Special Issue Editorial Introduction: Entangling Data while Entangling Disciplines

Discussing the Future of Anthropological Collaborations with Data Scientists

Roberta Raffaetà, Giovanna Santanera, Francesca Esposito

This special issue discusses forms of possible collaboration and mutual intermixing between anthropology and data science, by presenting projects and creative experiments that have been conducted astray the two fields. While we may say that all scientists work with data, this special issue focuses on data that are collected and/or processed by digital means. In addition, attention will be paid to computation as anthropologists have recently turned to the study of data, AI and algorithms, offering critical insights about their production and implementation. They have addressed the effects of algorithmic automation (e.g. increasing surveillance, inequality exacerbation, new forms of discrimination) and conducted fieldwork among data scientists in order to bring the socio-cultural dimensions of their work to the forefront. In this introduction, we will illustrate what motivated this special issue and will introduce the articles by positioning them critically within the current debate about computation, big data and AI.

The social study of science and technology and, within it, the study of how data are collected and employed in scientific practice (also known as critical data studies) are fields that have emerged in anthropology only recently (but for early examples of anthropology of technology cf. Helmreich 1998; Lemonnier 1986; 1992; Pfaffenberger 1988; 1992; Rabinow 1996; Suchman 1987). Other disciplines, notably sociology and philosophy of science, have been much more active in shaping these fields. Many authors have explained this anthropological delay (cf. Bruun and Wahlberg 2022: 54; Ingold 1997: 106–107; Pfaffenberger 1988: 237; Sigaut 1994: 420), linking it to the modern conception of technology as a system of relationships that falls outside the realm of the social and the sphere of the cultural (Ingold 1997;

2000). Seaver (2017) has recently observed that this is still true when it comes to algorithms, which are usually understood as autonomous objects, instead of 'as culture'. Imbued of this '"machine theoretical" cosmology' (Ingold 1997: 107) themselves, anthropologists have safely left the study of contemporary technological processes to other disciplines, focusing their research instead on the so-called analogue slot (Seaver 2018: 380). This is also in line with anthropology's inclination towards focusing on minorities, marginals and deviants and its resistance to 'look up' (Raffaetà 2022: 136). Furthermore, the lack of anthropological research on data can also be connected to the widespread belief that computational analysis represents a quick alternative to in-depth ethnography for the comprehension of social reality and human behaviour (Boellstoroff 2013). This anthropological scepticism toward data science is part of our personal experience as well, as researchers working mostly in a European context. The title and idea of this special issue derives from a panel abstract that we initially submitted for the 2020 European Association of Social Anthropologists (EASA) conference in Lisbon[1]. The proposal was not selected, in a conference that did not show any engagement with technoscience. Preference was given to multiple panels on valuable but more traditional topics of anthropological debate. We had better luck with the American Anthropological Association (AAA) conference, maybe given the US context in which anthropologists are more exposed to the study of science and technology along with applied, interdisciplinary collaborations. The panel counted four presentations and had Gabriele della Seta and Katherine Ryan Amato as discussants. This special issue is the outcome of that AAA panel, including two more arti-

cles that were not presented during that event. Our desire at the time of the organisation of the panel—as newcomers to the data debate—was that of mapping the field. We wanted to enter into a dialogue with colleagues who were not necessarily experts in critical data studies but ended up working in data-centric projects and needed to reflectively discuss their practices among colleagues. Our first aim was not a cutting-edge theoretical contribution or a reconfiguration of the field, but that more mundane task of comparing our experiences, finding shared solutions and common orientations in the midst of the multiplicity of prospects. The idea of crafting a space of anthropological dialogue was not to reinforce existing disciplinary boundaries (cf. Moats and Seaver 2019). Rather, it was to increase anthropological engagement with other disciplines within data studies and its capacity to contribute in a meaningful way. This, we argue, is possible when proceeding from the awareness of one's own positionality within an interdisciplinary field. There are some aspects, indeed, that characterise the anthropological approach that are in need of inquiry and emphasis.

