normative. The descriptive aspect is that (according to cybernetics) complex systems have internal processes that are highly differentiated and flexible, which allows them to deal with massive amounts of complexity and contingency in their environment. This observation is famously stated by Ashby's 'law of requisite variety' (1956, pp. 202–213). It is, however, easily turned into a normative statement: If you do not want to undermine highly complex systems, command-and-control approaches are the wrong way to go. Complex systems depend on diversity, flexibility and self-regulation, because they allow them to innovate, experiment and 'design' new answers in response to a highly volatile environment. Here, cybernetics has an inherent link to aesthetics and style (Ackoff, 1979, p. 101), as those answers are not 'the one best way' (as searched for by rational choice approaches) but only one 'viable' way found through the *creativity* that is unlocked by diversity and self-regulation. Cybernetics, thus, offered a *theory of difference* that undermined concepts of ontological identity, economic rationality and political integration.

Trajectories: Foucault and the cybernetic debate

In this section, I trace how the network concepts presented above may have travelled into Foucault's social theory. As the last chapter showed, 'network concepts' is a placeholder for a whole set of concepts and arguments that we must investigate for historicizing the rise of a technological rationality inspired by cybernetics. Although some research already indicated that Foucault's concepts bear traces of cybernetic ideas, the impact of the cybernetic rationality has not been explored very systematically. The contributions concentrate on structuralism (Geoghegan, 2011), provide only very brief reconstruction that lack a heuristic (Lafontaine, 2004, 2007) or focus on other, more specific concepts, such as the 'milieu' (Sprenger, 2019, pp. 61–78). Building on this line of research, I work towards a broader, more systematic account by applying the above heuristic of network concepts. First, I present two examples for Foucault advocating approaches from information and communication theory and argue that, during his early work, he was exposed to cybernetics via at least two influences, structuralism and the epistemological research of Georges Canguilhem.[2] In the next section, I then investigate the conceptual consequences, focusing on Foucault's network approach to power and its socio-ontological implications.

Two examples: Advocating communication and information theory

It is well known that Foucault was not in the habit of disclosing his sources by giving frequent references, which has always been a challenge for historicizing and locating his work. Moreover, Foucault's approach obviously differs in many ways from socio-cybernetic attempts like Niklas Luhmann's that openly and systematically embraced

cybernetics to build a theory of society. In other words, it is not to be expected that Foucault would simply acknowledge the impact of cybernetic concepts, such as information, noise or system. One exception, however, is the extraordinary piece *Message or Noise?*.

In this 1966 paper, Foucault (1994, I, p. 557) set out to criticize the 'benedictory humanisms' of medicine.[3] According to him, modern medicine believes that a disease sends messages, which doctors must only hear and interpret. To dismantle this assumption, Foucault drew on the concepts of noise and code from cybernetics and information theory. He argued that initially there is only noise. For noise to have a message, it would need to provide 'diverse discontinuous elements' that are connected among each other according to certain regularities. Those connected elements, then, must have a connection to another set of elements that holds the meaning. According to Foucault (1994, I, p. 558), these conditions are not fulfilled in medicine:

> But the illness does not send a "message," because a message depends upon a "code" that is established by the described rules. There is no code in nature [. . .]. The illness might "make noise," and that is already plenty. All of the rest is made up by medicine.

In sum, Foucault's argument is that medical diagnoses are not at all true representations of a disease, because both are constructed *inside the medical discourse*. It is according to the rules of this discourse that doctors define 'a difference which makes a difference', as Bateson (1987, p. 321) put it. In the final paragraphs, Foucault therefore argued that a theory of medical practice should not follow the old terms of humanistic medicine. Instead, he proposed to 're-think' such a theory 'in those [concepts] that are currently developed in the analysis of language and information processing' (Foucault, 1994, I, p. 560).

