Soenke Zehle:

Reclaiming the Ambient Commons: Strategies of Depletion Design in the Subjective Economy

Abstract:

The vision of an internet of things, increasingly considered in the context of the "internet of everything", calls for an ethics of technology driven less by the philosophical search for the essence of technology than by a transversal curiosity regarding processes of constitution. If growing interest in enhanced and expanded media literacy approaches facilitates ethical reflection, the scope of such reflection is related to the extent of our attention to and awareness of the immanence of our agency, our capacity for relation in machinic assemblages that structure and sustain our communicative existences far beyond the sphere of signification. While the positions from which such reflection occurs are necessarily multiple, we can still respond to the distribution of agency with an aggregation of responsibility and the creation of a commons with greater attention to the vastness of the spatial and temporal scales of our situation. The idea of depletion design is both a concrete set of design strategies and an attempt to establish an experimental institutional object to facilitate and frame such ethico-aesthetic practice, an architecture for commoning that situates and affirms our ethical agency under the conditions of mediation.

Agenda:

Author:

Dr. Soenke Zehle:

- xm:lab – Experimental Media Lab, Academy of Fine Arts Saar, Saarbruecken, Germany
- ☎ + 49 - 681 – 92651 - 150 , ✉ s.zehle@xmlab.org, 🖥 www.xmlab.org/about/people/zehle
- Relevant publications:
  - Documenting Depletion: Of Algorithmic Machines, Experience Streams, and Plastic People. In: Richard Maxwell, Jon Raundalen, and Nina Lager Vesterberg (eds), Media and the Ecological Crisis, London: Routledge 2015, pp. 52-68.
  - Transcultural Media Studies. In: George Ritzer (ed), The Wiley-Blackwell Encyclopedia of Globalization, Chichester, West Sussex; Malden, MA: Wiley Blackwell 2012.
  - Rossiter, Ned; Zehle, Soenke: Data Politics and Infrastructural Design: Between Cybernetic Mediation and Terminal Subjectivity. Special Issue: Datafied Research. APRJA 4.1 (2015).
  - Rossiter, Ned; Zehle, Soenke: Experience Machines, Sociologia del Lavoro 133 (2014), pp. 111-133.
  - Wiedemann, Carolin; Zehle, Soenke (eds): Depletion Design: A Glossary of Network Ecologies. Theory on Demand #8. Amsterdam: Institute of Network Cultures, 2012.

The vision of an internet of things, increasingly considered in the context of the "internet of everything", calls for an ethics of technology driven less by the philosophical search for the essence of technology than by a transversal curiosity regarding processes of constitution. If growing interest in enhanced and expanded media literacy approaches facilitates ethical reflection, the scope of such reflection is related to the extent of our attention to and awareness of the immanence of our agency, our capacity for relation in the machinic assemblages that structure and sustain our communicative existences far beyond the sphere of signification. And while the positions in which such reflection occurs are necessarily multiple, we can still respond to the distribution of agency with an aggregation of responsibility and the creation of a commons with greater attention to the vastness of the spatial and temporal scales of our situation, preceding and exceeding the scales of venture capital and innovation governance. The idea of depletion design is both a concrete set of design strategies and an attempt to establish an experimental institutional object to facilitate and frame such ethico-aesthetic practice, an architecture for commoning that situates and affirms our ethical agency under the conditions of mediation.

I. Metaphors of Mediation

"Understanding the nature of infrastructural work involves unfolding the political, ethical, and social choices that have been made throughout its development," making infrastructures "a fundamentally *relational* concept".[1] From the early days of vending machines sending status reports via dial-up modems to the sensor networks in an "industrial internet" of self-optimizing assets and operations, m2m communication is an integral element of an internet of things.[2] "M2M" no longer stands only for the many-to-many forms of communication facilitated by peer-to-peer logics, but also for the machine-to-machine communication among edge devices linked in cloud-based networks. Supported by "sensor driven decision analytics", smart objects make decisions, even if the initial degree of object agency may remain far more modest than anticipated in ambitious visions of artificial intelligence.[3] And while the computational capacity of individual devices is rather limited, the prospect of m2m communication on a massive scale already drives the design of network infrastructures and regulatory frameworks that can structure and sustain the (self-)organization of the emergent machinic multitude at the heart of a new dynamic of mediation.

