Check for updates

Original Research Papers

Ethnography

Ethnography
2022, Vol. 0(0) 1–22
© The Author(s) 2022
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/14661381211073287
journals.sagepub.com/home/eth
SAGE

Design ethnography: A view from an industrial think tank

Stuart Kirsch
University of Michigan, Ann Arbor, MI, USA

Abstract

Anthropologists increasingly turn to design research for inspiration. Yet work in design anthropology is frequently cut off from ethnographic research. To some extent this is intentional, given concerns that ethnographic methods have failed to keep pace with a rapidly changing world. But anthropologists should not have to choose between ethnography and design research. This article examines the author's participation in an industrial think tank in which anthropologists and engineers collaborated to address the environmental impacts of mining. This included discussion of unrecognized sources of pollution at mining sites and rising penalties for environmental damage. The members of the think tank also developed designs for new technology intended to reduce the exposure of artisanal gold miners to mercury and its release into the atmosphere, facilitate the recycling of electronic waste in developing countries, and reduce the catastrophic risks posed by tailings dams. Our collaborations point to the value of combining ethnography and design research in new ways.

Keywords

collaboration, design, engineering, environment, ethnography, mining, research methods, recycling, pollution

Anthropologists increasingly look to design research for inspiration, including better ways to understand the contemporary moment (Cantarella et al., 2019; Clarke, 2018; Escobar, 2019; Gunn et al., 2013; Murphy, 2016; Rabinow et al., 2018; Smith et al., 2016). Recent experiments in design anthropology are modeled on planning studios in architecture and other modes of design research that bring diverse parties together for collaborative problem-solving.[1] Participation in these spaces offers new possibilities for

Corresponding author:
Stuart Kirsch, University of Michigan, 1085 S. University Ave, Ann Arbor, MI 48109-1382, USA.
Email: skirsch@umich.edu

anthropological research and data collection, practices that differ from conventional ethnographic research in several important ways. In contrast to the tradition of individual fieldwork and sole-authored monographs, design anthropologists work in multidisciplinary teams (Clark and Caldwell, 2016: 18; Otto and Smith, 2013: 14). Whereas ethnographic description typically focuses on the present or the past, design anthropology is oriented towards the future (Otto and Smith, 2013: 13). In many cases, design anthropology is intended to do more than analyze existing social conditions; it frequently seeks to change them as well (Halse and Boffi, 2016: 93).[2] These interactions may yield tangible outcomes in the form of prototypes, action plans, and policy initiatives. But they are also intended to stimulate the capacity of the participants to imagine and bring alternative futures into being (Kilbourn, 2013: 70).

Design anthropologists examine a wide array of concerns in their work. They regularly address questions about environmental justice, access to technology, and other social problems. For example, Joachim Halse (2013) brought consumers, shopkeepers, and store owners together to design new ways to facilitate recycling. Morten Petersen (2018) involved community members in discussions about recycling household waste for use in a proposed bioethanol plant. Through public dialogues organized around an iterative series of graphic artifacts, Anastassakis and Szaniecki (2016: 137) helped to generate alternative visions for urban renewal, which they describe as “democratization. . . by means of design.” Gunn and Clausen (2013) engaged a variety of stakeholders to discuss indoor air quality with the aim of promoting innovation in the building industry. Taylor and Horst (2018) examined mobile money services and financial literacy, focusing on questions about access to new technologies. Other design anthropologists have studied social media use by “digital natives” (Smith and Otto, 2016) as well as senior citizens (Binder, 2016). Some of these projects in design anthropology are stand-alone interventions, while others are part of a coordinated sequence of events.

Design anthropology workshops

Design anthropology typically takes place in workshops held in generic meeting rooms in universities and hotels, but these interactions may also be staged at unique locations, such as an outdoor exhibit (Anastassakis and Szaniecki, 2016) or a derelict industrial building (Akama, Pink, and Sumartojo, 2018).[3] One or more facilitators lead the participants through a series of structured activities over a limited period of time, which ranges from several hours to a few days. These workshops are a well-established genre of activity that foster “a sense of democratic participation, openness, play, experimentation and learning” (Akama et al., 2018: 12). Whereas ethnographic research has historically been undertaken in social settings located either remotely in the “field” or “at home,” design workshops offer a new kind of site for anthropology inquiry.

Workshops in design anthropology include facilitation techniques familiar to anyone who has attended academic or NGO planning meetings in the past decade (see Clarke, 2018; Gunn et al., 2013; Smith et al., 2016). The participants may be given colored stickers to rank and prioritize options. Post-it notes with comments are randomly stuck to the wall and then sorted into meaningful categories that are named by the participants. Break-out groups are given posterboard and colored markers to diagram a novel process or a potential solution to a problem. The participants may be asked to build prototypes or mock-ups of new objects or to draw up plans for initiatives that move beyond feedback or critique of existing structures.

The collaborative process in creating these material representations of the discussion establishes a forum for conversation among the participants. It is also meant to accomplish more than just an exchange of ideas and information by producing something new. Other exercises are more dynamic, including role-playing, scenario building, and various participatory events and games. Different activities are sequenced to facilitate "iterative cycles of reflection and action" (Otto and Smith, 2013: 11) intended to encourage the participants to revise their views during the process (Miller, 2017: 64). "Working on and around concepts is a social activity" (Drazin, 2013: 4) in which collective perspectives are developed rather than just individual opinions. The process has also been characterized as fractal in the sense that the resulting knowledge has the capacity to scale up beyond the immediate example to "encompass larger social practices and systems" (Kilbourn, 2013: 70).

