SPECIAL ISSUE

DIS/CONNECTION MATTERS: NATURAL, SYNTHETIC, AND DIGITAL

Filipe Calvão, Matthieu Bolay, Lindsay Bell

Abstract

The world is experiencing new relations and transformations between natural, synthetic, and digital substances. Rather than considering these as materially distinct or ontologically separate, this Special Issue of TSANTSA interrogates how they are interlocked in socio-material processes of mediation, transmutation, and valuation. By conceptualizing the specificity of their separateness, the special issue makes possible the comparison and commensuration of their relationship, and to move beyond their essential qualities. What are the boundaries, leakages, or dis/connections between human and digital, natural and artificial, the organic and synthetic matters? Based on ethnographic research in laboratories, gold refineries, bio-tech microbial seeds and digitally-produced natural sounds, human-machine apps and cellular agriculture, each contribution theorizes the mediation, transmutation, and valuation of natural synthetics, the humanness of artificial intelligence, or the materiality of digital elements.

Keywords: *materiality, natural, ontology, digital, synthetic, mediation, valuation*

Introduction

Synthetic fibers, plastics, and fabrics have long been a mainstay of modern mass consumerism, but recent attempts to engineer life, or the growing prospects of digitally-mediated, algorithm-powered, and AI-driven futures, have led to the emergence of new relations between and transmutations across synthetic, digital, and natural materialities. These new substances and the dis/connections between them raise a series of questions. Can the synthetic or digital be biologic, and what is natural about artificial materials and processes? What are the boundaries, leakages, and contaminations between human and digital, natural and artificial, the organic, and synthetic matters? And in what ways have their imbrication led to new forms of social mediation, bio-economic transmutation, or economic valuation?

Social scientists are now taking stock of the emergence of, and transgressions between, natural, synthetic and digital products in a wide range of socio-cultural, political, and economic contexts. Scholarly research on synthetic worlds, for example, has taken an interest in theorizing the biological (Roosth 2017), the duality of inside and outside spaces of virtual reality (Castronova 2005), or the history of synthetic developments in chemistry and art (Leslie 2005). In spite of their overlap across various industries and economic processes,

source: https://doi.org/10.48350/161623 | downloaded: 12.10.2024

DOI 10.36950/tsantsa.2021.26.7680
© 2021 This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 License. (CC BY-NC-ND 4.0)

anthropological approaches have commonly privileged the material specificity and separateness of the synthetic and the digital in their relation towards what is framed as "human" or "natural." We push these analyses further by advancing the conceptualization of modes of interaction and mediation between humans and synthetic properties or automated and digital processes through the prism of socio-material processes of mediation, transmutation, and valuation.

Rather than considering natural, synthetic, and digital worlds as politically antagonistic, materially distinct, or ontologically separate, this Special Issue of TSANTSA interrogates how digital, synthetic, and natural materialities are interlocked in socio-material processes of mediation, transmutation, and valuation. Our approach to mediation privileges the conceptual and actual entanglements between materialities; transmutation takes into account the transformations of forms and substance across material orders; valuation, finally, implicates the commensuration, evaluation, and marketization of biosocial and economic processes within and across natural, synthetic and digital orders. The articles in this issue theorize these processes across natural synthetics, the humanness of artificial intelligence, and the materiality of digital elements by drawing on a range of ethnographic contexts, from laboratories, gold refineries, bio-tech apps, sound systems, cellular agriculture to machine-human simulations. By conceptualizing the specificity of their separateness, while moving beyond essential qualities, the special issue makes possible the comparison and commensuration of their relationship.

Mediation: machine-human biologies

We define the enmeshment of human and non-human matters as one concrete node of mediation. For Mazzarella (2004, 352), "nodes of mediation" can be defined as "sites at which the compulsions of institutional determination and the rich, volatile play of sense come into always provisional alignment in the service of... a vast range of social projects, from the grass roots to corporate boardrooms." In the unstable relationships of social practice, representation, and work, this approach to mediation can be used to commensurate and render visible how natural, synthetic, and digital properties are produced and replicated across different material realities. In this issue, the cases of synthetically produced meat (Abrell), diamonds (Calvão and Bell), bio-tech microbial seeds (Silva Garzón), natural sound (Vinck, Waeber, and Tanferri) or gold replicas (Bolay) share an experiential connection by artificially producing and extending naturally-occurring substances.

