Friedrich Kittler
An Introduction

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Truncated Controversies

FRIEDRICH KITTLER is arguably one of the most important contemporary German theorists. He certainly is one of the most controversial and one of the very few to have gained an international reputation despite the frequently highly esoteric subject matter and the stylistic idiosyncrasy of his work. Kittler is difficult to read, even more difficult to translate, and almost impossible to discuss without seeking cover behind well-worn ideas concerning poststructuralism, antihumanism, or technodetermism. Another obstacle is the fact that he – much like Peter Sloterdijk and, to a lesser degree, the late Niklas Luhmann – clearly distances himself from the Frankfurt School, whose well-oiled circuitry connecting Germany and North America remains a prime conduit for the export of German theory. Nonetheless, Kittler's work has drawn interesting responses, especially in English-speaking countries. This Anglophone reception, however, is somewhat skewed. Kittler is better known in the USA than in Britain; but even the American reception is noticeably truncated since it focuses almost exclusively on his media-theoretical work as it appears in *Gramophone, Film, Typewriter*, the second part of *Discourse Networks*, and the collection *Literature, Media, Information Systems*.

But Kittler did not start out as a media theorist nor does the label capture what he is doing now, as his contributions to this issue will demonstrate. This Introduction, therefore, has three aims. First, to provide an overview for those who are not familiar with Kittler (including some biographical remarks that will serve to complement John Armitage's interview); second, to broaden the English reception beyond the confines of media theory; and third, to briefly introduce the articles by Claudia Breger, Sybille Krämer and Geoffrey Winthrop-Young, each of which deals with a different facet of Kittler's expansive œuvre.[1]

■ *Theory, Culture & Society* 2006 (SAGE, London, Thousand Oaks and New Delhi), Vol. 23(7–8): 5–16
DOI: 10.1177/0263276406069874

Life Stories

The story behind Kittler's work can be told in many ways. It can, for instance, assume the guise of a pithy psychoanalytic narrative designed to show that his texts are an ongoing attempt to deal with a split that dominated his early childhood. He was born on 12 June 1943, in Rochlitz, a small town in East Germany in the vicinity of Dresden, as the son of two fathers. His real father, a teacher, had lost most of his students to the war and took to lecturing his children instead, with the result that, already at the age of 7, Kittler was able to recite long passages from Goethe's *Faust* off by heart. The other father, as it were, was his elder half-brother, a former wireless operator who drew on his wartime expertise to assemble illegal radios using parts scavenged from abandoned military aircraft. Thus, already at a very early stage much of what later came to dominate Kittler's work was already in place: the pre-established discursive order that ensnares children in a humanist universe; the dominance or ongoing presence of war (see Winthrop-Young, 2002); the emergence of wireless broadcasting as 'an abuse of army equipment' (Kittler, 1999: 97); and, of course, the binary of Goethe and the radio, Classicism and technology, high literature and modern media. But two decades passed before Kittler realized that he 'had grown up between two fathers and that somehow everything depended on uniting the two' (Kittler and Banz, 1996: 47). And so the two returned in the shape of the literary 'Discourse Network 1800' and the technological 'Discourse Network 1900'.

In 1958, the family fled to West Germany, at which point the story moves from a psychoanalytic to a more political register. Kittler recounts in his interview with John Armitage that one of the reasons for the relocation was his father's wish to secure for his children the kind of university education that could not be had in the East. This background, he adds, made him a keen and engaged student, unlike many others 'who simply went there on the understanding that it was their right to do so, or as a kind of hobby'. There is no reason to question Kittler's high opinion of his own academic performance, but this is a rather one-sided assessment of the student body of the early 1960s, when German universities were expanding to include larger portions of low-income families who hitherto had certainly not viewed post-secondary education as a 'hobby'. The comment reveals two biases noticeable in Kittler's work. First, only someone who (much like Michel Foucault) took his studies so seriously and subsequently became such a successful academic will be so concerned with universities as sites of power and crucial nodes in the great data-processing machinery known as culture (see Kittler, 1990: 124–73; 2004). Second, Kittler's early biography – given the East–West movement across two Germanys, Kittler himself speaks of his 'biogeography' (1997a) – sheds some light on his conservatism. It is in part the result of having spent over a decade under a socialist regime as the member of a family that was politically at odds with the system, only to end up, in the other Germany, among fellow students flaunting leftish ideals.

