Bats in the Belfry: On the Relationship of Cybernetics and German Media Theory

Jan Müggenburg
Leuphana University of Lüneburg

ABSTRACT

Background *When German media theory (GMT) took shape in the early 1980s it was influenced by cybernetic concepts; however, it eventually discovered the history of cybernetics as an object of research.*

Analysis *The article follows the assumption that GMT's double reference to cybernetics must be characterized as the result of both a shared epistemology and a specific discursive constellation. After contrasting McCulloch's concept of a synthetic physiological a priori and Kittler's concept of a technological a priori it examines how GMT adopted concepts from cybernetics, and how its members eventually became fascinated by the history of cybernetics.*

Conclusion and implications *The article concludes that the double reference to cybernetics explains its special role in GMT, while raising problems for GMT's current fascination with cybernetics.*

Keywords *Cybernetics; Second order cybernetics; German media theory; Warren McCulloch; Heinz von Foerster; Friedrich Kittler*

RÉSUMÉ

Contexte *Quand elle a pris forme au début des années 80, la théorie médiatique allemande (TMA) a été influencée par des concepts cybernétiques; plus tard, elle découvrirait l'histoire de la cybernétique en tant qu'objet de recherche.*

Analyse *Cet article suppose que ce double rapport à la cybernétique entretenu par la TMA est le résultat d'une épistémologie partagée et d'une constellation discursive spécifique. L'article, après avoir contrasté le concept d'a priori synthétique physiologique de McCulloch avec celui d'a priori technologique de Kittler, examine comment la TMA a adopté des concepts cybernétiques et comment les adhérents de celle-ci ont développé au fil du temps une fascination pour l'histoire de la cybernétique.*

Conclusion et implications *Cet article conclut qu'un double rapport à la cybernétique explique le rôle spécial de celle-ci dans la TMA en même temps que ce rapport soulève des difficultés en ce qui concerne la fascination actuelle de la TMA pour la cybernétique.*

Mots clés *Cybernétique; Cybernétique de second ordre; Théorie médiatique allemande; Warren McCulloch; Heinz von Foerster; Friedrich Kittler*

Jan Müggenburg, PhD, is Postdoctoral Research Assistant at the Institute of Culture and Aesthetics of Digital Media (ICAM) at Leuphana University of Lüneburg, Germany. Email: mueggenburg @leuphana.de .

Introduction: Break out from the ghetto of the mind

> However one defines feeling, perception, consciousness, substantial
> knowledge—so the definition is infinite and unambiguous—each and all
> are well within the tricky scope of circuitry. … Man-made machines are
> not brains, but brains are a very ill-understood variety of computing
> machines. Cybernetics has helped to pull down the wall between the great
> world of physics and the ghetto of the mind.
>
> —McCulloch, 1989a, pp. 162–163

> The media revolution of 1880, however, laid the groundwork for theories
> and practices that no longer mistake information for spirit. Thought is
> replaced by a Boolean algebra, and consciousness by the unconsciousness
> … . And that the symbolic is called the world of the machine undermines
> Man's delusion of possessing a 'quality' called 'consciousness,' which
> defines him as something other and better than a 'calculating machine.'
>
> —Kittler, 1999, pp. 16–17

Warren S. McCulloch and Friedrich A. Kittler share a remarkable commonality: their scientific work can be described as a sort of exorcism. McCulloch (1989a), who is arguably the most important founder of American cybernetics outside of Norbert Wiener, turned against mentalist theories of the brain that took consciousness, feelings, and other qualities of the mind for nonphysical phenomena that hovered in the head "like bats [in] the belfry" (p. 158). McCulloch (1989a) wanted to expose these "ghosts" (p. 158) as mere products of neuronal circuitry-operations. The literary scholar Friedrich Kittler, whose work was instrumental for large parts of the German-speaking media theory, also hunted for bats. Contrary to McCulloch, however, he did not expect to find them in mentalist theories about the brain, but in the belfry of the German-speaking humanities. According to Kittler (1980) these ghosts, for example, were called "history, mind," or plainly "man" (p. 8, author's translation). Artificially kept alive for decades by a humanist and hermeneutic tradition within German studies, they had to be "exorcized" (p. 9, author's translation) by means of poststructuralist theory. By examining the material networks underlying these apparitions, both exorcists wanted to break out from the ghetto of the mind and expel the bats of their own disciplines.

This article looks at the complicated relationship between cybernetics and German media theory (GMT), starting with the programmatic proximity of their founders.[1] There is no doubt that cybernetics plays a special role in GMT and that its influence differs from the influence other schools of thought had on GMT, such as psychoanalysis, post-structuralism, or the media theory of the Toronto school. Large parts of GMT after Kittler have been directly informed by cybernetic concepts such as "feedback," "information," or "recursion," while at the same time many of its representatives have chosen cybernetics as the central object of investigation regarding a media history of the twentieth century. This double (or recursive, if you will) reference to cybernetics

as archive and object is perhaps the reason why GMT never ceases to be fascinated by it: "something with media" turns into "something with cybernetics."