In *Linguistics and Social Science*, my second example published 3 years later when Foucault (1994, I, pp. 821–828) reflected upon the methodology of his inquiries, he further explored this approach of language and information analysis. He argued that structural linguistics abolished the old idea that language is a true representation. In consequence, it became possible to analyse language just like 'all the phenomena of information' – by using formal methods of mathematics and communication theory to decipher language in terms of 'senders' and 'receivers', 'messages' and 'codes or regulations [règles]' (Foucault, 1994, I, p. 825). In doing so, linguistics joins with other sciences in discovering the 'if not universal, at least extraordinarily broad character of the phenomena of communication that reach from microbiology to sociology' (Foucault, 1994, I, p. 828).

Foucault, here, explicitly affiliated himself with the (cybernetic) idea of a universal methodology that interprets the world through information, communication and regulation. However, two aspects in this article also indicate Foucault's critique of the structuralist programme. On the one hand, he argued that the structuralist analysis is not necessarily an ahistorical endeavour even though structural linguists often focused on synchronous models. On the other hand, he insinuated that the methodology goes beyond analysing language. '[T]he social', Foucault argued (1994, I, p. 826), can altogether be described as 'an assembly of codes and information'. Structural linguistics, thus, only

laid the groundwork to develop a new approach that builds on cybernetic concepts to analyse epistemic structures *and* historicize them by following the 'discontinuity and transformation' of 'discourses' (Foucault, 1994, I, pp. 827–828).

This is, of course, what Foucault (1994, I, p. 846) proposed in his application to the Collège de France: to analyse 'systems' of thought and 'how – via what channels and codes – knowledge registers [. . .] phenomena that have hitherto remained outside'. Here, as in the examples above, Foucault decidedly employed cybernetic vocabulary to antagonize against the humanistic ideas of meaning, development and sovereignty. He declared that he had discovered a new 'passion [. . .] for what I call the "system"', that is 'an assembly of relations that maintain themselves, transform themselves' (Foucault, 1994, I, p. 514).[4] In the influential essay *Of Other Spaces*, Foucault (1994, IV, p. 752) pinpointed the massive epistemological shift he himself intended, again using a cybernetic metaphor: 'We are at a moment when the world experiences itself, I think, less like a great life that would develop over time, but like a network [!] that connects points and intersects with its own threads'.

Two mediators: Structuralism and Canguilhem

The examples illustrate three aspects. Firstly, Foucault argued for introducing cybernetic concepts of networks and systems, information, codes and communication into the analysis of language and discourse. Secondly, they indicate some reasons for doing so. While it is a methodological invention that offers a completely new formal and analytical approach (which is useful for a young philosopher), the shift to the cybernetic language of systems and complexity, noise and information also helped to make a political point. It provided Foucault with concepts for criticizing philosophical and clinical humanisms and their core idea, the sovereign subject. Finally, both examples also hint towards the sources of Foucault's affinities for cybernetic ideas of communication and control, that is, structuralism and the history of knowledge as performed by his teacher Georges Canguilhem.

The close connections of structuralism and cybernetics are well known. On the one hand, contemporaries, especially neo-Marxists such as Henri Lefebvre, stressed the cybernetic background of structuralism (which included Foucault). But their perspective was more political than analytical as they aimed to expose structuralism as technocratic ideology that undermined critical human agency and thereby supported a rationalist rule (Dosse, 1997, I, pp. 163, 357; Lafontaine, 2004, pp. 109–114).[5] Recent research, on the other hand, offers an analytical account that is often rooted in a reading of cybernetic research (Dupuy, 2000, pp. 17–20, 107–108; Geoghegan, 2011; Johnson, 2015; Lafontaine, 2007).