To focus on the dynamic of mediation is to acknowledge the structural transformation of the technical object and take its disperal into technical networks as analytical point of departure: "The concept of the technical object has itself become, because of its fundamental environmentalization, problematic, if not obsolete ... In contrast to the ever-repeated refrain of a new immediacy, into which we (re)enter in the age of ubiquitous computing, ubiquitous media, intelligent environments, and so on, we are in fact now dealing with the absolute prioritization of mediation."[4] To assess the ethical stakes of mediation, we will need to comprehend its infrastructural relationalities, the modes of relation through which it structures our communicative socialities and imagines individual and collective engagement. Given the central role metaphors play in the way we come to terms with our experience, one way to begin such an assessment is to look for new metaphors, metaphors drawn directly from the material infrastructures of mediation.[5] The two following examples – the data fabric and the zero-bandgap semiconductor – offer a way to comprehend two key registers of the "infrastructural relationality" of mediation: the becoming-topological of culture, and the seamlessness of surfaces that not only envelop us but literally implicate us in the constitution of our material environments.

---

1 Bowker, Geoffrey C.; Miller, Florence; Ribes, David: Toward Information Infrastructure Studies. Italics in original.

2 On GE's vision of an 'industrial internet' ('Big Iron meets Big Data'), see http://www.gesoftware.com, also Lansiti, Marco; Lakhani, Karim T.: Digital Ubiquity.

3 McKinsey analysts describe IoT value chains in terms of 'sensor driven decision analytics', see Chui, Michael; Loeffler, Markus; Roberts, Roger: The Internet of Things. What defines an IoT is that many of these decisions are made by machines.

4 Hoerl, Erich: A Thousand Ecologies. 124.

5 Lakoff, George; Johnson, Mark: Metaphors We Live By.

In assessments of the cost of increasing the connective capacities of emerging human-nonhuman collectives, attention has shifted from end-user devices (conflict minerals, e-waste, occupational health and safety across the supply chain) to network infrastructures, including datacenters.[6] Exemplifying a trend toward software-defined networks, Facebook's new data center topology follows a fabric rather than a cluster model: "Fabric offers a multitude of equal paths between any points on the network, making individual circuits and devices unimportant – such a network is able to survive multiple simultaneous component failures with no impact."[7] The new generation of software-defined hyperscale networks is designed to facilitate "infrastructure as a service" approaches: "In the SDN architecture, the control and data planes are decoupled, network intelligence and state are logically centralized, and the underlying network infrastructure is abstracted from the applications".[8] A hierarchical network design (tiers of switches organized in a tree structure) "made sense when client-server computing was dominant, but such a static architecture is ill-suited to the dynamic computing and storage needs of today's enterprise data centers, campuses, and carrier environments".[9] Instead, SDNs are in principle programmable "by operators, enterprises, independent software vendors, and users (not just equipment manufacturers) using common programming environments."[10] Driven by changes in data management that call for scalable, dynamically reconfigurable infrastructures, the notion of "data fabrics" also recalls the historical link between mechanical looms and the origins of machinic computation.[11]

The notion of data fabrics reminds us that software is one of the dimensions in the becoming-topological of culture: „Just as adding a new dimension adds a new coordinate to every point in space, 'adding' software to culture changes the identity of everything that a culture is made from".[12] Software reconfigures the space of experience. The haptic qualities we imagine a fabric to have relate these scalable infrastructures to the proliferation of surfaces of sensation. For Cecilia Lury et al, that "contemporary culture is itself coming to display a proliferation of surfaces that *behave topologically*" becomes apparent in the way "the "borders" or „frames" of mirrors, windows, screens and interfaces have become surfaces of sensation themselves by operating the opposition between inside and outside in a dynamic re-making of relations to each other ... the frames of mediation have come to produce topological spaces".[13] As the number of interfaces grows in the wake of smart urbanization schemes based on internet-of-things technologies, for example, these interfaces don't simply provide access or information, they are involved (and involve us) in processes of mediation.

Popular visions of an informatization of urban environments take the technological vision of an active city further, envisioning the employment of sensor networks to create sentient spaces. For Mark Shephard, "To understand the implications of this folding of people, street, and data onto each other requires thinking about space in visual ways, where formal geometry and material articulation become less relevant than the topologies of networked information systems and their intersection with the socio-spatial practices of daily life".[14] While urbanists adopt urban experience design approaches to explore new relationships between users and informatized infrastructures, the growing interest in "smart" cities also intensifies conflicts related to the enmeshment

---

6 When the University of Delaware decided against the construction of a new data center in 2014, it did so in because of community opposition to the environmental impact of the 280 megawatt power plant meant to power the data center. http://www.datacenters.com/news/featured/plug-pulled-on-tdcs-delaware-data-center-and-power-plant/.

7 Andreyev, Alex: Introducing data center fabric.

8 See Open Network Foundation: Software-Defined Networking.

9 Ibid. 3.

10 Ibid. Future Facilities offers a popular data center modeling software, see http://www.6sigmadcx.com/.

11 On the Jacquard loom that inspired Charles Babbage's Analytical Machine, see Manovich, Lev: The Language of New Media; Essinger, James: Jacquard's Web.

