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## Media zoology and waste management

*Animal energies and medianatures*

Jussi Parikka

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### Abstract

In this article I will investigate the relations of media and ecology, arguing that the incorporation of nature and ecology as part of the media theoretical discourse should also be connected to the ecological contexts in which theory is being produced. This means a concretisation of media ecology in terms of its focus and topic to take into account the current eco-crisis, from perspectives related to animal studies, electronic waste, and even geology. In this sense, the argument of the text is simple: there is a concrete edge to media ecological theory, and in this instance it is elaborated through the themes of animals, waste, and mineral resources.

**Keywords:** animal, ecology, media, waste, zoology

In this article I will investigate the relations of media and ecology, arguing that the incorporation of nature and ecology as part of the media theoretical discourse should also be connected to the ecological contexts in which theory is being produced. This means a concretisation of media ecology in terms of its focus and topic to take into account the current eco-crisis, from perspectives related to animal studies, electronic waste, and even geology. In this sense, the argument of the text is simple: there is a concrete edge to media ecological theory, and in this instance it is elaborated through the themes of animals, waste, and mineral resources. This is summed up through the notion of ‘medianatures’, which follows Donna Haraway’s challenge to think of nature and culture not as two separate regimes but rather as a topological continuum. Indeed, in this way media is concretely and constantly related to nature, both through perspectives of human labour and through the environmental costs of media technologies (as recently

and convincingly argued by Richard Maxwell and Toby Miller in *Greening the Media*). This insight reminds us that it is not only the new media sphere of energy intensive cloud computing or toxic material-filled devices that demand an ecologically-aware eye – ‘old media’ too, from paper to film, had their own health and environmental hazards.

The animal and the ecological question is an increasingly important one for the humanities, including for such fields as screen studies.<sup>1</sup> We need to be able to conceptually weave together what is happening on a material level in terms of geopolitics and ecologically unsustainable practices, for example resource depletion, waste production, the lack of proper management strategies for such problems, etc. Such issues of practice and policy also demand a theoretical insight and relate to questions of ‘what then if not the anthropocene?’ How can we invent post-anthropocene futures in terms of our thinking and our material practices? In order to come up with a more ethically-sustainable focus we cannot start considerations of media technology from the human – we need more animal-, ecology-, and even geology-focused accounts for us to develop a horizon worthy of a posthuman ethical stance. It is in this sense that we need to pay attention to minor traditions of media theory that incorporate animals in various forms and initiate the theoretisation of media from a different set of affordances to that of the human being.<sup>2</sup> Affordance is understood as the set of ‘ecological’ forces that are always material and energetic, in Matthew Fuller’s way of understanding media ecology.<sup>3</sup> This brings in heterogeneous forces, practices, and material sets in which historically-varied media assemblages are born and die. Information technology is not just material, but it materialises in a longer process; it concretises in long networks and rematerializes as junk – a media garbology of sorts. Such an interest would not see waste as an appendix to the media studies agenda but rather as its starting point, as an ecological interest of knowledge.

In this context this article outlines two themes that are offered as horizons for the question of waste: an agenda for animal media studies that riffs on the recent surge in animal studies and the Derridean inspired ‘question concerning the animal’,<sup>4</sup> and the ecological dimensions of contemporary technical media. This does resonate with some of the recent debates in ‘media ecology’,<sup>5</sup> but with a curious twist that demands to take the ecological literally in the sense of the environmental contexts of screen media and information technology more widely.<sup>6</sup> Such media materialism pursues a connection to ecology and nature, but this is not to abandon political questions of labour or politics. Indeed, recent debates concerning vibrant matter<sup>7</sup> are relevant. For instance, Jane Bennett’s insights into non-human

matter are something that can be taken as part of the concerns of media ecologies and waste. However, we need to make sure that our notions of vibrancy are equipped to deal with the delimitating powers of things. There is a dark side of new materialism that also recognises the same dynamics of matter in destructive ways.

