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The entelechies of media: Formal and material causality in media ecology

Thomas Sutherland

'My own approach to the media has been entirely from formal cause', declares Marshall McLuhan (1999: 74) - a statement that, on the one hand, is a reminder of the influence that the largely Aristotelian metaphysics of St Thomas Aquinas exercise over his work, but on the other hand, is also an indicator of how great an extent his work diverges from the orthodoxies of this tradition. From Aristotle through St Thomas and Duns Scotus, formal cause - the intended shape, configuration, or appearance of an entity, as determined by a human or divine creator - is inherently subservient to the *final cause*, which is the end or purpose of any movement or becoming. For St Thomas in particular, all things are directed toward their purposive ends by a system of natural law grounded in and governed by the eternal intellect of the divine creator, and as such, the formal cause of an entity is always subordinated to its final cause. For McLuhan to abandon such teleology as the basis of his study in favour of an enthusiastic prioritization of formal cause represents a novel, and in fact rather unusual challenge to Aristotle's doctrine: one that, rather than merely recapitulating the latter's fourfold model of causality, seeks to reconfigure such that it might be better suited for the study of media in the age of electric and then electronic media.

The purpose of this article, therefore, is to interrogate McLuhan's focus upon the question of formal cause - an aspect of his work that has received renewed attention in recent years, particularly as a result of the additions made to this theory by his son, Eric McLuhan - and its relevance for media ecology as a broader field. After outlining the basic characteristics of this theory of formal cause, as it manifests throughout McLuhan's career, I will then go on to argue that in spite of his worthy attempt to critique the *hylomorphic* nature of the Shannon-Weaver model of communication, his prioritization of formal cause, which he associates with the effect that a medium has upon its audience, leads to a rather large blindspot in his theory: overly swayed by his belief that electricity unifies and etherealizes, transforming all media into software, McLuhan (1977: 80) - who claims that 'when man is "on the phone" or "on the air", moving electrically at the speed of light, he has no physical body' - fails to account for the problematic of *material cause* within mediation. Ironically, given the frequent (and to some degree unwarranted) accusations of technological determinism hurled at his work, his theory of formal cause actually places too much agency in the hands of the audience, by ignoring the multitude of ways in which the material configuration of hardware can not only alter the message of a medium, but can actually transform this audience itself.

It is for this reason, I go on to argue, that we must look toward the work of German media theorist Friedrich Kittler - whose stature within the English-speaking world has increased

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dramatically in recent years, thanks in part to a spate of translations - as an important supplement to, rather than replacement for, the theory of formal cause that still, in many ways, remains at the centre of media ecological inquiry. After all, as Kittler (2010: 30) notes, 'a lack of clarity in McLuhan's concept of media should not prevent further work on his fundamental theses'. What Kittler's studies - from his early work on post-hermeneutic reading, through his later ventures into digital media and its relationship to the proliferation of media forms over the past two centuries - provide is a crucial insight into the continued importance of hardware in an epoch characterized by modes of communication that would appear, at least superficially, to be more and more 'immaterial' (to use the buzzword of the times) - an especially important insight given the potentially catastrophic, and very much material footprint of contemporary information and communication technologies.

The medium is the form

It is commonly recognized that one of the chief flaws in Claude Shannon and Warren Weaver's mathematical theory of communication - the basis of information theory and probably the first sophisticated account of the process of technical mediation - is its hylomorphism: that is, its privileging of form over matter, in a manner largely commensurate with the broader tendencies of Western metaphysics. In simple terms, the problem with the model is that the very notion of measuring and correcting 'accuracy of transference' presumes the givenness of a message prior to its encoding and transmission (Shannon and Weaver 1998: 4). The channel, which we might otherwise refer to as the medium, therefore has no direct role in the determination of said message: although it may alter the message, for typically 'certain things are added to the signal which were not intended by the information source' (i.e. distortion or *noise*), this very notion of alteration relies upon the supposition of a self-evident intentionality of the sender (Shannon and Weaver 1998: 7). The effect of this is that the materiality of the medium itself, whilst not entirely eliminated from the calculus, is subordinated to the *form* of the message. The success or failure of communication is merely a question of whether such a medium is adequate for transmitting said form in such a way that a receiver is able to decode it with a reasonable amount of certainty.