12 Manovich, Lev: Software is the Message. 80.

13 Lury, Celia; Parisi, Luciana; Terranova, Tiziana: Introduction: The Becoming Topological of Culture. 9. Emphasis in the original.

14 Shepard, Mark: Toward the Sentient City. 21.

of such sentient spaces in the extractive economies of capture – the public and private surveillance of our communicative practices to establish data-driven models of governance and growth.[15]

The vision of everyday objects as active agents in the collection and redistribution of data is driven in part by materials research. With the help of new (single-layer) materials, suggests Tomas Palacios of MIT/MTL's Center for Graphene Devices and 2D Systems, "everything around us will be able to convert itself into a display on demand", including the design of smart dust.[16] As a zero-gap carbon monolayer semiconductor (essentially a one-atom thick layer of graphite), Graphene does not possess an inherent band gap, i.e. an energy range in which various states of electron flow can exist, making it difficult to harness its conductive properties for any application that requires an on/off capability. So the gap is what has to be engineered for these constituent elements of infrastructures of mediation to operate.[17] The material's properties offer a powerful metaphor - of always-on worlds, of uninterruptible faster-than-ever flows, of infrastructures comprehensible only to a molecular vision. It also illustrates that a new era of connectivity requires new materials - or a new sense of the materialities that already exist, of the role they play in our logics of existentialization and new economies of capture. Together with the notion of data fabrics of software-defined computational folds, the "gapless" material helps comprehend our implication in the "infrastructural relationalities" of mediation.

II. Strategies of Depletion Design

Depletion is where the common begins, in sites to which no one lays claims anymore because they have been exhausted. Exhaustion leaves fragments, ruins, waste, it is what comes after production, after use, after work. Depletion offers a way to map a terrain, to delineate a horizon from within which to articulate a politics of depletion. Traversing an open semantic field to sketch a cartography of the political, the use of depletion as a shifting vantage point to survey sites and situations of physical and psychosocial exhaustion opens up new modes of relation, suggesting that we translate shared (semantic) properties into technologies of the common as we connect the exhaustion of natural resources to the exhaustion that follows from the distribution of life and labor across real-time networks.[18] The question of depletion design is a question of agency under the condition of depletion: how do we engage with the dynamics of exhaustion, how do we create interfaces for engagement, how do we structure processes of decision-making.

„The commons is invisible until it is lost."[19] Designed to co-develop and facilitate practice-based projects in the spirit of depletion design, xm:lab's School of Things provides a setting to critically engage the vision and consequences of a world of informatized objects.[20] Because it is driven by the idea of a technological commons that strives to enable and maintain autonomous forms of use, the depletion design approach explored in the School of Things necessarily includes attention to strategies of enclosure-by-design that limit the scope of use afforded by many, if not most digital objects and infrastructures. Deliberately disallowing acts of commoning through reappropriation and reuse, such strategies include the specifications of hardware and software as well as the standards and protocols that govern the operation of digital technologies. All projects revolve around

---

15 See, for example, Singapore's „Smart Nation" initiative, where the discourses of smart urbanization are integral to national development roadmaps. http://www.ida.gov.sg/Infocomm-Landscape/Smart-Nation-Vision/.

16 Colapinto, John: Material Question. The design of smart dust captured the imagination of military researchers at RAND in the early 1990s and briefly reappeared in Gartner's 2013 Hype Cycle Report; smart dust (here: swarms of nano-robots) already appears as collective machinic protagonist in Stanislaw Lem's 1964 (English: 1973) science fiction novel The Invincible, a literary thought experiment that explores the "necroevolution" of self-organizing non-living matter.

17 The properties of Graphene (the strongest material ever tested) have attracted substantial research subsidies. See, for example, the Graphene Flagship, the EU's largest research project to date (1 billion €) http://graphene-flagship.eu/, the MIT/MTL Center for http://www-mtl.mit.edu/wpmu/graphene/, as well as journals addressing the needs of a new generation of materials researchers-turned-science-entrepreneurs, see http://iopscience.iop.org/2053-1613/.

18 Wiedemann, Carolin; Zehle, Soenke: Depletion Design.

19 Linebaugh, Peter: Stop Thief! The Commons, Enclosures, and Resistance. 14.

20 http://www.schoolofthings.org/.

the core principle of playful experimentation with concrete possibilities of intervening and participating in the aesthetic and technological design of such a "smart" world, (re)opening these technologies to individual and collective reappropriation.