All of this is seen as a way to frame ‘media waste’ not as a question of content, malicious media (e.g. viruses), the toxicity of the political economic structures of media ownership and imperialism, or even the intimate nature computer technologies play in the neoliberal global market economics. Media waste is understood as one example of the connection to resources and natural energy, as well as one index of the most urging aesthetico-political question of our age: the eco-crisis. First, I want to establish some historical points concerning the material and epistemological relation between animals and modern technologies. I will then examine themes of media ecology and materiality, with an emphasis on the ecological and energetic ground of modern media technologies,<sup>8</sup> eventually working towards the question of waste.

## Animal worlds

The concept of medianatures maps the continuum across ecological spheres in order to create a sense of the political economy of the new material forces at play in digital culture. It is a nod towards Donna Haraway’s grounding work, as well as the ecological concerns Felix Guattari raised in the 1980s in relation to the various spheres in which we need to understand the work of the politico-aesthetic constitution of contemporary culture. Medianatures focuses on relations of media and nature, including animals as well as ecological depletion. It does not shy away from epistemological issues, and it is important to understand how the production of knowledge about ecology and animals has been entangled with mediatic concerns.

Systematic mapping of the life worlds of animals both in the physiological (movement, perception, nerve systems, etc.) and the ethological sense (how they inhabit life worlds) are two key strands of the early 19<sup>th</sup> and 20<sup>th</sup> century interest in the animal. The mapping of the animal itself as ‘media’ – that is, the animal as a relay station of perceptions and sensations – is inherently connected to the physiological and experimental investigations of the human as a perceptual system. This relates to some of the arguments I offered in *Insect Media*, and it also resonates with the theme of mapping human and animal thresholds of perception. What can animal bodies do,

and what can ecological bodies do?<sup>9</sup> Scientific measurements of how sensation is governed on a material level reached a special importance in relation to the burgeoning media technological experimentation and innovation after the 19<sup>th</sup> century.<sup>10</sup> In addition, the systematisation of research methods across the fields of natural sciences (e.g. chemistry) was instrumental in setting up a new regime of relation to nature, resources, and later, synthetic products. It is in such fields as chemistry where we need to start looking for genealogies of media culture and capitalist exploitation of ecological bodies.

Furthermore, we can argue about how new techniques of measurement, the systematisation of knowledge, and the harnessing of the chemical and geological compounds of the earth can be seen as a specific *zoëlogy* of sorts – by which we mean reference to a much ‘rawer’ understanding of life than through *bios*. Indeed, as theorists such as Rosi Braidotti have argued, perhaps we would need to turn our attention not only to biopolitics as a constitution of governance of life in modernity, but also extend our critical interest to *zoë* as well. In Braidotti’s terms, this refers to understanding a certain Spinozist ethics of the subject that, for her, is informed through a Deleuzian nomadism.<sup>11</sup> What informs Braidotti’s take on feminist ethics can also be seen as a vehicle to understand the *zoë(/o)politics* necessary for not-just-human-social ways of governing material bodies and the specific cultural techniques of such. The mapping of biopower in relation to nonhumans is both an extension of Foucauldian methodology<sup>12</sup> and also something that needs to be thought through specific mediatic and knowledge techniques. The production of knowledge about animals happens through media technologies of measuring, and that knowledge itself is instrumental in establishing a range of relations to ecological resources, which can be described in Heideggerian terms as ‘standing-in-reserve’. What is essential to notice is that the world of media technological devices are themselves of nature and will return to nature often as electronic waste, emphasising the connection between epistemologies and ontologies.

Indeed, a proliferation of forms of life and epistemological understanding of concrete animal lives can both be connected to the wider birth of mass-produced consumer industries during the 20<sup>th</sup> century. The animal testing in the cosmetics industry is one obvious example of the connection to aesthetics on a concrete, material human-animal hybrid level. This reveals a different need for critical analysis of consumer capitalism, rather than one aimed at the end product of such processes. As it stands, our theoretical apparatuses and human sciences might need to pay more attention to the animal as well as the systematic technological appropriation of potentialities inherent in animals as a resource for a variety of material purposes.