In 1963, Kittler enrolled in German, Romance Studies and Philosophy at the University of Freiburg, where he was to remain, first as a student and

then as a teacher, for almost a quarter of a century. Given the length of this association, especially in light of his claim in the interview with John Armitage that we are 'produced by our schools, by our universities and by our lecturers', it is worth taking a closer look at this institution. Robert Holub pointed out that in the intellectual biographies of the young German scholars engaged in importing the new Parisian *pensée sauvage* across the Rhine, Berlin and Freiburg crop up 'too often to be coincidental' (1992: 43). Berlin – or to be more accurate, West Berlin – is an obvious venue: A supercharged metropolis perched on the needlepoint of global politics, a hotbed of 1960s student radicalism with a thriving art scene and a venerable pedigree of Bohemian unrest – how could it not be a receptive entry point for what German detractors derided as 'Lacancan and Derridada'? But Freiburg? That scenic deposit of philistine comfort besieged not by Soviet tanks but the sleepy firs of the Black Forest? And yet it was the Freiburg German Department that produced the most important dissertation in post-war *Germanistik*, Klaus Theweleit's *Male Fantasies*, and the most important post-war *Habilitation*, Kittler's *Discourse Networks*. What united them was not only a controversial bid to extend the boundaries of academic discourse, but also, and more importantly, the fact that they were among the first influential large-scale German engagements with so-called French theory: Deleuze and Guattari, in the case of Theweleit, and Foucault and Lacan, in the case of Kittler.

Various explanations have been put forward to account for Freiburg's role in the German engagement with poststructuralist thought, ranging from the geographical proximity to France to the overwhelming and – especially in death – larger-than-life presence of Martin Heidegger, that 'little old man . . . shuffling along the corridors of the Freiburg philosophy department', without whom 'Derrida and Lacan would be unthinkable' (Kittler, 2000: 220f.). Some cite Freiburg's heady subcultural politics with its motley crew of alternative life-style groups, peace activists, ecological fundamentalists, the usual sectarian phalanx of Marxist, Leninist or Maoist brigades (not to mention a group specializing in a bizarre mixture of Karl Marx and Wilhelm Reich that managed to have one of their members elected to the city council) and the remaining leftovers from the century-old tradition of South-west German radical liberalism – in short, a countercultural mélange that acted as an ideal breeding ground for undogmatic leftish bookstores, alternative publishing houses, and last but not least the spread of French ideas which the traditional left routinely condemned as a return of the dark traditions of German irrationalism. Other, less benign observers argue that the Freiburg German Department was characterized by a tactical alliance between conservative hermeneutics and budding poststructuralism, in which the former attempted to recruit the latter in order to establish a common front against the alleged hegemony of left-wing scholarship. But maybe it all boils down to a simple contingency: That at a certain point in time a number of scholars including Kittler himself happened to be located in one and the same provincial city.[2] These days, Kittler is prone to display a certain

nostalgia when looking back at the 'old fairy-tale time' (2006: 339) of Freiburg, that diminutive makeshift Camelot of German poststructuralism, yet he leaves no doubt that it was, if at all, a no more than very brief and not too shining moment. In a contribution to a *Festschrift* for a former Freiburg colleague, Kittler describes the current Freiburg German Department as a 'cenotaph – an empty tomb of wilder times', only to add: 'But who cares? The Holy Roman Empire already boasted an abundance of stupid professors and senile faculties' (2002a: 295). And with that, the Freiburg story ends. From 1987 to 1993, Kittler was Professor of Modern German Literature in Bochum. In 1993, he assumed his current position of Chair of Media Aesthetics at the prestigious Humboldt University in Berlin. Like many of his peers located further to the left, the rebel was recruited by the centre.

Work Stories

At first glance, Kittler's work is a sequence made up of three stages. The first stage, characterized by an innovative mix of poststructuralist theorems (in particular, the psychoanalysis of Jacques Lacan and the discourse-analytical work of the 'middle' Foucault), was primarily concerned with literary texts. The second stage, which emerged in the early 1980s, focused on media: in particular, phonography, cinematography, the typewriter-induced mechanization of writing, and the computer. The third stage is more difficult to label. Probably the most convenient term, however provisional, is 'cultural technologies', a direct translation of the German *Kulturtechniken*: It implies a wide-angle approach that deals not only with the whole array of the materialities of communication (ranging from media technologies and institutional frameworks to bodily regimes), but also includes in-depth discussions of sign systems such as alphabets and mathematical as well as musical notation systems.