We approach the mediation of humans, machines and synthetic products in the potential for making people and "nature," and thus creating value in the (re)production of social relations, practices, and meaning. At least since Marx (1973, 692), an "automatic system of machinery" has been seen as absorbing the living labour capacities of human workers, transformed into an accessory element of the labour process and rendered "merely as its conscious linkages." More recently, the ways in which humans and machines interact in a computer-mediated economy have been the object of heightened attention. Extending Marx's analysis of machinery to automated robots, Collins (2018) suggests that robotic work is misrecognized as

animate inasmuch as it would seemingly replicate a Taylorist version of the alienated human worker. In this reading, the extent to which humans are shaped, disciplined, and controlled by computerized algorithms would announce the coming age of a "robocracy." Where Ekbia and Nardi (2017) designate the new capitalist accumulation logics emerging out of the division of labor between machines and humans as "heteromation," Besteman and Gusterson (2019, 6) describe the interactions between humans and computerized processes as "roboprocesses," with their own cognitive models and rationality "used aggressively to discipline and objectify citizens, employees, and consumers and to mine them for profit." Anthropologists and other social scientists have also examined the social and political effects of digital and algorithmic processes from a variety of perspectives, including human-computer interfaces (Suchman 2007; Downey 1998; Kockelman 2017), the role of algorithms in trading sites, surveillance, and education (Zaloom 2006; Masco 2019; Lutz Fernandez and Lutz 2019), or new forms of sociality in technology-mediated work (Hakken 2000) and computer-mediated interactions (Wilf 2013a, 2013b). In her ethnography of coders and software developers, Coleman (2013) also puts forward an element of individuality and creativity in the work of computer machines, extending the self into the (digital) objects of their creation.

Such perspectives place strong emphasis on the agency of mediations once stabilized into intermediaries, to borrow from the Actor-Network Theory (ANT) vocabulary (Latour 2005). Considering that matters are eminently social, too, in that they are uncertain associations of hybrid elements, their stabilization requires a process of purification, which creates meaningful distinctions that can then be acted upon and interpreted. The contributions to this volume take seriously the networked composition of assemblages deemed synthetic, digital, or "natural." They also pay attention to the social work at play in connecting or disconnecting different entities, which inevitably implicate processes of selection, or "cutting in the network" in Strathern's phrasing (1996). This analytical focus helps us to account not only for the processes of subjugation or valuation that results from technological assemblages, but for the practical, and largely experimental, work of mediation that occurs beforehand. Due to the great load of uncertainty that surrounds the direction that socio-material associations will take before they are stabilized (or once their network is cut) and gets inscribed into repertoires of naturalness, synthetic or digital, social actors work to channel competing interpretations, such as whether laboratory-grown diamonds are "natural" or not (Calvão and Bell, this issue), or whether cell cultivated meat is meat or just resembles it (Abrell, this issue). They also have to deal with the "novel and previously unthinkable options" (Callon 1991, 132) – and not necessary wanted – inherent to technological experimentation, such as the increased speculative affordance of artisanal gold once digitized (Bolay, this issue).

This question is central to Diego Silva's analysis of microbial seeds' own redefinition of geography. Silva's article builds upon the case of an Argentinian biotech company seeking to develop region-specific climate resilient crops in the context of climate change. Focusing on the experiments to engineer microbial seed treatments, this ethnography highlights the mediations between computational technologies, plants, and microorganisms in the shaping of scientific and corporate meanings of place. Following an ANT framework, the article makes visible the selective biogenetic collection, digital documentation, and valuation of bacterial strains, and the subsequent efforts to stabilize new plant-microbial associations

expressing region-specific qualities for plant growth and health against crops' genetic uniformity. Silva shows that, while derived from engineers' imaginary replication of plant-microbia-soil relations, new associations concretely have their own agency in the production of plant qualities, which informs on a relational definition of "region-specificity" based on "microbes' taste of place."