These are the ways in which we can understand the biopower appropriation of living energies.<sup>13</sup>

A great deal of the systematic research and investment in fields such as entomology served straightforward ends. Entomology was a key area of research for battling the various insect problems in cities and in crop fields during the late 19<sup>th</sup> century in the United States. Applied entomology was establishing itself as an international discipline, where knowledge of ‘portable insecticide and fungicide appliance’ was imported from France to the United States for vineyards. Indeed, in the long history of cultivation techniques, from apiculture to the silk industry, one notices how fine the relations between animals and increasingly systematic modes of production are – and with the systematisation of research methods, how they gradually contribute to the birth of mass industries. Here, one should not underestimate this part of ‘insect media’ in relation to the technologisation of cultural and material life in the United States and Europe, establishing systems of knowledge production, coordination, and implementation in relation to agriculture. For instance, the periodical published by the Department of Agriculture was named ‘Insect life’.

Its columns are open to all station workers; and I would here appeal to the members of the association to help make it, as far as possible, national by sending brief notes and digests of their work as it progresses. Hitherto we have been unable to make as much effort in this direction as we desired; but in the future it is our hope to make the bulletin, as far as possible, a national medium, through which the results of work done in all parts of the country may quickly be put on record, and distributed not only to all parts of our country, but to all parts of the world.<sup>14</sup>

This is where the two sides concerning early insect research converge. The image of slightly crazed and lonely scientists like one Dr Reuter, said to have ‘spent much of his life studying’<sup>15</sup> one hemipterous family of capsidae, paints a vivid picture of the systematisation of knowledge which was the arena of amateur enthusiasts for a long time.

This is the situation in which we find lengthy discussions concerning insects as carriers of diseases (typhoid fever, yellow fever, cholera, and sleeping sickness) and as an alien life form that awes with their sheer number – something which inflects the calls for study.

There are in New York State some 20,000 different species of insects and perhaps 100 entomologists engaged in collecting and studying them. There

are presumably more than 100,000 species in the United States with over 1,000 entomologists and in the entire world a million to ten million different species of insects (a large portion unknown) and a relatively much smaller group engaged in their study.<sup>16</sup>

Obviously, we could talk of the regulatory work of metaphors in which new technologies were domesticated and made familiar through their subject topics – as for instance in the references to the millions of years of invention power that was matched only recently by humans through the massive investment in media technological and the aviation fields.<sup>17</sup> In addition, for E.P. Felt, the mediatic worlds of antenna-equipped insects were something worthy of close inspection by the burgeoning amateur radio enthusiasts of the 1920s. The writer's advice is to look at gall midges. The result, a meticulous investigation of the insect's body as optimised for transmission, with the quirky elaboration of antennae as extensions of (non-hu)man.

Ages ago the gall midges – minute flies which produce galls on many plants – learned the advantages of elevated or elongated antennae. Here we find species which have solved problems by the development of greatly elongated segments, thus increasing the length of the entire organ, and others which have attained the same end through a doubling or trebling of the normal number of segments or joints. As a result, some of these flies have antenna twice as long as their body. Each segment is a unit, and though the comparison may not be a strictly accurate one we are inclined to regard the antennal segments as linked.<sup>18</sup>

What is significant about such themes of 'insect media' are less the metaphoric links than the wider epistemological field in which techniques of analysis, observation, and distribution of the research concerning insects was mapped onto the core themes of technological urbanisation. Indeed, pests, food supplies, hygiene, and increasingly waste are part of the logistical life of urbanity and constitute one specific historical horizon through which to understand contemporary lives struggling with the same issues. The lives of cities and societies were never separate from the question of the animal. They were always linked on very material levels, even if not often recognised in early major sociological work. This was an important part of the research relating to sociology and the problem of the social, where insect societies acted as one key relay for considerations of the mass. However, mass society as a problem of affects and imitation was articulated through

ideas from Alfred Espinas' animal sociability research to Gabriel Tarde's 'microsociology'.<sup>19</sup>