The anthropological hesitancy in embracing the study of science and technology and of data appears to us as paradoxical given that our companion disciplines—such as philosophy and sociology—most active in the study of science and technology and of data, are often employing ethnography as methodology. Ethnography is a helpful approach if one wants to capture how data and technology are heavily reconfiguring our daily lives, and how they rely on human choices and practices, being embedded into social relations, cultural contexts, infrastructures and institutions. Ethnographic fieldwork helps understand both how algorithms impact people and how people impact how algorithms work. On the one hand, digital data are part of the quotidian routine of an increasing number of people around the world. By penetrating a wide array of domains such as domestic life, work, transport, education, religion, affect, and health, data make new parts of life open to manipulation and intervention, in a multiplicity of ways that need to be investigated contextually (Douglas-Jones et al. 2021). On the other hand, algorithms cannot work without data practitioners who continuously develop, model, stabilise, and repair them; besides, smart technologies often come with human support services, while research funding follows policies and agendas that are set by humans (Pink et al. 2022: 4). Here, the ethnographic approach is pivotal to bring the people at work behind the algorithms to the forefront, beyond a conception of ar-

tificial intelligence and automated decision-making as independent agents (cf. Lupton 2019; Jereza 2021; Mateescu and Elish 2019; Pink et al. 2022; Seaver 2018). Finally, ethnography can be beneficial for creatively addressing the ethical concerns raised by data-driven technologies. The emphasis on their negative societal consequences—such as the erosion of people's privacy and the emergence of new forms of mass surveillance, discrimination and inequality (cf. Andrejevic and Burdon 2015; O'Neil 2016; Raffaetà and Santanera 2021; Zuboff 2019)—has usually resulted in the call for sustainable and responsible automation, cast as fair, transparent, accountable and unbiased. According to this approach—championed by an increasing number of industries and governments—ethical outlines are independent from people's everyday life and must be inscribed and embedded in algorithms. Ethnographic fieldwork among technology users can imbue this normative, fixed and generalised conception of ethics with a contextual, emergent and relational perspective, which reconnects the technical and the social, understanding values and trust as evolving from the changing circumstances of everyday life. This could also contrast the algorithmic promotion of worldviews that—far from being universal—still reflect the interests and visions of Western white middleclass data practitioners (Pink et al. 2022: 6–7; *AI Decolonial Manifesto* 2021).

The focus on ethnography can unite disciplines. Ethnography is not only a method (Ingold 2014), but it shapes theory too. Ethnography may 'offer more than just empirical detail that can provide a reality-check on otherwise hyped phenomena. Ethnography done well also holds the promise of generating a new way of theorising and understanding digital data by building novel analytical concepts that are appropriate to the kinds of relations of knowledge production that digital data itself entails. … to interrogate whether data practices might be part of a broader unsettling of how to know the social' (Knox and Nafus 2018: 3–4). As many have noted (Blok and Pedersen 2014; Dumit and Nafus 2018; Knox and Nafus 2018: 19; Paff 2022), ethnography and data science have more in common than may appear at first sight and 'thick' data are not opposed to 'big' ones (Wang 2013). The high granularity of big data makes it similar to the real world depicted by ethnography and configures as an open and indeterminate potential (Fazi 2018, 2019; Hui 2019) which needs to be analysed through an abductionary logic (Brandt and Timmermans 2021) and eliminates the need to think in terms of oppositional categories such as 'nature' and 'culture' (Latour et al. 2012). The heteroge-