Addressing the complex relationship between cybernetics and GMT goes beyond simply exploring the impact of the history of ideas or the discursive influence of cybernetics on GMT—or even a structural comparison of the two approaches. To better understand the particular role cybernetics plays in GMT, this article argues that GMT's double reference to cybernetics must be characterized as the result of *both* a shared epistemology and a specific discursive constellation around 1980. First the article takes a closer look at the similarities and disparities between McCulloch and Kittler's exorcism in particular, and cybernetics and GMT in general. It then examines the epistemological proximity of the key assumptions of cybernetics and GMT respectively: the physiological and the technological *a priori*. Finally, it looks at how in the mid-1980s— via the work of Heinz von Foerster (1985, 1992; von Foerster & Bröcker, 2002; von Foerster & Glasensfeld, 1999; von Foerster & Pörksen, 1998) and other liminal figures— cybernetics inscribed itself doubly in the nascent GMT as a theoretical offer as well as the object of media-theoretical research.

Same but different

At first glance the similarities between McCulloch and Kittler's research agendas are striking indeed. McCulloch attempted to disprove mentalist explanations of human consciousness by experimentally examining the material basis of thinking. From the 1930s to the 1960s he fought for his conviction regarding the biophysical explicability of neuronal processes and was eager to "demystify knowing, as far as possible, and separate genuine mysteries from what is scientifically knowable" (Heims, 1991, p. 36). McCulloch (1989a) argued that the "bats" (p. 158) he was hunting for—i.e., vociferous nuisances such as "feeling, perception, consciousness" (p. 162)—had gone to the head during the nineteenth century, after a nascent biology had successfully "exorcised" (p. 158) them from the body. In order to finally eradicate them, he wanted to formulate mechanical principles that would explain these "affairs called mental" (p. 158). The primary goal of Kittler (1990)—who adopted the perspective of discourse analysis of "putting things in order" (pp. 371–372)—on the other hand was to rid his own discipline of similar "timeless values" (Winthrop-Young, 2011, p. 22) and to expose the "discursive regimes" (p. 51) that produced these values in the first place. Kittler (2012) no longer wanted to ask the objects of German studies "what they meant, represented, reflected, or criticized," (p. 117, author's translation) but instead wanted to examine texts on the "level of their pure existence" (p. 117, author's translation). He wanted to deconstruct hermeneutic explanations of literary works by uncovering the discursive basis of their analysis. In this respect, the materiality of neuronal networks from McCulloch's experimental epistemology corresponds with Kittler's (1990) historically contingent "networks of technologies and institutions that allow a given culture to select, store and process relevant data" (p. 369). While one network creates the false impression of a consciousness free from material ties, the other produces the illusion of a coherent and continuous speaking subject that appears to face us in poems and novels.

One could of course reply that the similarities between McCulloch and Kittler's exorcisms are merely superficial and confined to the goals of their respective research

programs. After all, the two ghostbusters operated according to radically different methods (dissection, microscopy, and invasive electro stimulation versus discourse analysis) and worked on entirely different objects of investigation (brain versus text). Nevertheless, there are passages in Kittler's texts in which his media theory comes surprisingly close to McCulloch's (1989b) "experimental epistemology" (p. 359). This applies to the Kittler's (1990) "discourse network of 1900" (p. 117), for example, where he diagnoses the disintegration of the "authority of production" (p. 186)—i.e., "the mind"—in its psychophysical parts. Kittler argues that on the conditions of the new media film, gramophone, and typewriter, these workings of the brain are no longer to be understood as processes of a conscious mind but only as exclusively scientifically describable operations (see Parrika & Feigelfeld, 2015). Later he even added that the introduction of the computer, unifying these analogue media, would reinforce this scientific understanding of the brain and lead to its interpretation as a calculating machine: "… everything is nothing but a modular device" (Kittler, 1993, p. 152, author's translation). That said, Kittler leaves his readers in the dark about the question of whether this thesis is epistemological or ontological in nature: is Kittler identifying a Foucauldian discourse formation, which is determined by media and could thus only think of the brain as a calculating machine, or *is* the brain for him—just as for McCulloch—nothing but a calculating machine, which only the media exposes as such? The answer to this question bears consequences for the relation between *cybernetics à la McCulloch* and *media theory à la Kittler:* do we have to understand McCulloch's exorcism as part of the episteme that Kittler (1990) calls "discourse network of 1900" (p. 117), or is the brisance of Kittler's media theoretical exorcism ultimately itself indebted to a "cybernetic way of thinking …" (Hörl & Hagner 2008, p. 17, author's translation) that has affected the humanities as well as the social sciences during the second half of the twentieth century?

