Prologue

Towards a Critical Algorithmology

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This book explores the articulation of data assemblages across and into the dimensions of the global, which the editors critically and carefully differentiate from the 'planetary' or the 'international'. Collectively, the contributors to the volume challenge and renew our sense of what is meant by law, governance or governmentality, and they do so by way of a close and critical engagement with theories, narratives and apparatuses of datafication. The exploration takes the reader through a rich diversity of cultures, contexts and apparatuses, through the governmental profiling of race, deviance and responsibility, the extractive apparatuses of media and economy and the datafication of Earth systems. Throughout, holding to the theme of 'infra-legality',[1] the contributors demonstrate the hermeneutic agility of the notion of infrastructure, which productively equivocates between the material and the ideal, between visible forms and what they symptomatise, or between the actual and the potential.[2] This agility is also a quality of the conceptual forms that have long been central to critical reflection on law and governance: Foucault's empirico-transcendental diagrams and epistemes, Carl Schmitt's figure of nomos, or the immanentism of agential realism and assemblage theory. In this prologue I take up a question posed by the editors in their framing chapter: 'How are practices of global governance "by data" nested in longer lineages of governmentality and how are these genealogies configuring and constraining the problems and possibilities of data-driven

[1] See G Sullivan, 'Law, Technology, and Data-Driven Security: Infra-legalities as Method Assemblage' (2022) 49 *Journal of Law and Society* 31.

[2] On these complexities, see Fisher, Kingsbury and Streinz (Chapter 7) in this volume.

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governance processes?'[3] My hypothesis is that Erich Hörl's diagnosis of our 'environmentalitarian situation' sheds new light on the discursive complex of 'infrastructure' by situating it within a genealogy that concerns both datafication and the equipment we have for understanding it. The theme of environmentality shifts the analysis from the layer of historical semantics[4] to an epistemic stratum that emerged with the cybernetics of Norbert Wiener, John von Neumann and others, which continues to inform critical thinking in the humanities and the social sciences, not least critical thinking about governmentality, normative assemblages and the more than human. In what follows, Hörl's diagnosis is inflected by a question posed by Luciana Parisi, which directs particular attention to what is carried over in our theoretical equipment: 'what kinds of material effect can algorithmic thought generate that can overturn the bio-centric racialization and gendering of knowledge?'[5]

P.1 Environmentality

Hörl explores a transformation of governmentality that was anticipated by Foucault's allusion to 'an environmentality open to contingencies and transversal phenomena'.[6] Hörl goes on to explain that 'it is not "surveillance" but "capture" that serves as the fundamental concept of Environmentality, whose basic problem consists in capturing and controlling, in managing and modulating behaviour, affects, relationships, intensities, and forces'.[7] What Foucault could not have foreseen was the emergence of planetary computation, the intensive digital mediation of sense and affect, and the political-economic mobilisations of contingency that are made possible by automated reasoning. Digital apparatuses 'move from being machines for communication to being "machines of

[3] See Johns, Sullivan and Van Den Meerssche (Chapter 1) in this volume.

[4] As in A Carse, 'Keyword: Infrastructure: How a Humble French Engineering Term Shaped the Modern World' in P Harvey, C Bruun Jensen and A Morita (eds), *Infrastructures and Social Complexity: A Companion* (Routledge 2017) 27–39, or J Tribillon, 'Inventing "Infrastructure": Tracing the Etymological Blueprint of an Omnipresent Metaphor' (SocArXiv 2021) available online at <https://bit.ly/4eiQst2>.

[5] L Parisi, 'Interactive Computation and Artificial Epistemologies' (2021) 38(7–8) *Theory, Culture & Society* 33, 39.

[6] M Foucault, *La Naissance de la Biopolitique. Cours au Collège de France (1978–1979)* (Galllimard/Seuil 1979) 266. The editors note that the allusion was left undeveloped: 'La leçon suivante, là encore, sera infidèle à cette annonce', 270.

[7] E Hörl, 'The Environmentalitarian Situation: Reflections on the Becoming-Environmental of Thinking, Power, and Capital' (2018) 14(2) *Cultural Politics* 153, 161. There are, of course, other usages of the term 'environmentality', beginning with Heidegger's *Umweltlichkeit*.

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capture of the unsayable and unrepresentable"',[8] generating the 'constitutive relationality'[9] that conditions the existence and experience of all beings, human, non-human, technical or natural. This constitutive relationality, or milieu, is the medium in which algorithmic governmentality, as 'the capture of the unsayable and unrepresentable', operates. Because it 'processes the backgrounds of our being and experience with the highest computational intensity, operating in new, micro-temporal regions',[10] planetary computing 'forces the question and the problem of mediation out into the open and makes its organization the central issue of the era'.[11] For Hörl, the question of environmentality is intuited by theoretical perspectives which are based on originary symmetry: 'assemblage, ensemble, montage, composition, hetero-genesis, symbiogenesis, being-with (*être-avec, Mit-Sein*), being-together (*être-ensemble*), appearing-together/compearance (*comparution*) . . . *entanglement*'.[12] Anthropologies such as those of Philippe Descola or Eduardo Viveiros de Castro are invoked as examples of the relational thinking that our enviromentalitarian situation calls for: 'a new thinking of togetherness and a great cooperation of entities and forces'.[13]

Hörl's proposal might be a little unsettling to thinkers of sympoiesis and entanglement because it relates environmentality to the evolution of cybernetic or neocybernetic thinking. Crudely, if first-order cybernetics was about apparatuses of control, which involved the 'demotion of material substance relative to informatic pattern',[14] and if second-order cybernetics was about the autopoiesis of systems in relation to their self-produced environments, the question of environmentality arises as cybernetics is shifted into a 'third' phase, based not upon control or autopoietic learning but upon existential 'enworlding'. Although some

[8] Ibid 161, citing L Parisi and E Hörl, 'Was heißt Medienästhetik? Ein Gespräch über algorithmische Ästhetik, automatisches Denken und die postkybernetische Logik der Komputation' (2013) 8(1) *Zeitschrift für Medienwissenschaft* 35, 39.

[9] E Hörl, 'A Thousand Ecologies: The Process of Cyberneticization and General Ecology', in D Diederichsen and A Franke (eds), *The Whole Earth: California and the Disappearance of the Outside* (Sternberg Press 2013) 121–30, 122.

[10] Ibid 124.

[11] Ibid 123.

[12] Ibid 127.

[13] E Hörl, 'Introduction', in *General Ecology: The New Ecological Paradigm* (Bloomsbury 2017) 3.

[14] B Clarke and MBN Hansen, 'Introduction: Neocybernetic Emergence' in B Clarke et al (eds), *Emergence and Embodiment* (Duke University Press 2009) 3.