Unfortunately, it is not that simple. Kittler did not stop writing about literary texts in the 1980s (as demonstrated, for instance, by his ongoing fascination with Thomas Pynchon's *Gravity's Rainbow*); nor has he, recent public claims to the contrary (e.g. Wegwerth, 2006), withdrawn from media theory. What is evident, however, is the extent to which his more recent discussions of objects from the earlier stages are informed by the switch to the later stages. Thus, his paper from the mid-1980s on *Gravity's Rainbow* (1997b) focuses squarely on the media technology in Pynchon's novel, while a paper written almost two decades later on the same text refers to mathematical notation systems (2003a). Kittler's 'progress' as a theorist, then, is less a linear sequence than a deepening, a widening spiral in which similar questions recur, but each time on a more extensive level. Not coincidentally, this conceptual expansion is matched by a temporal and geographical broadening. While the majority of his early, literature-centred texts are an almost exclusively German affair confined to the so-called age of Goethe (approximately 1770–1830) and its epigonal 19th-century aftermath, the media stage, which covers the two centuries from the late 1700s to

the present, is as much about American inventors and British rock groups as it is about German poets. With regard to the third stage, Kittler's essays 'Number and Numeral' and 'Lightning and Series – Event and Thunder' reveal that the focus on cultural technologies aims at nothing less than occidental history in its entirety, starting with Homer and the Greek invention of the vowel alphabet, passing through the European complicity of print and perspective in the Renaissance and the Early Modern Age (see also Kittler, 2002b), and culminating in the global reach of Turing's computer, the medium to end all media. This imperial sweep will be detailed in the ambitious tetralogy *Musik und Mathematik* ('Music and Mathematics'), of which so far only the first part of the first volume has been published (Kittler, 2006).

The three articles in this issue of *Theory, Culture & Society* each focus on one of these three stages. Winthrop-Young's article, 'Implosion and Intoxication', starts out with a discussion of Kittler's early discourse-analytical work on the twin peaks of German Classicism: Goethe and Schiller; Krämer's 'Time Axis Manipulation' provides a detailed analysis of some of the frequently overlooked technological intricacies of Kittler's preoccupation with storage media; and Breger's 'Philhellenic Fantasies' delves into the rarely discussed political and cultural background of Kittler's recent interest in Ancient Greece. At the same time, all three are concerned with issues – some foregrounded by Kittler himself, some lurking in the unacknowledged undergrowth of his work – that keep recurring in his work.

Winthrop-Young's article takes its cue from Kittler's concern with *control* – that is, his determined focus on historically differentiated instances of disciplining, inscription and programming, which, tied to varying discursive and technological regimes, shape human and machine subjects. By analyzing Kittler's readings of Goethe's 'Wanderer's Nightsong' and Pink Floyd's 'Dark Side of the Moon', the article aims to (re)acquaint readers with the basics of Kittler's poststructuralist and media-technological analyses. The key point is that, according to Kittler, both 'texts' clearly talk (and sing) about themselves and their effects: Goethe's poem, a lullaby that has sent generations of interpreters into a hermeneutic dreamland, recreates the discursive rules and language acquisition practices that enable its intoxicating spell, while Pink Floyd's song explicitly performs and foregrounds the sound-technological standards and achievements that are the basis of its appeal. If this premise is accepted, interpretation – the rephrasing of a text by referring it to collective and/or academic fictions that serve to obscure how those fictions were constructed in the first place – has to be replaced by *implosion*. Find the rules, the handbook, the algorithms that govern the production of a text (or a piece of music), and have the latter collapse into the former; in short, get a technologically informed grip on that which grips you. This will not, Kittler emphasizes, result in any human command over inhuman media or notation systems, but it will at least free us of the ongoing delusion that we can establish such mastery. And that, Winthrop-Young argues in conclusion, resonates with Kittler's more

conservative variant of the cultural upheaval of the 1960s, which in turn refers to many such upheavals in the past – all the way back to the divine events of Ancient Greece.