By tracking these modes of interaction and mediation between synthetic or automated processes and humans, the contributions to this special issue do more than describe hybrid networks (cf. Callon 1991, 139). Advancing beyond the network metaphor, we seek to identify and qualify the links between the discrete entities, or nodes of mediation, that empirically constitute them; for instance as "contamination" of industrially refined gold bars by so called blood minerals (Bolay, this issue), or as risks of "alteration" of audiowaves across analogic and digital devices (Vinck, Waeber, and Tanferri, this issue). Such connections manifest what could be termed, after Douglas (1966), the anxieties of social pollution that ultimately trouble attempts to control the presumed boundaries of naturalness.

Johannes Bruder's article takes up this challenge by discussing the contamination between human and artificial intelligence in computational neuroscience and machine learning research, or the leaking of settler colonialist thinking in machine-human computer simulations. The article narrates the experiment of computational neuroscientists with a 1980 arcade microprocessor used as a model organism to simulate human cognition. To legitimize the analogy between brains and computers, researchers selectively build upon laboratory experiments in biology – on nematode worms and genetically modified lab mice – and, in so doing, propose to use the digital as a transmuted and more easily manipulable version of the biological. While acknowledging that video games do not resemble the "real world," tested behavioural models are reduced to selected parameters deemed sufficient to run simulations, compare synthetic data with human's brain activity, and develop machine learning algorithm. Importantly, the synthetic and digital mediations at play in the elaboration of behavioural and cognitive models question the determining role of test beds in shaping our understanding of, and mediation between, human and artificial intelligence.

The lens of mediation also sheds light on the liberating potential of connections actively produced to challenge natural and artificial boundaries, potentially emancipating humans from the self-generated environmental destruction of extractivist forms of industrial production in livestock industry, mining, and agribusiness. If productive processes will move toward the complementarity between machines and humans (Brynjolfsson and McAfee 2014), we put forward the idea that new relations between machines and humans constitute novel and potentially emancipatory social relationships. In this, we follow Heidegger's (1977) conception of the essence of technology as revealing the world, or poesis. Unlike the *Enframing* of modern technology, or "das Gestell," that renders the natural world, and to a certain extend humanity itself, into a regulated and secured standing-reserve of raw materials and profit, alternative orientations towards technology can give rise to modes of revealing that escape this determinism.

Transmutation: Nature's synthetics

The special issue takes into account the transformations of forms and substance across material orders to theorize the relationship between synthetic and natural substances. The entanglements of animate and inanimate beings, knowledge, materials, and techniques resemble conceptualizations of "hybrid" collectives of human and non-humans (Latour 2005), the cyborg blurring of natural and artificial boundaries, bits and atoms (Haraway 1991; Mitchell 2003), the frictions of global interconnections of movement, forms, and agency (Tsing 2005), or the ontological relationality of Amazonian multinaturalism (Viveiros de Castro 2004). We build upon but depart from these conceptualizations in two fundamental ways: first, the process of qualification-singularization in "marketization," Callon (1998) suggests, is only possible through their temporary framing and disentanglement. These would ultimately deny the historical, sociopolitical, and ethnographic relations in which they are embedded (cf. Appel 2012). Although "to disentangle one has to entangle" (Callon 2005, 7), we suggest that the processes of disentanglement and re-entanglement should not obfuscate the transmutations in the meaning and materiality of value occurring between synthetic and natural substances. If through the work of purification (Latour 1993) and semiotic ideologies (Keane 2018) the separation between nature and culture or subject and object is radically reaffirmed, the work of disentanglement is an ideological and programmatic artifact subsequent to that of entanglement. Second, we do not deny an essential quality to synthetic and natural objects. Importantly, we question the post-plural predicament for refusing the assumption of discrete entities. Indeed, each contribution restates the borders between social and natural to interrogate the original referents and the work put into reinforcing these categories.