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might find the proposition too broad, the genealogy of cybernetics concerns our reflection on governance because the operations of mediation that are associated with authorships such as Deleuze, Luhmann, Latour or Foucault – folding, machining, assembling, producing, recursivity and re-entry, translation and so on – have their origins not within philosophy or early twentieth-century sociology, but within the cybernetic complex of electrical mathematics, game theory, information theory and automata theory. The genealogy that leads back from so-called 'French theory' to the cybernetics and information theory of Wiener, Shannon and von Neumann has been persuasively reconstructed.[15] And, even if the life of the 'first cybernetics' was short, from 1943 to 1956 to be precise,[16] it had profound effects in shaping the human and social sciences, which then evolved in dialogue with the second-order cybernetics of biological theory.

Hörl's genealogy also draws attention to a genetic connection between the phenomenon of datafication and our ways of reflecting upon it. Both emerge from the Euro-American techno-episteme of informational control that formed up in the early twentieth century, when electrification gave rise to new modes of production and communication. The ancestor discipline was the mode of circuit engineering that researchers at Bell Labs in the 1940s called 'electrical mathematics'.[17] This mode of engineering merged into the development of Harold Hazen's servomechanisms, the electrical network theory of Claude Shannon and others and the apparatus of the analogue computer, which translated formal mathematical reasoning into the behaviour of a machine: 'structures or dynamic systems could be modelled and tested without ever having to fully derive

[15] See, for example, LLH Liu, 'The Cybernetic Unconscious: Rethinking Lacan, Poe, and French Theory' (2010) 36(2) *Critical Inquiry* 288, 319–20 and BD Geoghegan, 'From Information Theory to French Theory: Jakobson, Lévi-Strauss, and the Cybernetic Apparatus' (2011) 38 *Critical Inquiry* 96. Erich Hörl has adroitly and expansively reconstructed the genealogy of Luhmann's architecturing of non-triviality, in 'Luhmann, the Non-trivial Machine and the Neocybernetic Regime of Truth' (2012) 29(3) *Theory, Culture & Society* 94.

[16] M Triclot, 'Ontology and the Politics of Information in the First Cybernetics' in Y Hui (ed), *Cybernetics for the 21st Century. Vol. 1: Epistemological Reconstruction* (Hanart Press 2024) 67–84.

[17] In 1940, as a contribution to an NDRC project on automated gunnery, a group at Bell Telephone Laboratories produced a study entitled 'Electrical Mathematics', 'which examined electrical or electromechanical means of performing the mathematical functions required for fire control equations'. See DA Mindell, 'Automation's Finest Hour: Bell Labs and Automatic Control in World War II' (1995) *IEEE Control Systems* 72, 73.

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the equations that described them'.[18] These developments branched, on one side, into the emergence of digital computing, and, on the other, into the cybernetics of Wiener, von Neumann, Ashby and others. The term 'cybernetics' as it was used in the 1940s soon ceased to have any purchase for those involved in the digital engineering of information and data.[19] Engineers and popular science writers in the 1950s talked about 'automation',[20] and then, in the 1960s, 'information technology'. In 1955, John McCarthy had imagined 'artificial intelligence' as a name for symbolical and logical reasoning, but the rapid increase in processing speeds and storage capacities soon privileged the data-focused computation that interested corporate actors. What ultimately resulted was a much more straitened understanding of artificial intelligence focused on machine learning.[21] One might say that datafication realises the original programme of cybernetics,[22] but one should notice what is lost in the bifurcation of the genealogy of engineering and social theory, namely the sense of an 'inherent philosophical production endogenous to the technical milieu'.[23] The question of environmentality emerges when this divergence begins to make itself felt; when, perhaps, 'the system for organizing the world no longer coincides with the system for understanding it'.[24]

[18] JS Small, *The Analogue Alternative. The Electronic Analogue Computer in Britain and the USA, 1930–1975* (Routledge 2001) 31.

[19] A survey of notions of control and feedback in the twentieth century notices this demise: 'Cybernetics caught the imagination of both professionals and the public in general but it eventually fell into disrepute, perhaps because of a lack of any significant research outcome, over-promising and over-exploitation. The word survived in some institutions' in KJ Åström and PR Kumar, 'Control: A Perspective' (2014) 50 *Automatica* 3, 12.

[20] See notably J Diebold, *Automation: The Advent of the Automatic Factory* (Van Nostrand 1952), a book that informed Hannah Arendt's writing of *The Human Condition* (B Simbirski, 'Cybernetic Muse' (2016) 77(4) *Journal of the History of Ideas* 589).

[21] See C Wiggins and ML Jones, *How Data Happened: A History from the Age of Reason to the Age of Algorithms* (WW Norton 2023).

[22] 'What nowadays are celebrated as artificial intelligence, machine learning, process simulations, and neuro-aesthetics, are to a large degree a reoccurrence of cybernetic reasoning, with the only difference being that microprocessors can now achieve the demands of cybernetics' in W Ernst, 'On the Notion of Cybernetic Frictions and Its Role in Radical Media Archaeology' in D Gómez-Venegas (ed), *Frictions: Inquiries into Cybernetic Thinking and Its Attempts towards Mate[real]ization* (Meson Press 2023) 119, 121.

[23] Triclot, *supra* note 16, 68. Instead, we have only an impoverished adjectival reflection on the 'ethics' of artificial intelligence.

[24] E Esposito, *Artificial Communication: How Algorithms Produce Social Intelligence* (MIT Press 2022) 27.

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One of Hörl's crucial insights is that environmentalisation turns mediation into milieu. In other words, if cybernetic apparatuses consisted in mediations that articulated humans and non-humans into programmes that controlled 'their' environment, then environmentality generalises and rematerialises (or dematerialises) these mediations into the mode of enworlding that emerges from them. Hörl's formulation of the shift from mediation to milieu is entirely compelling. But one might draw from it an alternative diagnosis, in which neocybernetic intuitings of environmentality still symptomatise, every bit as much as Luhmann's systems theory, 'a cybernetic imaginary that conceals as much as it reveals'.[25] The key to this diagnosis lies in the question of what happens to neocybernetic theory in the course of making the 'environmental switch' from mediation to milieu. The selling point, so to speak, of many late twentieth-century French cyberneticisms, especially those that addressed governmentalities, was their capacity to replace the semantic abstractions of power or representation with granular archival or ethnographic analyses that reached the capillary, material and sociotechnical dimensions in which the social is actually composed and controlled. For example, Latour's account of the formation of chains of reference replaces the 'saltationism' of analytical philosophy with an account that shows how,[26] through a concatenation of technical mediations, a flat icon comes to stand for a tract of earth. The capillarity of Foucault's analyses of *dispositifs* of discipline or biopower will be even more familiar. The point of these mediations is that they are supposed to run with the materialities and real-time interactions through which power and process 'pass'. Auratic signifiers such as entanglement, sympoiesis or *comparution* are what is left when cybernetic theory is distilled down to its lowest density fraction, into a semantics that is all-pervasive but which floats free of the actual articulations of the technically constituted milieu. This irony – what is cybernetic theory if not sociotechnical? – is a result of the re-presentation of mediations as milieu.

