

The Urban, The Classified, the Coupled

Selena Savić

Weird urbanity of radio signals

Radio signals manifest as ‘weird’ materiality when observed from a position within the classical human/nature divide. In Parikka’s articulation of new materialist concerns as media theory, weird materialities designate that which escapes direct human perception, and is irreducible to categories of ‘soft’ or ‘hard.’¹ Radio signals are ‘simply’ energy, but they have a material and symbolic importance for human societies, both as environmental radiation and as messages they transmit. Contemporary feminist and new materialist thinkers, such as Donna Haraway, Rosi Braidotti, Vicki Kirby, ecofeminist Val Plumwood among others, took issue with the deep rootedness of nature/culture and body/mind divide

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- 1 Parikka specifically refers to Serres’ distinction between ‘soft’ and ‘hard’ as mutually exclusive levels of materiality, to which, he claims, weird materialities of contemporary technological culture cannot be reduced; Jussi Parikka, “New Materialism as Media Theory: Medianatures and Dirty Matter,” *Communication and Critical/Cultural Studies* 9, no. 1 (March 2012): 95–100, <https://doi.org/10.1080/14791420.2011.626252>. While I agree with such a view on weirdness, it is important to note that contrary to Parikka’s reading of Serres, ‘hard’ and ‘soft’ are for Serres indeed a continuum, as discussed in Vera Bühlmann, *Mathematics and Information in the Philosophy of Michel Serres*, Michel Serres and Material Futures (Bloomsbury Academic, 2020). Parikka’s interpretation draws more closely on Serres articulation of pollution in *Malfeasance: Appropriation Through Pollution?*, while materiality of communication and communication physics for Serres are based on the irreducibility of communication or physics to hard and soft.

in Western thought and proposed ways to articulate inseparability of naturalized differences. The same dualism is the object of Bruno Latour's critique of the 'modernist settlement'.²

Radio is an interesting phenomenon to challenge dualisms and hyper-separations. "Radio was heard before it was invented [...] telephone users listened to radio for two decades before Guglielmo Marconi or anyone else invented it."³ wrote Douglas Kahn in his comprehensive exploration of artistic engagements with radio signals. *Hiss, Whistler, Dawn chorus* are some of the names given to naturally occurring electromagnetic phenomena that can be 'heard' with specific receiving equipment. Kahn challenged the distinction of nature and culture on the premise that media (as in telecommunications media) do have nature and are undetermined. If radio has nature, how could we observe its materiality? Beyond sprawling transmission equipment, radio signals can be considered as what Keller Easterling termed an *active form* in an *infrastructure space*⁴: an organization of a large collection of humans and nonhumans co-opting the electromagnetic spectrum into the domain of human politics. Radio signals are one way the city leaks into nature.

When we speak of cities and infrastructures, it might be useful to reflect on the mid 20th century writing of Lewis Mumford and his influential *Myth of the Machine*.⁵ Mumford's focus on city and civilization is sustained by his analysis of the *Megamachine*: a complex mechanism of message transmissions, passing from the top to the smallest working unit, able to mobilize a large body of individuals and coordinate their activities for a clearly envisaged and calculated purpose. In antiquity it appeared as a vast human organization that built the pyramids; in the 20th century, *Megamachine* featured the neatly automated organization

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- 2 Bruno Latour, *Pandora's Hope: Essays on the Reality of Science Studies* (Cambridge, Massachusetts: Harvard University Press, 1999).
 - 3 Douglas Kahn, *Earth Sound Earth Signal: Energies and Earth Magnitude in the Arts* (Berkeley: University of California Press, 2013)
 - 4 Keller Easterling, *Extrastatecraft: The Power of Infrastructure Space* (Brooklyn: Verso, 2014).
 - 5 Lewis Mumford, *The Myth of the Machine*, vol. 1: Technics and Human Development (San Diego: Harcourt Brace Jovanovich, 1967).

of humans and technology that provided us with the atomic bomb and telecommunications. A lesser-known fact is that Mumford was a radio amateur himself and had ambitions of studying electrical engineering. Having become instead a thinker of civic relations and a fierce critic of capitalism, Mumford theorized the link between technics and civilization not in terms of life processes, and not in terms of determination or shaping. Technologies have nature.