The programmatic proximity of their founders, however, is only one of many noticeable commonalities shared by cybernetics and GMT and at least four more must be mentioned here. First, they are both what Thomas Macho calls "temporary signature sciences" (cited in Pias, 2016, p. 15). They vehemently oppose the specialized disciplines of their time, subsequently fundamentally alter them, and finally are threatened with being merged into them. Second, this order of critique, transformation, and diffusion is in both cases based on a "universal, in any case meta-theoretical approach" and they both "promote terms and figures of thought with a wide and cross-disciplinary applicability" (Bergermann, 2015, p. 48, author's translation). Cybernetics and GMT relocate the problems of other disciplines to a higher (or "lower," depending on the perspective) level of analysis and can thus be called "meta sciences." At this, both act as a kind of a "philosophy by other means" (Hayles, 1999, p. 95), inasmuch as they seek to negotiate traditional questions of philosophy, such as the conditions, possibilities, and limits of human cognition. Third, this universalism is expressed in cybernetics as well as in media theory via an idiosyncratic and at times self-referential terminology, which facilitates taking up this superordinate position when dealing with the most disparate objects. Fourth, both discourses are research programs dominated by men with a preference for technological clarification and a propensity to put ques-

tions that are social, cultural, or philosophical in nature on their "media-technological feet" (Winthrop-Young, 2011, p. 59).

Of course—and this must not go unmentioned—such a comparison from the perspective of the history of the sciences is a rather daring manoeuvre. On the one hand, this is because equally fundamental antagonisms can be mentioned: while cybernetics came out of the military-industrial-academic complex of American postwar sciences (see Kline, 2015), GMT is first and foremost the result of a delayed reception of French post-structuralism within the humanist enterprise in the Federal Republic of Germany during the late 1970s that was thirsty for new theories. While the former constructed actual machines in order to answer philosophical questions by other means, the praxis of media theory—and even here, only in some exceptional cases—would be limited to occasional programming, to some tinkering with soldering irons, or to dismantling some old computers. And while cybernetics never achieved the ranks of an actual "discipline" in its country of origin, never founded any courses of study, and only survived institutionally in the form of singular societies, GMT was taken by surprise in light of its own success when it became a course of study for the masses and was internationally recognized as a "*Sonderweg,*" or special path, in research (Breger, 2009). A large percentage of students, who wanted to study "something with media" during the 1990s, found themselves in classes where texts from Kittler, Sybille Krämer, Bernhard Siegert, and other representatives of GMT were canonized. Furthermore, what goes for cybernetics as well as for media theory is that neither is a methodologically, institutionally, or programmatically coherent, distinct, and addressable construct. Both were, or are, highly heterogeneous and in parts contradictory discourses that become increasingly hard to grasp, the harder one tries.[2] In spite of the dubiousness regarding the history of science in reference to both cybernetics and GMT, this article nevertheless compares two key assumptions underlying McCulloch's and Kittler's exorcisms respectively.

Physiological and technological *a priori*

The first central aspect of cybernetics' role in GMT is the epistemological proximity of their two key assumptions. Both research programs are informed by an apriorism that is interested in those elements and factors of cognition that precede the production of knowledge and are thus not immediately accessible to examination and reasoning. On the one hand, there is McCulloch's search for a "synthetic physiological *a priori*" (Lettvin, Maturana, McCulloch, & Pitts 1989, p. 253) of human knowledge, which eventually became one of the central research desiderata of cybernetics. His aim to experimentally identify those structures of the human sensory system that decide on the what and the how of human knowledge *a priori* was not just of interest to the neurophysiologists of the original cybernetics group but kept the cybernetic discourse with its various branches busy well into the 1960s and 1970s. On the other hand, GMT works hard on Kittler's (1999) postulation of a "technological a priori" (p. 117), which attempts to account for the technological mediatedness regarding all knowledge that pertains to human cognition: "we knew nothing about our senses until media provided models and metaphors" (Kittler, 2010, p. 37). And it is commonly accepted that the lowest common denominator of the numerous heterogeneous approaches of GMT

may be brought down to this "media-apriorism … as … [the] initial problem" (Winthrop-Young, 2008, p. 122, author's translation).

Of course, the fact that cybernetics and GMT cultivate their own respective varieties of *a priori* thinking is in itself not all that informative. The philosophical history of the nineteenth and twentieth century is—in the wake of Immanuel Kant—rife with apriorisms, and more than a few deem the question what it is that precedes cognition to be the central and most important philosophical question since Plato (see Kompa, Nimtz, & Suhm, 2009).[3] But wherein consists the specific epistemological proximity of physiological and technological *a priori*? Is there a certain property that distinguishes them from the synthetic, empirical, material, dialectical, historical, economic, religious (and many more) *a prioris* from the history of philosophy? In order to answer this question, I will briefly outline the genesis of the cybernetic apriorism in order to subsequently correlate it with the "technological *a priori*" of GMT.

Shortly after his studies in philosophy in New Haven and his subsequent medical studies in New York, McCulloch's assumption that neurophysiological research practices and epistemological thought could be advantageously linked materialized.[4] During his psychiatric training at Rockland State Hospital for the Insane in nearby Orangeburg, New York, McCulloch met the German neuropsychiatrist Eilhard von Domarus and the American philosopher Filmer Stuart Cuckow Northrop in the early 1930s (see McCulloch, 1974). Both scientists encouraged him to investigate pathological phenomena such as psychopathy from a logical-structural perspective and not from a clinical one (see Abraham, 2016). Inspired by this new perspective, McCulloch dedicated his future research to a question that had bothered him ever since his student days: "What is a Number, that a Man May Know It, and a Man, that he May Know a Number?" (McCulloch, 1989c). McCulloch hoped that by the unified application of analytic philosophy and the experimental methods of neurophysiology, particular mechanisms in the brain could possibly be identified, which, based on their structure, could be immediately linked with the cognitive operations during calculating.