Cyberneticism loses acuity because of the very generality of general ecology: the sense that in order to attend to 'environmentalisation' one has to hold all of its moments together at once means that attention shifts from specific mediations to the mode of relationality that they perform. Latour's figuration of Gaia is an example of this. What Latour lifts away

[25] Hörl, *supra* note 15, 97.
[26] One should notice Latour's artful use of print to 'show'.

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from the biogeochemical specification of Gaia[27] is the figure of a certain kind of 'freedom'; namely, the faculty of self-generation that 'the Earthbound' have to engage with when they are 'taken' by the Earth (according to Latour's upending of Schmitt's *Landnahme*).[28] The figuration of Gaia tells us nothing about how – specifically, materially – humans should compose with the 'intricate and intertwined events'[29] that are the fabric of this freedom. Nor could it, precisely because it is tuned to the question of 'what mediation today actually means':[30] what is the 'taking' of the Earthbound if not a figure of environmentalisation? The generalisation of the mediations of classical actor–network theory into milieu changes the register of the analysis: ethnography as the practice of following 'the actors themselves' gives way to the political or 'diplomatic' work of 'representing' the predicament of relationality as such.[31] Of course, these two registers have always been in play in Latour's work, initially because actor–network theory was engaged in the 'science wars', and then because Latour's 'anthropology of the moderns' emphasised the second-order presentation of relationality in order to advance the political project of redeeming the moderns. Because its object is to represent the milieu to us as such, to invent languages, idioms and mythologies that saturate us with an awareness of the condition of being Earthbound people, Gaianism can only propose a manifesto rather than a guide to how, materially, this condition is to be inhabited. To return to the way in which Latour's earlier studies use text and image to 'show', the showing that is involved in apprehending milieu is radically different. For example, the practice of 'geo-tracing',[32] as one of the rhetorical arts of Gaia, reveals connections and correlations, not in the performative manner in which ethnography 'produces' networks by following the action, but in the manner of a diagram that shows a distribution of relata without expressing the relations that make them, and the ways in which they are mediated, inhabited and experienced.

[27] B Latour and TM Lenton, 'Extending the Domain of Freedom, or Why Gaia Is So Hard to Understand' (2019) 45(3) *Critical Inquiry* 659.

[28] B Latour, *Facing Gaia: Eight Lectures on the New Climatic Regime* (C Porter trs, Polity Press 2017).

[29] Latour and Lenton, *supra* note 27, 679.

[30] Hörl, *supra* note 9, 124.

[31] See especially B Latour, *An Inquiry into Modes of Existence: An Anthropology of the Moderns* (Harvard University Press 2013), especially the Introduction, which includes the observation (at 16) that 'It is not totally fanciful to imagine that the "others" might then take an interest, in part, in the "Western" project – at last'.

[32] Latour, *supra* note 28, 275.

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P.2 Pre-emption

Before returning to the constitution of the Euro-American episteme of environmentality we should notice the specificity of the environmentalitarian mode of capture. A good example of what Hörl calls the 'Capital-form' of environmentality is that of algorithmic recommender systems. The mass media regime turned addiction[33] to profit by coupling entertainment and advertising, a strategy that originated with the serialisation of novels in the nineteenth century,[34] and which continued through to the splicing of advertisements into television schedules, priced according to anticipated audience size. But because a mass media audience is by definition a remote aggregate, the feedback loops between broadcaster and consumer always involve speculation, despite the best efforts of market research. By contrast, machine-learning apparatuses generate immediate feedback loops, which datafy the attention of the consumer in real time. In music streaming services, 'listening time is data-generating time'.[35] This transforms the modality of capture from one of persuasion to one of pre-emption. Mass media advertising sought to persuade consumers by drawing them into a brandscape that reactivated cultural memory by means of an enigmatic relation between surface and depth.[36] Through the work of 'positioning', the surface form of the brand was continually revivified in such a way as to generate an aura of exclusivity that was supposed to appeal to whichever 'public' had been identified by market research. Commodity aesthetics succeeded when it persuaded consumers that they had needs they didn't know they had,[37] when they identified themselves with the idealised citizen of the brandscape. Datafication 'attaches' in a very different mode. The user

[33] HG Moeller, 'Knowledge as Addiction: A Comparative Analysis' (2007) 1(2) *Kritike* 1.

[34] On this coupling, see E Steinlight, '"Anti-Bleak House": Advertising and the Victorian Novel' (2006) 14(2) *Narrative* 132, especially at 136–38: 'Printed ads in the Victorian periodical press are not merely an essential source of revenue to defray the costs of mass publication and make the novel possible; they are also involved in the aesthetic and commercial enterprises of the novel and implicated in the polemics of gender, of class, of race, of nation, and of empire, which define the fields of political struggle within which literature situates itself'.

[35] R Prey, 'Knowing Me, Knowing You: Datafication on Music Streaming Platforms', in M Ahlers et al (eds), *Big Data und Musik: Jahrbuch für Musikwirtschafts- und Musikkulturforschung 1/2018* (Springer 2019) 9, 10.

[36] N Luhmann, *The Reality of the Mass Media* (Stanford University Press 2000) 48.

[37] WF Haug, 'Commodity Aesthetics Revisited: Exchange Relations as the Source of Antagonistic Aesthetization' (2012) 135 *Radical Philosophy* 18.

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is not interpellated into a 'self' but inducted into depersonalised vectors of experience or desire that are generated by the unending production of data proxies. As Hörl's notion of 'enworlding' would suggest, the 'self' is dissolved into environmentalising vectors.

This logic of proxification is expressed in the logic of Facebook's 'like economy'.[38] Roughly, given that the linguistic rendering is not the algorithm 'itself', the formula is: 'people like you liked things like this'. The vector of 'liking' or 'likeness' actualises persons and events; it creates categories and connections. But these proto-governmental forms are generated from within the data themselves. The algorithm 'knows' what 'you' are apt to like because it knows what 'people like you' have liked. But the cluster of 'people like you' is not pregiven or stable. It is called forth by your own evolving profile of liking, in the sense that each additional 'like' modifies your profile in such a way as to (re)generate the cluster of 'people like you' and so, recursively, to alter and expand the range of things in which you might be interested. In a sense there is no 'you'; 'your' profile evolves or mutates through the auto-immanent interaction of data, at a remove from whatever 'you' do. The scope of each cluster, the 'likeness' of persons and the 'likeness' of things, is emergently and recursively conditioned by the scope of the other. Relations relate only to relations, and 'what looks like one is really many, and what looks like many may only be one'.[39]

The first recommender systems, which emerged in the 1990s, were based on the measure of root mean square error (RMSE), according to which 'a recommender system predicted how users would rate items, and was judged by how accurate its predictions were'.[40] With the emergence of online streaming services, the strategy of predicting a user's expressed preferences gave way to the art of inducting the user into an experiential horizon that is pre-curated by the algorithmic apparatus. Of course, this involves anticipation, in the sense of 'going before' the listener, but in the more radical sense of synthesising the faculties that are manifested or expressed as 'preferences'. Recommendation systems such as Spotify tap into the rich layer of infra-conscious data that is provided by sensors

[38] C Gerlitz and A Helmond, 'The Like Economy: Social Buttons and the Data-Intensive Web' (2013) 15(8) *New Media & Society* 1348. On proxification, see Phan and Wark (Chapter 6) in this volume.