neity and multiplicity of big data unite ethnography and data science. Ethnographers navigate in big and thick data because their data, as life, are not only relational but also excessive. Ethnographers, moreover, are trained to not get lost in that excess, but to provide meaningful explanations to complex social processes: 'Ethnography is not, however, the infinite tracing of all threads. We cut the network at a certain point (Strathern 1996), usually the point at which we believe our gathered partialities have a plausible coherence' (Knox and Nafus 2018: 14). Ethnography adapts exceptionally to the challenges brought on by big data that makes traditional disciplinary alliances explode for the quantification of biosocial processes. More deductive, rigid, positivistic and systematised methodologies lose traction in favour of more flexible and creative practices. As Dumit has observed, in the new landscape offered by big data, the production of knowledge becomes a 'third thing' (Dumit and Nafus 2018), an interdisciplinary trading zone that cannot be based only on quantitative or qualitative methods and their opposition. Instead it forces these contrasts to interface and interfere with each other, blurring their fake boundaries. Big data disengage scientists from the need to think in terms of oppositional dichotomies and scales thus honouring and gesturing toward an anthropology cross-scalar practice of thinking 'large issues' from 'small places' (Eriksen 1995; Latour et al. 2012).

It is therefore good news that anthropology—even if with some delay—has started to actively intervene in the study of science and technology (Bruun et al. 2022) and of data more specifically. For almost a decade, a growing number of authors have been reflecting on data (Blok and Pedersen 2014; Boellstorff et al. 2015; Seaver 2012, 2017). A recent special issue edited by Rachel Douglas-Jones, Antonia Walford and Nick Seaver in the *Journal of Royal Anthropological Institute* has put 'data's apparent novelty into conversation with many of anthropology's central concepts, from kinship to value to personhood'. It has given a comprehensive overview of 'the potential for a transformative anthropology of data—one that goes beyond updates to the ethnographic record and uses data as a generative site of anthropological theory building' (Douglas-Jones et al. 2021: 10). In this view, the engagement of anthropology with data not only entails a critical unveiling of the political dimensions of data practices but also triggers a rethinking of traditional anthropological concepts, as data are (possibly) reconfiguring the social in new and unexpected ways, which require the elaboration of fresh analytical tools.

In an attempt to go a step further, Axel Morten Pedersen (2023), in his introduction to a special issue on 'machinic anthropology', has summarised anthropological scholarly production on data in three main categories: anthropology *of* big data, anthropology *with* big data and anthropology *as* data science. The first category includes works that critically analyse data scientists' practices, the second category moves beyond a simple critique in engaging with data scientists and the last category, the focus of Pedersen's special issue, hints at conceptualising anthropology as a kind of data science in an attempt to realise Levi-Strauss' old computational dream, a 'distinctly anthropological forms of machine learning and AI' that also opens up 'for a fusion between the radically empiricist commitment of much contemporary anthropology and sociology's continuing commitment to big theory building' (Pedersen 2023: 5–6).

With reference to these three categories, identified by Pedersen to depict the current landscape of anthropological engagement with data science, the articles included in this special issue position themselves across a spectrum. In our panel's abstract, we looked for what Pedersen defines as 'anthropologies *with* big data'. Proceeding from the consideration that anthropological critique of big data rarely alters the practices of data science, allowing for the boundaries between disciplines to be quite durable, we asked potential contributors to put their forms of collaboration with data scientists into question, reflecting on experiments that straddle disciplinary boundaries and craft shared spaces of practice. The aim was to facilitate the envisioning of productive, inclusive, just and diverse collaborative practices between anthropologists and data scientists. Practicing anthropology as a study *with* people rather than a study *of* people, our AAA panel invited contributors, interested not only in discussing and criticising 'data cultures' but also in sharing experiences, exploring and speculating on innovative forms of collaboration between data scientists and anthropologists in various fields. There are a number of authors that have already discussed their anthropologies *with* data scientists (Bjerre-Nielsen and Glavind 2022; Blok et al. 2017; Christin 2020; Roberts 2021; Seaver 2017, 2018), and we wished to build on that and gather more experiences and insights. Discussing forms of engagement *with* data science automatically also includes a discourse *of* it because in engaging, anthropology opens up a space for generative critique. This connection is well expressed throughout the Special Issue. In their article 'Ideal-Real-Actual: Models *for* Collaboration between Anthropology and Computational Sciences', Jonas Falzarano