In the second half of the 1930s, McCulloch would continue on this way of coalescing neurophysiology and philosophy. Upon his return to Yale University in 1934, he was able to deepen his experimental skills as an associate in the laboratory of neurophysiology of the Dutch physiologist Johannes Gregorius Dusser de Barenne. In numerous experiments he dealt with the localization of specific areas of the brain in the cortex and their attribution to certain physical functions (see Abraham, 2016). Furthering his long-term objective—i.e., a scientifically substantiated epistemology—was the idea of a *physiological synthetic a priori*, which he found in the work of the German pharmacologist and physiologist Rudolf Magnus. Magnus, of whom he learned thanks to Dusser De Barenne, argued that while Kant's synthetic *a priori* "is normally interpreted 'philosophically-psychologically,' that is, as an aspect of the psyche … the a priori must also have a physiological basis" (Abraham, 2016, p. 60; see also R. Magnus, 1930; O. Magnus, 2002). The possibility of such a corporally anchored filter of cognition strengthened McCulloch's feeling that he was on the right track with his "search for a physiological substrate of knowledge" (McCulloch, 1989c, p. 1).

A decisive enhancement to McCulloch's apriorism occurred during the 1940s, when the neurophysiologist—in his new capacity as a professor at the Illinois Neuropsychiatric Institute of the University of Illinois in Chicago—met a group of mathematical biologists led by the Ukrainian physicist Nicolas Rashevsky (see Abraham, 2016). Rashevsky's research project consisted of developing mathematical models that would allow him to analyze psychological and neurological phenomena. Rashevsky thought this abstracting approach to be imperative, since the objects in the domain of biology (such as cells, neuronal networks, etc.) were essentially not describable by man in their entirety. Due to their enormous complexity, mathematical biology was supposedly dependent on "… highly idealized systems, which at first may not even have any counterpart in real nature …" (Rashevsky cited in Abraham, 2002, p. 16). In this approach, McCulloch recognized recognized the methodological key to the unification of contemporary neurophysiology and Kantian idealism he had hoped for.

Of peculiar interest to the epistemological proximity of McCulloch's apriorism and the technological *a priori* of GMT is the fact that McCulloch's apriorism subsequently made more and more recourses to technological concepts. This especially pertains to his joint works with Walter Pitts, whom he met through Rashevsky's entourage. McCulloch and Pitts' famous model of neural networks (see Arbib, 2000) constitutes nothing more than the attempt to interconnect experimentally acquired insights regarding the neurophysiological structure of the brain with the formal logic of the Turing machine (McCulloch & Pitts, 1989a). Their aim was to reveal the material preconditions of thinking—albeit accessed by way of abstraction and idealization. As chairman of the Macy Conferences from 1946–1953 (see Heims, 1991; Kline, 2015), McCulloch was able to establish this neurophysiological-biophysical apriorism firmly within that universal discipline called cybernetics. Together with Pitts, he would repeatedly return to classic epistemological questions that he wanted to coalesce with the cybernetic approach (see McCulloch & Pitts, 1989b). By the end of the 1950s, this development reached its preliminary climax at the Research Laboratory for Electronics (RLE) of the Massachusetts Institute of Technology (MIT) in Boston, where McCulloch had transferred with some of his associates in 1951. As members of McCulloch's research team, the biologist Humberto Maturana and the neurologist Jerome Lettvin researched the functional principles of the retina of the northern leopard frogs (*Rana pipiens*) and concluded that the frog's visual perception is determined by "a physiological synthetic *a priori*" (Lettvin, Maturana, McCulloch, & Pitts, 1989, p. 253), which does not allow for any objective knowledge regarding an independent reality but, quite the contrary, initially determines what "reality" is for the frog. On the way to this conclusion, at least Lettvin was heavily inspired by the application-oriented and militarily demanded research work in the area of "pattern recognition" that his colleague and friend Oliver Selfridge conducted (Lettvin, 1989, p. x).[5] His search for a physiological *a priori* of cognition was superimposed by a kind of machine thinking that let abstract and idealized filters of cognition become "real" in the first place. "The retina," following Lettvin (1989), "is a machine, meaty and miraculous, but still a machine" (p. x). This strategy of overlapping the physiological *a priori* with a mechanical *a priori* would

decisively influence "second-wave cybernetics" (Hayles, 1999, p. 135), which will be discussed below.