Like other educational efforts across the global maker movement, it is sustained by the enthusiastic embrace of new forms of embodied education and procedural media literacy that shift the focus and perspective of analysis toward the immersive stance of comprehension-through-creation.[21] Shared across hackers, makers, and creative coders, such an ethico-aesthetic stance counters the technodeterminist visions of predictive politics, economies of capture, and behaviorist governance made possible by an internet of things. Rather than constituting a retreat into the nostalgic terms of digital craft, it is motivated by an ethos of making that involves an active engagement with algorithmic cultures, a parametric politics of collaborative creation, a technology of play to change the rules of the networking game. At the same time, it is aware of the limits of generalizing prototyping approaches into a neo-industrial development framework, of replacing public support with the logic of venture capital, and of turning "making" into an all-encompassing paradigm of social innovation that crowds out autonomous and more antagonistic socialities.[22]

While it is (comparatively) easy to comprehend how different licensing schemes for hardware and software constrain or expand the agency of users choosing to work with a specific set of digital technologies, it is more difficult to see how the collection of data in automated "smart" systems affects such freedoms of use, especially when these dynamics are designed to disappear from view.[23] One strategy to keep the increasing number of real-time flows manageable has been the shift toward natural interfaces that require less and less explicit attention. The less our interaction with such a world of ambient intelligence is based on prior knowledge, structured searches, and deliberate choices, the more our environments have to know about us, our location, our preferences, our histories of interaction: we are, by definition, not only on the terrain of discourse and deliberation but of experience, of affect, of sensation.[24] Yet whereas it is the depletion of a commons that makes us aware of its existence, it is difficult to make this loss visible in the case of algorithmic processes operating beyond our scales of perception.[25] One way to think about life and labor in the sentient spaces of our smart cities (whose semiotic machines are fueled by our data exhaust) is to imagine the sphere of atmospheric media as an "ambient commons".[26] The tradition of commoning, of reproducing resources as shareable and in principle subject to collaborative forms of governance, offers rich resources to comprehend the enclosure of experience.[27] The notion of ambience captures both the characteristics and the consequences of the becoming-ubiquitous of information and communication technologies, enveloping us in the multi-layered fabrics of a subjective economy in which every expression, every act of relation can be stored and retrieved as potential element in processes of valorization.

---

21 Blikstein, Paulo: Digital Fabrication and 'Making' in Education; Bogost, Ian: Procedural Literacy; Halverson, Erica Rosenfeld; Sheridan, Kimberly M.: The Maker Movement in Education; Honey, Margaret; Kanter, David: Design, Make, Play; Schoen, Sandra; Ebner, Martin; Kumar, Swapna: The Maker Movement; Sharples, Mike et al: Innovating Pedagogy; Streeck, Juergen; Goodwin, Charles; LeBaron, Curtis (eds): Embodied Interaction.

22 Fonseca, Felipe: Repair Culture.

23 For conceptualizations of a „data commons" see Yakowitz, Jane: Tragedy of the Data Commons; Zuiderwijk, Anneke; Janssen, Marijn; Davis, Chris: Innovation with open data; Dragona, Daphne: Counter-Infrastructures.

24 Hansen, Mark B.N.: Feed-Forward.

25 Zehle, Soenke: Documenting Depletion.

26 McCullough, Malcolm: Ambient Commons.

27 Ostrom, Elinor: Governing the Commons; Ostrom, Elinor; Hess, Charlotte: Understanding Knowledge as a Commons; Linebaugh, Peter: The Magna Carta Manifesto.

III. Machinic Matrices of Experience

To better comprehend communication infrastructures as "matrices of experience", it does not make sense to reestablish the dichotomy between machines (technical objects) and non-machines (human beings).[28] In his brief history of the 'Guattari-Effect', Eric Alliez recalls that "Guattari-Deleuze had warned us: the machine is not a metaphorical figure."[29] In his own survey of the term machine, Gerald Raunig recounts the history of a disappearance. Whereas „the commonplace concept of the machine … refers to a technical object, which can be precisely determined in its physical demarcation and seclusion, as well as in its usability for a purpose, … the machine was once conceptualized quite differently, namely as a complex composition and as an assemblage that specifically could not be grasped and defined through its utilization".[30] A delineation of object/subject boundaries alone cannot grasp the distributed actuality of machinic multiplicity, comprehend what is happening to us - our agency, our capacity for relation.[31] If media becomes machinic, so do we.