According to this research, main figures of structuralism had both personal ties to and theoretical enthusiasm for cybernetics. In 1955, for instance, Jacques Lacan gave an influential seminar that intended to bring cybernetics into psychoanalysis, thereby redefining the unconscious in terms of a formalistic model of language (Lafontaine, 2007, pp. 33–36). Claude Lévi-Strauss, on the other hand, probably had even closer ties to cybernetics. He was in contact with Roman Jakobson who advanced formal linguistics by implementing the cybernetic theory of communication and information, which he

encountered as a participant of the Macy conferences (Geoghegan, 2011, pp. 104–121; Gerovitch, 2008). Moreover, Lévi-Strauss conferred with Warren Weaver who sent him copies of the *Mathematical Theory of Communication* published by him and Claude Shannon (Geoghegan, 2011, p. 117). Finally, Lévi-Strauss frequently quoted Norbert Wiener, arguing that cybernetics provides the instruments to give anthropology a new, formalistic direction (Le Roux, 2009; Lévi-Strauss, 1954).

Although Foucault would strive beyond the structuralist projects, he was strongly inspired by structuralism, from where he took the concept of the system, which the structuralists, in turn, took from cybernetics (Foucault, 1994, I, p. 514; Lafontaine, 2004, p. 109). Perhaps, he even knew about this connection to cybernetics, since he linked structuralism with communication theory, as we saw above. Foucault (1994, I, p. 447) also paralleled Lacan's and Lévi-Strauss' proposals with cybernetics and information theory, as they would try to enable the humanities and sciences to develop a self-reflexive relationship, opening a new 'non-dialectical' perspective on knowledge (Foucault, 1994, I, pp. 541–543). In this regard, however, structuralism was not the only, perhaps not even the most important, mediator for cybernetic ideas.

Another source was Georges Canguilhem's epistemological project. Canguilhem's areas of interest, biology and medicine, were up front in redefining life by using cybernetic concepts of information and regulation. Renowned scientists, such as the Nobel laureate François Jacob, casted genetics and molecular biology in a cybernetically inspired vocabulary, redirecting the research agenda and transforming our view on the 'genetic code' (Fox Keller, 2002; Kay, 2000). Canguilhem located this epistemological transformation in a history of biological concepts of regulation; but he also used these concepts to develop his own philosophy of life (Muhle, 2008). As early as 1947, Canguilhem (1992) even followed the cybernetic analogy of machines and life, arguing that technology is a universal biological phenomenon.[6]

When Foucault wrote the introduction to the English translation of Canguilhem's *On the Normal and the Pathological*, he remembered the special interest Canguilhem took in 'the theory of information: code, message, message carrier, etc.' (Foucault, 1994, III, p. 440). According to Foucault, the importance of Canguilhem's work for a new generation of French researchers derived from him introducing this cybernetic vocabulary and, with it, a new perspective on the humanities and their history. Instead of viewing history as linear progress, and instead of attributing this knowledge to a sovereign subject, information theory helped to understand evolution and the history of knowledge as a contingent 'game of codes and of decoding' (Foucault, 1994, III, p. 441). The history of knowledge would thus not be that of increasing knowledge but of redistributing what counts as true and false. This interpretation of Canguilhem's influence in mind, it takes no wonder that Foucault remained interested in the crossroads of biology, history and information theory. For instance, he wrote a glowing review for François Jacobs *La logique du vivant*, in which Jacob explained how cybernetics and information theory can be applied to biology and its history. During the 1970s, Foucault would refer to this book multiple times and compare it with his own efforts (Foucault, 1994, II, pp. 99–104, 160–162).

Moreover, it is obvious that Foucault's introduction described what inspired him in Canguilhem's work. While Sprenger (2019, pp. 61–81) and Muhle (2008) argued that

Canguilhem's philosophy of life influenced Foucault's later depiction of biopolitics, his critique of structuralism already imported some of the above arguments. On the one hand, Foucault criticized that the linguists thought there was a unifying structure (*langue*) behind the single utterings (*parole*). In contrast to 'the uniform simplicity of causal assignations' still inherent in structuralism, he aimed at reintroducing the 'concepts of discontinuity and transformation', which he knew from Canguilhem's adaption of the cybernetic vocabulary (Foucault, 1994, I, pp. 680, 827). On the other hand, Foucault argued that focusing on language, as structuralists did, narrowed their perspective. Language is not a representation of thinking, he plead, but only one 'form of communication'. The theory of language, thus, refers to a more general theory of communication that works with concepts, such as 'senders', 'receivers', 'messages', 'codes and regularities', that can now be used to describe 'the social' altogether (Foucault, 1994, I, pp. 825–826).