Workshops in design anthropology facilitate the creation of "a cooperative and collaborative intellectual space" (Rabinow et al., 2008: 66). Although participant observation in anthropological fieldwork is also a collaborative process (Binder, 2016: 273), the interests of ethnographers are often incommensurate with the concerns of their interlocuters, a relationship that has been criticized as extractive. In contrast, the participants in these new design spaces share common goals. The resulting power relations have been described as "more balanced, or even reversed" from those established through conventional ethnographic research (Rabinow et al., 2008: 66). In these encounters, the anthropologist becomes "one voice among many," putting "ethnographic insights and authority up for grabs" (Clark and Caldwell, 2016: 17).

Design anthropology is oriented toward a future that is viewed as never entirely empty; it has already been partially filled by prior human activity, including social categories and institutions (Smith and Otto, 2016: 21, referring in part to Mazé, 2016). The future is also plural rather than singular: "multiple, often conflicting, futures are *always already here* as part of a continuously unfolding present and past" (Kjaersgaard et al., 2016: 1; emphasis in the original). But design anthropologists also point out that the future is not "politically or socially neutral" (Drazin, 2013: 36). Instead, it is shaped by the ontological politics of "(re)producing, choosing between and multiplying different realities" (Mazé, 2016: 41, paraphrasing Mol, 1999). Design anthropologists treat the future as the outcome of multiple interactions and contributions rather than singular "visions created and implemented by [individual] scientists or designers" (Kjaersgaard et al., 2016: 1). The participants in design workshops are "tasked. . . [w]ith creating 'better' futures together" (Akama et al., 2018: 2).

Design anthropology and the critique of traditional ethnographic methods

For some anthropologists, the use of alternative methods derived from design research is driven by the view that ethnography and ethnographic methods have outlived their usefulness. This critique asserts that there is a “profound mismatch between old concepts and new analytical requirements” of studying the contemporary world, including much-needed attention to “technoscience, finance, media, law, etc.” (Rabinow et al., 2008: 13). Another frustration with ethnographic methods is what Tobias Rees (2008: 7) describes as the “temporality of slowness” associated with anthropological knowledge production, which Rabinow et al. (2008) suggest can be expedited by studying design encounters. Consequently, Murphy and Marcus (2013: 261) propose to “dismantle ethnography’s aging frame, tear it down to its most basic elements, and then reconstruct something new. . . with the goal of rebuilding the core engine of anthropology”. They argue that embracing design research will “inject [the discipline of anthropology] with a newfound creativity, new ways of thinking, new kinds of collaboration, new pedagogical techniques, new raw materials, and new kinds of outputs” (2013: 262). Hence, these authors promote a shift from conventional ethnographic methods to research *within* the frames of the design space (Murphy and Marcus, 2013: 254).

In a similar vein, Tim Ingold draws on phenomenology to distinguish between ethnography and participant observation, describing the latter as a “practice of correspondence in which the anthropological observer joins with the lives of those whom he or she follows, coupling his or her movements of awareness or attention with theirs” (Gatt and Ingold, 2013: 147). Writing together with Caroline Gatt, Ingold argues that collaborative practices of design enhance the correspondence between anthropologists and their research partners (Gatt and Ingold, 2013: 148). Their call to replace “anthropology-by-means-of-ethnography” with “anthropology-by-means-of-design” (Gatt and Ingold, 2013) has had an important influence on design anthropology. But Ingold’s (2014) characterization of ethnography as description added after the fact ignores the continuous interplay between anthropology, ethnography, and fieldwork (Shryock, 2016). Similarly, the exclusive focus on participant observation ignores other important contributions to anthropological knowledge production, including historical research and sociological comparison.

The alternative of design ethnography

In contrast to these views on the anthropology of design, I argue that efforts to replace ethnography with design research are problematic on several grounds. Design spaces are temporally compressed formats (Binder, 2016: 270), whereas ethnographic inquiry typically takes place over extended periods of time. In some cases, workshops conducted by design anthropologists have an ad hoc quality that results from being decoupled from the concerns of longer-term ethnographic research. The published literature in design anthropology tends to emphasize methodological innovation and focus reflexively on questions about design and anthropology, often at the expense of the specific topics or domains being examined, whether recycling, indoor air pollution, urban planning, or access to digital technology. There is a considerable risk to the value of anthropology and ethnography in terms of the quality of understanding that would result from restricting research and data collections to these productive but fleeting interactions.

But there is no reason why anthropologists should have to choose between ethnography and the new methods derived from design research. Instead, this article argues in favor of hybrid alternatives that combine the value of deep or thick ethnographic knowledge with the novel and valuable opportunities offered by design research. I suggest that the collaborative possibilities opened up in these new spaces are better seen as complementary to ethnographic research rather than as a replacement or alternative. Consequently, I propose the term *design ethnography* to refer to the synergies that can be unleashed by combining ethnography and design research.[4] My views on the value of incorporating ethnographic knowledge into design spaces are based on my participation in an industrial think tank that brought anthropologists and engineers together to discuss the challenges facing the mining industry.