In terms of mapping the links between human societies and managing animal life, we should never fail to understand the massive impact information has had on agriculture, and later pesticide production. The latter has a mediatic and military history from trench chemical warfare, mass murders during the Second World War, and then back to fighting insects again.<sup>20</sup> Hence, it was not only that organisational issues relating to insects arrived with cybernetics in the 1950s, and that earlier interest can be summed up only as speculative psychological and social studies of insect worlds.<sup>21</sup> This is the parallel history we need to account for: a systematic material and mediatic apparatus of knowledge production concerning animals such as insects; and – as for instance in robotics and cognate fields in artificial intelligence and life after the 1950s – biomimetical insights into simplicity as the new complexity, from W. Grey Walter's tortoise to Herbert Simon's ants as featured in *The Sciences of the Artificial*. In the latter, an ant on his beach stroll takes a rather aberrant, irregular route across obstacles, which for Simon demonstrates the complexity arising from the ant + environment as an assemblage of sorts.

Viewed as a geometric figure, the ant's path is irregular, complex, hard to describe. But its complexity really is a complexity in the surface of the beach, not a complexity in the ant. On that same beach, another small creature with a home at the same place as the ant, might well follow a very similar route.<sup>22</sup>

Indeed, two things stand out. The late 19<sup>th</sup> century witnessed the articulation of animals and ecology as a relay point where the social was negotiated. Human sociability, sociological features, and the birth of an understanding of the social in the modern academic sense were articulated in relation to animal worlds, with an eye towards psychological, urban, and technological contexts. Similarly, postwar cultures established an agenda where issues of communication and sociability were discussed through a specific zootechnical approach – evident for instance in the research into dolphin communication, as well as the social behaviour and pathologies of rats.<sup>23</sup>

The applicability of information gathered on rats and ants was pitched as transferrable to humans. This is revealed in Herbert Simon ('in this chapter, I should like to explore this hypothesis but with the word 'man' substituted for "ant"<sup>24</sup>) as well as Abraham Moles, whose information theory approach to ant colonies as communication systems made the link through



‘sociometric nets’ and ‘sociograms’. One could almost say that here the Foucauldian concept of diagram gets a further twist, towards the worlds of myrmecology:

[a] sociometric set of communications is expressed by a sociogram, more or less developed according to the number of connections between individuals, related to some convenient unit. In fact, these communications can be made at various levels or with various channels, and one may be led to distinguish basic patterns of specialized sets according to the nature of the communication, e.g. food, war and love.<sup>25</sup>

Cybernetics was a central context and driver for the realisation of such an emphasis on insects and animals. Despite some of the more daily contexts having to do with agriculture, much of the insect discourse was branded by an emphasis on psychology, perception, and the social aspects of insect life. This included experimentation and analysis of the pathological features of the social. Even if we cannot speak of a sudden change, it is clear from wider analyses such as Charlotte Sleight’s *Six Legs Better* that the cybernetic context brought in new aspects. Informational and organisational views of insect life were topped up with a further interest in what could be jokingly called the cultural techniques of animals. For instance, an interest in the language and dance practices of bees in Karl von Frisch’s popular research was one aspect that spun off into a wider geographical mapping of comparative nature, paralleling the work of anthropologists (the Rockefeller Foundation funded travel to India and Ceylon for investigations of bee languages in non-Western locations).<sup>26</sup>

An emphasis on language is also evinced by the birth of biosemiotics (in Thomas Sebeok’s work). Indeed, Sebeok himself is one of the bridges between anthropology and what evolved into an interest in animal worlds. This was not the cybernetics that refers to Norbert Wiener or Claude Shannon’s versions of mathematical information theory – he dedicated his *Animal Communication* to Claude Lévi-Strauss, and is perhaps closer to figures such as Marcel Mauss, as Sleight speculates.<sup>27</sup>

## Material media ecologies

As noted early on in this article, media ecological concepts have enjoyed a comeback in recent years, particularly after Matthew Fuller’s book *Media Ecologies*. Fuller provided a different sense in relation to the term ‘media

ecology' as it had been regularly used by the Toronto School of Media Ecology (the post-McLuhan legacy) and the Media Ecology Association, with their slightly alternative emphases. Neil Postman's style of media ecology was more of the sort worried about the harmful influences of mass media; it proceeded as a rather normative attitude towards television. If a necessary phase of mass media critique, it did not engage with media as conditions of knowledge on the techno-epistemic level that Fuller proposes in his mix of theoretical influences ranging from Felix Guattari to Friedrich Kittler. Indeed, media becomes understood as affordances of sorts that remind of the vocabulary of J.J. Gibson (laced with Guattarian political ecology).