If one wants to connect this cybernetic merger of physiology and machine with Kittler's thesis regarding man as calculating machine quoted at the beginning of this article, it has to be registered first that Kittler's apriorism initially links with discourses from the history of philosophy that are completely different from McCulloch's cybernetics. Whereas McCulloch's search for physiological proof of the Kantian *a priori* led him to follow the "tradition of a priori philosophizing" that started with Plato, Kittler's technological *a priori* stands in the line of tradition of a "descriptive apriorism" (Halbfass, 1971, p. 476, author's translation) that originated in Edmund Husserl's phenomenology and that Kittler reached by way of the intensive influence of Foucault (see Flynn, 2016). Instead of suspecting that the prerequisites and conditions of cognition lie within the transcendental (or, as with McCulloch, neurophysiological) structures of individual consciousness, this form of apriorism searches for a historically evolved and supra-individual formation that "in a given period, delimits in the totality of experience a field of knowledge" (Foucault, 2007, p. 158). Kittlerian media-*apriorism* is first and foremost an adaptation and continuation of this historicizing and deconstructing *apriorism*, which was especially influential in French structuralism and poststructuralism (see Ernst, 2015; Tuschling, 2016).

However, in addition to this heavily pronounced discourse-analytical side of Kittler's work, which examines the rules that govern the historical meaning of cognition, thinking, and language, there is another assumption in his media theory that suggests that cognition, thinking, and language *are* in fact the operations of a bodily machine. Accordingly, Kittler assumes a categorical compatibility of machine and body—following Marshall McLuhan (2013)—based on which technological media could be connected to our sensory organs. Even if Kittler inverts McLuhan's media-anthropocentric thesis and speaks of an overpowering of the senses and organs by media instead of the technological enhancement of man (see Mersch, 2006), McCulloch's cybernetic apriorism appears to have had an immediate impact on this aspect of Kittler's media theory. As is well known, McLuhan has been one of the authors who made the cybernetic paradigm—"one in which material reality could be imagined as an information system" (Turner, 2008, pp. 4–5)—accessible to the academic public and compatible with other theoretical discourses since the early 1950s. As a member of the Explorations Group—a precursor to the Toronto School of Communication Theory (see Darroch, 2008)—McLuhan had learned about Wiener's cybernetics through multiple sources and had started a "conversation … with advocates of cybernetic theories," such as Wiener himself (Darroch & Marchessault 2016, pp. x–xi). At any rate, the superposition of the physiological with mechanical conditions of knowledge constitutes the core of the epistemological relationship between cybernetics and GMT. Both approaches postulate a compatibility of physiology and technology, and they derive a fundamental material contingency (and, in the case of Kittler, manipulability) of human cognition from it.

From second-order cybernetics to German media theory

Their epistemological proximity, however, is only one aspect of the special relationship

between cybernetics and GMT. The fact that cybernetics was discovered as an object of investigation by Kittler and his "students" during the 1980s and identified as a key historical discourse for media history of twentieth century is every bit as important. That this "rediscovery" of cybernetics did not happen accidentally, but on the contrary, occurred due to a specific discursive constellation around 1980, will be shown in the following section. One of the decisive liminal figures between cybernetics and media theory is the Austrian physicist Heinz von Foerster, who was equally present in both discourses and who consequently played a crucial role in sparking GMT's interest in cybernetics.

Once Foerster had immigrated to America in 1949, he had a chance to meet the cyberneticists of the first generation around Wiener and McCulloch as a participant at the Macy Conferences. During the 1950s, Foerster (1958), a professor of electrical engineering at the Department for Electrical Engineering at the University of Illinois, demonstrated an aptitude for research politics when he reformulated the cybernetic program as the research of "biological computers" (p. 240). In doing so, Foerster was oriented toward McCulloch's physiological apriorism and wanted to focus on the construction of "artificial sense organs for systems displaying artificial intelligence" (1958, January 7). In this way, in 1957 he succeeded in convincing the mainly military research sponsors of the idea to found a new and independently operating division at his department called the Biological Computer Laboratory (see Hutchinson, 2008; Mueller, 2007a). One of the machines built at this new laboratory was an artificial retina called the "NumaRete," which imitated the frog eye's capability of "pattern recognition" (see Müggenburg, 2016; Asaro 2007) as described by Lettvin, Maturana, McCulloch and Pitts (1989). During the period of growth in the first half of the 1960s, Foerster was able to win over some of the protagonists of the early history of cybernetics, such as the neuropsychiatrist Ross Ashby and the psychologist Gordon Pask, as either permanent staff members or as visiting researchers for his new laboratory. Additionally, he hired researchers, such as the German philosopher Gotthart Günther and the Chilean biologist Humberto Maturana, who would only get to know cybernetics by way of their research activity at the Biological Computer Laboratory, but who would later contribute to cybernetics' theoretical advancement (see Wilson, 1979). The research group was completed by a heterogeneous group of PhD students who were fascinated by Foerster's transdisciplinary program and who were incorporated to a high degree in the everyday research within the context of the funded projects (see Mueller, 2007a). In order to be able to further finance his growing division, Foerster had to extend the research program of his laboratory, and he had to convince his sponsors of cybernetics' authority regarding contemporary research trends, such as "Artificial Intelligence Research," "self-organization research," or "bionics" (see Kline, 2015; Müggenburg, 2014). Initially, he was able to rely on points of contact in Washington that were favourably inclined toward him. Because of its involvement in conferences sponsored by the military, the Biological Computer Laboratory developed into a well-connected and renowned institute during the 1960s (Mueller, 2007a).