The mining futures think tank

The think tank was sponsored by a large European engineering firm that designs and builds equipment for mining projects, including rock crushers and grinders, conveyor belts, and bucket wheel excavators, which are some of the largest machines in the world. There were four participants in the group, two engineers and two anthropologists. The senior engineer was from India and had decades of experience in the company's offices there. The other engineer was from Brazil, where he had worked for a mining company before joining the firm. My invitation to participate in the workshop was based on long-term ethnographic experience studying the mining industry, including research with communities impacted by mining, collaboration with civil society organizations concerned with the harmful impacts of mining on the environment, and work as an engaged anthropologist in several lawsuits against mining companies (Kirsch, 2014, 2018). The other anthropologist was originally from Germany but conducted his research in Australia. He had recently defended his dissertation on the politics of risk and knowledge in the natural gas industry. The convenor of the project, an engineer who specializes in design and innovation, coordinated regular meetings of the think tank with executives from the engineering firm, but gave the members of the think tank complete autonomy over the subject matter.[5]

The members of the think tank spent several months working on the project during the summer of 2018. We met together five days a week in coworking spaces dispersed across central Amsterdam. Over time, we developed several strategies for communicating among ourselves. One of our regular activities involved the use of a whiteboard to stimulate brainstorming on a particular topic and organize the resulting information into a table or grid. This proved to be a useful way of eliciting, integrating, and visually representing information about the mining industry, especially unresolved problems and ideas for how to address them. These diagrams also facilitated exchanges between the engineers, who were primarily visual learners and thinkers, and the anthropologists, who were more discursively oriented.

The members of the think tank also developed other communication strategies. Over time, we built up a shared vocabulary that allowed us to index key concepts. Two examples of the catchphrases that we used were "silent spill," coined by the sociologist Thomas Beamish (2002) to describe unacknowledged sources of pollution that can have cumulatively large impacts, and "capital punishment" (Kirsch, 2020a: 406), referring to the rising economic penalties imposed on corporations for their environmental impacts. We named other productive insights after the team member who first articulated them. One example is R.'s law of design, which he described in the following way: "instead of trying to solve a problem that has proven resistant to solution, devise a way to substantially reduce the scope of the problem." M.'s law refers to the phenomenon of capital punishment, that "it no longer pays for corporations to do the wrong thing." In honor of our Brazilian colleague, we assigned Portuguese code names for our inventions, including *o jacaré* (the caiman), for a machine that recycles rebar from demolition sites; *aranha urbana* (urban spider), for a device that could facilitate the recycling of electronic waste in developing countries; and *formigas* (ants), for our plan to reduce the environmental impacts of mineral extraction in the future.

We also found that sharing stories about our prior work experiences provided us with valuable insights. For example, one of the engineers explained how he had helped to convert a cement plant in India from a wet process, which required a large volume of water and discharged polluted wastewater, to a dry process. This innovation greatly reduced the demand for water by the cement plant, which was often acquired at the expense of nearby farmers, while also decreasing the plant's energy consumption and eliminating water pollution. His account led us to consider how the introduction of dry processing technology might reduce the environmental impacts of the mining industry. The other anthropologist's description of how gas companies have reduced the size of their well pads encouraged us to consider how mining projects could decrease their surface footprint.

The team members also benefitted from visits to nearby industrial sites. At the Rotterdam port, which handles raw materials ranging from iron ore pellets and coal to olivine, which is used in steel manufacturing, we were shown a machine that was supposed to automate conveyor belt adjustments. Our host informed us that the equipment was not working that day, which he characterized as a "good thing," because he found it easier to manually realign the belt than rely on the automated machinery. This was a valuable corrective to the optimistic claims about the potential for automating the mining industry that we had been reading. However, we also learned during our visit that it has become increasingly difficult to find skilled workers willing to engage in this kind of labor at remote mining sites, which provides another motivation beyond cost savings for why the mining industry seeks to automate its operations. We also visited a coal mine in Germany that environmentalists refer to as the largest single contributor to greenhouse gases on the planet. The mine managers were developing plans for further expansion but acknowledged that the future of the project was more likely to be driven by concerns about climate change than profit margins, an observation that proved prescient when the

German coal commission introduced an accelerated timetable for phasing out coal consumption the following year (Egenter and Wehrmann, 2019; see Kirsch, 2020b).

The shared vocabulary that we developed provided the members of the think tank with a convenient shorthand to refer to matters on which we had already forged a common understanding. Similarly, the tables and charts we produced proved useful in bridging the gap between the communicative styles of the engineers, who regularly presented their insights in the form of diagrams and drawings, and who frequently shared technical videos posted on YouTube, and the anthropologists, who tended to circulate the articles and books they found interesting. Our exchanges facilitated the development of collective perspectives that reflected contributions from both the anthropologists and the engineers. Akama et al. (2018: 119) invoke Kathleen Stewart's (2010: 4) concept of "attunement" to describe how shared ideas and concepts emerge in design contexts like the think tank, which also applies to our interactions. In addition, the diagrams we produced became the basis of presentations we made to executives from the engineering firm who joined the think tank in Amsterdam on a regular basis.

Capital punishment

Given my experience conducting ethnographic research with communities affected by pollution from large-scale mining projects, I persuaded the other members of the think tank that we should focus on environmental issues. Our goal was to change the engineering firm's approach to designing equipment for the mining industry. The members of the think tank agreed that the engineering firm had an opportunity to develop new technology that could help reduce the environmental impacts of mining. Based on my involvement in litigation against the mining industry, I also argued that this approach would save mining companies money. By treating the executives from the engineering firm who visited us in Amsterdam as fellow participants in the think tank, we sought to challenge the way they approached and thought about these issues.