Another pivotal issue (and indispensable for an understanding of Kittler's combative stance) is that of *discontinuity* – a forceful, at times polemical emphasis on ruptures, breaks and caesuras designed to obliterate any attempt to infuse history with gradualist, progressive, teleological or dialectical notions. History is not smooth; it doesn't lead out of the cave of early illusions into the mature blaze of enlightenment; it does not exhibit any growing intelligibility; and it cannot be reduced to a fanciful relay of revolutionary subjects. This is, no doubt, a Foucauldian heritage, and, just as in the case of Foucault, it constitutes an update of Nietzschean genealogy and Heideggerian *Seinsgeschichte* that is deployed on two fronts against the Procrustean paradigms of hermeneutics on the right and dialectics on the left. But this raises the question of discontinuities *within* Kittler's theory, especially with regard to the switch from the first to the second phase. What are the full implications of the shift from literature as a soul-inscription technology to the technological media 'that determine our situation' (1999: xxxix)? On the surface, things appear pretty straightforward: In *The Order of Things*, Foucault presented a discontinuous sequence of epistemes without explaining why new discursive orders appear. Kittler, in turn, referred these shifts to medial changes. In the shift that concerned him most in his middle, 'media' stage, the emergence of the 'Discourse Network 1900' is linked to the arrival of new, analog Edisonian recording and storage technology. But what exactly is the difference between a book and a phonograph? The obvious answer is that writing operates in a symbolic realm by pressing data through 'the bottleneck of the signifier' (Kittler, 1999: 4), while analog media capture physical traces of the real in the shape of light or sound waves. This, no doubt, is a substantial rupture that changes the very basis of representation and thus the expectations we have of reproductions. In the words of Rudolf Arnheim (and one of Kittler's favourite quotes in the 1980s), with the arrival of new media, reproductions 'are not supposed to resemble the object, but rather guarantee this resemblance by being, as it were, a product of the object in question, that is, by being mechanically produced by it' (quoted in Kittler, 1999: 11f.).

But once again, there is a lot more to it, as Sybille Krämer points out in her contribution. For Krämer, Kittler's media theory looks, at first sight, rather conventional, not least because it is structured around a media history that is split into three familiar phases: 'the invention and dissemination: (1) of the alphabet; (2) of the printing press; and, finally, (3) of the computer'. This history, however, is far more complex than it initially appears, for Kittler theorizes such technologies in relation to Lacan's registers of the symbolic and real. For Kittler, print media is tied to the symbolic realm, for, as Krämer explains, writing and discourse are tied to the order of the sign: 'In the era of writing one could only write things down that already existed as elements in the symbolic universe.' With the emergence of digital

technologies, however, we go beyond the world of signification and enter what Lacan calls the 'real', for such 'media allow one to select, store, and produce precisely the things that could not squeeze through the bottleneck of syntactical regimentation in that they are unique, contingent, and chaotic'. Accompanying or perhaps underpinning this shift is a fundamental change in the human experience and technological management of *time*. For Krämer, this takes us to the very heart of Kittler's media theory, for time – the irreversibility of which has always structured human experience – is now increasingly open to technological manipulation: 'What is unique about the technological era (from the gramophone to the computer) is that these technologies allow one to store "real time" . . . and, at the same time, to process "real time" as a temporal event.' At the same time, however, digital technologies now work at such speed that increasingly their operation escapes human perception. In a parallel move – one that mirrors the information science of Claude Shannon – the human body all but disappears from Kittler's account. This is something that clearly frustrates Krämer, not least because it uncouples 'media and the human senses'. By way of response, Krämer, whose own work centres on questions of mediality and performativity, poses a number of questions in return to Kittler in a bid to put the sensory back on the agenda. She asks, for example: 'Does "time" even exist without the connection to observation and/or experience, also, and particularly, when one is concerned not with subjectively experienced but rather with objectively measured time?'

But how do we get from here to Ancient Greece? How does Kittler engineer his tiger-leap from modems back to muses? Strangely enough, one revealing clue is Kittler's high appreciation of Shannon (and, by extension, of Alan Turing). As has been pointed out by many concerned observers, Shannon's theory of communication factors out questions of meaning and context. More interesting, however, is the fact that it also sidelines questions of mediality. It is a *mathematical* theory of communication that focuses on the probability of sign events; hence it may be applied to any communication system whose messages can be analyzed using statistical methods. Shannon's theory is thus the formal equivalent of the media technology that can reproduce (most) media – the computer. Analog media operate by way of storing, processing and retracing physical effects such as light and sound waves; hence there is an elementary distinction between sights and sounds. For the digital computer, such distinctions are mere surface phenomena: 'The general digitization of channels and information erases the differences between the individual media. Sound and image, voice and text are reduced to surface effects, known to consumers as interface' (Kittler, 1999: 1). We are literally and metaphorically screened off from the inner workings of the computer, where everything (sounds, images and text; data, addresses and commands) is reduced to binary digits. The computer is a universal medium by virtue of its universal alphabet, but the latter – though anticipated at least as far back as Leibniz – could not be fully put to work without the former, and the former – though anticipated as least as far back as Babbage