In the second half of the decade, however, it became increasingly difficult for Foerster to keep the research funds flowing. Whereas in the early 1960s Foerster was

still able to benefit from cybernetics' reputation as an innovative and future-oriented science, things changed when its momentum started to slow down and its universal approach was increasingly called into question (see Kline, 2015). Competing research perspectives, such as the symbolist approach within Artificial Intelligence Research, edged cybernetics—which was still insisting on its neural approach—away from its traditional areas of research and application. Additionally, Foerster was no longer able to rely on the first generation of cybernetics that had supported him in founding his laboratory. Changes of personnel in Washington, as well as a modification to funding guidelines for military foundational research, caused Foerster's well-established connections with military research laboratories to gradually wither around 1970 (see Mueller, 2007b). While the Biological Computer Laboratory thus had to struggle with financial straits during the second half of the decade, its research focus also shifted: away from the construction of electrical machines toward rather theoretically oriented operations. In doing so, Foerster and his colleagues dealt more and more with social problems, such as human language, and they were thinking along the lines of—usually unsuccessful—project proposals dealing with societal fields of application for cybernetics in various areas (Mueller, 2007a). Small, student-organized projects and teaching formats borne by the American counterculture were now characteristic for the laboratory and lead to controversies with the university administration (see Clarke, 2012). Once Foerster had filed for retirement in the summer of 1974, his division at the Department for Electrical Engineering was first phased out and finally liquidated in 1976 (Mueller, 2007b).

Accordingly, whereas the first years of the Biological Computer Laboratory were characterized by designing machines, close proximity with the military-industrial-academic complex, and far-reaching independence from the department and the university administration, the second half of the decade reveals "a departure from the mainstream of research" (Mueller, 2007a, p. 288), decreasing support from Washington, and an orientation toward teaching. However, from precisely this turbulent late stage arose numerous writings that are nowadays commonly seen as the most influential products of the research conducted at Foerster's laboratory. Here, the heterogeneous strands of research, with Foerster's theory of "second-order cybernetics"—or, as he also used to call it, "cybernetics of cybernetics" (Scott, 2004, p. 1373)—on the one hand and Maturana's "biology of cognition" on the other (see Köck, 2015), merged to become a transdisciplinary theory of cognition. The integration of the concept of an "observer" into cybernetics would reach far beyond the end of the laboratory and it would have an effect on various scientific and non-scientific fields, before finally reaching Kittler and the GMT.

During the 1980s, Foerster periodically left his retirement home in Pescadero, CA, to accept invitations to speak in Europe. This was mainly the case since numerous influential authors made his texts popular in the German-speaking discourses during the first half of the decade, and since they consequently triggered a broad Foerster reception within the context of postmodern theory construction. The philosopher and family therapist Paul Watzlawick, for instance, would present Foerster's work to a large audience early on, thus establishing him as a central thinker of radical constructivism

and of the nascent systemic therapy (see Levold, 2015; Watzlawick, 1981, 1985). Niklas Luhmann (1984) also had a large influence on the Foerster reception, since he would adopt numerous concepts of the latter for his sociological systems theory and since he quoted the cyberneticist in his main work, *Soziale Systeme*, multiple times and in prominent positions (see Clarke, 2011). Probably the most important scientist with regards to the reception of Foerster's texts is the Germanist Siegfried J. Schmidt, who, similar to Luhmann, was conversant with the texts of the second wave of cybernetics since the early 1970s. By adapting the system-theoretical deliberations of Foerster and others such as Maturana to his theory of communication, Schmidt (1987) accomplished for literature and communication studies that which Luhmann would simultaneously accomplish in the field of sociology. Furthermore, Schmidt—together with the linguist Wolfram Karl Köck—was after translating and republishing essays central to Foerster's and Maturana's works in various anthologies that had a high circulation (see Foerster, 1985, 1992; Maturana, 1982). Within the context of this recirculation of Foerster's texts, he would eventually also be observed and discussed by the Berlin postmodernists, who were thirsting for new theoretical trendsetters that could further their discourse on media arts and media sciences (see Ars Electronica, 1988). The artist and media theoretician Peter Weibel recommended the publication of an anthology with Foerster's autobiographical essays to the publisher Merve in the early 1990s. At least since the publication of this book, called *KybernEthik* (Foerster 1993), the historicization movement—to which Foerster would contribute over the course of the 1990s by means of numerous interviews and recorded memories (see Foerster & Bröcker, 2002; Foerster & Glasersfeld, 1999; Foerster & Pörksen 1998)—began. In the years 1991 and 1997, two commemorative publications (Watzlawick & Krieg, 1991; Müller, Müller, & Stadler, 1997) as well as the republication of the Macy Conference protocols in 2003 by Claus Pias (2003) would further consolidate Foerster's role as the German-speaking witness to American cybernetics.