At one of our regular meetings with our counterparts from the engineering firm, we presented a diagram from the think tank, listing examples of large mining projects that have had catastrophic environmental impacts, costing the industry billions of dollars.[6] The first case study was the Panguna copper mine operated by Rio Tinto on the island of Bougainville in Papua New Guinea. Opposition to the mine and its environmental impacts turned violent in 1989, shutting down the project. Thousands of lives were lost during the ensuing civil war and the mine remains closed three decades later (Kirsch, 2014: 43–45). The Bougainville rebellion cost Rio Tinto access to assets that are currently valued at more than US$50 billion.

The next case study was the Ok Tedi copper and gold mine in Papua New Guinea, which has discharged more than one billion metric tons of tailings and waste rock into local rivers since 1986. Litigation against BHP forced the company to transfer its shares in the project to a development trust fund based in Singapore. The failure to adequately manage tailings from the mine has cost the company at least US$3 billion in revenue (Kirsch, 2014).

Another example of the economic costs of environmental impacts from mining came from Freeport–McMoRan's Grasberg gold and copper mine in West Papua, Indonesia. The project is the world's largest polluter by volume, discharging 180,000 metric tons of tailings per day into local rivers (Kirsch, 2014: 45–47). In 2018, the Indonesian government announced a US$13 billion assessment of the environmental damage from the mine as part of its negotiations to acquire a $4 billion stake in the project.

Our final example was the 2015 collapse of an earthen tailings dam at the Samarco iron ore mine in Minas Gerais, Brazil, which resulted in 19 fatalities (Dos Santos and Milanez, 2017). Contaminated mud from the accident polluted the Doce River the length of its 630 km journey to the Atlantic Ocean. Vale and BHP, the mining companies jointly responsible for the mishap, agreed to pay US$7 billion in damages. The companies still face an additional $55 billion in civil claims in the Brazilian court system.

After sharing this information with the executives from the engineering firm, we asked them whether they could identify what the four cases have in common apart from their environmental impacts and the resulting capital losses. They were surprised when we told them that the engineering firm had provided mining equipment to all of the projects. We explained that while the engineering firm was not necessarily responsible for these environmental catastrophes, it was worth considering whether they could have done more to prevent these catastrophes from occuring.

We then shared a final case study, the Deepwater Horizon oil spill in the Gulf of Mexico in 2010. The total cost from that accident to British Petroleum (BP) has been estimated at US$65 billion. We argued that the response to this disaster has permanently altered the way corporations are held liable for environmental impacts. Since the BP oil spill in the US, corporations are increasingly held accountable for the total economic value of damage to the environment instead of generic fines established by legal statutes. International attention to the oil spill has also greatly reduced the gap between penalties for environmental accidents in developed and developing countries, as indicated by the seven billion dollar settlement of the Samarco case in Brazil, which was reached five years after the BP oil spill. While in the past such penalties were only paid after extended litigation and were often greatly reduced on appeal (see Kirsch 2020a), states have increasingly begun to follow the precedent set in the BP case by demanding immediate payment for clean-up and damages. Economic penalties for environmental impacts have increased by several orders of magnitude. These changes were what we meant by the concept of "capital punishment" for industrial disasters.

On the value of candidly sharing different views

Our recommendation to the engineering firm was that they should design new equipment to reduce the environmental impacts of the mining industry and their exposure to economic penalties. For example, we suggested that the firm could build on its expertise in dry processing technology to reduce the threat of catastrophic failure associated with the management of wet tailings in the iron ore industry, as occurred in the Samarco case. We also encouraged the engineering firm to adopt a more proactive role in managing environmental impacts by offering site audits that would help to identify and eliminate the kinds of silent spills that plague the mining industry. Given the rising demand for metals needed to assist the transition to a post-carbon future, we recommended that the engineers develop new technology to facilitate recycling, which also reduce the need for additional mining. We argued that the shift towards greener practices should be more than an exercise in branding by explaining how the engineering firm could gain a strategic advantage by improving standard operating practices in the mining industry (see Wasson, 2014: 379).

But this kind of change in orientation is never easy, and we received considerable pushback in the conversations that we had with executives from the engineering firm about developing environmentally-friendly technology. In one of these discussions, it was pointed out that the firm's signature technology is the bucket wheel excavator used to mine ligneous or soft coal, which has a high carbon footprint. They asked whether we expected the company to abandon one of its most profitable product lines. Undaunted, we responded that coal is increasingly regarded as a sunset industry (Cornot-Gandolpe, 2019; Kirsch, 2020b), and therefore might not be the most promising target for expanding their economic opportunities. We were able to reinforce this point by referring to the conversations we had at the coal mine we visited, which used bucket wheel excavators designed and built by the engineering firm. We also had a similar conversation about the firm's customers in the tar sands industry, which is under significant pressure from environmentalists and regulators given its outsized carbon footprint and extensive environmental impacts. In response to our suggestion that the engineering firm could use dry processing technology to help reduce the risks associated with the storage of wet tailings, one of the executives candidly explained that no one wants to assume responsibility for the safety and integrity of tailings dams. He argued that mining companies would rather transfer the liability for these structures to a "paper company" that would go bankrupt in the event of failure, instead of spending what is needed to make these structures safe. Another executive told us that they could not design equipment their customers had not requested, or those companies would simply give their business to the engineering firm's competitors. Such debates and even occasional impasses are not only expected but often desirable in these encounters. As Akama et al. (2018: 50) note, there is a long history of treating conversational "'breakdowns' as a generative way to manifest and deal with conflict and contradictions" among the participants in design workshops.