It is the making and interrogation of these categories that Dominique Vinck, Sarah Waeber, and Mylène Tanferri propose in "Produire un son 'naturel'." In their detailed ethnography of the sound system of a large-scale live performance, Vinck and colleagues investigate the mediations at work in the production of a "natural sound" across digital and analogic technologies. By describing the sociotechnical assemblages experimented by a team of twenty sound engineers, the article questions the ontology of what makes up sound, and reveals how its naturalness is produced in the enmeshment of different materialities. Original soundwaves are continuously transmuted into separated series of disassembled data and reassembled across analogic and digital signals towards a sound perceived as "pure." The capture and mediation of choirs, instruments, and ambient sounds across digital and analogic infrastructures is never fully stabilized. A sound valued as "good", they show, requires continuous work to monitor the agency of sonic assemblages to produce a sound which is paradoxically perceived as unmediated.

Drawing inspiration from the new materiality studies and the posthuman literature, this special issue critically moves beyond a subject-object dichotomy in an effort to rethink the ecology of materials in a landscape of mixed and hybrid materials (Whatmore 2002) and radical recomposition of nature-societal assemblages (McFarlane and Anderson 2011). We understand the materiality of nature's synthetics as social and not merely physical, encompassing the value of material objects and immaterial signs (Mintz 1985; Pietz 1985; Graeber

2005; Masuzawa 2000). For instance, the synthetic production of meat (Abrell, this issue) or diamonds (Calvão and Bell, this issue) builds upon essential elements such as tissues' cells or graphite and carbon contents, and bank upon their assumed naturalness. Digital replicas of the physical and ethical properties of gold (Bolay, this issue), of smart-phone based sleep patterns (Sikka, this issue), or the modeling of humans/microprocessors/mice's behavior (Bruder, this issue) is the outcome of a process of re-presentation, or a "second order description" (Strathern 2000, 313). In these cases, techniques of visibility through hashes, graphs, or models become essential to make replicas tangible and valuable.

What appears to be crucial in both digital and synthetic replicas is the sensorial or affective resemblance between the original and its transmuted form (be it materially for diamonds, gustatory in meat, behavioral in seeds or brain research, or auditive for sound), as well as the additional affordances they enable, and which add new layers of valuation. In the example of synthetic qua-natural diamonds, Calvão and Bell explore the making and makers of lab-grown "memorial diamonds" out of carbon sourced from genetic material of the deceased such as hairs or cremation ashes. These diamonds, which are identical to those found in nature, can be deemed at once synthetic and organic, living objects but also representations of inert substances. These memorial diamond companies do not seek to compete in the market of mined diamonds or that of mass-produced lab-grown diamond industry, but offer a paradigmatic case to question established ontological categories. The "realness" of these diamonds, Calvão and Bell explain, is mediated through references to the specifics of their physical composition, through reduction of "nature" to original carbon elements, and through its figurative and literal connection to the deceased. This, in turn, creates new forms of unstable value through precarious transmutations between the emotional absence of the deceased and the real presence of the memorial diamond. Their ethnography suggests that the qualities of natural and synthetic are not always distinct, but are negotiated inside labs and outside them by bridging between the emotional (though natural) absence of the dead body and the real (though artificial) presence of the diamond.

As such, the special issue expands research on the agency of animate and inanimate things and object biographies (Appadurai 1986; Bennett 2010), proposing a return to unstable forms of "matter" (Ingold 2012), such as when rigid classifications of the size and color of diamond stones are contested and differently appraised by machines and traders in Angola (Calvão 2015). Adding to this scholarship, we take interest in recent theorizations of processes of materialization as critical to subject formation and the entanglements between objects and subjects. Examining the moral panics and the politics of matter associated with plastics in Kenya, for example, Meiu (2020) suggests that this polluting and mutable substance is deeply and inextricably tied to belonging, and thus constitutive of relations of inclusion and exclusion, identity, and politics. Along a similar line, Sikka (this issue) questions how the informational body is categorized in ways that further gender, racialize, and stigmatize; Bolay's work on the speculation over divisible digitized gold bars (this issue) describes how artisanal miners get excluded from the new fields of value that gold opens once transmuted into a digital form.