Hylomorphism is of course in no way new, appearing quite overtly, for instance, in Plato's *Timæus*, wherein he describes a space known as the '*khôra*' which is, in effect, an utterly formless container, devoid of all character, within which the originary forms are held. This *khôra* is a space of becoming, rather than being; it is the stable substrate that enables change. Such hylomorphism is more clearly articulated however in the work of Plato's student Aristotle, who makes the famous distinction between four separate causes through which entities come into being: efficient cause, material cause, formal cause, and final cause. Where efficient cause is the source of either motion or rest (and hence, is typically another entity that brings this specific entity into being), and final cause is the purpose of this entity, the most important for our enquiries are material cause, which refers to the specific raw material (rather than a metaphysical substratum) out of which an object is constructed or moulded, and

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formal cause, which denotes the pattern or archetype of the thing produced.

According to Aristotle's account, the specific configuration of the material cause can be modified based upon changes in the forms used, such that it remains largely passive and inert, requiring the intervention of formal cause in order to provide it with some definite shape or function, and thus offering no real possibility that the material itself may not merely determine whether or not the form is generated adequately, but may actually hold an active role in determining the formal characteristics of the entity. As soon as one separates form from matter, in other words, one will inevitably privilege the former over the latter, for such a severance forecloses the true significance of the latter by presupposing the existence of a distinct, discernible form that precedes its injection, so to speak, into a specific material. We can see the quite apparent similarities between such a schema and the Shannon-Weaver model, hence Gilbert Simondon's (2009: 12) proposal that there are two manifestations of formal cause that we must rescue: 'in relation to classical culture, the notion of form must be saved from the reductive manner the notion was used in the *hylomorphic schema*; and a second time, in order to save information as signification from the *technological theory* of information in modern culture, with its experience of transmission through a channel'.

One of the most frequent critics of this model of communication - and hence, in a way, one of the most important thinkers to attempt to rescue both conceptions of form in exactly this fashion - is McLuhan (1964: 291), who contends that it 'tends to ignore the function of form as form'. This argument ties into a larger focus upon the concept of formal cause which pervades his work from the 1960s onward, and yet, has only really gained attention in the last few years. In McLuhan's conception, influenced to a significant extent by the philosophy of St Thomas and G.K. Chesterton, form is equivalent to the medium, in direct contrast to the *content* of that medium. Students of literature and philosophy, he suggests, are 'prone to be concerned with book "content" and to ignore its form', and consequently, in an argument so famous and so notorious is barely requires reprisal, they are unable to grasp that it is the medium itself, rather than the message that it carries, that is of true importance (McLuhan 2011b: 88). Hence, McLuhan's (2011b: 22) claim that 'the African child lives in the implicit, magical world of the resonant oral word,' encountering 'not efficient causes but formal causes of configurational field such as any non-literate society cultivates'.

To say that McLuhan's conception of formal causation is unusual would be a profound understatement. Although he claims to have derived his views on the subject from St Thomas, this is potentially misleading, given that the latter's usage of the term hews quite closely to that of Aristotle: in the *Summa Theologiae*, Thomas (1989: 14) makes it quite clear that 'matter is defined by its potentiality to take on forms'. In fact, McLuhan is surprisingly critical of the Aristotelian conception, arguing that it in large part represents the transformation of formal cause 'from resonant ground to rational figure' as it gradually came under the influence of phonetic writing (producing what he refers to as 'visual space'), shifting form from

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the 'dynamic to abstract and ideal' (McLuhan and McLuhan 1988: 88). He opposes any notion of form as 'Platonic abstract ideal blueprint that is never perfectly realized in any given material example' (McLuhan and McLuhan 1988: 89). Instead, he derives his understanding of formal cause from his observation that Thomas 'always put his public on view at the opening of his disputed questions' (McLuhan 2011a: 16) - in other words, he sees formal cause as demonstrated, rather than articulated, in Thomas' dialectical method of writing, wherein his audience become the very ground of his argumentation, toward whom it is directed. Formal causality, he contends, can be understood as a "concern with the audience" that can never be abstracted or reified, given that it is 'always a dynamic relation between the user and the ever-changing situation' (McLuhan 2011a: 18-19).

Accordingly, he is able to state that the medium is the message precisely because 'it is the medium that shapes and controls the scale and form of human association and action' (McLuhan 1964: 9) - that is, the medium *qua* formal cause is defined by its dynamic effect upon an audience, rather than its content, which always remains in some way abstract and indeterminate. 'The audience is,' McLuhan (1999: 74) writes, 'in all matters of art and expression, the formal cause, e.g. fallen man is the formal cause of the incarnation, and Plato's public is the formal cause of his philosophy'. There is no formal cause without an effect, and thus, no medium without an audience to be affected. Hence the critique of the hylomorphic Shannon-Weaver model: what they fail to realize is that each medium 'not only carries, but translates and transforms, the sender, the receiver, and the message,' with the result that it 'alters the patterns of interdependence among people, as it alters the ratios among our senses' (McLuhan 1964: 97-98). Key to McLuhan's (2011a: 17) position here is his argument that 'formal causality reveals itself by its effects', with the odd, paradoxical consequence that 'the effects usually appear before their causes'. In essence, this means that a medium cannot be understood - and as already noted, cannot even exist in this specific, formal sense - outside of its effects upon the audience, and thus, one can never speak of a message as existing prior to such effects. The medium is an emergent quality of the audience in the latter's affective entelechy.