Jessen, Adrienne Mannov, and Astrid Oberborbeck Andersen reflect upon their fruitful participation as anthropologists in two projects led by computational engineers in Denmark. The two projects dealt with, respectively, the development of optimised and secure computation through a cryptographic method and the optimisation and management of water-flows by developing algorithms and automation technologies, without compromising data security and privacy. In order to work productively across disciplines—conducting anthropology *with* data scientists—they simultaneously practiced an anthropology *of* data scientists that allowed them to become familiar with computational engineers' theoretical universe. This was crucial for building a common 'socio-mathematical vocabulary' that made ethnographic data legible by other professionals, integrating them into the logic they work with. Recalling Geertz (1973: 93), the authors argue that this has resulted in the elaboration of a model for collaboration between anthropology and data science where a shared project, shared physical spaces, and the mutual engagement with each other's theoretical and epistemological universe alter the disciplinary boundaries.

From a different angle, Jennifer J. Thompson's article 'Embracing Disconcertment: On the Need for Anthropological Engagement in Interdisciplinary Research' maintains that anthropologists do not need to give up their critical approach—typical of the anthropology of data science—in order to take part in interdisciplinary projects with data scientists. Sensing the risk of becoming either a sterile critic or a coopted anthropologist, the author advocates for the crafting of an intermediate space where carrying out a 'generative critique' (Verran 2001). Thompson finds this necessary as she works in a multi-state US sustainable agriculture project whose goal is to develop predictive models (and ultimately web-based decision-support tools) to reduce the uncertainties and maximise the benefits of cover cropping for American farmers. By filling the gap of knowledge about farmer-participation in on-farm research and uncovering the representation bias (i.e., the recurrent exclusion of farmers from minority groups), ethnography can enhance, not only the equity and transparency of the project but also its scientific relevance.

Francesca Esposito's article 'It's All about Data: The Relationship between Anthropologists and Data Scientists from a Technical Point of View' considers that a multidisciplinary collaboration between anthropology and data science is the key to producing a broader understanding and interpretation of the world we live in, which is totally immersed in and shaped by data and its related practices, and also for creating further innovations. In the context of an IT consulting company in Milan, Italy, she explains how in collaboration with data scientists she has built a draft of what Nick Seaver (2017) calls a socio-technical approach simply starting by creating customer-oriented data analysis packages or educating algorithms (Master 2023) that are people-caring. Esposito goes on to describe how she started a process where anthropology can impact data science and data science can affect anthropology, starting from the awareness of the social complexity behind data.

Finally, Edoardo Occa's article 'Outlining a "Semantic Anthropology of Data Science": The Humanitarian Response to the Cholera Epidemic of Doctors with Africa CUAMM in Mozambique' shows the importance of collaboration between anthropology and data science in emergency contexts where action must prevail over critical postures. The author recounts—through the format of the notes from the field—his work as a medical anthropologist with the NGO Doctors with Africa CUAMM, during the cholera outbreak in 2022 and 2023 in Mozambique. Interestingly, he reflects on the problematic process of the datafication of intimate experiences such as suffering and illness. Local communities affected by cholera do not trust digitally processed quantitative data, which they accuse of depicting a health situation far worse than the one they experience every day. An anthropological approach that is attuned to local conceptions of disease and well-being—even when there is no time to conduct in-depth ethnography—can therefore help bridge this gap and effectively contribute to the design of culturally compatible interventions by consulting with the data scientists in charge of the development of cholera predictive models and prevention plans.

Only one article, that of Ritwik Banerji, ventures into 'anthropology *as* data science'. As an anthropologist with training in coding, the author designed artificially intelligent virtual musicians that perform with human improvisers and with one another. He draws on his ethnographic fieldwork on free improvisation (an avant-garde post-war musical practice) in Germany and the United States. In his article 'Artificial Intelligence, Humanness, and Nonverbal Sociality', he illustrates how this kind of engagement with AI can allow anthropologists pursue their field's goals in ways that are not typically possible through canonical research practices. Algorithmic ethnographic performers enable new radical forms of elicitation and novel modes of ethnographic communication, as they perform culture, rather than simply

depicting it, overcoming the limits of fixed media, such as texts, images, and sounds. With regard to the study of big data, anthropological experimentation with AI is also crucial for conducting proper participant observation and for gaining credibility among AI practitioners, who generally do not take into account anthropological criticism of their work, due to anthropologists' lack of practical expertise.