Moreover, contributors render especially salient the role of what Abrell (this issue) calls the "politics of resemblance" in processes of transmutation. Abrell's contribution examines

the emerging industry of cell-cultured animal tissue whose efforts to produce synthetic meat might render industrial agricultural animals obsolete. By adapting techniques from the biomedical industry, cell cultivation start-ups claim to potentially mitigate the environmental ills of conventional animal agriculture, which also raises ethical and ontological questions regarding the reduction of animals to their most minimal viable productive capacities: replicated cells severed from the animal body. Rendering the perspective of cultured meat companies, Abrell describes how these "politics of resemblance" are central to the fabrication of products that not only resemble but replicate conventional meat. These politics highlight sensory and affective challenges related to perceptions of naturalness and artificiality, and, subsequently, market struggles in the definition and conceptualization of the boundaries between what counts as natural or synthetic. By examining the replication of all or certain features of a thing into another material form, this and other contributions are attentive to the continuities and discontinuities across material orders, and their role in making transmuted replicas tangible.

Valuation: digital materialities

Finally, contributors to this special issue examine the commensuration, evaluation, and marketization of biosocial and economic processes as one form of valuation. The approach espoused in this collection privileges the conceptual and actual entanglements between materialities, raising the problem of how digital materialities are differently embodied and dis/connected. As we have seen earlier, authors deploying the Actor-Network-Theory framework have long imagined relational collectives where humans are entangled with non-humans, displacing the human-nature divide by examining the way scientific knowledge is produced and retrospectively constructs that divide. Importantly, if the networks in ANT are more than metaphors, they necessarily implicate separate nodes with distinguishable and commensurable properties – as in any representation of a network matrix – and consequently connections of varying value depending on their strengths and directions. We expand the ANT scholarship in connection to materiality and multiple ontologies, in both social and material non-human agencies and subjectivities (Coole and Frost 2010; Holbraad, Pedersen, and Castro 2014; Law and Mol 1995). We suggest privileging relations over bounded objects, in particular as they manifest in moments of conflict and dispute borne out of ontological multiplicities, coupling provisional and shifting assemblages of humans and non-humans with a relational and processual understanding of value. In examining artificial intelligence or computer apps, contributions to this issue move away from the specific object of technological innovation toward the broader cultural, social, and political matrix in which such objects become meaningful and whereby they create value. As Hornborg (2015) aptly demonstrates, the agentive capacity of technological objects is not an intrinsic quality of the objects themselves. Drawing attention to the alliances, connections, and disputes translating and constituting different forms of power, these authors overcome the difficulty of theorizing the isolated object by focusing on the concrete social and political operation of human, digital, and automated technologies and materialities.

Matthieu Bolay's article illustrates this problem by tracking how the industry of gold refining seeks to expand its understanding of "product integrity" from physically true to ethically responsible. It depicts the legal and technical practices put to work in the selective compartmentalization and (in)visibility of the social life of refined gold, and the hybrid imbrication of mineral and digital materialities used in this process. Focusing on refiners' role of mediating authority, the article questions the industry's attempts to reconcile operational erasure in the purification process with normative disclosure against standards of "responsibility" assumed to certify qualities of honesty and fairness regarding the environmental and social harms of extraction. In this endeavour, processes of transmuting gold into the digital (blockchain and ICO) are used to render visible the human and non-human networks constitutive of gold products. At the same time, once digitized, gold paradoxically becomes both integral and divisible. These digital fetishes, Bolay argues, are essentially more liquid, more rapidly tradable, and potentially more speculative than their original source. Thus, they open new fields of value, not out of the substance but out of its traces, from which ground producers selling physical gold remain excluded so far.