For Maurizio Lazzarato, "the component parts of subjectivity – intelligence, affects, sensations, cognition, memory, physical force – are components whose synthesis lies in the assemblage or process, and not in the person".[32] A subjective economy is designed to exploit these component parts: "Subjective economy means subjectivity existing for the machine, subjective components as functions of enslavement which activates pre-personal, pre-cognitive, and pre-verbal forces (perception, sense, affect, desire) as well as supra-personal forces (machinic, social, linguistic, economic) which go beyond the subject: it involves neither representation nor consciousness, it is machinic."[33] He conceptualizes the machine as something other than a tool, "which makes the machine an extension and projection of the human being."[34] Machines are assemblages, operating below and above our levels of cognition and perception: "*In a machine-centric world, in order to speak, smell, and act, we are of a piece with machines and asignifying semiotics.*"[35] As users whose agency is enmeshed in sensor networks, we are on the terrain of an a-signifying semiotics of sensation.[36]

In his *Summa Technologiae*, Stanislaw Lem anticipated the need of networked societies overwhelmed by information to overcome such an „information barrier" through the automation of cognition.[37] Recalling Lem's vision, N. Katherine Hayles reflects on the „scope and essence of interpretation" and notes that to acknowledge that interpretation „applies to information flows as well as to questions about the relations of human selves to the world", we need to approach thought and cognition as distinct processes: „while all thinking is cognition, not all cognition is thinking".[38] What she terms „nonconscious cognition" is not, however, a capacity of computational objects, but „operates across and within the full spectrum of cognitive agents: humans, animals, and technical devices."[39] And whereas „material processes operating on their own rather than as part of a complex

---

28 Foucault, Michel: The Government of Self and Others. 41.

29 Alliez, Eric: The Cause of the Guattari Effect. 96.

30 Raunig, Gerald: A Thousand Machines.

31 Lazzarato, Maurizio: Exiting Language.

32 Future Art Base: Power at the End of the Economy.

33 Ibid.

34 Lazzarato, Maurizio: Signs and Machines. 80, 81.

35 Ibid. 88.

36 Alliez: „if there is no real distinction between expression and content, we are in a semiotics of intensities. And surely the fundamental category of Félix is the idea of an a-signifying semiotics" (ibid.). On the concept of a semiotics of intensities, also see Alliez, Eric: Diagrammatic Agency Versus Aesthetic Regime of Contemporary Art.

37 Stanislaw Lem, Summa Technologiae, trans. Joanna Zylinska, Minneapolis: University of Minnesota Press, 2014. In a chapter dedicated to „intellectronics" (artficial intelligence), Lem describes the options in addressing the information barrier in terms of a „game of information"; with the evolution of „automatic gnosis" (for Lem, the winning scenario), information can act on other information without human involvement.

38 Hayles, N. Katherine: Cognition Everywhere. 218, 201.

39 Ibid. 202.

adaptive system do not demonstrate emergence, adaptation, or complexity", the delineation of boundaries between „conscious thinking, nonconscious cognition, and material processes" is a matter of debate rather than mere distinction.[40] Reflecting on nonconscious cognition as a discrete capacity distributed across a wide variety of agents, Hayles also draws attention to the costs of consciousness. They include its belatedness, i.e. the „missing half second" that separates the initiation of neural activity and conscious awareness, which can be exploited by new forms of nonconscious cognition in advertizing or the algorithmic trading in near-real time financial markets. But perhaps more importantly, such costs include the anthropocentric bias consciousness establishes: „The same faculty that makes us aware of ourselves as selves also partially blinds us to the complexity of the biological, social, and technological systems in which we are embedded."[41] Attention to nonconscious cognition not only leads us to realize that „an object need not be alive or conscious in order to function as a cognitive agent", but to greater awareness of this complexity.[42] And if the new commons are ambient, we need ambient methodologies to create new forms of commoning – methodologies that comprehend the "infrastructural relationalities" of mediation and the dynamic of semi-autonomous systems operating in the subjective economy.

IV. Reclaiming the Ambient Commons

As informatization expands to include a vast array of everyday objects as active agents in technological networks, it is the ambient commons of our space of experience that is subject to new forms of enclosure. Which is why, „if ‚commoning' has any meaning, it must be the production of ourselves as a common subject", as the practices of creating and recreating the commons necessarily involve processes of individual and collective self-constitution.[43] As more and more corporate actors intervene in the space of self-relation, offering infrastructures and operating systems to organize the distribution of life and labor across the complex topologies of our algorithmic cultures, we need a much better sense of how these processes shape our modes and capacities for relation, of how we can come to terms with the enclosure of this space of experience, what role we envision for ourselves in stories of commoning.