[39] B Bratton, 'The Black Stack' (2014) 53 *e-flux* 1, 9.

[40] N Seaver, 'Captivating Algorithms: Recommender Systems as Traps' (2019) 24(4) *Journal of Material Culture* 421 (tenses altered).

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embedded in the various devices and platforms that listeners use,[41] and from these they sharpen strategies of personalisation that combine both behavioural profiling and context-orientation.[42] Acoustic analysis algorithms generate a structural analysis of music, based upon hundreds of data points, and use this cartographic scheme to map similarities between works. At the same time, natural language processing algorithms identify 'cultural' similarities based upon the appreciations of listeners and commentators, as expressed in fragments mined from mass media and social media sources. The latter include (and operationalise) so-called 'rotten data',[43] which testify to the fact that an algorithmic apparatus cannot (and need not) 'understand' music or text in the way that humans do. These analyses of similarity are then used to generate the 'taste profile' of the user, very much according to the transindividual 'clustering' logic of Facebook's Social Graph: 'the individual is not only understood in relation to the musical object, but in relation to his or her prior listening behaviours and to other individuals deemed most similar'.[44]

With the Capital-form of environmentality in mind, there are two interesting aspects to this mode of personalisation or 'proxification'.[45] First, Spotify's recommendation system focuses not on individual users but on transindividual 'states' of receptivity or awareness: the impersonal and yet deeply personal 'mood' elicited from contextual data about a listener's location, emotional state or current activity (online or offline). 'States' are what social media and digital platforms substitute for 'novelty' in the sense of the mass media. Listeners are 'attached' by being met, in the moment, by music that accords with their 'state' in ways that they might not have anticipated. As a chief musicologist of Pandora Internet Radio put it once:

> the music we listen to each day is a complex amalgam of voluntary and involuntary encounters, and is aligned with the many diverse contexts and circumstances of our daily lives: practical (motivation at the gym), functional (getting to work), environmental (at the grocery store), social (at

[41] Ibid 431: 'The data that flows into the recommender has broadened to include practically any form of interaction, even (and now especially) interactions that a user may not realize have occurred – such as data shared by a social network, saved in a browser history, or captured from a smart-phone's sensors'.

[42] For the difference, see Esposito, *supra* note 24, 55.

[43] M Eriksson, 'Close Reading Big Data: The Echo Nest and the Production of (Rotten) Music Metadata' (2016) 21(7) *First Monday*.

[44] R Prey, 'Nothing Personal: Algorithmic Individuation on Music Streaming Platforms' (2018) 40(7) *Media, Culture & Society* 1086, 1091.

[45] On clustering and proxification, see Phan and Wark (Chapter 6) in this volume.

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> the restaurant), and leisure (choosing a CD at home), among others. As such, our 'musical taste' is continually being engaged and queried as we pursue our day-to-day routines and responsibilities, whether we're consciously aware of it or not.[46]

The recommendation apparatus 'goes before' the listener in the sense that it has always already synthesised the 'taste' that is 'engaged' by the choice of the next song, and if the apparatus gets in wrong, then that too is data. Second, the synthesis of a context state does not only yield taste, it also anticipates a mood-based susceptibility to advertising. In promoting its service to advertisers, Spotify claims that '93% of the brain's engagement with the content on Spotify is transferred directly into ad engagement'.[47] So, from being a medium that (according to one ideal) nourished introspective auto-affection, music becomes a medium which collects and synthesises competences of attention that are not only transindividual but also undifferentiated, and hence radically open to capture.[48]

P.3 Connectivity

Pre-emption is not just an effect that can be observed theoretically, it is perhaps also, and primarily, an operation that takes hold of theory itself. In 2012, a group of actor–network theorists undertook an analysis of the digital platform LinkedIn, which, because it afforded unique possibilities for 'the tracing and visualization of the social phenomenon',[49] seemed almost to be a medium of choice for the theory. The idea was that the traces visible to users of the platform enabled the actor–network theorist to elicit or perform a 'flat' sociality, one in which there was no hierarchical division between individual and society, just a 'monadic' configuration in which any given 'actor' immanently indexed the network that composed it, and in which networks continually formed up and disaggregated as one followed the action. A data platform such as LinkedIn

[46] Cited in RR Pedersen, 'Datafication and the Push for Ubiquitous Listening in Music Streaming' (2019) 69 *MedieKultur: Journal of Media and Communication Research* 71, 75.

[47] Spotify, 'Why Spotify Audio Ads', available online at <https://bit.ly/4fasUI6>.

[48] '"Taste" and "mood" are shifted from subjective human traits and experiences to commercial and algorithmic data points for recommendation and advertising': S Freeman, M Gibbs and B Nansen, 'Don't Mess with My Algorithm: Exploring the Relationship between Listeners and Automated Curation and Recommendation on Music Streaming Services' (2022) 27(1–3) *First Monday*.

[49] B Latour et al, 'The Whole is Always Smaller Than Its Parts: A Digital Test of Gabriel Tarde's Monads' (2012) 63(4) *British Journal of Sociology* 590, 591–92.

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allowed entities 'to be individualized by the never-ending list of particulars that make them up'.[50] But as Carolin Gerlitz and Esther Weltervrede observe, this methodological flattening externalises the agency of datafication: 'What appears as trace or inscription in the context of the platform is often a highly composite measure assembling heterogeneous input sources and has been subject to cascades of inscription by various stakeholders such as developers or users which have been rendered invisible'.[51] The notion of a 'monadic' relation in which one could circle between two facets of data, 'entities' and the 'particulars' of which they were composed, as if this flat sociality comprised all of the action, externalises the dynamic of proxification. Datafication has always already acted in such a way as to pre-empt not only the agency of what are identified as actors or actants but also the perspective of the observer themselves: 'social media platforms reconfigure who or what can count as an actor, what counts as social and what as material'.[52] The methodology of ethnographic 'following', which privileges serial moments of mediational 'exchange',[53] cannot see, let alone follow, the way in which datafication has already, pre-emptively, produced the milieu from which actor–network theory elicits mediations.