While we did not reach agreement on how to respond to all of these issues, the engineering firm has followed up on several of our more specific recommendations for new technology, as I describe below. But it would be a mistake to conclude that our interactions had been unsuccessful; the two members of the think tank employed by the engineering firm subsequently informed me that many of the ideas and examples we shared with them, including problems caused by "silent spills" and the risks of catastrophic failure and the resulting "capital punishment," continued to be discussed within the engineering firm long after the conclusion of the think tank. The concepts we developed helped the executives in the engineering firm to think about these issues in new ways (see Kilbourn, 2013: 70).

These interactions reveal the value of candidly sharing different points of view within design spaces, including the ability to stimulate concrete innovations and the opportunity to initiate conversations that can contribute to the formulation of alternative futures. They illustrate how collaboration involves "performing the labor of difference, to articulate something that could not [otherwise] be said" (Fortun, 2012: 453). They also indicate the value of incorporating ethnographic knowledge, which was the source of many of our ideas and examples, into design spaces.

The gold machine

In one of our meetings with executives from the engineering firm, we presented another chart we had developed in the think tank, which provided an overview of the mining industry by scale, from artisanal mining projects to large-scale corporate mines vulnerable to catastrophic failure. We used the diagram to identify potential interventions the engineering firm might make at different levels of production. One of our proposals was a design for a machine that could help small-scale gold miners reduce their exposure to mercury, which is used in the amalgamation process that separates gold from other materials, and its release into the environment. Mercury is a powerful neurotoxin with significant health impacts, especially for pregnant women and young children. The risks from mercury are especially significant, given that it bioaccumulates in ecosystems and food webs. This is a very large problem with a global distribution, as between 10 and 19 million artisanal gold miners regularly use mercury to amalgamate their finds (Esdaile and Chalker, 2019: 6910).

Drawing on ethnographic knowledge about indigenous miners from previous research in Guyana (Kirsch, 2018), I partnered with one of the engineers from the think tank to develop a machine that would amalgamate gold in an environmentally-friendly manner. In rural Guyana, artisanal gold mining crews are often multiethnic and multilingual. Like small-scale miners in many parts of the world, they typically work for a portion of the finds rather than a daily wage, as it is the hope of a substantial windfall that keeps people engaged in artisanal mining (see Samarawickrema, 2020). Because they are compensated in shares of the overall take, cooperation among the members of work crews is contingent on their ability to observe the processing of the gold ore on site. Thus, the miners in Guyana witness the opening of the shaker or sluice box, which uses gravity to separate the heaviest particles from the remainder of the excavated earth and rock. They also observe the amalgamation process, in which mercury is first mixed with gold and then burned off, separating the impurities and leaving the gold behind in a form that can be sold directly to buyers. Gathering to observe this process increases their exposure to harmful mercury fumes. Nonetheless, their ability to monitor the handling of the gold is essential as mutual verification is what maintains trust among the members of the ethnically diverse workforce.

Our goal in designing the gold machine was to reduce the risk from exposure and release of mercury into the atmosphere during the process of amalgamation. We understood that the solution had to accommodate the social conditions of production by allowing the miners to observe the processing of gold on site.[7] It would also need to be portable, so that it can be transported by motorbike or ATV between remote mining sites. In consultation with a colleague who conducts ethnographic research with artisanal

Figure 1. The gold machine. Drawing by Michael Herzog.

miners in Brazil and Suriname, we suggested a price ceiling of €2,000, in keeping with their ability to purchase other mining equipment, such motorbikes, generators, and hydraulic pumps (Marjo de Theije, pers. comm, July 2018).

Although we initially hoped to design a machine that would not use mercury at all, my colleague determined that it was not possible to produce the forces needed to reduce the size of the material sufficiently to extract the gold in such a small space. So following R.'s law of design, we collaborated on the blueprint for a machine that would continue to use mercury but not expose miners to its fumes or allow its release into the environment. Our design employs a closed-circuit system that recovers the mercury vapor produced by heating the amalgam, permitting multiple reuse. The front panel of the machine would need to be transparent so the mining crew could observe the process (see Figure 1).

The executives from the engineering firm were enthusiastic about our design and the possibility of offering a practical solution to a global environmental problem and major health concern. We met with the patent attorney for the engineering firm and finalized the design, which was submitted to the appropriate authorities for review. The concept was then tested in a laboratory at a university in Spain. However, problems arose with the "stickiness" of mercury within the equipment, which led the company to investigate alternative chemicals for use in amalgamating gold, while employing the same overall design.[8]

The design for the gold machine also worked surprisingly well as a communication device, signaling to the engineering firm that there were opportunities to design machinery that could reduce the environmental impacts of mining. Further development of the concept would help alleviate one of the most pressing environmental problems in the world, the contribution to atmospheric mercury pollution by small-scale gold mining, which is responsible for 37% of global mercury emissions, more than the amount of mercury released by burning coal, the second-largest source of mercury pollution (Esdaile and Chalker, 2019: 6906)

From wet to dry processing

When we recommended that the engineering firm apply its expertise in dry processing to the problem of unstable tailing storage, pointing to the fatal collapse of the Samarco tailings dam three years earlier, it set up a working group to explore various options. Several months later, disaster struck again. On 25 January 2019, a second earthen dam collapsed in Minas Gerais, Brazil. The dam was located above a different Vale iron ore mine near the city of Brumadinho. The resulting mudslide swept through the company's offices and cafeteria at 12:28 p.m., when many of the employees for the mining company were eating lunch. At least 270 people were killed, many of whom worked for the company. Twelve million cubic meters of mud were released by the tailings dam, contaminating 200 miles of the Paraoba River, an important source of water for the state (Andreoni and Casado, 2021).