The consequence of this claim, it would seem, is that there is no medium prior to its audience: the television, for instance, simply does not exist without someone or something to be affected by it. Consequentially, at least in theory, the formal cause of a medium, rather than merely being an inert carrier for a message delivered to an audience, is in fact equivalent to the audience for which such a message might be said to have been created and which it was intended to affect - it is, at the very least the audience in a particular moment of affectivity. It would seem, therefore, that the formal cause of a medium is not quite synonymous with the medium itself; rather, what we might refer to as the *parousia* of the medium - that is, its physical instantiation or emergence - succeeds its formal cause, in the precise sense that the appearance of this material cause is only an epiphenomenal product of the formal cause's effects. There is a certain theological overtone here - as Galloway, Thacker, and Wark (2014:

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13) observe:

media are pure presence for McLuhan, pure positivity. Yet at the same time media such as light are never present in and of themselves. What results therefore is a theophany of media, wherein the medium stands in as a visible manifestation of what is ultimately a mystical or religious relation.

The dynamic interplay between the audience and the medium - a relationship often described in terms of the ancient, cosmic *logos* - is a palpable illustration of this mystical bond, for which the technological medium in its materiality is little more than an idealized, reified *eidolon*.

It was, claims McLuhan (2011b: 19), the "rhetorical" interplay between philosophy and its public which was eliminated by Descartes in the seventeenth century with the result that formal cause was transferred from the public to the subjective life of the individual philosopher or student of philosophy', such that 'formal causality simply ceased to have any conscious role in the arts and sciences from then until our own present day'. From the moment Descartes - sitting alone by his fire - conceived of philosophy as a solitary, almost solipsistic exercise in self-examination, the connection between the philosopher and his or her audience that had characterized scholasticism was severed. This squares with McLuhan's broader conceptualization of the transition from an auditory to visual bias, which he characterizes not as a sharp or sudden rupture, but rather, as a gradual shift beginning with the disruptive effects of phonetic writing described in Plato's *Phaedrus*, and culminating in the private, individualistic book culture of the nineteenth century romantics. From that point onward, it was the artists who 'took up the cause of formal causality,' given that 'the philosophers had abandoned it' (McLuhan 1999: 21).

This is in itself a notable admission, for McLuhan has long tended, in spite of his own protestations, to be branded as a technological determinist: someone who finds humanity a largely helpless creature at the whim of the prostheses that it has created for itself. Yet in spite of his Thomist intellectual heritage, McLuhan (1999: 59) appears to have little interest in the study of final causes - his explicitly theological claim that he has 'never been an optimist or a pessimist' because 'our only hope is apocalypse' is not so much teleological as it is eschatological: there is no need to think the designated ends of individual entities or media, for such purpose is foreclosed in fidelity to this single moment of divine salvation. There is no need to worry oneself about 'secular institutions as a place to have a nice or a bad time' (McLuhan 1999: 60).

It is for this reason that McLuhan (1964: 71) consistently extols the position of the artist in the modern age, for he or she is 'indispensable in the shaping and analysis and understanding of the life of forms, and structures created by electric technology'. Formal cause, he explains,

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is neither ideational nor conceptual - it 'exerts its pressure non-verbally and non-conservatively,' impressing itself upon you 'without benefit of awareness or conscious attention on your part' (McLuhan 1999: 37). The difficulty in studying formal cause then, is that it is effectively hidden from view, and unable to be adequately represented through mimesis - hence the usual recourse instead to the content of the medium, which is by its very nature representational. What *is* visible, however, is the material upon which the medium acts - that is, its audience - and the effects that, in some sense, bring the medium into existence *as* a formal cause. It is artists who are able to illuminate the ways in which these media 'exert their structural pressure by interval and interface' (McLuhan 1999: 74); to reveal the necessary disjuncture between the new environment that such formal cause produces and the old environment that it transforms into its content.