While we welcomed Banerji's article for its creative mobilisation of anthropological categories along with computation, we are still hesitant to readily assimilate computation into our anthropological imagination and methodology. Still positioning, as humble and cautious observers in the midst of the tension between computation's opportunities and risks, we are not ready to embrace computation as a method instead of as an object of inquiry and of analytical engagement. Despite acknowledgement of the fact that anthropology as data science can hack data science itself (Kockelman 2020; Paff 2022), we are still uncertain about employing computation as a method of anthropological inquiry. Computation was born under Western industrial and military capitalism and its logic expresses specific forms of economic and political order which may be possible (Lowrie 2018) but difficult (Berardi 2023; Pasquinelli 2023) to escape. For the moment, we prefer to join others in unpacking what computation and data are, while observing those who bravely experiment with what these may become through playful and activist practices, especially in light of non-Western perspectives and multiple socio-political agendas (Cave and Dihal 2023; Hui 2016; cf. also *AI Decolonial Manifesto* 2021). For example, since smartphones have entered the scene, start-ups developing apps have opened up in many African cities. Tech enthusiasts have inaugurated tech hubs, with California-inflected names such as Silicon mountain (Cameroon), Silicon savannah (Kenya and Uganda), Silicon lagoon (Nigeria), Silicon desert (Namibia), Silicon Cape (South Africa). While some are supported by foreign investments, others are genuinely bottom-up enterprises. They are situated within wider contexts shaped by practices of inventions and innovations from 'below', which lead to the experimentation of new images of the future (cf. Odumosu 2017; Pype 2017). While usually overlooked, these ventures could be crucial to the idea of 'decolonising computing' advocated by many scholars and to the possible emergence of alternative socio-technical paradigms (cf. Amrute 2016; Harding 2011; Mavhunga 2017; Philip et al. 2010).

Maintaining a gap between anthropology and data science, and not yet assimilating the former to the latter, allows anthropology *as* data science to partially overlap with anthropology *with* big data (keeping the engagement part alive, with all its complexities [Roberts 2021]), and also *of* data (for its critical approach). This partial overlap between the articles despite—or thanks to—their diversity is what characterises this special issue, which mirrors the current data moment—in anthropology and beyond—marked by a variety of partially intersecting themes, methods and visions. An afterwork in the form of a dialogue between Katherine Amato (panel discussant) and Roberta Raffaetà, closed the special issue.

For some specialised networks, to think with data is nothing new. However, for the majority of people, data are emerging as a pervasive phenomenon only for a few years, and this is forcing them to reconsider usual practices. Esposito, for example, works in a company of IT consultancy that has always dealt with data. Beginning just a couple of years ago, however, she notices how in IT world many processes have had to evolve and to be reinvented and recalibrated readily in light of the new social coordination and regulations around data (e.g., GDPR) and will continue to evolve along with these regulations and with the society. Similarly, some anthropologists not previously interested in data or technology have started familiarising themselves with these themes. This is due to the fact that they have become pervasive in social processes, from technologies of migrants' identity recognition to domestic technologies, along with digital assistants that are designed to help people with their everyday tasks. We therefore hope that the articles in this special issue can offer useful and interesting insights for the many who apply anthropological insights to projects that deal with computation, data, algorithms and AI. Building on the specificities of the ethnographic method, we hope that this special issue can strengthen their attempt to carry on research across an anthropology *of*, *with* and—maybe even—*as* data science, thus entangling data while entangling disciplines and approaches.

Roberta Raffaetà[2] is Associate Professor of cultural anthropology at Ca' Foscari University Venice – Department of Philosophy and Cultural Heritage and deputy-director of NICHE (The New Institute: Center for Environmental Humanities).