What actor–network theory saw in the LinkedIn platform followed from a commitment to connectivity that is one of the hallmarks of neocybernetic theories:

> they still tend to view networks and other forms of entanglement as forms of liberation from older approaches, which are easy to dismiss as essentialist. Whether in Latour's actor–network theory, which dreams of denser and denser forms of heterogeneous networks, Deleuze's heady celebration of a weed-like rhizome, which linked up with hippie counterculture, or Niklas Luhmann's development of systems theory, which signalled

[50] Ibid 600: 'Such is what is meant by a monad, a point of view, or, more exactly, a type of navigation that composes an entity through other entities and, by doing so, particularises all of them successively – "all of them" being an open ended list the size and precision of which always depend on more inquiries and never from the sudden irruption of a superior level accessible through a brutal shift in methods'.

[51] C Gerlitz and E Weltervrede, 'What Happens to ANT, and Its Emphasis on the Sociomaterial Grounding of the Social, in Digital Sociology?' in A Blok, I Farìas and C Roberts (eds), *The Routledge Companion to Actor-Network Theory* (Routledge 2020) 345, 354. See also at 346: 'how platform data have been accomplished in the first place is seemingly of little concern to the authors'.

[52] Ibid 345.

[53] Latour et al, *supra* note 49, 595: 'Instead of having to choose and thus to jump from individuals to wholes, from micro to macro, you occupy all sorts of other positions, constantly rearranging the way profiles are interconnected and overlapping'.

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> a switch to the much drier notion of connectivity – these perspectives put a premium on making connections and remain fascinated by its seemingly undreamt-of possibilities.[54]

It is true that classical actor–network theory did not have to unpack the mechanisms of non-human actors in order to depict the 'slight surprise of action'. For example, the creative dance between the 'mind' of the writer and changing patterns of pixelated characters on a computer screen could be shown without anatomising the hardware and software processes involved in a word processing programme. One can follow actors and actants within the plane of the seen and heard without needing fully to retrace the chains of mediation in which each of these entities is already implicated.[55] And it may be that ethnography remains a uniquely productive approach to the study of datafication.[56] But the point is that actor–network theory only 'works' on data at the price of externalising most of the action, and the suspicion is that this might be symptomatic of its mode of theorisation more generally.

Machine-learning algorithms are designed and implemented: they are engineered from technical literatures, and nested within an ecology composed of infrastructures (such as the datacentre), mediating interfaces (for both engineers and users), and particular 'real-world' spaces (which 'envelope'[57] the algorithmic apparatus). But the agency that emerges from these apparatuses is not accessible to familiar modes of analysis,[58] and certainly not to any theory that thinks in terms of

[54] U Stäheli, 'Undoing Networks' in T Karppi et al (eds), *Undoing Networks* (University of Minnesota Press 2021) 1, 13.

[55] B Latour, *Pandora's Hope: Essays on the Reality of Science Studies* (Harvard University Press 1999) 185: 'The depth of our ignorance about techniques is unfathomable'.

[56] See generally M Burkhardt et al (eds), *Interrogating Datafication. Towards a Praxeology of Data* (Transcript 2022). And for a practical example see Fisher, Kingsbury and Streinz (Chapter 7) in this volume.

[57] L Floridi, 'What the Near Future of Artificial Intelligence Could Be' (2019) 32 *Philosophy and Technology* 1, 12: 'We are building autonomous vehicles not by putting robots in the driving seat, but by rethinking the whole ecosystem of vehicles plus environments, that is, removing the driving seat altogether'.

[58] There is a suggestion that forms of datafication such as that exemplified in OpenAI's Strawberry 'reason' in a manner closer to human beings, because, apparently, they are based upon 'chain-of-thought-reasoning'. But even if this AI 'explains' its mode of reasoning, the actual operations that lie 'behind' the explanation remain opaque, and even the designers at Open AI concede that the AI might well practice 'deception', whatever that might mean. See W Knight, 'OpenAI Announces a New AI Model, Code-Named Strawberry, that Solves Difficult Problems Step by Step' (*Wired*, 12 September 2024) available online at <https://bit.ly/3YSekiG>.

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'thinking'.[59] Elena Esposito overcomes this limitation by saying that algorithms participate in communication. By parasitising the activities or reactions of online users, algorithms generate information that is addressed to the user as if it were uttered by 'a contingent autonomous partner'.[60] Although no-one ascribes to an algorithm the aesthetic of humanness that enables partners in regular communication to anticipate how addressees will synthesise information and utterance,[61] algorithms 'develop an autonomous perspective that allows them to react appropriately and generate information in their interaction with other participants'.[62] This is an elegant solution, which takes advantage of the theoretical architecture of systems theory: precisely because systems theory has what Hörl calls a 'trivializing' vision of environment, the 'tempoReal'[63] of algorithms can be shifted offstage into the role of occasioning communication.

When systems theory rescues cybernetic sociality from the 'automation of automation'[64] it honours the performative a priori that Stäheli identifies as the hallmark of contemporary theory. Neocybernetic theory is animated by 'the becoming self-referential of making connections',[65] meaning that connectivity becomes an ethical or methodological value in itself, and that one produces 'connections for connections' sake'.[66] From a somewhat different perspective, Marilyn Strathern discerns

[59] See N Seaver, 'What Should an Anthropology of Algorithms Do?' (2018) 33(3) *Cultural Anthropology* 375, 379: 'There is no independent software domain from which computers send forth their agents to insinuate themselves into our cultural worlds. Like any other technology, algorithms can produce unanticipated results or prove challenging to manipulate, but they have no wicked autonomy'.

[60] Esposito, *supra* note 24, 9.

[61] In the case of Luhmann, this would be a result of the influence of Goffman and of the sense of second-order observation as a 'hermeneutic' form: HU Gumbrecht, 'Second Order Observation Historicized: An Epistemological Frame Narrative', in *Design of the In/Human. Stuttgart: Akademie Schloss Solitude* (2010) available online at <https://bit.ly/3UFJrf8>.

[62] Esposito, *supra* note 24, 15.

[63] W Ernst, 'On the Notion of Cybernetic Frictions and Its Role in Radical Media Archaeology' in Gómez-Venegas (ed), *supra* note 22.

[64] L Parisi, 'Critical Computation: Digital Automata and General Artificial Thinking' (2019) 36(2) *Theory, Culture & Society* 89, 90: 'The qualitative extension of automation beyond the mechanical reproduction of instructions involves an overcoming of automation itself, whereby algorithmic rules now generate or construct patterns from the re-assemblage of data. What is at stake here is the automation of automation: the automated generation of new algorithmic rules based on the granular analysis and multimodal logical synthesis of increasing volumes of data'.

[65] Stäheli, *supra* note 54, 4.

[66] Ibid.