The historian of science Philipp Felsch recently gave an outline of the historical milieu within which the "re-discovery" of cybernetics took place in the German-speaking world (see Felsch, 2015): after the break with neo-Marxism and following the erosion of structuralism, the German humanities were on the lookout for new role models and propositions in theory. First, this search was characterized by the desire to think beyond old established disciplines as well as literary canons and to finally overcome the ideological turf wars. Second, there was an attempt at turning away from the "text" and toward a dedication to material objects, scientific facts, and secrets from military history: "Tinkerers are in demand," writes Felsch (2015), "and kaleidoscopic thinking: objects became more powerful than words" (pp. 166–167, author's translation). With some delay, French poststructuralism also broke ground and West Berlin entered the age of postmodernism around 1980: "From Baudrillard to Benn, from Lyotard to Gehlen, from Spengler to Kojéve all theoretical trendsetters that came into question were surveyed" (Felsch, 2015, p. 190, author's translation). Third, theoreticians of the early 1980s used to maintain a "nimbus of hermeneutical knowledge" (Felsch, 2015, p. 210, author's translation). The new paradigm was, according to Felsch (2015), the "figure of the initiated" (p. 207, author's translation). In this way, one was devoting

oneself to Paul Virilio (2006) and his search for the secret military roots of culture or to Baudrillard's (1983) fatalism. With that said, it does not come as a surprise that finally some of GMT's representatives would realize that this new interdisciplinary and scientific foundation of epistemological questions had already been raised by Foerster, Wiener, McCulloch, and other cyberneticists some decades ago in the U.S.

    In this academic milieu of disciplinary change and intellectual reorientation—within which cybernetics was one of many "new" impulses—Kittler too grew aware of the historical "universal science" of Wiener and McCulloch. And yet, as Moritz Hiller (2016) recently worked out on the basis of Kittler's literary remains in the German Literature Archive in Marbach, it is hardly possible to make out *one* distinct influence or first contact. It rather appears as if cybernetics gradually reached the literary scholar over the course of many years and from different directions. At this, as Hiller (2016) shows, an early implicit influence of cybernetics and information theory on Kittler's discourse analysis has to be differentiated from a later explicit appropriation of cybernetics as media theory: at first, Kittler received authors such as Watzlawick, Luhmann, or Schmidt in the late 1970s, who—as outlined above—can be regarded as humanistic importers of concepts such as second-order cybernetics. In his dissertation, for example, Kittler (1977) quotes Watzlawick's (1969) book *Menschliche Kommunikation: Formen, Störungen, Paradoxien,* in which the latter discusses central cybernetic concepts such as "feedback" and introduces the work of cyberneticists such as Gregory Bateson or McCulloch. In fact, besides structuralism, poststructuralism, and other contemporary discourses, "communication and media theory" is part of the "colorful conglomerate of new theoretical concepts," (Hiller, 2016, p. 4, author's translation) with which German philology around 1980 had to deal. Kittler's longstanding enthusiasm for electrotechnical bricolages also had the effect that he would periodically draw on the "language of telecommunications" in his manuscripts on *Aufschreibesysteme* (Kittler 1990), which suggests that he must have been familiar with the practical side of control engineering concepts as early as the late 1970s (Hiller, 2016). As Hiller (2016) thus shows, in Kittler's early work, linguistically transformed information theories à la Schmidt met a rhetoric of telecommunication derived from his own tinkering experience. However, neither of the two reached beyond the status of an "implicitly-unconscious" affect (Hiller, 2016, p. 11, author's translation).

    During a guest stay in Stanford in the years 1982–1983, after the submission of Kittler's (1985) professional dissertation *Aufschreibesysteme 1800/1900* and upon receiving a request by the reviewers for an explanatory introduction, Kittler's implicit influences from cybernetics and information theory became explicit. For the first time, the literary scholar read texts by Claude Shannon deliberately and explained retrospectively that the way of looking at the problem in his professional dissertation was "visibly characterized by media theory and cybernetics" (Kittler, 2012, p. 117, author's translation). What added to this conscious turn toward historical sources was not least the reading matter of contemporary technico-historical works such as, for example, the dissertation by the Berlin physicist and sociologist Friedrich-Wilhelm Hagemeyer. On the basis of numerous interviews in the U.S. with Foerster, Shannon, and Donald McKay, Hagemeyer (1979) reconstructed the history of information theory. Thus, what

Kittler's student Bernhard Siegert (2011) would later identify as a constitutive element of a nascent media historiography, was also true for the beginning of Kittler's examination of cybernetics: "Media histories were not written, media histories were found" (p. 96, author's translation).

In summary, in the mid-1980s cybernetics inscribed itself doubly in the nascent GMT. On the one hand, cybernetic and information-theoretical concepts mediated by McLuhan, Schmidt, Luhmann, and other authors were part of the many theoretical offers against which or by means of which media theories around 1985 were established. In this regard, one could say that GMT presupposes cybernetics. On the other hand, the apprehension to get into view an important part of the history of one's own technological presence by means of cybernetics, lead to the fact that it became the object of media-theoretical research. By continuously rewriting its history, many scholars of media theory after Kittler have defined and are still defining what cybernetics was. In this regard, one could also say that, as an object of investigation and ever-controversial issue within media theoretical debates, cybernetics presupposes GMT.