Before Fuller and in a context outside the humanities, a rather peculiar way of mobilising the notion of media through environmental affordances is found in Gibson's work.<sup>28</sup> Gibson's way of using and changing perceptual psychology into a proto-form of media ecology is one way to understand the materiality of the environment as part of perceptual patterns. For animals (including humans), the environment articulates perception and motion – from the terrain, to shelters, to such relatively stable elements as air, gravity, and water. The environment enables different ways of occupying the globe, even if Fuller points out that there is still too much stasis in Gibson's notion for it to take into account the 'inherent dynamism' of the world.<sup>29</sup> As such, it points towards the perceptual worlds of animals as being actively mediated, as well as gives insights into media as embodied formations of the environment for perceptions and motility.

For Fuller, the wider agenda of media ecology relies on an emphasis on circulation of energies and other materialities as affordances – a view that approaches media in a slightly complementary way:

[c]ultures, media ecologies mixed in with and passing through them, are conveyors of heat, materials and intelligence that at once provide a means, with their own particular rhythms, for the mix and conservation of modes and the multi-scalar conveyance of potentially mutational effects and dynamics, that themselves intermingle, block, and replicate dimensions of relationality, congealing as events, medial entities and processes of subjectivation. They certainly exist in and as the classically defined sense of media as systems for storage, processing and distribution of cultural material, but also pass along out with them.<sup>30</sup>

What Fuller introduces and makes such a significant difference to the earlier media ecological theories of Postman et al. is this mode of entangled materialities as *potentials* for action and relations. Media ecology as research

on affordances is interested in what capacitates and what incapacitates, and as such offers not a view on objects but rather their potentialities.<sup>31</sup> Fuller's stance inspires the following question: what if we could take one more material step in terms of embracing media ecology literally, perhaps in ways that emphasise the 'medianature' continuum of it, but also in ways that extend the idea of affordances to themes of depletion and waste?

As for the materiality of media, perhaps it starts way before media are media. Media technologies can be understood as a long story of experimenting with different materials – from glass plates to chemicals, from selenium to silicon, from coltan to rare earth minerals, from dilute sulphuric acid to shellac silk and gutta percha – and processes such as crystallisation, ionisation, and so forth. Besides materials of production, media history is a story of systematic relations with the living, both organic and non-organic, and the waste products emerging from the use and misuse of materials. Besides materials and waste, media deal and function through energy. The transistor-based information tech culture would not be thinkable without the various meticulous insights into the material characteristics and differences between germanium and silicon, not only in their 'pure' state but mixed with just the right dose of impurities.

The energetic regime is as important to consider – whether that involves taking into account current cloud computing,<sup>32</sup> or the constant attempts to manage power consumption in relation to size and functionality, which are one aspect of the media history of computing. Here, for instance, the junction transistor's benefit was how it could be completely functional with less power, operating at 'a tenth of a volt, drawing a current of only 10 millionths of an ampere',<sup>33</sup> providing a much more cost-effective way of amplification around 1951. Whereas media and communication regimes and information technology might support fantasies of immateriality removed from flesh and entropy, they are based in high-level physics, material sciences, and investigations into characteristics of things such as minerals and chemicals, processed and managed from materiality to media.