Giovanna Santanera is Assistant Professor of cultural anthropology (non-tenure track) at University of Milan-Bicocca – Department of Human Sciences for Education 'Riccardo Massa'.

Francesca Esposito has a master's degree in anthropological and ethnological sciences from the University of Milano-Bicocca. She is currently working in an IT consulting company, Porini, as HR Process Lead. Her role is partly focused on research and development of Human Resources technology products.

Notes

1. The final program of the 2020 EASA conference is available at this link: https://easaonline.org/conferences/easa2020/ (accessed 23 August 2023).
2. Raffaetà has written the second half of the article, Santanera has written the first half. Esposito has collaborated at the overall discussion and coordinated the guest editors' organizational tasks.

References

AI Decolonial Manifesto (2021), Available at: https://manyfesto.ai/index.html (accessed 23 August 2023).

Amrute, S. (2016), *Encoding Race, Encoding Class: Indian IT Workers in Berlin* (Durham, NC: Duke University Press), 9780822374275.

Andrejevic, M., and M. Burdon (2015), 'Defining the Sensor Society', *Television & New Media* 16, no. 1: 19–36, 1527476414541552.

Berardi, F. (2023), 'The Completion—Journal #137', *E-Flux*, https://www.e-flux.com/journal/137/544269/the-completion/ (accessed 15 August 2023).

Bjerre-Nielsen, A., and K.L. Glavind (2022), 'Ethnographic Data in the Age of Big Data: How to Compare and Combine', *Big Data & Society* 9, no. 1, 20539517211069892, 20539517211069893.

Blok, A., and A. M. Pedersen (2014), 'Complementary Social Science? Quali-Quantitative Experiments in a Big Data World', *Big Data & Society* 1, no. 2, 205395171454390, 2053951714543908.

Blok, A., H. B. Carlsen, T. B. Jørgensen, M. Madsen, S. Ralund, and M. A. Pedersen (2017), 'Stitching Together the Heterogeneous Party: A Complementary Social Data Science Experiment', *Big Data & Society* 4, no. 2, 2053951717736337.

Boellstorff, T. (2013), 'Making Data Big, in Theory', *First Monday* 18, no. 10, fm.v18i10.4869.

Boellstorff, T., B. Maurer, G. Bell, M. Gregg, and N. Seaver (2015), *Data, Now Bigger and Better!* (Chicago: University of Chicago Press).

Brandt, P. and S. Timmermans (2021), 'Abductive Logic of Inquiry for Quantitative Research in the Digital Age', *Sociological Science* 8: 191–210, 10.15195/v8.a10.

Bruun M. H., and A. Wahlberg (2022), 'The Anthropology of Technology: The Formation of a Field', in *The Palgrave Handbook of the Anthropology of Technology*, (ed.) M. H. Bruun, A. Wahlberg, R. Douglas-Jones, C. Hasse, K. Hoeyer, D. B. Kristensen, et al. (Singapore: Palgrave MacMillan), 35–94.

Bruun, M. H., A. Wahlberg, R. Douglas-Jones, C. Hasse, K. Hoeyer, D. B. Kristensen, et al. (eds) (2022), *The Palgrave Handbook of the Anthropology of Technology* (Singapore: Palgrave MacMillan).

Cave, S. and K. Dihal (2023), *Imagining AI: How the World Sees Intelligent Machines* (Oxford: Oxford University Press).

Christin, A. (2020), 'The Ethnographer and the Algorithm: Beyond the Black Box', *Theory and Society* 49, no. 5: 897–918, 10.1007/s11186-020-09411-3.

Douglas-Jones, R., A. Walford, and N. and Seaver (2021), 'Introduction: Towards an Anthropology of Data', *Journal of the Royal Anthropological Institute* 27, S1: 9–25, 10.1111/1467-9655.13477.

Dumit, J. and D. Nafus (2018), 'The Other Ninety per Cent: Thinking with Data Science, Creating Data Studies – an Interview with Joseph Dumit', in *Ethnography for a Data-Saturated World*, (ed.) H. Knox and D. Nafus (Manchester: Manchester University Press), 252–274.