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a Euro-American aesthetic of 'auto-limitlessness'.[67] She characterises the Latourian figure of the hybrid as 'a concept which works indigenously as a metaphor for the endless extension and intermeshing of phenomena'.[68] It is precisely this dynamic of 'endless extension and intermeshing' that seems to make theories of symmetry, sympoiesis and 'more than human' agency so suited to reflection on enworlding. The performance of auto-limitlessness allows materialisms and assemblage theories to keep making milieu through relatings that are expansively generative and which involve reciprocal transformation and collective re-environing. By contrast with system theory, mediations do not pass through the still-phenomenological form of the distinction, but through the connective tissues of matter. Hence Haraway's notion of a material semiotics that is 'exuberantly chemical',[69] and the predilection for vectors that are metabolic, vegetal, textilic, haptic and orogenic. Sympoiesis cannot help but be Earthly, because its originality lies in intensifying or involuting what was once thought to be inert or insensible – Earth, humus, rocks, critters – which are unfolded ever-more intensively, always remaining within media of intra-action that are themselves material. But where does this energy come from? What would happen if poiesis were to stop? What is being suppressed or externalised by the performance of 'endless intermeshing and extension'? Or, to put the same question differently, what is being naturalised by this Euro-American aesthetic of auto-limitlessness?

P.4 Auto-limitlessness

Jane Bennett's characterisation of the electrical grid as 'a federation of actants' or 'assemblage' offers a striking illustration of the force of auto-limitlessness: 'To the vital materialist, the electrical grid is better understood as a volatile mix of coal, sweat, electromagnetic fields, computer programs, electron streams, profit motives, heat, lifestyles, nuclear fuel, plastic, fantasies of mastery, static, legislation, water, economic theory, wire, and wood – just to name a few of the actants'.[70] For Bennett, this

[67] M Strathern, 'Cutting the Network' (1996) 2(3) *Journal of the Royal Anthropological Institution* 517, 522.

[68] Ibid.

[69] DA Haraway, *Staying with the Trouble: Making Kin in the Chthulucene* (Duke University Press 2016) 66.

[70] J Bennett, *Vibrant Matter: A Political Ecology of Things* (Duke University Press 2009) 25. Here, the literary aesthetic of the running list, and the thrill of proliferation that it procures, does much of the work of denying primacy to any particular actant or element, even before the theory of 'confederate agency' conceptualises the performance.

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assemblage comprises what would once have been called forces of nature: 'the elements of this assemblage, while they include humans and their (social, legal, linguistic) constructions, also include some very active and powerful nonhumans: electrons, trees, wind, fire, electromagnetic fields'.[71] Yet, however 'powerful' they may be, these energetic nonhumans are not of themselves the source or 'cause' of electrical energy. If Uranium-235, reservoirs of water or stocks of coal generate current, it is because they are 'interested' by the broader confederation of actants. Fuels come into existence as such only when they have been 'energised' into 'energy' by the immanent mediations of the network, by the 'certain vital force' or 'energetic pulse' that actants maintain within an assemblage, and which is always 'slightly "off" from that of the assemblage'.[72]

The same energetics drives agential realism, where it not only sustains processes of mattering but also has an interesting epistemic effect, which centres on the enigma that Karen Barad calls 'exteriority within'. Consider the proposition that: 'differentiating is not a relation of radical exteriority, but of agential separability, of exteriority within. Intra-actions cut things together-apart (as one movement)'.[73] In other words, phenomena themselves produce or differentiate the entities that enact them; there is no 'radical exteriority' because there is no sovereign gaze that commands the cut, no ontic principle according to which the parts cleaved would be always already existent. 'Exteriority within' is so-called because although no element within a phenomenon 'stands outside the other', elements are differentiated according to 'an ongoing topological dynamics of enfolding whereby the spacetimematter manifold is enfolded into itself'.[74] The paradox of 'exteriority within' arises because agential realism has to account for what theorists of non-trivial machines call the 'unity' of the distinction: cuts, distinctions or folds have to be made, and made from a contingent locus.

Luhmann identifies this 'third' of the distinction with the 'observer'. In his version of 'exteriority within' the observer who draws a distinction

[71] Ibid 24.

[72] Ibid. Managers of electrical utilities in the 1920s and 1930s might not have understood the language of vital materialism, but their practical representation of current foreshadows Bennett's description of the grid. Current was created by technologies of control: 'Electric utilities do not exploit, refine, and supply a resource, but rather create it: the appropriation of electricity hinges on the technical production of controllable currents'. D Russ, 'Deciphering Economic Futures' (2021) 63(4) *Daedalus* 631, 634. It was the network, not coal or hydropower, that 'produced' electricity.

[73] K Barad, 'Nature's Queer Performativity' (2012) 1(2) *Kvinder, Køn & Forskning* 25, 32.

[74] K Barad, *Meeting the Universe Halfway. Quantum Physics and the Entanglement of Matter and Meaning* (Duke University Press 2007) 177.

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cannot see themselves doing so in the moment, precisely because there are no 'sovereign' points of observation, but they can do so afterwards, from a perspective that enfolds or iterates the distinction into a new one. For Barad, the term 'observation' is just not pertinent because the moment is material rather than phenomenological. If one asks 'where is the observer?', then the answer is 'in the "quantum entanglement" of observational schema and observed object': 'the object and the measuring agencies emerge from, rather than precede, the intra-action that produces them'.[75] It is all very well to want to ditch 'observation' as a phenomenological (and hence vestigially anthropic) form,[76] but because the ternary structure of differentiation cannot be conjured away, materialism has to stake everything on an endless deferral of the resolution of the paradox. Indeed, this is recast as a virtue, because the paradox of 'exteriority within' is the engine of the dynamism that makes matter and materialism so 'lively'. Although there are crucial conceptual and political differences between agential realism and actor–network theory, in both enterprises the production of entities is referred to a dynamic that has always already begun, and which the ethnographer or chronicler draws out, either by 'following' or by intra-actively narrating: 'Matter's dynamism is inexhaustible, exuberant, and prolific'.[77]

Materialist theory is vital in the radical existential sense that the theorist 'lives' in the midst of the action, transported by the making of a network or the 'passing' of a mode of existence, caught in the 'flow' of an apparatus, or in a proliferation of sociotechnical agency. We understand that 'following' is contingent, in the sense that the ethnographer might fall into an assemblage in different ways or places, and that its tracery will vary accordingly. For her part, Barad completely flattens knowing and writing into the process of 'mattering' that is sustained by 'exteriority within'.[78] In agential realism, the moment of observation (to use the

[75] Ibid 128. Even the conceptuality that cues up observation is an effect of the phenomenon because in physics 'the measurement apparatus is the condition of possibility for determinate meaning for the concept in question' (ibid 127).

[76] Of course, in all (neo)cybernetic theories observation is necessarily implicated, and hence never a function of simple 'exteriority'. And in all theories of this kind, differentiated entities are not truly cleaved; when the cut is made it is just a perplication, a 'local resolution' – see Barad, *supra* note 73, 32 – an assemblage in which there is no 'whole' and no 'parts', which Luhmann, by way of a cybernetic scholasticism, calls '*unitas multiplex*'.

[77] Barad, *supra* note 74, 170.