The last decade of digital technological developments has pivoted the conversation in different directions, from the concealment of the human contribution to data-processing and digitally-enabled work (Irani 2015) to enhanced monitoring and invisible control, particularly acute in the context of the "invisible" structures governing the deployment of algorithms (Musiani 2013). Contributors to this special issue bring ethnographic relief to these inscrutable processes as well as the contested valorization of digital materialities by examining, as Tina Sikka proposes, value extraction from digital records of sleep patterns. Sikka's article offers a critical discourse and materialist analysis of sleep apps as an attempt to colonize and make sleep profitable, or what she frames as one of the last vestiges of the human lifeworld outside neoliberal biopower. By connecting through sensors the sleeping human body with an externalized and datafied version of itself, these apps are used to correct pathologized behaviours – modelized sleep patterns – and to instil a form of subjectivity aligned with objectives of efficiency and normative health. Through the reduction of sleep to scores and parameters, these apps thus mediate an economic service with the promise of a more connected self, but which ironically introduces an imperative of labour in the act of sleep. Paying attention to the configuration of these apps down to their algorithms, Sikka argues that they enable the tracker to exert agency on the physical body transmuted into a readable and passive object to be controlled and a set of informational categories that further gender, racialize, and stigmatize.

Transposed to the discussion of natural, synthetic, and digital materialities, this issue enables a number of key innovations, namely pushing back against the notion of disintermediation in that humans are not entirely disentangled from these processes. Critically, the articles in this collection shed new light on these domains of research by considering automated and human work in tandem with the production of natural and synthetic substances, effectively dismantling them to then interrogate the boundaries between culture and nature, human and machine domains, digital and material production.

We return to our opening questions: Can the synthetic or digital be biologic, and what is natural about artificial materials and processes? How is value created and defined across

these different social, epistemological, and material orders? What are the political, epistemological, ecological, and social conditions underpinning a future that promises to be increasingly enmeshed in synthetic and digital properties?

By providing answers to these questions, this Special Issue meets two main objectives. Theoretically, it brings back the social and material transformations in processes of mediation, transmutation, and valuation of natural synthetics, the humanness of artificial intelligence, or the materiality of digital elements. From economic spaces to intimate spheres of life, this newfound focus challenges assumptions about the conditions of natural life, the future of digitalization, or what it means to be human and posthuman. Ethnographically, contributors to this special issue detail the relationship between digital and material properties, organic and synthetic substances, to move beyond their inherent qualities. In so doing, this special issue opens up a new space for reflection on the *naturalness* of digital and synthetic properties; the *phenomenological experience* of embodying synthetic substances and inhabiting digital spaces; as well as the meaning of new *social and working practices* enabled by the entanglement of natural, digital and synthetic materialities.

References

Appadurai, Arjun. 1986. "Introduction: Commodities and the Politics of Value." In *The Social Life of Things: Commodities in Cultural Perspective*, edited by Arjun Appadurai, 3–63. New York: Cambridge University Press.

Appel, Hannah. 2012. "Walls and White Elephants: Oil Extraction, Responsibility, and Infrastructural Violence in Equatorial Guinea." *Ethnography* 13: 439–465.

Bennett, Jane. 2010. *Vibrant Matter: A Political Ecology of Things*. Durham, NC: Duke University Press.

Besteman, Catherine, and Hugh Gusterson. 2019. *Life by Algorithms. How Roboprocesses are Remaking our World*. Chicago: Chicago University Press.

Brynjolfsson, Erik, and Andrew McAfee. 2014. *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. New York: W. W. Norton & Company.

Callon, Michel. 2005. "Why Virtualism Paves the Way to Political Impotence: A Reply to Daniel Miller's Critique of 'The Laws of the Market'". *Economic Sociology: European Electronic Newsletter* 6, no. 2: 3–20.

Callon, Michel. 1998. "The Embeddedness of Economic Markets in Economics." In *Laws of the Market*, edited by Michel Callon, 1–57. London: Blackwell Publishers.