Eriksen, T. H. (1995), *Small Places, Large Issues: An Introduction to Social and Cultural Anthropology* (London: Pluto Press).

Fazi, M. B. (2018), *Contingent Computation: Abstraction, Experience, and Indeterminacy in Computational Aesthetics* (London: Rowman & Littlefield Publishers).

Fazi, M. B. (2019), 'Can a Machine Think (Anything New)? Automation beyond Simulation', *AI & SOCIETY*, 34 no. 4: 813–824.

Geertz, C. (1973), *The Interpretation of Cultures: Selected Essays* (New York: Basic Books).

Harding, S. (ed.) (2011) *The Postcolonial Science and Technology Studies Reader* (Durham, NC: Duke University Press).

Helmreich, S. (1998), *Silicon Second Nature. Culturing Artificial Life in a Digital World* (Berkeley: University of California Press).

Hui, Y. (2016), *The Question Concerning Technology in China* (Falmouth: Urbanomic).

Hui, Y. (2019), *Recursivity and Contingency* (London: Rowman & Littlefield Publishers).

Ingold, T. (1997), 'Eight Themes in the Anthropology of Technology', *Social Analysis*, 41 no. 1: 106–138.

Ingold, T. (2000), 'Society, Nature, and the Concept of Technology', in *The Perception of the Environment*, (ed.) T. Ingold (London: Routledge), 312–322.

Ingold, T. (2014), 'That's Enough about Ethnography!', *HAU: Journal of Ethnographic Theory*, 4, no. 1: 383–395, 10.14318/hau4.1.021

Jereza, R. (2021), 'Corporeal Moderation: Digital Labour as Affective good', *Social Anthropology* 29, no. 4: 928–943, 10.1111/1469-8676.13106.

Knox, H. and D. Nafus (2018), *Ethnography for a Data-Saturated World*, 1st ed (Manchester: Manchester University Press) https://www.jstor.org/stable/j.ctvnb7k8z (accessed 12 January 2022).

Kockelman, P. (2020), 'The Epistemic and Performative Dynamics of Machine Learning Praxis', *Signs and Society* 8, no. 2: 319–355, 10.1177/20539517231153803.

Latour, B., P. Jensen, T. Venturini, S. Grauwin, and D. Boullier (2012), '"The Whole Is Always Smaller than Its Parts" – a Digital Test of Gabriel Tardes' Monads', *The British Journal of Sociology* 63, no. 4: 590–615, 2056305120940697.

Lemonnier, P. (1986), 'The Study of Material Culture Today: Toward an Anthropology of Technical Systems', *Journal of Anthropological Archaeology*, 5 no. 2: 147–186, 1359183514540065.

Lemonnier, P. (1992), *Elements for an Anthropology of Technology* (Ann Arbor: University of Michigan, Museum of Anthropology).

Lowrie, I. (2018), 'Algorithms and Automation: An Introduction', *Cultural Anthropology* 33, no. 3: 349–359, 10.14506/ca33.3.01.

Lupton, D. (2019), *Data Selves: More-Than-Human Perspectives* (Cambridge: Polity).

Master, A. (2023), 'Please stop drawing neural networks wrong', *Towards Data Science*, (https://towardsdatascience.com/please-stop-drawing-neural-networks-wrong-ffd02b67ad77).

Mateescu, A. and M. C. Elish (2019) *AI in Context: The Labor of Integrating New Technologies* (New York: Data & Society Institute).

Mavhunga, C. (ed) (2017), *What Do Science, Technology, and Innovation Mean from Africa?* (Cambridge, MA: MIT Press).

Moats, D. and N. Seaver (2019), '"You Social Scientists Love Mind Games": Experimenting in the "Divide" Between Data Science and Critical Algorithm Studies', *Big Data & Society* 6, no. 1: 1–11, 2053951719833404.

Odumosu, T. (2017), 'Making Mobile African', in *What Do Science, Technology, and Innovation Mean from Africa?*, (ed.) C. Mavhunga, (Cambridge, MA: MIT Press).