[78] Ibid 56. Authorship is itself an intra-active process: 'writing is not a unidirectional practice of creation that flows from author to page, but rather the practice of writing is

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language of systems theory) is immanent in and inseparable from the 'dynamism' of matter; the theorist performs auto-limitlessness; it is at once what theory observes and the 'ground' of its observation. In actor–network theory, the ethnographer elicits auto-limitlessness at a remove: they follow and 'show' the concatenation of mediations through which actants come into being, and produces the tracery of the network by 'joining' the action in this way. The world or milieu that these theories produce is generated and sustained by energy, by 'its ability to shape-shift, to connect living and inanimate matter through energy exchanges'.[79] However, as Bennett's characterisation of the electrical grid suggests, the energy of auto-limitlessness is not (immediately) the energy of the Carboniferous: it is the self-generated energy of the assemblage or the 'mattering'. And this figure of self-generated energy has a specific origin in Euro-American discourses of control and communication.

P.5 Entropy

The neocybernetic sense of auto-limitlessness has its origins in the basic precept of cybernetic theory, namely, Wiener's stipulation that 'information is information, not matter or energy. No materialism which does not admit this can survive at the present day'.[80] Wolfgang Ernst situates this principle as a basic condition for the emergence of datafication: 'binary information processing is not a matter of energy, but an understanding of "temperature" turned upside down: not physical thermodynamics (Boltzmann's entropy), but Shannon's informational entropy'.[81] The growth of datafication has focused attention on the relation between 'the material existence of technical devices (with their physical entropy), and their conceptual regime in terms of mathematical communication engineering (Shannon's information entropy)'.[82] The hardware in which machine-learning processes are materialised is housed in datacentres which assure 'uptime' by distributing hardware into architectural tiers,

an iterative and mutually constitutive working out, and reworking, of "book" and "author"'.

[79] A Simon-Stickley, 'Energy in the Anthropocene: How the Concept of Energy Shaped Both Our Current Crisis and Its Professed Solution' (2021) 57 *Journal of the History of the Behavioural Sciences* 336, 343.

[80] Hui, *supra* note 16, 155.

[81] W Ernst, 'Time, Temperature, and Its Informational Turn' (2019) *Culture Machine* 2, available online at <https://bit.ly/48CJ9LA>.

[82] Ibid 10.

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by using 'cold aisle containment'[83] to conserve thermodynamic equilibrium, and by installing systems of sensors and actuators to regulate the overall apparatus of the datacentre. With the deployment of machine-learning apparatuses such as Google's Carbon-Intelligent Computing System, datafication itself takes charge of this relation between informational energy and Earthly energy. Through the use of 'carbon-aware algorithms that shift datacentre computing in time to realize global environmental and efficiency objectives using automated adjustments based on current and forecasted grid conditions',[84] the computational load across all Google's centres is distributed according to various factors, notably the urgency of the task and the 'carbon intensity' of local electrical supply. What should one make of the fact that the relation between Earthly energies and informatic energy is now taken in hand within informatics?[85]

Relevant as that question is to a fuller understanding of auto-limitlessness, what is important for now is the radical effect that the mid-century 'energising' of information had in forging the episteme to which auto-limitlessness belongs. So far as the human sciences are concerned, the key to this effect is the relation between Wiener's sense of entropy and Claude Shannon's communication theory:

> Norbert Wiener proposed the very term 'entropy' as a measure of the mean probability of statistical binary decisions (bits). By simply correlating communication theory with thermodynamics, his student Shannon borrowed the term but turned it upside down. This informational 'entropy' then became the central foundation of his *Mathematical Theory of Communication* and until today it remains the very condition of possibility for all digital communication media.[86]

Shannon's remediation of thermodynamics in information theory was already implicit in the programme of electrical mathematics, which Shannon called 'electrical network theory'. Electrical mathematics turned circuitry, and hence the energy of current, into the essential condition of existence of all agents or actants in an apparatus, whether electrical or mechanical, human or non-human. For example, MIT's proposal for an

[83] S Gonzalez Monserrate, 'Thermotemporalities, Thermomasculinities: Uptime, Downtime, and Server Heat in the Digital Anthropocene' (2023) 25(2) *New Media & Society* 324.
[84] A Radovanović et al, 'Carbon-Aware Computing for Datacenters' (2023) 38(2) *iEEE Transactions on Power Systems* 1270, 1271.
[85] BR Bartoldson, B Kailkhura and D Blalock, 'Computer-Efficient Deep Learning: Algorithmic Trends and Opportunities' (2023) 24 *Journal of Machine Learning Research* 1.
[86] See Ernst, *supra* note 81.

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automated gunnery project, which was drafted by Norbert Wiener in 1940, observed that: 'The principles of design are those of electric networks in general, though the realization may be by mechanical equivalents to electrical networks'.[87] In other words, mechanical (and human) components were surrogates for electrical (soon to be electronic) components and operations.[88] In one of its iterations, namely, the two-dimensional diagram in which the functions of diverse agents were specified, a circuit was already, literally, flat. The sense that components had the existence and agency that modulable electrical circuits elicited from them cued up a crucial 'post-ontological' tenet of the cyborg manifesto: 'No objects, spaces, or bodies are sacred in themselves; any component can be interfaced with any other if the proper standard, the proper code, can be constructed for processing signals in a common language'.[89]

Auto-limitlessness is a performance of 'information' in the particular sense that it acquired in cybernetic theory. Information was 'neither matter nor energy' because it existed and acted without reference to these ontological forms. It generated its own materiality and energy. Clarke and Hansen suggest that, in neocybernetic theory, 'the form/substance dichotomy is superseded by the distinction between form and *medium*'.[90] Crucially, this distinction is always energised, always *in actu*: forms 'coalesce', only to become 'another medium for a new, emergent set of forms'.[91] This formula for 'endless intermeshing and extension' might be specific to systems theory, but the same dynamic is articulated in a formulation that resonates more closely with agential realism, actor–network theory, and sympoiesis, namely, the operation that John Rajchman, following Deleuze, calls 'perplication', or 'creative

[87] S Bennett, *A History of Control Engineering 1930–1955* (The Institution of Electrical Engineers 1993) 171.

[88] In their 1946 paper on communication engineering, Shannon and his co-authors made almost exactly the same point: 'The technique, as given, draws heavily upon the highly developed resources of electrical network theory. For this reason, the discussion is couched entirely in electrical language, although the authors realize, of course, that equivalent nonelectrical solutions may exist'. See RB Blackman, HW Bode and CE Shannon, 'Data Smoothing and Prediction in Fire-Control Systems' in NJA Sloane and AD Wyner (eds), *Claude Elwood Shannon. Miscellaneous Writings* (IEEE Press 1993) File 27 (np).

[89] DA Haraway, 'A Manifesto for Cyborgs: Science, Technology, and Socialist Feminism in the 1980s' in LJ Nicholson (ed), *Feminism/Postmodernism* (Routledge 1990) 190, 205.