This media theory of formal cause is perhaps most clearly formalized within Marshall and Eric McLuhan's *tetrad*, which poses four supposedly verifiable questions that they regard as being central to any study of the laws of media, relating to *enhancement, obsolescence, retrieval, and reversal*. For the McLuhans, each part of this tetrad is 'a dimension of formal cause', and as a whole, it brings to light 'the *logos* or *formal structure* of its subject, whether hardware or software artefact' (McLuhan and McLuhan 1988: 227, 229, my emphasis). Attempting to think media not in terms of efficient causes (the 'effects' model), but rather, in terms of their transformation of the *ground* (a term that they use specifically in reference to Gestalt psychology, counterposed against the *figure*) of mediation, it is through this tetrad, they claim, that one is able to escape the rigid, linear temporality of traditional associationist cause-effect frameworks and study the resonance and dynamism of form.

As we saw earlier, McLuhan identifies formal cause, in the specific sense that he uses the term (as opposed to the Aristotelian/Thomist conceptualization), with the holistic, resonant awareness of pre-literate auditory space. In the retribalized environment of the global village, he therefore suggests, we are once again able to state that the medium is the message - that is, we can recognize formal cause in its original sense. It is 'the instant speed of electric information that, for the first time, permits easy recognition of the patterns and the formal contours of change and development' (McLuhan 1964: 385), resulting in an ability to perceive the complex interplay and interface between media and audiences. The supposed simultaneity of electric media, from the electric telegraph through radio and television to the digital computer 'has created the mass media and mass publics,' McLuhan (1975: 105) claims, 'for the mass has less to do with numbers than with speed'. Rather than viewing mass culture pessimistically, in the manner of the Frankfurt School, McLuhan (1995: 185) views this creation of a mass audience in cautiously enthusiastic terms, for once consciousness has been integrated in such a fashion, 'all that remains to study are the media themselves, *as forms*, as modes ever creating new assumptions and hence new objectives'. Formal cause is returned to the fore, so to speak.

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The problem of materiality in media ecology

This focus upon formal cause within McLuhan's work is all well and good, but what I believe is not sufficiently interrogated is the question of *materiality*. For it would seem interesting to me that as much as McLuhan highlights the importance of form in actually undermining the Shannon-Weaver model of communication, he rarely deals with the other side of the coin - the material cause. What I hope to therefore demonstrate is that McLuhan is actually unable to escape the hylomorphism of so many of his forebears, precisely because he is unable to think the specific, irreducible role of materiality in mediation.

Eric McLuhan (2011: 203), who seems to have positioned himself as the most enthusiastic explicator of this aspect of his father's theory, argues quite unequivocally that 'formal cause is the ground for the material, efficient and final causes' such that it contains all of these latter causes - a rather heterodox statement coming from a Thomist, given that St Thomas follows Aristotle in arguing that it is in fact the *final cause* that encompasses all other causes, determining the end (*terminus*) of the entity in question. What we can state initially, therefore, is that McLuhan clearly subordinates the question of materiality to that of form: although he never suggests that it is unimportant, it would appear that in determining the essence of a medium, the question of effect trumps the material configuration that produces it. In this specific sense, the medium still remains effectively black-boxed, such that its output determines its nature - although his conception of formal cause is a definite improvement upon the Shannon-Weaver model, given that it abandons both the stark linearity of the latter and its presupposition of the givenness of any message prior to transmission, it still retains this inattention to the role of hardware in the communicative act.

McLuhan is, on the brief occasions that he discusses it, rather sceptical regarding *materialism* in a specifically philosophical sense. He characterizes the Greek atomists, arguably the first overt materialists, as driven by 'the new abstract visual space' of writing, arguing that they 'broke down the ancient boundaries of the universe and set before mankind, for the first time, the abhorrent and really unimaginable picture of a limitless Void' (McLuhan and McLuhan 1988: 18). Likewise, he takes Karl Marx and Friedrich Engels to task for their supposed ignorance of 'the hidden ground underlying all their figures of "experience" - the visual assumptions of Western "sciences" and "humanities" alike' (McLuhan and Nevitt 1973: 6). He goes on to argue that Marx and Engels' ontology rests on the Greek abstraction of Nature (*physis*), whilst remaining 'oblivious of the new information surround that had transformed their assumptions' (McLuhan and Nevitt 1973: 8).

In both cases, McLuhan's critique would seem to be primarily that such materialists naturalize or ontologize observations contingent upon the media that they elide - a quite reasonable evaluation. The more that formal cause is biased toward the visual sense, he seems to suggest, the more it tends toward abstract, universal notions of Being, rather than the dynamic interplay of medium and audience. This is certainly his reproof of Martin Heidegger, who he

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claims is 'quite unaware of the role of electronic technology in promoting his own non-literate bias in language and philosophy' - in other words, Heidegger's non-representational account of ontological Being, interpreted through the non-sequential ecstasies of Dasein's authentic temporality, in contrast to the visible presence of ontical being, is only possible in 'the metaphysical organicism of our electronic milieu', and its subliminal effects upon us (McLuhan 2011b: 281).