How might we think this nature of technology, networks, and signals? A key distinction that remains to be unfolded here is that between nature and city. Presumably, the city is the manifestation of culture, and is therefore the opposite and exclusive of nature. Nature, in this account, only appears outside of the city, at least if we talk about 'true' nature that cannot include parks and urban forests. In contrast, with contemporary theorists of the city and technology, the interest is to recognize the entanglement of human with non-human or more-than-human, to characterize the posthuman relationships. This relationship is founded on including politics in what we consider 'nature' or 'wild'. In Braidotti and Hlavajova's *Posthuman Glossary*, Paulo Tavares gives an account of the term *Forest*, its' role in the history of Western thought and expansion projects such as colonization.⁶ Tavares insists on reading the forest as always already cosmopolitan, inhabited by beings (trees, jaguars and people) that form a large political space. "Instead of seeing the forest as an environment lacking the city, it is the very concept of the city that has to be widened and transformed to incorporate the constructed, political nature of the forest"⁷ Towards a different, informational understanding of the city, Vera Bühlmann put forward an urban philosophy of potentiality that relates form and materiality through the concept of the informational motor.⁸ Technology, mediating information by means of electrical

6 Paulo Tavares, "Forest," in *Posthuman Glossary*, ed. Rosi Braidotti and Maria Hlavajova, Theory (London Oxford New York New Delhi Sydney: Bloomsbury Academic, 2018), 162–67

7 Tavares. pp. 165–6.

8 Vera Bühlmann, "III. Primary Abundance, Urban Philosophy — Information and The Form of Actuality," in *Printed Physics: Metalithikum I*, ed. Ludger Hov-

networks becomes variably composable out of mediality which unfolds within logistic networks (social, political, economic). Benjamin Bratton put focus on the logics of the logistical activity of the planetary network of infrastructures, the *Big Machine*.⁹ This machine, according to Bratton, might not see humanity as distinct among the stuff of the world. While the imaginary of such a relationship certainly facilitates a certain withdrawal of the human subject from the anthro-po-scene, as discussed by object-oriented thinkers, I propose that the way to think the nature of technology is not to withdraw, but rather to think about indexing materiality of information and practice intentionality.

The challenge of classification

The work on materiality of information is premised on data. Positivist ontology posits that data exists independently of an interpretive frame, waiting to be 'collected' by a human or a machine. This is untrue for both qualitative and quantitative data, obtained through measurement and/or observation. Contrary to its Latin name in the singular, 'datum,' data is never simply 'given' but produced in complex processes. Cultural and literary studies scholar Elizabeth Adams St. Pierre wrote on understanding the appearance of data, which requires asking "when, where, why, how, and by whom data is called into being to do some work [as well as] what data looks like when it appears, in what counts as data."¹⁰ According to recent accounts from philosophy and history of science, which are informed by contemporary quantum theory, data

estadt and Vera Bühlmann, vol. 1, *Applied Virtuality* (Berlin, Boston: Ambra Verlag, 2013), 113–53.

9 Benjamin H. Bratton, *The Stack: On Software and Sovereignty*, Software Studies (Cambridge, Massachusetts: MIT Press, 2015).

10 Elizabeth Adams St. Pierre, "The Appearance of Data," *Cultural Studies ↔ Critical Methodologies* 13, no. 4 (August 2013): 223, <https://doi.org/10.1177/1532708613487862>.

is not discreet but a continuous discreetness obtained through measurement.¹¹ Once data is acquired through some form of observation or measurement, to be put to use, it must be classified in some way. In their well-known work on classification and its consequences, *Sorting Things Out*, Geoffrey Bowker and Susan Leigh Star discussed classification as essential to any working infrastructure.¹² Datasets and digital archives provide comprehensive lists and a systematization of details that document diverse natural and social phenomena (for example, a dataset of European animals, of world temperature and precipitation measurements, or social media interactions dataset, or a corpus of European Parliament transcripts). Once the system works, its organization becomes 'naturalized'.