To quote Sy Taffel:

[i]t borders on tautology to state that ICTs require electricity to power them, but electricity has to be generated somewhere and somehow, and within the contemporary cultural context that predominantly means the combustion of fossil fuels, entailing the release of carbon dioxide and other greenhouse gases into the atmosphere, contributing to anthropogenic climate change, alongside the localised ecological costs of fossil fuel extraction, as dramatically highlighted by events on the BP-owned Deepwater Horizon oil rig in

2010. Recent data suggests that the energy requirements of powering ICTs is substantial and rapidly rising, presenting questions surrounding the ethical and political status of these technologies.<sup>34</sup>

Media ecology functions as a concept to transport the academic theoretical agenda regarding animal and ecological studies into a relation with media theory – it is a zoographical writing of media studies from an alternative perspective of animals, energy, resources, and waste. Indeed, one of the arguments this article proposes is that it is not sufficient in the media ecological focus to stay on the level of the animal, which in the current and past 10 years of animal studies and post-humanities discourse has gained a lot of currency. Besides illuminating important ethical and aesthetic debates concerning the animal (inspired by Derrida, also readings of Heidegger, Levinas, Agamben,<sup>35</sup> and Deleuze), such cultural theoretical dimensions benefit from a wider insight into the ecological layering of the various issues at hand.

One way of broadening the agenda of animal research in relation to the materiality of media is through an ecology of political economy, ethics, and aesthetics. This is an approach that borrows as much from Fuller as it does from Guattari in the sense that it provides an expanded mode in which to map specific cultural techniques and epistemological objects. Such an extended mode of focus on ‘not-just-animals’<sup>36</sup> introduces a question that demands a wider take on the mediatic nature in which ecology – and ecological problems of life – are being articulated. Hence, it is where we need to expand on notions of biopolitics and even zo(e/o)politics. This aspect becomes clearer when approached through themes of resource depletion<sup>37</sup> and their relation to the high-tech material science basis of media, including statistics on the critical status of oil and water resources and the constant political and economic struggle over the mining of rare earth minerals essential to batteries, screens, and in heat-resistant semi-conducting elements in mobile phones and computers.<sup>38</sup>

For such major political entities like the European Union, the future of information technology planning starts not only from the emphasis on software-based creative industries but also in depths below the surface. This relates to critical raw materials, which the EU territory does not possess to a large degree. The advanced technologies identified as crucial for a longer term socio-economic change are also ones at the centre of future geopolitical hotspots, where ‘geos’ starts to refer to Earth quite materially. In terms of politics, this refers to the crucial status of China, Russia, Brazil, Congo, and South Africa as producers of raw materials and as key

global players for future technological societies. All of this comes with the refocusing of *geos* down below. The materiality of information technology starts underground – the deeper you can go, the more you might find in terms of necessary resources.

From animals to nature as a resource, a material ecology for media is an increasingly important topic. This is the double bind that relates media technologies to ecological issues: material ecology is raw material for the actual hardware aspects, from cables to cell phones; also, it is an important epistemological framework, whether in relation to the mapping of climate change or in terms of further resources for exploitation, as in the recent proposal not just for an Internet of Things, but an Internet of *Underwater Things*.<sup>39</sup> We constantly produce knowledge and imaginaries as well as future design solutions through an active conceptual and material relation to nature. Indeed, we need to account for the variety of speculative design ideas that are now emerging. These ideas use not only different materials but a very different set of material thinking altogether, building from biodegradable matter (for instance computer parts that are biodegradable) as well as in relations to nature in ways that are described as biomimetic. The constant back and forth co-determination is what characterises this medianature-assemblage. It is here that media technologies are essential nodes in this epistemo-ontological tie, with an important relation to questions of waste, but also to the level of design we are thinking/doing regarding the world of ecological life as well as non-organic reality.