– could not live up to its potential without the latter. Kittler's argument is anything but easy to follow, but it appears that these two key features (the notion of a universal alphabet *and* the close working relationship between this sign system and a protean 'universal machine') are the key to the Greek connection. Looking back at the Greek vowel alphabet, Kittler recognizes it to be, as it were, an early, pre-mechanical instantiation of the computer's universal sign system. As he discusses in 'Number and Numeral', it too uses one and the same sign system to indicate letter, number and tone; and it too evolved in constant feedback with 'a magical thing that connects mathematics to the domain of the senses', the lyre. This link-up of Homer and hardware is, no doubt, the grandest of all spiralling movements in Kittler's theory.

In order to understand Kittler's arguments, two points are important. First, the Greek alphabet – in essence, a pivotal modification of the Phoenician consonant alphabet which used the signs for those Phoenician sounds that did not occur in Greek to denote Greek vowels – initially referred to (meaningless) sounds only. Signs were letters. The reference to numbers followed later. Kittler claims, however, that the original modification came about for the 'exclusive purpose of transcribing the oral-musical *Iliad* and *Odyssey*'. The phonetic alphabet did not, as others maintain, originate in the mundane realms of trade, politics, or the law. To echo Claudia Breger's critique, it appears that Kittler is subscribing to the old view of Ancient Greece as a kind of *Kulturnation*, a historical singularity whose peak achievements are located in what later epochs came to call aesthetics and culture. Second, Kittler emphasizes that many of the concepts that we identify as high points of classical Greek philosophy are, if critically looked at, distortions of more practical, numero-technical terms that had been worked out by the complicity of finger, strings and multi-purpose signs. For instance, *logoi* initially referred to simple musical ratios (e.g., fourth, fifth, octave), but the term later suffered an unfortunate conceptual promotion at the hands of Aristotle and others. Here, Kittler appears to be engaged in a kind of Heidegger-inspired 'fundamental etymology' (Schüle, 2006). Find the first, frequently practical meaning of a mental concept in order to deconstruct the metaphysical layers it has accumulated. While the incidentals are frequently strikingly original, the basic thrust – as detailed by Breger – is not new. Kittler is retracing a path cleared, among others, by Bachofen, Nietzsche and Heidegger. He too is in search of the other, earlier Greece, the Greece of yore before things went wrong, that is, before they became all too abstract, metaphysical, and forgetful of the media in and through which they had evolved.[3]

But Breger does not only look backward. Examining some of the 'philhellenic fantasies' that underpin Kittler's recent excursions into ancient Greece, she argues that they are founded on an act of 'Atlantic distancing', for they turn away both from American academia – particularly American cultural studies, which Kittler claims ignores all canonical texts – and from what he terms the 'American Empire of capitalism'. By way of response,

Kittler reconstructs his own canon, which, as Breger points out, is made up largely of 'virtual figures coded as Greek in the European imagination'. She goes further by arguing that Kittler's recent work on Greece constructs a 'world-historical' narrative of culture that takes ancient Greece as its focal point. In this respect, Kittler has much in common with the Orientalism of 19th-century German philosophy. Indeed, Breger argues that Kittler 'mostly in indirect ways' defends such German thinking and its idealization of ancient Greece, while at the same time giving its 'imperial inflections' a 'positive twist'. Breger explains: 'In this discourse, ancient Greece is doubly coded as a realm of both cultural identification and otherness, "the epitome of Europe", but also "its pure childhood".' Thus, Kittler affirms the 'special status of Greece for the European tradition', at the cost of other cultural influences and connections. Alongside this, Breger argues that Kittler's philhellenic fantasies shape his call for the reformulation of collective identity in post-unification Germany, and with this produces a direct line connecting the Greek *Kulturnation* to the present. In his defence, Breger notes that Kittler recognizes the influence of both Greece *and* Egypt on European culture (something which Hegel neglects), and adds that he 'does not explicitly defend any notion of Greek "Aryan" purity or cultural autonomy'. However, given that a vision of the purity of ancient Greek culture is to be found at the centre of his media history, she draws the conclusion that 'his historical narrative for the most part re-affirms variations on these themes'.