Callon, Michel. 1991. "Techno-economic Networks and Irreversibility." In *A Sociology of Monsters*, edited by John Law, 132–161. London: Routledge.

Calvão, Filipe. 2015. "Diamonds, Machines and Colours: Moving Materials in Ritual Exchange." In *The Social Life of Materials: Studies in materials and society,* edited by Adam Drazin and Susanne Küchler, 193–208. London: Bloomsburry.

Castronova, Edward. 2005. *Synthetic Worlds: The Business and Culture of Online Games*. Chicago: The University of Chicago Press.

Coleman, Gabriella. 2013. *Coding Freedom: The Ethics and Aesthetics of Hacking*. Princeton, NJ: Princeton University Press.

Collins, Samuel G. 2018. "Working for the Robocracy: Critical Ethnography of Robot Futures." *Anthropology of Work Review* 39, no. 1: 5–9.

Coole, Diana, and Samantha Frost (eds.). 2010. *New Materialisms: Ontology, Agency, and Politics*. Durham, NC: Duke University Press.

Douglas, Mary. 1966. *Purity and Danger: An Analysis of Concepts of Pollution and Taboo.* London: Routledge.

Downey, Gary L. 1998. *The Machine in Me: An Anthropologist Sits among Computer Engineers*. London: Routledge.

Ekbia, Hamid R., and Bonnie A. Nardi. 2017. *Heteromation, and Other Stories of Computing and Capitalism*. Cambridge, MA: MIT Press.

Lutz Fernandez, Anne, and Catherine Lutz. 2019. "Roboeducation." In *Life by Algorithms. How Roboprocesses are Remaking Our World*, edited by Catherine Besteman and Hugh Gusterson, 44–58. Chicago: University of Chicago Press.

Graeber, David. 2005. "Fetishism as Social Creativity or, Fetishes are Gods in the Process of Construction." *Anthropological Theory* 5, no. 4: 407–438.

Hakken, David. 2000. "Resocialing Work? Anticipatory Anthropology of the Labor Process." *Futures* 32: 767–75.

Haraway, Donna J. 1991. *Simians, Cyborgs and Women: The Reinvention of Nature.* London: Routledge.

Heidegger, Martin. 1977. *The Question Concerning Technology*. Translated by William Lovitt. New York: Harper & Row.

Holbraad, Martin, Morten A. Pedersen, and Eduardo V. de Castro. 2014. "The Politics of Ontology: Anthropological Positions." *Cultural Anthropology*, Theorizing the Contemporary, Fieldsights, January 13. Accessed April 20, 2021. https://culanth.org/fieldsights/the-politics-of-ontology-anthropological-positions.

Hornborg, Alf. 2015. "The Political Economy of Technofetishism. Agency, Amazonian Ontologies, and Global Magic." *Hau: Journal of Ethnographic Theory* 5, no. 1: 35–57.

Ingold, Tim. 2012. "Toward an Ecology of Materials." *Annual Review of Anthropology* 41: 427–442.

Irani, Lilly. 2015. "Difference and Dependence among Digital Workers: The Case of Amazon Mechanical Turk." *South Atlantic Quarterly* 114, no. 1: 225–234.

Keane, Webb. 2018. "On Semiotic Ideology." *Signs and Society* 6, no. 1: 64–87.

Kockelman, Paul. 2017. *The Art of Interpretation in the Age of Computation*. Oxford: Oxford University Press.

Latour, Bruno. 2005. *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford: Oxford University Press.

Latour, Bruno. 1993 [1991]. *We Have Never Been Modern*. Translated by Catherine Porter. Cambridge: Harvard University Press

Law, John, and Annemarie Mol. 1995 "Notes on Materiality and Sociality." *The Sociological Review* 43: 274–294.

Leslie, Esther. 2005. *Synthetic Worlds: Nature, Art and the Chemical Industry*. London: Reaktion Books.