Remarkably, Foucault's critique of structuralism has much in common with the critique second-order cybernetics voiced regarding first-order cybernetics. They criticized that the initial attempts tended to downplay complexities, discontinuities and contingency. To overcome these shortcomings, they initiated a reflexive turn. What was coined 'cybernetics of cybernetics' on the one side (von Foerster, 1974), Foucault (1994, I, p. 583) described as an attempt to analyse structuralism in structuralist terms. Moreover, in the following years, Foucault would often refer to two authors and friends who explicitly drew on second-order cybernetics, the philosopher Gilles Deleuze and the mathematician and 'neocybernetician' Michel Serres (Clarke, 2014; Clarke & Hansen, 2009; Lafontaine, 2004, pp. 150–155). Therefore, one might argue that post-structuralism relates to structuralism as second-order cybernetics to first-order cybernetics.

Conceptual consequences: Foucault's network approach to power

Following my claim that Foucault had contact with cybernetic network ideas, I argue that they also had profound impact on his concepts, ranging from his theories of history and subjectivity to his relational concept of space (see the above quote from his essay *Of Other Spaces*). However, the scope of the article forces me to illustrate the impact of cybernetic network ideas picking only one concept. For this purpose, Foucault's concept of power is ideal as carving out a new theory of power is central to his work and has had a massive impact on many disciplines of the social sciences.

Foucault's emphasis on power marks a second major phase in his work, following the more or less structuralist analyses of the 1960s and dawning with his inaugural lecture on *The Order of Discourse*, which for the first time mentioned the forces shaping discourses beyond the internal control mechanisms. At the same time, Foucault's work on power is inspired by political activism. He supported the fight against the imprisonment of political activists following the ban of the Maoist *Gauche prolétarienne* and founded the famous *Groupe d'Information sur les Prisons* (GIP). Although in support of the cause, the GIP deliberately distanced itself from the organizational form of the *Gauche prolétarienne*, which was centralized and hierarchical in character, forming 'inquisitive

courts' to investigate the situation (Kindtner, 2016). Rather than drawing on this judicial imaginary, the GIP manifesto refers to cybernetic vocabulary, calling for more 'information' about a part of the 'social system' that remains a 'black box' (Foucault, 1994, II, p. 175). Foucault also imagined the organizational principles of the GIP as part of a communication circuit, in which the group would work as a decentralized 'relay', enabling the 'information to circulate' (Foucault, 1994, II, pp. 177–178). This technological imaginary persisted in his theory of power.

In the mid-1970s, Foucault translated his political commitment into an analytical form. Similar to his earlier critique of humanism and the sovereign subject, his perspective on power attacked the long-standing theory of 'law and sovereignty', aiming for a 'much more complex' analysis of the 'technology' that governs subjects (Foucault, 1978, p. 90). As we saw, the narrative that humanistic and mechanistic theories must be replaced with a new way of thinking that registers 'much more complex' relations was planted by cybernetics. It shifted the attention from being to doing and from questions of who and what to questioning how a certain effect is produced by connections among the elements of a network. Foucault formulated his approach in a similar manner, shifting the analysis of power *from what to how* and transforming it into a question of *ubiquitous control* that governs behaviour:

> The course of study that I have been following [. . .] has been concerned with the how of power. [. . .] the analysis [. . .] should refrain from posing the [. . .] question: "Who then has power and what has he in mind? What is the aim of someone who possesses power?" [. . .] Let us ask, instead, how things work at the level of on-going subjugation, at the level of those continuous [. . .] processes which subject our bodies, govern our gestures, rein [régissent] our behaviours etc. (Foucault, 1980, pp. 92, 97; translation adapted, following 1994, III, pp. 175, 179)