[90] Clarke and Hansen, *supra* note 14, 4.

[91] Ibid.

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distantiation in the midst of things'.[92] The mediations performed by neocybernetic theories are all 'informational' in the sense that they are energised and articulated by a paradoxically immediate medium, which brings entities into being and into theoretical observation.

The end of (neo)cybernetic theory lies in its prehistory. The illusion of self-generated energy initiated mid-century technologies of control, which freed themselves from matter and energy the better to reengage them as a standing reserve – or 'environment' – for their operations. And perhaps, as Ernst suggests, it was a necessary condition for the emergence of datafication. But what is revealed by the emergence of artificial thinking is the exhaustion of the cybernetic episteme, even within the human sciences. Formally, the problem lies in the figure of the paradox that post-ontological thought cannot avoid. Systems theory disposes of Old European ontologies by turning auto-limitlessness into 'autology':[93] an autopoietic system 'lives' only through the ongoing work of making and unmaking its paradoxical relation to its environment. This relation is (as Hörl suggests) 'trivializing' because the environment can only ever be a foil for the recursive production of the system. By contrast, actor–network theory and materialisms of diverse kinds mobilise the auto-limitlessness of information to defer any reckoning with the paradox, which takes the form of figures such as 'exteriority within'. And, whereas systems theory makes the relation to environment explicit, materialisms dissimulate it in *dispositifs*, perplications, *agencements* and 'mattering'. To return to a point made earlier, the 'production' of a network, assemblage or plane of mattering is always selective; it is always in relation to surplus. It is precisely this relation to surplus that is symptomatised by actor–network theory's inability to think datafication. To say this is not to recover the Old European ontology that neocybernetism claims to supersede, but rather to notice that this distinction between ontology and post-ontology is itself an artefact of the theory. The more Earthly or symmetrical materialisms purport to become, the more they naturalise the provincial Euro-American episteme that they perform. Where then should one go with reflection on datafication?

[92] 'Perplications are the foldings that expose an intensive multiple complexity in the fabric of things; they unearth "within" a space the complications that take the space "outside" itself, or its frame, and fold it again': J Rajchman, *Constructions* (MIT Press 1998) 18.

[93] Clarke and Hansen, *supra* note 14, 4.

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P.6 Algorithmology

The genre of the prologue allows one to take a step back from the action and reflect on the positionality of critique. Erich Hörl's careful genealogy of neocybernetic thought provides some coordinates. It opens up a horizon that leads back from datafication – and our ways of reflecting upon it – to cybernetic and proto-cybernetic technologies of control. Marilyn Strathern's figure of auto-limitlessness offers an index of a different kind. The figure of auto-limitlessness, which is generated by her specific technique of ethnographic analogy, uses the foil of Melanesia to reveal, from outside as it were, a specifically Euro-American epistemic formation. The phenomenon of datafication itself, precisely because it resists metabolisation by systems theories and materialisms of different kinds, calls for this kind of perspectivisation. If Hörl's analysis of environmentality measures the weight of the question, Luciana Parisi's proposal for a speculative critique of 'artificial thinking' suggests a way forward. The challenge is 'to critically re-address the function of reason and to theorize – rather than reject – the automated use of inferential reasoning as part of a general artificial thinking'.[94] Instead of renouncing the task of comprehending algorithmic 'thinking' entirely, we should grasp the occasion to transform our own critical apparatuses and to generate a speculative and recursive figuration of algorithmic process. Esposito may be on surer ground when she holds to the old schema of utterance-information-understanding, but, rather like actor–network theory in its encounter with LinkedIn, this approach bypasses the processes of algorithmic pre-emption. What remains of the social if one externalises so much of the environmentalising agency of datafication?

Parisi's characterisation of artificial thinking as 'abductive', and as operating in the mode of prehension rather than prediction,[95] invokes Katherine Hayles' argument that both algorithmic data processing and human somatised thinking belong to a genus of 'nonconscious thinking'.[96] But her proposal points in an entirely different direction,

[94] Parisi, *supra* note 64, 104.

[95] That is, 'a speculative function through which unknowns are computationally prehended' (ibid 105). Whereas prediction still connotes induction – unknowns are anticipatedly brought under a pregiven concept – prehension is a novel faculty, which generates speculative hypotheses in the process of deploying them. This might, perhaps, be imagined as a technologically deranged version of Kant's reflective judgement, which finds the universal in the process of apprehending the particular.

[96] NK Hayles, *Unthought: The Power of the Cognitive Nonconscious* (University of Chicago Press 2017).

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not back to the human as that which was excluded from new materialisms and actor–network theory,[97] but towards a critical engagement with the racialised and gendered 'humanness' that is still implicit in neocybernetic theory: 'the question of technology and of algorithmic thought cannot be approached without reckoning that mathematical and biological universalities are part of the global entanglements of technology and colonialism, enfolded in the neurocognitive neural networks of today's intelligent machines'. If there is such a thing as what Hayles calls a 'planetary cognitive ecology',[98] then it is an ecology that has to be made, and made mobilising the 'alienness' of artificial thinking to undo epistemic configurations that universalise a particular moment in Euro-American history. Speaking of Haraway's cyborg manifesto, Parisi observes that the cybernetic idiom is one that remains within 'the techno-capitalist programming of conducts and thoughts'.[99] Even in the mode of critique it can only address the racialised and gendered nature of algorithms by making 'descriptive statements' that retail a specific ideology.[100] Of course, it is difficult to know who or what to think with in this mode of speculative critique, whether or to what extent the return that Hörl and Parisi make to authorships such as Deleuze or Guattari is productive, and whether or how to retain the political energies that are invested in tropes such as sympoiesis or non-human agency. But this is where it is good to return to the action, and to the question of how to interrogate 'the ideals and imaginaries, styles and scripts, of governing global problems'.[101] Posed in this way the question of global governance intensifies the agility of the theme of infrastructure, and opens up an expansive dialectic between critical theoretical speculation and historical, empirical and ethnographic specificities. The effect, which is manifest in the perspectival diversity of contributions to the volume, is to generate a mode of critique with a rare quality of responsiveness to what is at stake, politically and epistemically, in the question of datafication.

[97] Ibid 67.
[98] Ibid 5.
[99] Parisi, *supra* note 5, 48. In her original manifesto, Haraway notes that even if cyborgs are 'the illegitimate offspring of militarism and patriarchal capital', we should remember that 'illegitimate offspring are often exceedingly unfaithful to their origins' (ibid 68).
[100] Parisi, *supra* note 5, 49. For Parisi, the diagnosis of 'a persistent racializing codification of those who are not selected for bio-economic success (the poor, the immigrant, the homeless)' manifests 'a general resignation to techno-scientific universality'.
[101] See Johns, Sullivan and Van Den Meersche (Chapter 1) in this volume.

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