Throughout McLuhan's work, argues Eric Havelock (1986: 33), 'there runs a vein of mysticism, or at least of romantic nostalgia for the directness, the fluidity, the sincerity, the comprehensiveness of a system of communication of ideas which had to yield to the more constricting limits laid upon it by the Gutenberg invention'. Although this apparent logocentrism is not as pervasive or as clear-cut in McLuhan's work as it is in Walter J. Ong's (2000), for instance, there is a quite distinct sense in which the former conflates the new electric and electronic media of his age with the mystical power of the ancient *logos*, which is in turn conflated with his peculiar interpretation of formal cause: 'Man has the power to reverberate the Divine thunder, by verbal translation' (McLuhan 1964: 63). Critiques of this aspect of McLuhan's work have been commonplace for many years now. Arthur Kroker (1984: 81) contends that in many of its features - 'the privileging of space over time; the fascination with the exteriorisation in electronic technology of an "inner experience" which is electric, mythic, inclusive, and configurational; the primacy of "field" over event; the vision of "processed information" as somehow consonant with the perfectibility of the human faculties' - his theory strives toward a new Pentecostalism. Similarly, Donald Theall (2001: 118) observes that 'the function of electricity can be seen as reflecting the formula borrowed from theology concerning the God (equivalent in McLuhan to acoustic space) whose center is everywhere and whose circumference is nowhere'.

This observation regarding the perceived omnipresence of electric media - offering 'the possibility of a world without words, a wordless, intuitive world, like a technological expression of the action of consciousness' (McLuhan 1967: 167) - is particularly important, for it is demonstrative in my view of the problem with McLuhan's privileging of formal cause, and the exact reason why his theory is unable to escape the hylomorphic schema within which it is embedded. It is not unusual for him to emphasize the way in which electricity eliminates the notions of both discrete media and specialized knowledge. As the movement of information speeds up, he suggests, 'information levels rise in all areas of mind and society, and the result is that any subject of knowledge becomes substitutable for any other subject' (McLuhan 1995: 185). By the same token, under such conditions, 'almost any kind of material will serve any kind of need or function' (McLuhan 1964: 40). Although this would initially seem to imply that the very concept of *the medium* becomes meaningless in the electric age - a claim that would completely undermine his underlying thesis - reading more generously it would seem that what he is observing instead is a shift from a model whereby media are differentiated on the basis of their content, to one in which this occurs instead on the

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basis of their effects (i.e. their formal cause).

Lance Strate (2006: 100) argues both that 'the *material* is the message; it is the *material* that communicators draw upon for their content' and that 'the material is the *medium*; it is the *substance* through which we exchange messages, and the *environment* within which we communicate'. Yet this is precisely *not* what McLuhan argues in his own writings, for it is not the material that matters in either case, but the form in which that material takes. This is not to say that he never speaks of materiality, or of the specificity of the material configurations of certain media - for example, he does often reiterate Harold Innis' (2007; 2008) claims regarding the spatial and temporal characteristics of different media throughout history, and the socio-cultural effects of such differences - but rather, I would proffer that it appears to be a question that he considers to be largely, if not entirely irrelevant in the electric age. The composition of a medium, what might once have been referred to as its material cause, is entirely subordinated to its effect. The concept of electricity is idealized to such an extent that its specific instantiation within hardware is ignored.

Innis, one of the first great media ecologists, in his theory of the time/space biases of various media, pays quite careful attention to the ways in which their physical attributes - weight, durability, and so on - affect the societies within which they are utilized. Similarly, Lewis Mumford (2010: 60), beginning with 'the original exploration of the raw environment, the utilization of objects shaped by nature', focuses in large part upon the ways in which technics are defined by, but also have a determinative effect upon the material world. Mumford, in fact, provides one of the first clear examinations of the strain that industrial technologies had placed on the natural world. In the case of McLuhan, by contrast, argues Robert K. Logan (2010: 30), he 'did not explicitly distinguish between the various phases of the electric information age; however, rather he tended to treat all electric forms of information uniformly', lumping together 'a number of separate and distinct breakthroughs perhaps because each involved the electric speedup of information'.