This concept of power entails socio-ontological assumptions that correspond with cybernetics.[7] Like the cybernetic concept of control, Foucault (1978, p. 93) assumed an 'omnipresence of power', arguing that there is no society without control mechanisms (see already Foucault, 1971, p. 8). Omnipresence, however, did not mean that power is a monolithic and stable structure or a substantial thing that can be owned. Just like the cybernetic critique of these naïve concepts of control, Foucault rejected to think of power as linear, causal steering originating in a 'control center' or the 'king's head' (e.g. 1978, pp. 49, 89), just as he refused theories of non-domination that envision a society free of power structures. In contrast to those modern theories, Foucault conceptualized power as cybernetics conceptualized control: as decentralized self-organization. He maintained that power is but 'the name' for the 'complex strategical situation' that *emerges from the permanent self-reproduction of the elements in a network*:

> it is produced from one moment to the next [. . .] in every relation from one point to another. [. . .] "Power," insofar as it is permanent, repetitious, inert, and self-reproducing, is simply the over-all effect that emerges from all these mobilities. (Foucault, 1978, p. 93)

This conceptualization not only echoes cybernetics' terminology, it also shares its epistemological premises. *Firstly*, power must be (re-)produced in any moment of time. It is a genuinely temporal phenomenon that only is in being permanently reproduced. In this process of self-reproduction, power, *secondly*, has a 'strictly relational character' (Foucault, 1978, p. 95); it is reproduced through the connectivity of the elements in a network that connect with each other 'from one point to another'. These processes, *thirdly*, are self-organizing in that they lack a controlling centre; the elements relate themselves to other elements, yielding a pattern that is neither planned nor pre-determined – what is called emergence by Foucault and cyberneticians alike. *Finally*, the network model of power has an impact on the role of subjectivity and of historical change.

In terms of historical change, any power pattern is a historical singularity. Foucault's genealogical project attempted to trace how a pattern emerged and evolved over time by delineating the complex interaction of transformations: 'this analysis requires the deployment of a complex and tight causal network [. . .]. We have to establish a network which accounts for this singularity as an effect' (Foucault, 2007, p. 63–64). As indicated above, this historicist approach stressed the 'concepts of discontinuity and transformation' (s.a.) and the concepts 'of event and of series' (Foucault, 1971, p. 23), thereby paralleling the cybernetic concept of evolution Foucault knew from Jacob and Canguilhem. His description of genealogy prolonged this affiliation, coming very close to the wording of second-order cyberneticians. Like Foucault, they maintained that each state in evolution is a singularity that must be explained by 'a causal network of sequentially coupled events, in which each event is a state of the network that appears from a transformation of the previous state' (Maturana & Varela, 1985, p. 206; my transl.).

Cybernetic concepts of emergence and evolution provided an epistemology in line with Foucault's critique of viewing history as a linear, continuous development. Adopting the cybernetic imaginary, however, also transformed the role of the subject. In Foucault's network approach to power, subjects are no longer envisioned as integer persons or human beings, as it would be in the sovereignty paradigm. Instead, the individual now 'functions, serves as node in the systemic network' (Foucault, 1994, II, p. 165), or it occurs as a relay in the electric circuit:

> Power functions, power is exercised [s'exerce] as a *network*, and in this network, individuals do not only *circulate*, they are always in a position in which they experience power as well as they exercise this power; [. . .] they are always their *relays* (Foucault, 1994, III, p. 180; emphasis added).

Here, the cybernetic imaginary is a powerful tool for Foucault to generate a completely different epistemology of power and subjectivity. He undermined the humanistic ideas of *unity and identity* by metaphorically dissolving the human body into a diversity of 'relays, communication routes, and support points' of power (Foucault, 1975, p. 33; my transl.). As a node in a network, multiple threads of the network run through the subject, which, in turn, is neither an integrated unity nor an independent, sovereign arbiter. In a socio-ontological imaginary consisting of electric circuits, networks or systems, this argument is not plausible any longer: a relay is always controlled by an

incoming power flux. The metaphors block the way to thinking of the subject as a sovereign entity.