Masco, Joseph. 2019. "Ubiquitous Surveillance." In *Life by Algorithms. How Roboprocesses are Remaking our World*, edited by Catherine Besteman and Hugh Gusterson, 125–144. Chicago: University of Chicago Press.

Marx, Karl. 1973 [1939]. *Grundrisse: Foundations of the Critique of Political Economy*. Translated by Martin Nicolaus. London: Penguin Books.

Masuzawa, Tomoko. 2000. "Troubles with Materiality: The Ghost of Fetishism in the Nineteenth-Century." *Comparative Studies in Society and History* 42, no. 2: 242–267.

Mazzarella, William. 2004. "Culture, Globalization, Mediation." *Annual Review of Anthropology* 33: 345–367.

McFarlane, Colin, and Ben Anderson. 2011. "Thinking with Assemblage." *Area*, 43, no. 2: 162–164.

Meiu, George P. 2020. "Panics over Plastics: A Matter of Belonging in Kenya." *American Anthropologist* 122, no. 2: 222–235.

Mintz, Sidney W. 1985. *Sweetness and Power: The Place of Sugar in Modern History*. New York: Penguin Books.

Mitchell, William J. 2003. *Me++: The Cyborg Self and the Networked City*. Cambridge: MIT Press.

Musiani, Francesca. 2013. "Governance by Algorithms." *Internet Policy Review* 2, no. 3. https://doi.org/10.14763/2013.3.188.

Pietz, William. 1985. "The Problem of the Fetish I." *Res. Journal of Anthropology and Aesthetics* 9: 5–17.
Roosth, Sophia. 2017. *Synthetic: How Life Got Made*. Chicago: University of Chicago Press.
Strathern, Marilyn. 2000. "The Tyranny of Transparency." *British Educational Research Journal* 26, no. 3: 309–321.
Strathern, Marilyn.1996. "Cutting the Network." *Journal of the Royal Anthropological Institute* 2, no. 3: 517–535.
Suchman, Lucy. 2007 *Human-Machine Reconfigurations: Plans and Situated Actions*. Cambridge: Cambridge University Press.
Tsing, Anna. 2005. *Friction: An Ethnography of Global Connection*. Princeton, NJ: Princeton University Press.
Viveiros de Castro, Eduardo. 2004. "Exchanging Perspectives. The Transformation of Objects into Subjects in Amerindian Ontologies." *Common Knowledge* 10, no. 3: 463–484.
Whatmore, Sarah. 2002. *Hybrid Geographies: Natures, Cultures, Spaces*. London: Sage.
Wilf, Eitan. 2013a. "Toward an Anthropology of Computer-Mediated, Algorithmic Forms of Sociality." *Current Anthropology* 54, no. 6: 716–739.
Wilf, Eitan. 2013b. "Sociable Robots, Jazz Music, and Divination: Contingency as a Cultural Resource for Negotiating Problems of Intentionality." *American Ethnologist* 40, no. 4: 605–618.
Zaloom, Caitlin. 2006. *Out of the Pits: Traders and Technology from Chicago to London*. Chicago: University of Chicago Press.

Authors

Filipe Calvão is an associate professor in anthropology and sociology at the Graduate Institute of International and Development Studies (IHEID). His research examines extractive industries in postcolonial Africa, materiality and mining labor, and digital economies in the Global South.
filipe.calvao@graduteinstitute.ch
Graduate Institute of International and Development Studies, Geneva

Matthieu Bolay is a social anthropologist and a postdoctoral researcher at the Graduate Institute of International and Development Studies. He has expertise in the politics of extraction and his research lies at the crossroads of migration, labour, politics, technology and the law.
matthieu.bolay@gmail.com
Graduate Institute of International and Development Studies, Geneva

Lindsay Bell is an assistant professor of anthropology at the University of Western, Ontario in Canada. Situated at the intersection of linguistic and cultural anthropology, her research has largely focused on extractive industries in arctic countries.
lindsay.bell@uwo.ca
University of Western Ontario