Diana Coole and Samantha Frost challenged the common sense that the 'real' material world consists of solid bounded objects with predictable and controllable behaviours. In the tradition of New Materialism, they insisted on new materialist suspiciousness towards fixed, predetermined categories and modes of existence. Contemporary critique of database ontology challenges their universal aspirations for "carefully and hierarchically represent[ing] knowledge according to a singular logic of the world, with embedded ontologies that exclude others."¹³ The authors note that: "within databases [...] we construct categories of normativity, singular ways of commanding the logic of the world". From a media-theoretical position, Posner and Klein extend this critique to emphasize that everything we encounter is already categorized in some way, which further propagates the presumption these

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- 11 Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* (Durham: Duke University Press, 2007).
 - 12 Geoffrey C. Bowker and Susan Leigh Star, *Sorting Things out: Classification and Its Consequences*, 1st paperback edition, Inside Technology (Cambridge, Massachusetts London, England: The MIT Press, 2000).
 - 13 Linzi Juliano and Ramesh Srinivasan, "Tagging it: Considering how ontologies limit the reading of identity," *International Journal of Cultural Studies* 15, no. 6 (November 1, 2012): 619, <https://doi.org/10.1177/1367877912451684>.

categories are meaningful.¹⁴ Connecting to one of the author's works on *Data Feminism*,¹⁵ Posner and Klein rely on feminist theory (in particular the work of Butler, Haraway and Barad) to challenge classification's repressive systems.¹⁶

Another relevant problematization of classification is Roberto Bottazzi's chronologically-ordered treatise on computational mechanics, *Digital Architecture Beyond Computers*.¹⁷ Bottazzi traced the undulating trends of proof- and search-oriented combinatorics. He recounted the case of Ramon Llull's wheels of *Ars Magna*, as a mechanism for disseminating the author's doctrine and religious beliefs. Giulio Camillo's articulation of *L'Idea del Teatro* and Leibniz's *Ars Combinatoria* are discussed as methods of search. Aby Warburg's *Mnemosyne Atlas* was a pioneering way to organize large collections by purely visual means. Contemporary design work with machine learning is a culmination of these trends, a way to investigate datasets in search for patterns or sources of intuitions that can be used in the architectural or urban design process, for example. In further pursuit of this thread, Bottazzi put forward a provocative proposal to consider cryptography to venture into domains beyond human cognition (such as abstract data, or recordings of radio signals) by carefully constructing a system of signs that move in and out of the realm of human legibility (encryption and decryption) and moving productively across different domains.¹⁸

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- 14 Miriam Posner and Lauren F. Klein, "Editor's Introduction: Data as Media," *Feminist Media Histories* 3, no. 3 (July 1, 2017): 1–8, <https://doi.org/10.1525/fmh.2017.3.3.1>.
 - 15 Catherine D'Ignazio and Lauren F. Klein, *Data Feminism* (Cambridge, Massachusetts: MIT Press, 2020).
 - 16 Posner and Klein, "Editor's Introduction: Data as Media," p 4.
 - 17 Roberto Bottazzi, *Digital Architecture beyond Computers: Fragments of a Cultural History of Computational Design* (London New York Oxford: Bloomsbury Visual Arts, 2018) See also the text by Bottazzi in this volume.
 - 18 Roberto Bottazzi, "Crypto Architecture: Notes on Machine Learning and Design," in *Ghosts of Transparency: Shadows Cast and Shadows Cast Out*, ed. Michael R. Doyle, Selena Savić, and Vera Bühlmann (Birkhäuser, 2019), <https://www.degruyter.com/document/doi/10.1515/9783035619171-002/html>.

Andrew Lisony addressed the question of search in his introduction to *Archives*¹⁹ a book about alternative, self-organized, contested archival practices. We often take availability of archives for granted and equate availability with access. Lison connects access to search, inextricably linked to retrieval of information, whose privatization he problematizes as “a totalizing expansion of knowledge retrieval under the privatizing conditions of neoliberalism”, operated by Google for example. He proposes unconventional archives to contest this dominance by privileging a more eccentric curatorial touch.

Intersectional feminism poses important questions to methods for working with data and classification. In *Data Feminism*, Catherine D'Ignazio and Lauren F. Klein,²⁰ the authors engage with an intersectional analysis of the ways in which systems for counting and classification perpetuate oppression. They recognize an initial impasse of having to classify data in some way to work with it. To question classification is a feminist concern: how are people divided in categories of, for example, men and women? Data feminism is concerned with uses and limits of data, informed by direct experience and by intersectional feminist thought and paying attention to power and privilege.