Another important point of Breger's essay is her analysis of Kittler's reading of Plato's *Symposium* – a point that will shed some light on Kittler's references to *love* in the Armitage interview. An exclusively male philosophical circle sits around and discusses love, inspired by Diotima, the absent woman, whose words need to be transposed into a philosophically accessible key, while the love she spoke about is in diluted fashion directed at other love objects such as Alcibiades. The key point is that Kittler's narrative appears to praise a 'lost' masculinity as sexual potency. Philosophy did not only distort, or cover up, the basic relationship between media and senses that gave rise to it in the first place, it is also complicit in forgetting, or covering up, the alleged basics of love – that is, the fundamentals of love and lust between men and women, gods and goddesses 'This fiction of mythical masculinity', Breger states, 'is clearly heteronormative.'

This short introduction, no doubt, raises more questions about Kittler than it can answer. (We could, for instance, start at the end and wonder what Foucault would have said about Kittler's paean to elementary heterosexuality.) It is far too early to tell how Kittler's work will survive, and if his latest excursions (which have met their share of consternation and even ridicule) will be worked out in detail and related to his already established work on literature and media. One thing, however, is clear: If Kittler is indeed a thinker whose work raises important questions regarding the relationship between technological mediation and social relations that need to be addressed in the context of a '*post-human* sociology' (Gane, 2005: 40), or if

Kittler may even help map out 'posthuman cultural studies' (Winthrop-Young, 2006), then it is not so much because of what he said but because of the many things that, after Kittler, one can no longer say without sounding a bit naïve. Ironically, for all his critique of capital-E Enlightenment, it appears likely that Kittler's legacy will continue the tradition of the 18th century (the century in which he, philosophically, appears to be least at home) by furnishing an apparatus of cultural criticism that, first and foremost, aims at debunking stories by highlighting the mechanisms – and sometimes the pains and intoxications – these stories are indebted to.

Notes

1. Interested readers may wish to consult other introductions to Kittler's work that are currently available in English: e.g. Gane (2005); Griffin (1996); Holub (1992: 97–107); Johnston (1997); Wellbery (1990); and Winthrop-Young and Wutz (1999). The most comprehensive bibliography of Kittler's writings (up to 2003) can be found in his *Festschrift* (Berz et al., 2003: 359–74). For a good online bibliography, see http://www.hydra.umn.edu/kittler/kittlerpub.html

2. This very heterogeneous group includes, among others, Kittler's brother Wolf, the recently retired Freiburg Germanist Heinrich Bosse (whose study on the construction of authorship around 1800 is alluded to in John Armitage's interview), and of course Theweleit. Unlike Kittler, Theweleit had been a high-profile left-wing student protester and was subsequently not even deemed worthy of a limited-term appointment by the German Department (see Kittler, 2002a: 294).

3 Another very important influence on Kittler is one of his former teachers, the linguist Johannes Lohmann (1895–1983). Kittler singles him out as 'Freiburg's only professor who in the presence of Heidegger dared to conduct *Seinsgeschichte* [i.e., Heideggerian history of being] globally, factually, mathematically' (Kittler, 2006: 339) – that is, to do what Kittler is doing now, *après* Heidegger (and far from Freiburg). In the later part of his career, Lohmann, who, according to Kittler, spoke 39 languages, became increasingly interested in questions that are at the centre of Kittler's *Music and Mathematics* project. Lohmann delved into the question of how linguistic structures play into philosophical conceptualizations in ways that are reminiscent of the Sapir–Whorf hypothesis. For instance, Heidegger's famous ontological difference between beings and being [*Seiendes und Sein*] 'no longer falls out of the sky' since it related to the Greek separation of endings and roots (Kittler, 2003b: 501; see Lohmann, 1965). Furthermore, Lohmann also preceded Kittler in analyzing the close relationship between music, language and sign systems in his book, *Musiké und Logos* (1970). Kittler admits that '[i]t is only a step from Lohmann's *Musiké und Logos* to *Music and Mathematics*' (2006: 339).

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