## Medianatures

This sort of an extended media ecological perspective stretches media studies from humans to animals, but even more significantly to extended notions of ecology in the non-organic sense. Hence, the concept of affordance again gains currency in relation to persistent environmental themes, which in this case relate to the long-term sedimentations that form mineral reserves. This is where I would like to offer two related perspectives to make sense of this turn from a media of humans and human practice to a wider set of affordances. By affordance, with a nod towards Fuller's definition(s),<sup>40</sup> I refer to the material constitution of hardware in terms of production as well as the other end of the material cycle of electronic media technologies: electronic waste. Indeed, the capacitation of thought and being might emerge from lived bodies – as Fuller argues in a manner that resonates with claims concerning vibrant matter by Bennett – but we need to map

the Spinozian double-nature of this work of capacitation and be aware of energies of incapacitation. As identified by a growing number of studies and policy reports, both governmental and NGO, electronic waste is the globally-distributed underbelly of high-tech media culture.<sup>41</sup> From screens to computers, waste as a sign of (planned) obsolescence of signal processing devices presents hazardous effects on various fronts, from the risky production conditions in China to the dangerous materials which people in various developing world contexts are exposed to when opening devices to extract valuable materials (copper wires, gold, iron, plastic, nonferrous metals, cables, cathode-ray tubes, printed boards).<sup>42</sup> The global flow of waste is from 'Western postindustrial to Asian developing countries',<sup>43</sup> revealing the twisted logic in which media objects affect the lives of people after their use, also how they intertwine with flows of consumer objects.

Indeed, what persists as part of creative industries, digital economy, and discourses such as attention economy is the material 'substrate' on which the claimed immateriality and lack of scarcity is being built. This is an argument that Taffel elaborates well by underlining that there are 'ecological costs associated with the lifecycle of the attention economy's microelectronics hardware',<sup>44</sup> which begs for a transversal analysis of the ecology of media, starting from its relation to other ecologies. Such ecologies are, on a political and economic level, about allocation and distribution of benefits and costs, where the latter too often hone in on already 'impoverished communities'.<sup>45</sup>

Such an agenda that looks at the transversal links across the semiotic and the material refers to a particular way of understanding the residual matter in media.<sup>46</sup> This sort of media materialism takes such insignificant particles as dust or discarded e-waste and sorts out a different kind of understanding of the process in which media materialises. Hence, I use the term 'medianatures'. It refers to the manner in which Donna Haraway established an argument about 'naturecultures' – a continuum of the material semiotics and production of nature as deeply embedded in the cultural. This should not be understood as a naïve form of social constructionism but rather to account for the various folds that such categories exhibit. It is a co-determination where the terms are entangled in a dynamic relation, indistinguishable from each other. In a parallel way we can understand the co-determination of media and nature, which offers a material epistemology concerning the ecology of media and environmental concerns that technologically-advanced media are embedded in. It relates to both the way in which potentialities of earth materials are essential for media devices to become media in the first place, but also how our relation to the

earth is mediated by the epistemological framing of advanced media. From digital visualisation technologies to different techniques of representation, analysis, and tracking of the earth and its resources, media participates in excavation for its own existence.

This focus on medianatures should not be restricted to epistemological concerns; it is entangled with the material ontology that makes it possible. This relates to resources – to use a term that is rather instrumental, a Heideggerian ‘standing-in-reserve’ – but should also take into account specific human (labour) practices. We have to consider an extended notion of media work in relation to techniques of a very different, rudimentary sort, from mining to factory work in China and the use of ‘special economic zones’ as a way to create intensive free market zones with what is at times a dubious lack of labour protection laws. Besides production conditions, working conditions for people dealing with ‘dead media’ are also as problematic. This refers to scrapping and salvaging at the receiving end of obsolescent media in developing countries in Asia and Africa. In between use and disuse we find a long network of logistics of shipping containers, recycling centers, and the *management* of disposal, as Jennifer Gabrys outlines in her elegant study *Digital Rubbish*. Indeed, even disposal can be seen as an ever more central technique concerning our media culture, and it reveals a much more complex relation to materials, nature, and the economy than just pure discarding. Waste is postponement, not disappearance. It is a question of management, not getting rid of. Its momentary disappearance from sight just extends to a longer geopolitical and geographical network of waste management. This is an extension of our normal media studies concerns. It just ‘does not necessarily involve an absolute expelling of unwanted material but, rather, reveals attempts to recuperate or delay the demise of objects in order to postpone their decline of value’.<sup>47</sup>