Johanna Zylinska has sketched a *Minimal Ethics for the Anthropocene*, defined as „a set of actions we can undertake once we have intuitively grasped this constant movement of life, of which we are part, and then turned to our compromised and imperfect faculty of reason - which is perhaps primarily a storytelling faculty - in order to tell better stories about life in the universe, and about life (and death) *of* the universe".[44] For her, "ethics is a historically contingent human mode of becoming in the world, of becoming different from the world, and of narrating and taking responsibility for the nature of this difference", and she describes "ethics as a relatively narrow cultural practice, worked out by humans across history, as a form of regulating ways of co-existing and co-emerging with others. This cultural practice also involves providing an account - verbally, experientially, or aesthetically - of these processes of co-existence and co-emergence."[45] Understood both as a concrete design strategy and an experimental institution, depletion design involves the elaboration of an architecture for storytelling from within such an ethical horizon. What such stories share is the sense that their ethical impact does not derive from the construction of ethical agency that severs the human from its machinic contexts, but precisely from an acknowledgment of the irreducible machinic constitution of our capacities for communication and relation.

For Bruno Latour, here we will already have to make a decision, and it is a decision about the temporal horizon from within which we engage these questions: "Between matter and materiality, then, we have to choose. …

---

40 Ibid. 202.

41 ibid. 204-5.

42 Ibid. 216.

43 Federici, Silvia: Revolution at Point Zero. 145.

44 Zylinski, Johanna: Minimal Ethics for the Anthropocene. 46.

45 Ibid. 93, 92.

Matter is produced by letting time flow from the past to the present via a strange definition of causality; materiality is produced by letting time flow from the future to the present, with a realistic definition of the many occasions through which agencies are being discovered."[46] The comprehension of agency does not proceed by way of reaggregating their dispersion: "The point of living in the epoch of the Anthropocene is that all agents share the same shape-changing destiny, a destiny that cannot be followed, documented, told, and represented by using any of the older traits associated with subjectivity or objectivity. Far from trying to "reconcile" or "combine" nature and society, the task, the crucial political task, is on the contrary to distribute agency as far and in as differentiated a way as possible - until, that is, we have thoroughly lost any relation between those two concepts of object and subject that are no longer of any interest any more except in a patrimonial sense."[47] Instead, we need to imagine the implications of a radical distribution of agency.

The way we tell stories is a a key element in our decisions regarding the creation and (re)use of old and new technologies. While interactive and immersive aesthetics have already come to play a central role in the exploration of storytelling futures, storytelling continues to draw on the complexity and richness of existing practices. Rather than stressing the compositional dimension of narrative constitution, the conceptual and metaphorical focus on architectures shifts analytical attention to the infrastructural implications of storytelling, i.e. quite literally the way in which stories fold / unfold across the topologies of experience: "It is easy to see why it will be utterly impossible to tell our common geostory without all of us - novelists, generals, en- gineers, scientists, politicians, activists, and citizens - getting closer and closer within such a common trading zone."[48] The gestures of reappropriation that are the core of depletion design strategies are key elements in comprehending the potentialities of technologies, of exploring their constitution, of gauging their impact – and of creating matters of concern: "Traditionally, politics needs to endow its citizens with some capacity of speech, some degree of autonomy, and some degree of liberty. But it also needs to associate these citizens with their matters of concern, with their things, their circumfusa and the various domains inside which they have traced the limits of their existence - their *nomos*."[49] If we wish to support the narrative self-positioning of individual and collective actors in the geostories of an ‚Anthropocene', we urgently need to expand our stories across the machinic terrain of our existence, scaling our collective agency to govern the ambient commons.

References

Alliez, Eric: Diagrammatic Agency Versus Aesthetic Regime of Contemporary Art: Ernesto Neto's Anti-Leviathan, Deleuze Studies 6.1 (2012), pp. 6-26.

Alliez, Eric: The Cause of the Guattari Effect, trans. Eric Anglès, Shifter Magazine 16 (April 2010), pp. 85-96.

Andreyev, Alex: Introducing data center fabric, the next-generation Facebook data center network, (11/2014), https://code.facebook.com/posts/360346274145943/introducing-data-center-fabric-the-next-generation-facebook-data-center-network/.

Blikstein, Paulo: Digital Fabrication and 'Making' in Education: The Democratization of Invention. In Walter-Herrmann, Julia; Bueching, Corinna (eds.), FabLabs: Of Machines, Makers and Inventors, Berlin: Transcript 2013, pp. 1-21.

---

46 Latour, Bruno: Agency at the Time of the Anthropocene. 14. The Subcommission on Quaternary Stratigraphy (SQS), a constituent body of the International Commission on Stratigraphy (ICS), has established a Working Group on the Anthropocene: "The 'Anthropocene' is a term widely used since its coining by Paul Crutzen and Eugene Stoermer in 2000 to denote the present time interval, in which many geologically significant conditions and processes are profoundly altered by human activities. These include changes in: erosion and sediment transport associated with a variety of anthropogenic processes, including colonisation, agriculture, urbanisation and global warming; the chemical composition of the atmosphere, oceans and soils, with significant anthropogenic perturbations of the cycles of elements such as carbon, nitrogen, phosphorus and various metals; environmental conditions generated by these perturbations; these include global warming, ocean acidification and spreading oceanic 'dead zones'; the biosphere both on land and in the sea, as a result of habitat loss, predation, species invasions and the physical and chemical changes noted above." http://quaternary.stratigraphy.org/working-groups/anthropocene/. Also see the Anthropocene Project (2013-14), http://www.hkw.de/anthropocene/.