There was a national outcry in Brazil after the second fatal dam accident in less than four years. Vale stock prices immediately lost US$19 billion in value. Shortly after the event, the federal government ordered the company to pay an initial $260 million in compensation to the affected parties. Two years later, Vale agreed to pay $7 billion in compensation in a settlement with the Brazilian state of Minas Gerais (Andreoni and Casado, 2021). Criminal charges filed against 16 employees of the mining company, including accusations of corruption and homicide, are still pending in the Brazilian courts. The disaster also triggered a global review of the structural integrity of tailings dams around the world (Mining.Comm, 2021).

Applying the firm's expertise in dry processing technology to iron ore mines could greatly reduce the volume of tailings to be stored and the resulting risk posed to human life and the environment by unstable wet tailings. One possibility would involve drying the excavated ore before it is processed and then sorting the materials using infrared technology rather than the flotation technology currently employed by the industry. After the collapse of the second tailings dam in Brazil, Vale established a pilot plant to assess this new technology on site. Dry processing technology could eventually be applied to the extraction of other minerals as well, including copper, gold, lithium, and vanadium.

In response to the concerns raised by our presentation and the second tailings dam accident in Brazil, the engineering firm also developed new technology to treat existing

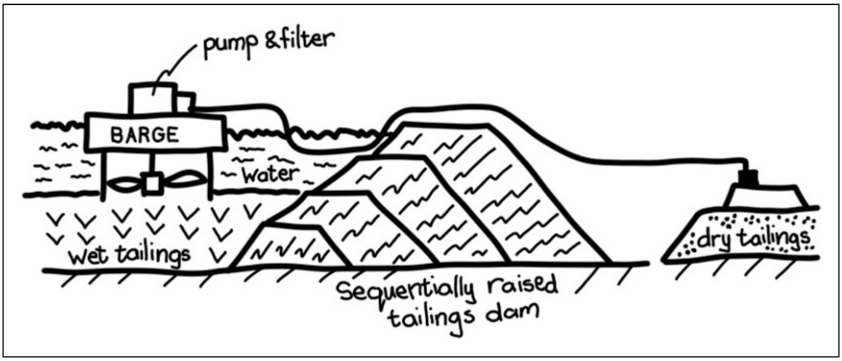

Figure 2. New technology to stabilize wet tailings. Drawing by Michael Herzog.

storage of wet tailings. This equipment is already being used at a tar sands processing site in Canada, and could also be applied to wet tailings storage in iron ore mines in Brazil and elsewhere. (See Figure 2).

Circular economies

To encourage the engineering firm to become involved in metal recycling, we developed the preliminary design for a machine that would help recycle electronic waste in developing countries. While most developed countries already have established systems for recycling cell phones, computers, and other portable electronic devices, similar facilities are not generally available in developing countries. The machine we designed would disassemble these devices into their component materials. It would not fully recycle these materials but separate them for delivery to facilities capable of processing high-value materials like gold, silver, copper, and coltan. Because of the different functions the machine would have to carry out, we imagined a spider with multiple arms, each wielding a different tool. This led us to nickname our invention *aranha urbana,* or urban spider. We designed the machine to fit inside of a standard shipping container, ubiquitous in developing country settings, which could be placed in a parking lot beside an existing store; individuals who bring electronic goods to be recycled would receive compensation in the form of store credit. (See Figure 3).

We also designed another machine to recycle rebar (iron rods) from construction sites, which we called *o jacaré* because of its resemblance to a caiman. (See Figure 4). In addition, we also pointed out that many of the machines that the engineering firm designs, including grinders and crushers, can easily be adapted for use in recycling metals. Greater involvement in the circular economy for minerals would also demonstrate the firm's commitment to reducing the environmental footprint of the mining industry, as every cell phone and computer that is recycled means less impact from mining in the future.

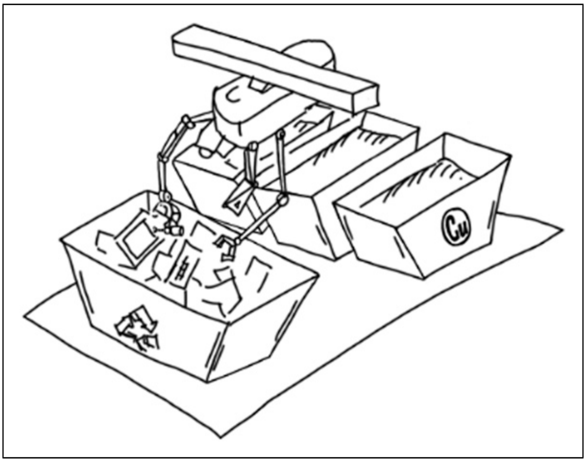

Figure 3. *Aranha urbana* (urban spider) to facilitate e-waste recycling. Drawing by Michael Herzog.