However, while Foucault often stressed the ways the subject is conditioned by power technologies, for instance by disciplinary power, the image of a subject as a relay in an electric circuit already implied that the subject has an active part, too: a relay is not only controlled by the incoming power, it also always (re)directs it. This cybernetic argument enables Foucault to think of the subject as powerful despite being controlled by its relations. The metaphor of the relay therefore proves that Foucault already held an active concept of subjectivity in the mid-1970s. In his later work from about 1978 to his death in 1984, he would shed more light on this active dimension, starting from the idea that the 'base of the network [. . .] has its own logic as a game of interaction' (Foucault, 2015, p. 56; my transl.). As in cybernetics, the game metaphor here provides an intelligible model of acting in a complex situation of interdependence and uncertainty.[8]

In sum, Foucault's explanations illustrate that he used the metaphorical models of cybernetics to develop his self-organizing and relational concept of power. As the quotes show, he did not only refer to the network concept but blended it with circuit, diagram, machine, matrix and game metaphors, as it was proposed by cybernetics. Foucault's so-called microphysics of power is therefore indeed related to microelectronics, insofar cybernetic research inspired his theory as well as the development of computer and Internet technology in the 1970s. Moreover, cybernetics' impact on Foucault goes beyond vague metaphors as he incorporated the rationality behind it, stressing complexity, circulation and connectivity. For that reason, his mechanismic metaphors are not mechanical metaphors (that imply linear cause-effect connections) nor are they mechanistic in the 'old' sense, focusing on the parts of a machine (a spring, a pump). In explicit contrast to ontological approaches, Foucault utilized the operational perspective developed in cybernetics.

Conclusion

In this article, I explored the rise of network concepts. Motivated by the apparent spread of network ideas in social theory, management practices and politics, I chose the writings of Michel Foucault as a starting point for a historicocritical investigation into the epistemology of network-based reasoning. Unravelling some of the sources, inspirations and conceptual dimensions of network metaphors in Foucault's writings, I argued that network concepts here are rooted in cybernetics, a research programme that called for a 'new thinking' that would overcome the 'old' ontological and mechanical views dominating modern sciences. 'Network concepts' is, thus, a pars-pro-toto for a set of narratives and concepts that expresses a specific, operational epistemology based on information and circulation, connectivity and complexity.

As I demonstrated, cybernetic metaphors and arguments are present in Foucault's writings. This is relevant because deciphering the impact of cybernetics expands a new, still not sufficiently investigated perspective on his work. It systematically explores a generative source of his theory that provides the background for him distancing himself from neo-Marxism, psychoanalysis or theories of sovereignty, as all of them hold 'under-complex' concepts of power. Of course, I only scratched the surface as to how

cybernetics influenced Foucault's work, focusing on his network approach to power. More research is needed. However, the relevance of Foucault goes beyond this exegetic dimension, because his concepts had a massive impact, disseminating cybernetic network ideas to many disciplines, which now use the concepts without reflecting on their origins and epistemological consequences.

This can create methodological challenges. Firstly, much research on the 'network society' and 'network governance' diagnoses (or even supports) a spread of networks and a higher degree of connectivity, but they do so by using concepts that are designed to view the world as a world of complex networks. Their diagnoses are, thus, potentially an artefact of their conceptual framework. Moreover, the associated argument that computer and Internet brought a structural change that makes networks necessary is denounced. As the article showed, describing the society in terms of networks was possible even before network technologies took off. Secondly, critical approaches often use Foucault's concepts to interrogate modes of reflexive, cybernetic or technological governance without sensing that their own concepts bear a similar signature (e.g. Bröckling, 2003; Larsson, 2020). Exploring the impact of cybernetics on Foucault, and on social theory in general, will help to detect and tackle those methodological challenges (Sprenger, 2019, pp. 63–64, for instance, discusses this challenge explicitly). For doing so, further research will have to investigate the immense breadth of the cybernetic legacy, tracing and comparing cases that seem most dissimilar.