Conclusion: Something with cybernetics

Ulrike Bergmann (2015) has recently suggested that the rediscovery of the history of cybernetics by the first generation of GMT primarily contributed to rethink the "status of technology in Media Studies" (p. 50). However, following Bergmann (2015), this historicization was characterized by an "author-centric and partially heroizing" (pp. 50–51) approximation to the newly discovered texts. Furthermore, the secret knowledge of a "cybernetization" happening behind the back of history was well kept for many years, and the legend of cybernetics as an "uber-science" (Kittler, Berz, Hauptmann, & Roch, 2000, p. 332) was carried further. The representatives of the second generation of media theory followed the first generation when it came to their enthusiasm, but began at the same time to reflect on the historical context and the factual epistemological effect of cybernetics.[6] Accordingly, as Bergermann (2004) noted in an earlier article, they "work out relations with 'cybernetics' that no longer focus on pioneers, but provide and conduct theory-formation based on interdisciplinary material" (p. 10, author's translation). This different understanding of cybernetics provides "a model folded in itself, in order to conceptualize media/transmissions … it offers a connection to the field of the history of science, offers epistemological prospects on medial possibility conditions of knowledge as well as a history for the constitution of the digital" (Bergermann, 2004, p. 10, author's translation). But the second generation does also not seem to be able to completely detach itself from the complicated relationship between cybernetics and GMT. Along those lines, especially the two volumes published by Claus Pias (2003, 2004) on the Macy Conferences resemble the transformation of the second generation on the fine line between enactment and re-enactment: the first volume enacts by publishing the conference protocols anew, thus reviving them as theoretical archive. The second volume contains a number of secondary texts and archival materials as a stimulus for a further historicization of cybernetic visions and concepts. And finally, there is a third and even a fourth generation of German media theorists, who want to do "something with cybernetics" in their M.A. theses or dissertations. Cybernetics has be-

come a permanent issue within media studies and somehow it continues to create the promising feeling of getting onto the track of our own episteme.

In light of GMT's double reference on cybernetics outlined in this article, at least three problems for this type of intellectual love of adventure arise. First, given the epistemological proximity between cybernetics and GMT and their discursive entanglement around 1980 it appears that current debates within GMT and related areas of media theory about cybernetics and its influence on contemporary science, society, and culture (see Hansen & Clarke, 2011; Hörl, 2013) should pay more attention to their own epistemological and discursive relatedness to it. First, future research work in this area must first and foremost distinguish more carefully between cybernetics as a theoretical offer for media studies and as an object of research. Second, there is the risk that GMT will continue to repeat the 1980s rediscovery of cybernetics as the key to a media history of contemporary digital cultures. It is therefore important that GMT should work to better understand the history of its own fascination with cybernetics. Third, the epistemological and discursive interrelations between cybernetics and GMT suggest that parts of GMT have prioritized cybernetics and neglected other important factors of the multifaceted media history of the twentieth century. Only recently have scholars of GMT and related fields of media studies started to pay attention to the hidden layers of media development. They are uncovering these layers by opening up to other disciplines (Zielinski, 2013), by looking at non-Western cultures (Kusahara, 2011), or by drastically expanding their period of research (Parikka, 2015). It seems that it is finally time to "exorcize" cybernetics as a "timeless value" from the belfry of GMT.

Acknowledgements

Notes

1. By using the term "German media theory"—as problematic as the label may be—I want to address a major school of thought within German media studies that relies on Kittler's approach and focuses on the media technological conditions of culture (see Horn, 2007).

2. Regarding the "disunity of cybernetics," see Ronald Kline (2015). On the other hand, Geoffrey Winthrop-Young (2006) calls GMT a "motley crew of media-theoretical paradigms" (p. 89).

3. The circumstance that both approaches also direct this question regarding the conditions of knowledge to themselves and their own practice of cognition as a last consequence (cybernetics to cybernetics, or media to media science respectively) is not proof for a shared originality but is in the nature of things: the existence of an *a priori* can itself only be postulated *a priori* and never *a posteriori.*

4. McCulloch's philosophical training was largely influenced by his readings of Descartes' physiological studies, Leibniz's (2014) *Monadology,* and Immanuel Kant's (2009) *Critique of Pure Reason.* On McCulloch's philosophical training, see Michael Arbib (2000).

5. Maturana (2000) objected later; probably because he knew of the epistemologically problematic implications regarding his collaboration with Lettvin: "When Jerry Lettvin states in the preface to the second edition of McCulloch's 'The embodiments of the mind' that our work on visual systems was heavily influenced by Oliver Selfridge, he speaks for himself. Oliver Selfridge had no influence on me

or my thought. I furthermore do not think that Oliver Selfridges thought had any impact on the work that Lettvin and I did together" (p. 16, author's translation).

6. When talking about the "generations" of GMT I am following Pias (2016) who compared the history of GMT with the history of the Red Army Faction tongue-in-cheek.

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