Think of how this media culture of systematised electronic waste management differs from other object worlds of non-use, how practices of sorting and preservation characterise the obsolescent objects of museum culture, which has traditionally been a defining feature of how we think of ‘past media culture’. But in this case, we have to face a much cruder notion of obsolescence that has to do with piling heaps of rubbish, of environmentally hazardous materials, and collecting and disposing of different sorts.<sup>48</sup> As Lisa Parks argues, we need to revise our division of media objects/systems to ‘new’ and ‘old’ media. This dual setting risks ‘inadvertently reinforcing the imperatives of electronics manufacturers and marketers who have everything to gain from such distinctions’.<sup>49</sup>

We should rethink the way in which concepts for memory and time are used, but also how they resonate with our understanding of institutions of memory. Perhaps we can think in terms of an 'ecological' museum of accidents, like Gabrys points out in a Virilioesque manner. To continue this idea, we can think in terms of media ecology as a constant production of such inbuilt 'accidents' as electronic waste and energy intensive systems. But this accident is not a sudden crash. Instead, it is a long-term process of environmental durations, a slow decay and contamination of nature.

## Notes

1. Cubitt 2012.
2. See Parikka 2010.
3. Fuller 2005.
4. See for instance Wolfe 2003, 2010.
5. Fuller 2005; Goddard & Parikka 2011.
6. Cubitt 2011; Parikka 2011; Maxwell & Miller 2012; Taffel 2012.
7. Bennett 2010.
8. See Taffel 2012.
9. Parikka 2010.
10. Crary 1999.
11. Braidotti 2006.
12. Youatt 2008; Pettman 2011, pp. 134-135.
13. Shukin 2009.
14. *The Outlook for Applied Entomology*, 1891, p. 32.
15. Banks 1906, p. 867.
16. Felt 1922, p. 529.
17. *Ibid.*
18. *Ibid.*, pp.529-530. See also Newland 1916.
19. Johach 2011.
20. Sloterdijk 2009.
21. Sleight 2008, p. 169.
22. Simon 1969, p. 24. Insect aberrations seem to be a constant reference in relation to mathematical formalisations such as Markov chains and transformations of series and systems. See for instance Ashby 1957, pp. 165-171.
23. Müggenburg & Vehlken 2011. On rats, see Calhoun 1962.
24. Simon 1969, p. 25.
25. Moles, quoted in Sebeok 1968, p. 633.
26. Von Frisch 1955; Parikka 2010, pp. 126-140; Sleight 2008, p. 168.
27. Sleight 2008, p.183; Sebeok 1968.
28. Gibson 1986.
29. Fuller 2005, p. 46.
30. Fuller 2008, p. 46.
31. Fuller 2005, p. 45.
32. Cubitt & Hassan & Volkmer 2011.



33. Riordan & Hoddenson 1997, p. 193.
34. Taffel 2012, pp. 13-14.
35. See for instance Calarco 2008.
36. Cf. Fuller 2008.
37. See Widemann & Zehle 2012.
38. Including: cobalt, used for lithium-ion batteries and synthetic fuels; gallium, necessary for thin layer photovoltaics among other things; indium, used for displays; tantalum, for micro capacitors; germanium, for fibre optic cables and specific optical technologies, and so forth. European Union Critical Raw Materials Analysis, 2010. Executive Summary by Swiss Metal Assets, 2011: [www.swissmetalassets.com](http://www.swissmetalassets.com) (accessed on 24 July 2012).
39. Domingo 2012.
40. 'Just as capacities of thought, of being, are made in lived bodies, in complex and delicately conjoined tissues and processes, and just as powers are inherent in all matter, materialism also requires that the capacities of activity, thought, sensation, and affect possible to each composition whether organic or not are shaped by what it is, what it connects to, and the dimensions of relationality around it.' (Fuller 2005, p. 174)
41. For a collection of perspectives and research, see Parikka 2011.
42. Gabrys 2011, p. 91.
43. Parks 2007, p. 38.
44. Taffel 2012, p. 6.
45. Ibid., p. 5.
46. See Acland 2007.
47. Gabrys 2011, p. 89.
48. Ibid., p. 107.
49. Parks 2007, p. 33.

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