Finally, in further research, the political dimension of the cybernetic concepts must be explored: What are the historical conditions of them getting prominent since the 1970s? What is their impact on political institutions and decision-making? Starting from Foucault, we observe that applying the cybernetic imaginary to the social world was instrumental to discouraging other political approaches, such as neo-Marxism. His distance grew over the years into a rather harsh critique of socialist theories and practices, arguing that everything of this tradition must be condemned (Foucault, 1994, III, p. 398). Yet, Foucault also discharged institutionalist approaches that focused on the procedures and organization of democratic representation. Although he respected their past innovations, he argued that their approach has become 'sterile', lacking any fruitful contribution to solving the crises of the 1970s and 1980s (Foucault, 1994, IV, pp. 372–373).

In general, Foucault strongly argued against representative political institutions, such as universal intellectuals or political parties. Parties, he maintained, are typically modern organization that want to integrate the subject, submitting it to defend positions it does not hold (e.g. Foucault, 1994, IV, pp. 51, 746). Similarly, he cautioned against forms of protest that organize in parties or judicial committees, as the above example of the GIP demonstrated, and criticized the integration of the subject in the welfare state (Foucault, 1994, IV, p. 368). Against those forms of modern, representational organization, Foucault argued for policies and institutions that follow the network rationality, the GIP and other social movements being prominent examples for social organizations that do not rely on representation and collectivity but allow for flexibility, experimentation and innovation (e.g. Foucault, 1994, IV, pp. 108–109, 372–383).

As I have argued elsewhere (August, 2020), this is a common position linked to network approaches: In terms of normative preferences and their institutional consequences, they tend to encourage diversity, creativity and flexibility, while they are highly

critical of hierarchical arrangements and representative institutions. Those observations correspond to the findings of Boltanski and Chiapello (2005), who argue that recent capitalism is shaped by a network rationality that fosters permanent flexibility, connectivity and adaptability. Network concepts, and the related metaphors and arguments, thus, seem to have a profound impact on shaping economic as well as political discourse and institutions. As this article suggests, the network rationality does not coincide with neoliberalism, as some researchers claimed (Brown, 2015). It rather forms a distinct tradition of diverse social theories and political practices inspired by cybernetics. Further investigating their origins, trajectories and consequences will therefore enhance our analysis of contemporary societies.

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Notes

1. Of course, the semantics of systems and networks has forerunners in infrastructure, physiology and physics, the history of which would reach well beyond the scope of this article. For some aspects, see Friedrich (2015).
2. This does not necessarily mean that he knew their background or intended to apply cybernetics. My argument is not dependent upon a claim of intentionality, although it will present passages of Foucault's work that may suggest so.
3. When quoting from Foucault (1994), all translations are my own.
4. Using cybernetic vocabulary, Foucault (1994, I, p. 800) also argued that the author is not the prototype of a sovereign individual but a 'function', the 'effect of a complex operation' in a system of knowledge that is permanently re-produced.
5. In a later essay prolonging this debate, Baudrillard (1978) criticized Foucault and others for their conceptual similarities to cybernetics. However, his essay remains highly speculative and polemic, giving no systematic account of either cybernetics or Foucault.
6. He located the frontrunners of this idea at the Massachusetts Institute of Technology, where Norbert Wiener had started a proto-cybernetic research group. Also, he referred to a new discipline called bionics, which sees itself in a cybernetic tradition.
7. For the socio-ontological quality, see Saar (2007, pp. 208–210).

8. Foucault blended game metaphors (including strategy, tactics) with network, system, machine metaphors in earlier stages, for instance, when introducing the concepts of power (s.a.) and of dispositif (Foucault, 1994, III, p. 299). In his later work, the game metaphor became more elaborated. It substitutes war metaphors, which he dismissed after briefly 'flirting' with the so-called war hypothesis.

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