We are thus back where we began: passive matter as merely a featureless receptacle for active form. As much as McLuhan recognizes the importance of both the carrier and the receiver in determining not just the accuracy of a transmitted message, but the nature of the very message itself, he fails to acknowledge the way in which the material specificities of said carrier can not only alter the message, but can actually transform the audience that acts as the ground (and hence the formal cause) of this medium. Ironically, it would seem that this neglect of the role of materiality occurs for exactly the opposite reason as it does in Plato and Aristotle: whereas they view matter as inferior primarily because of its indeterminacy - the fact that it can be shaped into many different forms - McLuhan seems to view it in this manner for the reason that it offers none of the dynamism demanded of a medium. As Eric McLuhan (2011: 218) puts it, 'material cause too is extratemporal; that is, time may be present but its chronological aspect is incidental at best, or simply irrelevant'. The being of mat-

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ter is spurned in favour of the becoming of form.

German media theory and the turn toward hardware

One of McLuhan's repeated claims is that 'the Greeks did not study the entelechies or formal effects of human artifacts, but only those of natural forms, whether of mineral, flora, or fauna' (McLuhan and Logan 1977: 377). This is a somewhat odd claim to make, given his repeated references to Plato's *Phaedrus*, which is a patently apparent meditation on the effects that a single medium (orthographic writing) has on its audience. Just as importantly though, Kittler (2009: 25) argues, 'it is precisely because the opposition of form and matter stems from technology, not from natural and living forms, that ontology systematically excluded media technologies from its domain'. Aristotle was unable to think mediation, he claims, because 'his ontology deals only with things, their matter and form, but not with relations between things in time and space', thus completely eliding the privileged role 'of writing as philosophy's own (technical) medium' (Kittler 2009: 23-24). It is from this perspective, I now wish to propose, that Kittler offers an important - and perhaps, underappreciated - rejoinder to McLuhan's somewhat blinkered formalism.

It is the methodology of Michel Foucault, the 'last historian or first archeologist', as well as that of McLuhan, that forms the foundation of Kittler's (1999: 5) own work. 'Media record, transmit and process information', he claims, defining them not as mere extensions of the human, as McLuhan does, but as autonomous information systems (Kittler 1996: 722). Yet this entire concept of the medium is elided in Foucault's work, he contends, for Foucault's interest lay in an epoch when writing operated as a solitary, universal medium, and as such, his archaeological method fails to take account of the *discourse network* – that is, 'the network of technologies and institutions that allow a given culture to select, store, and process relevant data' – which underpins the epistemes that he seeks to describe (Kittler 1990: 369). In the discourse network of the nineteenth century, the materiality of the written/printed word was obscured by the universalization of the alphabet as the means through which data was stored and transmitted – writing is 'the technology of which the archeologist simply forgot... whatever else was going on dropped through the filter of letters or ideograms' (Kittler 1999: 5-6).

It was only with the advent of competing technologies – the typewriter, the film camera, and the gramophone – that the materiality of discourse gradually became evident, as different media offered different forms of data storage, each with their own methods and limitations. It is thus only within such a discourse network that we are able to speak meaningfully of the material basis of communication: that is, the importance of hardware in the transmission of messages. Materialities of communication are a modern enigma, Kittler (1993: 161) argues, and any attempt to study them must grasp two presuppositions: firstly, that materiality cannot be understood apart from the physics that underpins it, and secondly, that information and communication cannot, in themselves, produce materiality. It is from these presupposi-

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tions that we can derive the two most basic principles of Kittler's 'information-theoretical materialism': firstly, that all forms of communication are reducible to the hardware through which they are facilitated, and secondly, that mediation must be understood as a process of data transmission, in the manner described by the Shannon-Weaver model of communication.

In regard to the first principle, this means in short that there is no communication without material support, and that this support directs and alters the shape of this communication: a 'fundamental data processing has been at play whenever ontological thought or mathematical writing changed the course of cultural history' (Kittler 2009: 30) In the case of literary analysis, for instance, he argues that traditional forms of hermeneutics have failed to grasp the book as medium - at best, they understand it in terms of its production and labour value. Conversely, a discourse analysis under his model is forced to comprehend 'the fact that literature (whatever else it might mean to readers) processes, stores, and transmits data, and that such operations in the age-old medium of the alphabet have the same technical positivity as they do in computers' (Kittler 1990: 370). Correspondingly, the boundaries upon discourse that both constrain and open the possibility of agency within any particular *episteme* are not simply social, in the more narrow sense of the term, but also informational. Translation becomes the very basis of mediation: 'to transfer messages from one medium to another always involves reshaping them to conform to new standards and materials' (Kittler 1990: 265).