47 Latour. Ibid.

48 Latour. 13.

49 Latour. 14. Emphasis in original.

Bogost, Ian: *Procedural Literacy. In: Persuasive Games: The Expressive Power of Videogames. MIT Press 2007, pp. 233-260.*

Bowker, Geoffrey C.; Miller, Florence; Ribes, David: *Toward Information Infrastructure Studies: Ways of Knowing in a Networked Environment, in Jeremy Hunsinger, Lisbeth Klastrup and Matthew M. Allen (eds), International Handbook of Internet Research, Berlin: Springer Science+Business Media B.V., 2010, pp. 97-117.*

Colapinto, John: *Material Question, The New Yorker (10/12/2014), http://www.newyorker.com/magazine/2014/12/22/material-question/.*

Chui, Michael; Loeffler, Markus; Roberts, Roger: *'The Internet of Things', McKinsey Quarterly (March 2010).http://www.mckinsey.com/insights/high_tech_telecoms_internet/the_internet_of_things/.*

De Angelis, Massimo; Harvie, David: *The commons. In Martin Parker, George Cheney, Válerie Fournier, Chris Land: The Routledge Companion to Alternative Organization. New York: Routledge 2014, pp. 280-294.*

Dragona, Daphne: *Counter-Infrastructures: Critical Empowerment and Emancipation in a Networked World. Media-N Journal of the New Media Caucus 10.03 (Fall 2014). http://median.newmediacaucus.org/art-infrastructures-information/counter-infrastructures-critical-empowerment-and-emancipation-in-a-networked-world/.*

Essinger, James: *Jacquard's Web: How a Hand-Loom Led to the Birth of the Information Age. Oxford: Oxford University Press 2004.*

Federici, Silvia: *Revolution at Point Zero: Housework, Reproduction, and Feminist Struggle. Oakland, CA: PM Press 2012.*

Fonseca, Felipe: *Repair Culture. 2015. http://efeefe.no-ip.org/livro/repair-culture/.*

Foucault, Michel: *The Government of Self and Others: Lectures at the Collège de France, 1982-1983, ed. Arnold I. Davidson, trans. Graham Burchell, New York: Palgrave Macmillan, 2010.*

Future Art Base: *Power at the End of the Economy: A Discussion with Maurizio Lazzarato, Brian Massumi, Peter Pál Pelbart and Akseli Virtanen, (07/10/2014), http://www.futureartbase.org/2014/10/07/power-at-the-end-of-the-economy-2/.*

Genosko, Gary: *A-signifying Semiotics, The Public Journal of Semiotics 2.1 (January 2008), pp. 11-21.*

Halverson, Erica Rosenfeld; Sheridan, Kimberly M.: *The Maker Movement in Education. Harvard Educational Review 84.4 (Winter 2014), pp. 495-504.*

Hansen, Mark B. N.: *Feed-Forward: On the Future of Twenty-First Century Media. Chicago and London: University of Chicago Press, 2015.*

Hayles, Katherine N.: *Cognition Everywhere: The Rise of the Cognitive Nonconscious and the Costs of Consciousness, New Literary History 45.2 (Spring 2014), pp. 199-220.*

Honey, Margaret; Kanter, David: *Design, Make, Play: Growing the Next Generation of STEM Innovators. New York: Routledge 2013.*

Hoerl, Erich: *A Thousand Ecologies: The Process of Cyberneticization and General Ecology, trans. James Burton, Jeffrey Kirkwood and Maria Vlotides, in Diedrich Diederichsen and Anselm Franke (eds), The Whole Earth: California and the Disappearance of the Outside, Berlin: Sternberg Press, 2013, pp. 121-30.*

Kitchin, Rob: *Big Data, new epistemologies and paradigm shifts, Big Data & Society 1.1 (April-June 2014), pp. 1-2, http://bds.sagepub.com/content/1/1/2053951714528481.full/.*

Lakoff, George; Johnson, Mark: *Metaphors We Live By. [1980]. With a new Afterword. Chicago: Chicago University Press 2003.*

Lansiti, Marco; Lakhani, Karim T.: *'Digital Ubiquity: How Connections, Sensors, and Data Are Revolutionizing Business', Harvard Business Manager 11 (2014), https://hbr.org/2014/11/digital-ubiquity-how-connections-sensors-and-data-are-revolutionizing-business/.*