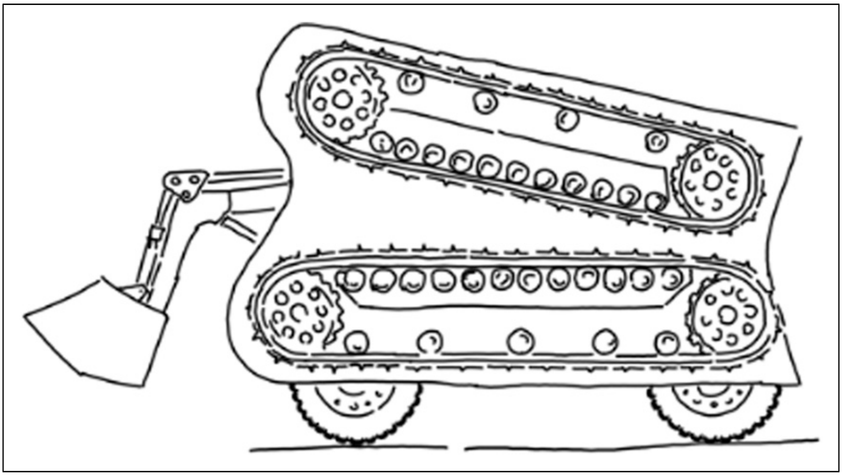

Figure 4. *O jacaré* (the caiman) for recycling rebar from concrete. Drawing by Michael Herzog.

Blue sky futures

Finally, the members of the think tank shared several of their speculative ideas about resource extraction in the future. The goal of these forward-looking proposals is the co-existence of mining with other uses of land. We began by asking our counterparts in the engineering firm to imagine what mining will look like in two decades. Many of these new projects will need to operate underground to exploit deeper mineral deposits, as most of

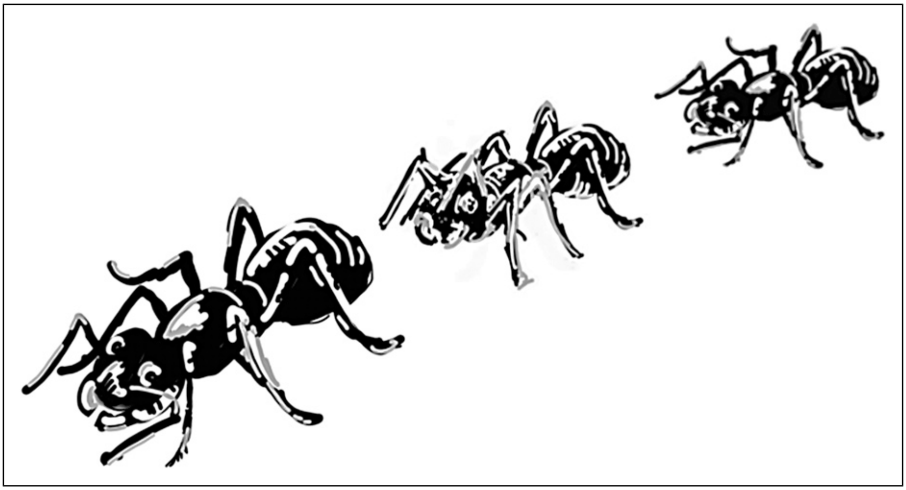

Figure 5. *Formigas* (robotic ants). Drawing by Michael Herzog.

the large ore bodies close to the surface have already been exploited. The ability to separate, process, and treat ore underground would significantly reduce the environmental impacts from mine wastes, which would remain in situ. This technology might take greater advantage of recent developments in automation. The development of new underground technology would also shrink the size of surface installations and reduce competition with other productive uses of the land.

But when looking even further into the future, we found ourselves imagining new ways of acquiring minerals without the need for conventional mining technology. Consequently, we proposed the idea of *formigas*, robotic ants with the ability to tunnel underground and return with small amounts of iron ore. (See Figure 5). These tiny robots could be deployed in large numbers to extract ore without affecting the surface above. In this hypothetical future of micro-mining, environmental impacts would be minimized. It would provide the metals needed by the economy while only impacting the underground at a scale commensurate with the organisms already living there. Comparable proposals for extracting minerals located in surface deposits, including lithium and bauxite, might make use of plants known to absorb certain elements through their roots and store them in their tissue, which could eventually be harvested to obtain the minerals, a process known as phytomining (Morse, 2020). This process, which is already being used to help remediate sites polluted by uranium and other toxic materials, would transcend the age-old opposition between farming and mining (Mumford, 1934). It is also possible to imagine bioengineering bacteria or fungi to play a similar role.