I extend the data feminist intersectional approach to knowledge of radio signals and focus on the way data classification encodes power in this database. Whose power organizes the knowledge on radio signals? Which knowledge counts? What is considered as optimal or efficient organization? These are not easy questions to ask, as they require opening large avenues of thinking about what it means to apply the matrix of domination optics onto radio signals. It is an inquiry into the ways we gather around a technical artefact, and how this in turn organizes our knowledge of it.

Artificial neural networks of the SOM machine-learning algorithm extract whatever can be essential information from the data, but they do not give us any *reason* for it: reason itself stays in a kind of a black box.

19 Andrew Lison et al., *Archives*, 2019, <https://meson.press/wp-content/uploads/2019/08/978-3-95796-150-1-Archives.pdf>

20 D'Ignazio and Klein, *Data Feminism*.

Reasoning *with* ML algorithms therefore becomes interesting if it is not used to explain how the world *is* or *will be* (as in predictions), but if we take its outputs as an incentive to make another translation. I am not suggesting that ML algorithms are not efficient in making probabilistic predictions, such as which books one might want to buy, or which advertisement is most effective for a certain user profile. However, the interest here is in exploring the possibilities of working with machine learning ‘humanistically’, without delegating human responsibilities of reasoning with and making sense of data to algorithms. The challenge picked up in this book and this research project is to take the network topology (the two-dimensional distribution of network nodes) as an invitation to rethink the way to talk about these engineered energy transmissions.

Sensorial coupling with radio signal data

Radio signals cannot be known through engineering knowledge alone or indeed a single disciplinary perspective. They are part of the natural environment but are also made with broadcasting equipment; they are energy transmissions but also material,²¹ they are technical artefacts but also information. The data on radio signals collected in the SIGID database, even if mainly intended to circulate among communication engineers and radio amateurs, illustrates well how these aspects are entangled.

Digital data such as pixels embody certain logics but also lend themselves to the logics of computational processing. The research discussed in this book suggests that travel and vision constitute methodical tools to unfold disciplinary concerns starting from something specific, such as a single radio signal recording or a group of pixels. In working with computation to preserve, rather than suspend richness in interpretations, such an observation describes a concrete imaginary of interdisciplinarity.

21 Art historian and theoretician Douglas Kahn talks about artistic use of radio as material in Kahn, *Earth Sound Earth Signal*.

The book documents a method of working with this database with an emphasis on preserving the complexity and entanglement of information. Sensorial coupling with radio signals is about practicing intentionality: articulating ways to index data by something meaningful and deliberately chosen. With such multiplicity of relationships comes a potentiality and responsibility to follow through ensuing narratives.

In *Earth Sound Earth Signal*, Douglas Kahn challenged the distinction on nature and culture in the instrumentalization of radio signals, on the premise that media (as in telecommunications media) do have nature and are underdetermined.²² Jussi Parikka focused on the joint history of media and nature to tease out senses and rationalities inherent in the logic of life and technic, as in 'bio-logy' or 'techno-logy'.²³ In this parallel between media and nature, Parikka creates room to discuss natural technics in the context of organization and architecture, such as insect-builders or self-organized swarming systems. A new materialist media theory recently proposed by Vera Bühlmann, engaged Michel Serres' philosophy of natural communication to speak of the mediality of public knowledge.²⁴ The double articulation of time as/in space, of physics of communication as a communication of physics, requires attending to materiality of time that passes (commutes), to its communicative materiality. In the ways highlighted here, technicity and communicative capacity of radio signals are expressed as nature, but also have nature. Radio is not passive energy waiting to be put to use, but active energy, whose materiality unfolds in time and space.

The outputs of this research aim to facilitate speculation on the connection between signal representation and technical communication protocols, by shifting criteria of similarity from taxonomical and instrumental (e.g. used in military) or physical (e.g. high or low frequency), to properties shared across all signals – such as the probability of silence or

22 Ibid.

23 Jussi Parikka, *Insect Media: An Archaeology of Animals and Technology* (Minneapolis: University of Minnesota Press, 2010).

24 Vera Bühlmann, "In Medias Naturae," *Media Theory* 5, no. 1 (September 25, 2021): 231–52.

noise in the signal. It remains clear that the SOM is simply sorting high dimensional data in the space of possibilities that are always/already encoded. Nevertheless, it is in the interaction with this information that we should look for the ways to articulate interdisciplinary knowledge.