Latour, Bruno: *Agency at the Time of the Anthropocene, New Literary History 45.1 (Winter 2014), pp. 1-18.*

Lazzarato, Maurizio: *Exiting Language: Semiotic Systems and the Production of Subjectivity in Felix Guattari, transl. Eric Anglés, in: Deborah Hauptmann and Warren Neidich (eds), Cognitive Architecture: From Biopolitics to Noo-politics - Architecture & Mind in the Age of Communication and Information, Rotterdam: 010 Publishers 2010, pp. 502-520.*

Lazzarato, Maurizio: Signs and Machines: Capitalism and the Production of Subjectivity, trans. Joshua David Jordan, Los Angeles: Semiotext(e), 2014.

Lem, Stanislaw: Summa Technologiae, trans. Joanna Zylinska, Minneapolis: University of Minnesota Press, 2014.

Linebaugh, Peter: The Magna Carta Manifesto. Liberties and Commons for All. Berkeley, University of California Press 2008.

Linebaugh, Peter: Stop, Thief!: The Commons, Enclosures, and Resistance. Oakland, CA: PM Press 2014.

Lury, Celia; Parisi, Luciana; Terranova, Tiziana: Introduction: The Becoming Topological of Culture, Theory Culture Society 29.4-5 (2012), pp. 3-35.

Manovich, Lev: Software is the Message. Journal of Visual Culture 13.1 (April 2014), pp. 79-81.

Manovich, Lev: The Language of New Media. Cambridge, MA: MIT Press 2001.

McCullough, Malcolm: Ambient Commons: Attention in the Age of Embodied Information. Cambridge, MA: MIT Press 2013.

McCullough, Malcolm: Governing the Ambient Commons. Hedgehog Review. 16.2 (Summer), pp. 44-55.

Open Network Foundation: Software-Defined Networking: The New Norm for Networks, ONF White Paper (04/12/2012), https://www.opennetworking.org/images/stories/downloads/sdn-resources/white-papers/wp-sdn-newnorm.pdf/.

Ostrom, Elinor. Governing the commons: the evolution of institutions for collective action. Cambridge New York: Cambridge University Press 1990.

Ostrom, Elinor; Hess, Charlotte. Understanding Knowledge as a Commons: from theory to practice. Cambridge, Massachusetts: MIT Press 2011.

Raunig, Gerald: A Thousand Machines: A Concise Philosophy of the Machine as Social Movement, trans. Aileen Derieg. New York: Semiotext(e) 2010.

Sharples, Mike; Adams, Anne; Ferguson, Rebecca; Gaved, Mark; McAndrew, Patrick;, Rienties, Bart; Weller, Martin; Whitelock, Denise: Innovating Pedagogy: Open University Innovation Report 3. Milton Keynes: The Open University 2014.

Shepard, Mark: Toward the Sentient City, in Mark Shepard (ed): Sentient City: Ubiquitous Computing, Architecture, and the Future of Urban Space, Cambridge, MA: MIT Press 2011, pp. 15-26.

Schoen, Sandra; Ebner, Martin; Kumar, Swapna: The Maker Movement. Implications of new digital gadgets, fabrication tools and spaces for creative learning and teaching. eLearning Papers. Open Education Europa 2014. http://www.openeducationeuropa.eu/de/article/The-Maker-Movement.-Implications-of-new-digital-gadgets,-fabrication-tools-and-spaces-for-creative-learning-and-teaching/.

Streeck, Juergen; Goodwin, Charles; LeBaron, Curtis (eds): Embodied Interaction: Language and Body in the Material World. Cambridge University Press 2014.

Wiedemann, Carolin; Zehle, Soenke (eds): Depletion Design: A Glossary of Network Ecologies. Theory on Demand #8. Amsterdam: Institute of Network Cultures, 2012.

Yakowitz, Jane: Tragedy of the Data Commons. Harvard Journal of Law & Technology. 25.1 (Fall 2011), pp. 1-67.

Zehle, Soenke. 'Documenting Depletion: Of Algorithmic Machines, Experience Streams, and Plastic People '. In: Richard Maxwell, Jon Raundalen, and Nina Lager Vesterberg (eds), Media and the Ecological Crisis, London: Routledge 2015, pp. 52-68.

Zuiderwijk, Anneke; Janssen, Marijn; Davis, Chris: Innovation with open data: Essential elements of open data ecosystems. Information Polity: The International Journal of Government & Democracy in the Information Age 19.1-2 (2014), pp. 17-33.

Zylinska, Joanna: Minimal Ethics for the Anthropocene, Ann Arbor: Open Humanities Press 2014.