The mode of processing offered by print, Kittler (1990: 115) argues, was fundamentally altered by the discourse network of the romantic age: 'poetry supplanted the data of the senses in a way that was reproducible and multiplacatory'. Similarly, the rise of electronic computing in the mid twentieth century provided us with a novel understanding of information processing, based upon a 'new trinity made up of commands, addresses, and data' (Kittler 2009: 30). It is this architecture, he argues, derived from the pioneering work of mathematician John von Neumann, which allows us to finally overcome the hylomorphic dyad of form/matter that we have inherited from Aristotle, and to begin to discern the way in which discourse is not simply carried by, but *emerges from* the medium in its material specificity. As he puts it in one of his earliest essays, a discourse analysis of this kind seeks to 'dissolve the phantasm of world history into many individual storage devices which themselves were forgotten and/or retained' (Kittler 1981: 91).

From such theses follows one of Kittler's (1997: 150) most notable and controversial assertions: that 'there is no software'. Where McLuhan observed hardware being supposedly 'transmuted into pure information by the process of "etherealization"', - a claim that supports his general privileging of form over matter - Kittler instead argues that if we descend from our most basic, superficial interactions with a computer down to the lowest levels of its hardware, we will recognize that all software is reducible to voltage differences (McLuhan and Nevitt 1973: 9). This is not an unproblematic argument to make, given that one of the

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most characteristic features of digital computation and mediation in general is its potential (not always realized, of course) for hardware independence and interoperability. Yet for Kittler (1997: 150), such arguments are simply obfuscatory, given that any 'transformation of matter from entropy to information, from a million sleeping transistors into differences between electronic potentials, necessarily presupposes a material event called reset' - *software* always remains simply an idealized abstraction of the functions of hardware.

Following quite neatly from this is the second key principle of Kittler's (1993: 168, my translation) materialist philosophy of media: that 'communication (to speak of Shannon) is always *communication in the presence of noise*: not only because real channels never fail to produce noise, but because messages themselves are generated as selections or filtering operations of noise'. Kittler's theory is heavily indebted to the Shannon-Weaver model, effectively viewing all mediated communication (that is, all communication that is reliant upon physical media) as a series of relays circuits and switches, and taking a decided interest in the way in which perturbations (i.e. noise) affect the communicative process. Yet whereas this model remains fundamentally hylomorphic, Kittler (1990: 183) brings to the fore both the active, transformative properties of the medium and the necessity of noise in the communicative process: in 'the realm of all sounds and words, all organisms, white noise appears, the incessant and ineradicable background of information'. Even speech itself - with its pauses, tics, stutters, coughs, and so on - involves the insertion of a noise that is entirely impertinent to the meaning being transmitted, and yet, is the audial indication of the physiological mechanisms that actually enable such communication in the first place.

This is the basic paradox that underlines the concept of noise: on the one hand, noise is, as Michel Serres (1982: 4) describes it, the 'ultimate parasite', interrupting all transmissions; yet at the same time, it is a reminder of the material basis for any communication. That which threatens the intelligibility of a message is also the guarantor of its arrival. Noise is vital to Kittler's (2000: 82) materialism precisely because it is an indication of materiality at a time when speaking of such a quality is increasingly difficult - in our present age of technical ubiquity, in which media are formed through complex configurations of diverse materials, 'no-one can really comprehend or understand these elements – which have been developed through millions of man-years of engineering – as such'. The so-called 'user-friendly' interface, designed to make such media accessible to the humans whose capabilities for data processing have now been absurdly outpaced by these machines that they have created, simply ossifies the gap between the medium and its user: one only interacts with 'only the outer onion skin of an entire series of conjuring tricks that must first be invented, calculated, and optimized' (Kittler 2010: 46).

Under such circumstances, in which 'errors and failures cannot be ascribed anymore to persons' (Kittler, 2004: 253), noise becomes the means by which we are able to perceive the role of various media and their material composition in their enabling and limiting of communi-

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cation. This is a complete reversal of the Shannon-Weaver model, whereby noise is only understood as something to be eliminated - the parasite that degrades an already-given signal - because for Kittler, this noise is the medium itself, or at least a particular representation of it, and as such, any attempt to excise it is once again simply idealizing the content of media, by separating it from its material base. What is interesting, however, is that this is more than simply a qualified repudiation of information theory (in its conventional form, anyway), but a complete reversal of traditional metaphysics, which from Parmenides onward has been largely premised upon the removal of noise (sensory data, in most cases) - through various means of encoding and abstraction - from the "signal" of knowledge. The problem is not the process of abstraction in itself, but rather, the notion that such a process can actually produce the idealized, purified form intended. In an age of ubiquitous digitality, in other words, we must keep in mind Serres' (1982: 63) claim that 'the third is always there, god or demon, reason or noise', and that this third term grounds the conditions of possible communication.