O'Neil, C. (2016), *Weapons of Math Destructions. How Big Data Increases Inequality and Threatens Democracy* (New York: Broadway Books).

Paff, S. (2022), 'Anthropology by Data Science', *Annals of Anthropological Practice*, 46, no. 1: 7–18, 10.1111/napa.12169.

Pasquinelli, M. (2023), *In the Eye of the Master: A Social History of Artificial Intelligence* (London: Verso Books).

Pedersen, M. A. (2023), 'Editorial Introduction: Towards a Machinic Anthropology', *Big Data & Society* 10. no. 1, 20539517231153804.

Pfaffenberger, B. (1988), 'Fetishised Objects and Humanised Nature: Towards an Anthropology of Technology', *Man* 23, no. 2: 236–252, 10.2307/2802804.

Pfaffenberger, B. (1992), 'Social Anthropology of Technology', *Annual Review of Anthropology*, 21: 491–516.

Philip, K., L. Irani, and P. Dourish (2010), 'Postcolonial Computing: A Tactical Survey', *Science, Technology, and Human Values* 37, no. 1: 1–27, 0162243910389594.

Pink, S., M. Ruckenstein, M. Berg, and D. Lupton (2022), 'Everyday Automation: Setting a Research Agenda', in *Everyday Automation. Experiencing and Anticipating Emerging Technologies*, (ed.) S. Pink, M. Berg, D. Lupton, and M. Ruckenstein (London: Routledge), 1–19, 9781003170884.

Pype, K. (2017), 'Smartness from Below: Variations on Technology and Creativity in Contemporary Kinshasa', in *What Do Science, Technology, and Innovation Mean from Africa?*, (ed.) C. Mavhunga (Cambridge, MA: MIT Press).

Rabinow, P. (1996), *Making PCR: A Story of Biotechnology* (Chicago: Chicago University Press).

Raffaetà, R. (2022), *Metagenomic Futures: How Microbiome Research is Reconfiguring Health and What it Means to be Human* (London: Routledge).

Raffaetà, R., and G. Santanera (2021), 'Designing Unpredictable Futures. An Anthropological Perspective on the Algorithmical Prediction of Human Behavior', in *Design Culture(s). Cumulus Conference Proceedings Roma 2021*, no. 2 (Helsinki: Cumulus), 279–289.

Roberts, E. (2021), 'Making Better Numbers through Bioethnographic Collaboration', *American Anthropologist* 123, no. 2: 355–369, 10.1111/aman.13560.

Seaver, N. (2012), 'Every Sensation Is Only a Number: Tardean Statistics, Computer Audition, and Big Data', *Sociology of Power* 30: 193–200, 10.22394/2074-0492-2018-3-193-200.

Seaver, N. (2017), 'Algorithms as Culture: Some Tactics for the Ethnography of Algorithmic Systems', *Big Data & Society* 4, no. 2, 2053951717738104.

Seaver, N. (2018), 'What Should an Anthropology of Algorithms Do?', *Cultural Anthropology* 33, no. 3: 375–385, 10.14506/ca33.3.04.

Sigaut, F. (1994), 'Technology', in *Companion Encyclopaedia of Anthropology*, (ed.) T. Ingold, (New York: Routledge), 420–459.

Strathern, M. (1996), 'Cutting the Network', *The Journal of the Royal Anthropological Institute*, 2, no.3: 517–35, https://doi.org/10.2307/3034901.

Suchman, L. (1987), *Plans and Situated Actions: The Problem of Human-Machine Communication* (Cambridge: Cambridge University Press).

Verran, H. (2001), *Science and an African Logic* (Chicago: University of Chicago Press).

Wang, T. (2013), 'Big Data Needs Thick Data', *Ethnography Matters*, http://ethnographymatters.net/blog/2013/05/13/big-data-needs-thick-data/ (accessed 23 August 2023).

Zuboff, S. (2019), *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power* (London: Profile Books).