Jussi Parikka (2011: 273) also follows this line of thought in arguing that 'noise is our ontology - but also our politics'. Noise becomes the uncanniness that is inherent within technical media: the awareness of a processuality outside of the confines of human awareness. It is the trace of an exteriority that cannot be unproblematically subsumed into a field of inquiry. It is not measurable in the way that Shannon and Weaver intended, but it is there: whenever a medial translation involves loss of some kind - be it through alphabetic inscription, the discrete frames of the film camera, the aliasing produced through digital signal processing, and so on - there is noise. Kittler's philosophy of materiality is, in short, a philosophy of hardware, and the informational structures that are enabled by it in its myriad of forms.

Conclusion: The problem of materiality in a networked society

The most difficult problem when discussing materiality today is the question of what we might consider to actually be 'material'. The problem, I would contend, as it manifests itself specifically within the realm of media studies is that information does not have an obvious material existence: whilst digital information is undoubtedly material, in the sense that it is transmitted in the form of electrical signals, its time-criticality and overdetermined material presence makes it impossible to locate within any single material element. Whereas in regard to paper, one can easily identify the material basis of the information stored upon it precisely because that information remains (for all intents and purposes) static, digital information - like that which is stored in the human brain - is reliant upon circulation, and is thus not apprehensible in the same fashion. In other words, this is not a question of materiality - there should be no doubt that there is a material basis to information - so much as it is one of temporality; it is a result of 'the speed of the electric current, surpassing the human senses altogether' (Parikka 2011: 270).

'Technology,' argues Parikka (2010: 147), 'has increasingly shifted from an issue of matter (as stability) to one of variation and metamorphosis'. This is less a change in the ontological

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nature of technicity itself, however, as much it is an unveiling, forced by increasing speeds of computation and transmission, of the processuality that enables all mediation. The object of mediation is never a single material unit, indexed at a particular spatio-temporal point, but instead is by its very definition a translation through which information is transmitted and transformed. Even the humble printed word is only mobilized as information in relation to an observer (be it a human, a universal Turing machine, or some other entity): the words in themselves mean very little without further processing. The difficulty, therefore, when studying digital media is that as soon as we take any one specific element of the medial process at any one specific moment as being the material that constitutes an object's materiality, the becoming that constitutes its being is lost within a frozen abstraction. The paradox of materiality is that the content of a specific medial process - most obvious in the case of digital data - perpetually exists as a production of difference *between* materials.

In neglecting to properly account for the temporality of mediation, we come to see media as unlocatable, and thus immaterial. This is a triumph of accelerative tendencies: to quote Paul Virilio (2008: 120), it is as if 'the vivisection of speed now attacks the very density of masses'. It is not that the solidity of mediation has actually disappeared, but that the speed at which information production, processing and transmission occurs today allows for the justification of communication in such terms. As Sean Cubitt (2013: 137) notes, a 'friendly, fuzzy consensus between entrepreneurs, engineers, economists, and English professors that thought is weightless promotes belief that externalities need not be accounted'.

Waste, Cubitt (2005: 15) argues, is a mode of communication, for 'neither intention nor consciousness are requirements of communication - we communicate by virtue of our place in the network'. 'Industrial and population waste', he goes on to illustrate, 'were at one time demarcators of class, intensely local to factories and the workers living in walking distance of them', but now, 'waste export, atmospheric pollution and global warming are broadcast'. We are reminded here that supposedly immaterial forms of communication are wholly reliant upon an increasingly complex and ubiquitous technical apparatus that carries with it a distressingly heavy ecological footprint. The digital economy, with its rapid obsolescence of technological devices and seemingly ever-accelerating upgrade path, is not a culture of abundance, but one of obsolescence and waste, and as such, declares Wolfgang Ernst (2013: 43), 'in a digital culture of apparent, virtual, immaterial realities, a reminder of the insistence and resistance of material worlds is indispensable, and all the more so from a media-theoretical point of view'.

Paul Ryan (1993: 339), a former student of McLuhan, once remarked that 'the species that destroys its ecology destroys itself'. Unfortunately, we live in a time when this is a genuine existential risk, and unless we want to adopt the apocalyptic eschatology of McLuhan himself, we can no longer operate under the illusion that communication is necessarily free or endlessly plentiful. The effects of networked media upon the physical environment

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are considerable, and to a disturbing extent unrecognized by both media scholars and the broader populace, far exceeding the concerns addressed in the McLuhanian conception of formal cause. If we follow Neil Postman (1973: 10) in arguing that 'unlike most communication students, who are trained in a single conceptual scheme, the Media Ecologist must know about all the systems that are presently and reputedly used to describe the communication process', then we must accept that the causality of mediation exceeds the formal characteristics outlined by McLuhan, and move toward a far more attentive approach to the question of hardware (that is, material cause) and its effects.

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