The ethnographic difference

The work at the industrial think tank on mining futures sheds light on how ethnographic knowledge can contribute to design goals. Our interactions were modeled on practices in design anthropology intended to promote innovation, including brainstorming, collaborative discussion, the use of diagrams to share information drawn from our respective experiences, and other strategies that promoted collaborative understandings between the engineers and the anthropologists in the group. We also developed concrete examples of the kinds of interventions that are possible in the form of a design for a machine to amalgamate gold without exposing artisanal miners to mercury or releasing it into the environment, by applying dry processing technology to reduce the risks of unstable tailings dams built by iron ore mines, and in our proposals to accelerate the recycling of electronic waste in developing countries. These designs served as "boundary objects" (Star and Griesemer, 1989) that facilitated communication between the members of the think tank and the executives from the engineering company. We also identified opportunities across the different scales at which mining occurs, from artisanal gold mines to large-scale iron ore mines. In addition to interventions that could be implemented immediately, such as conducting audits at mine sites to identify and stop silent spills, we also made recommendations that the company needed to develop, such as the implementation of dry processing technology, and we introduced blue sky innovations like the *formiga* that encouraged the engineering firm to consider the distant future of the mining industry. We hoped that these suggestions would encourage the engineering firm to prioritize opportunities to reduce the environmental impacts of the mining industry and the resulting economic penalties.

What differed between these interactions and other examples from the literature on design anthropology was that my contribution to the think tank was based on prior ethnographic knowledge about mining rather than solely on analytic perspectives drawn from anthropology. While the engineers with whom we collaborated possessed extensive knowledge about the mining industry, their attentions had previously been focused on the technical aspects of the design, installation, and operation of mining equipment. They had relatively little knowledge about the long-term environmental impacts from the mining industry, and were taken by surprise that the engineering firm had contributed machinery to four of the most destructive mining projects in recent history. Our perspectives and expertise proved to be complementary. By working together, we were able to show each other new dimensions of a process we had previously seen only from our respective points of view, an example of how people can look at the same thing but see something entirely different (Henare et al., 2007).

The sharing of information and ideas among the contributors to the think tank resulted in a final work product that none of us could have produced on our own (see Fortun, 2012). These achievements were possible because the design process facilitated collaboration, although we also experienced occasional moments of friction that proved to be generative (Akama et al., 2018: 50, 127). One example of this was the moment at which we realized that one of the engineers in our group had helped to design the crushers and grinders at the Ok Tedi mine that were responsible for destroying the rain forests downstream, where I have conducted research since the mid-1980s, even though he was not party to the decision to discharge tailings directly into the river system. This ended up being a transformative moment for both of us, as my colleague later expressed his gratitude for the opportunity to pursue alternatives to such environmentally destructive practices. Similarly, this moment of recognition made me appreciate the opportunity that participating in the think tank had given me to put the ethnographic knowledge of the mining industry I had acquired over several decades of research to new ends, helping to prevent the recurrence of the disastrous outcomes that I had witnessed and written about.

The example of the think tank on mining futures conveys the potential of design ethnography, including the opportunity to extend the value of ethnographic knowledge beyond its conventional end points, in articles and monographs read primarily by other anthropologists and social scientists. The outcome of our collaborative work was a burst of creativity and imagination that exceeded all of our expectations. New synergies are possible by following the insights and practices developed in the emerging genre of design anthropology. But the results will be even more powerful and productive if they draw on knowledge accumulated through long-term ethnographic research.

Conclusion

This article draws on my experiences participating in an industrial think tank to argue for new practices of *design ethnography* that bring ethnographic knowledge together with recent innovations in design anthropology. This combination could unleash a new mode of doing engaged research. For example, Jason De León's (2015) harrowing depictions of the experiences of Latin American border crossers could be mobilized to foster consideration of alternative, more humane policies towards migrants that emphasize care and respect. Similarly, Peter Benson's (2009, 2011) searing accounts of racialized forms of capitalism in North Carolina's tobacco industry could serve as a starting point for new conversations and interactions between migrant workers, tobacco growers, and public health officials to improve the dehumanizing living and working conditions in farm labor camps. Kedron Thomas' (2016) insightful ethnography of small-scale textile workshops in Guatemala would be a valuable starting point to help design new policies that support these entrepreneurial spaces and the cross-training they provide indigenous laborers, who acquire the skills they need to start their own businesses, instead of becoming dependent on dead end, low wage jobs in *maquiladoras*. Nikhil Anand's (2017) innovative study of the public water system in Mumbai shows why neoliberal reforms are likely to fail and how the politics of exclusion affect the residents of a Muslim neighborhood, but how might these insights be mobilized through design ethnography to promote alternative outcomes?

The proposal to incorporate ethnographic knowledge and experience into new design contexts parallels the argument that engaged anthropology should be based on ethnographic research (Kirsch, 2018: 223). However, insisting on this particular sequence of interactions may be selling design ethnography short. What if the tools and methods of design anthropology were incorporated into ethnographic research? How might a closer integration of ethnography and design research enhance the ability of anthropologists to address pressing problems in the world? How might this alter our disciplinary goals? Could these practices enhance anthropology's public profile by demonstrating the continued value of ethnographic research in the context of globalization and rapid change?

The incorporation of methods from design research into anthropology should strive to benefit from ethnography rather than seek to replace it. There is considerable value in encouraging anthropologists to pay greater attention to the future, move from description and analysis to intervention, and expand the possibilities for collaboration beyond the academy. This article seeks to promote the innovations developed by design anthropologists without turning our backs on the value of ethnographic research and knowledge. As Arturo Escobar (2019) argues, there is a pressing need to design more meaningful, just, and environmentally responsible ways of living, and by combining the insights of design anthropology with ethnographic research, anthropologists are well-positioned to contribute to the shaping of future possibilities.

Acknowledgments

I am grateful to the convener of the think tank, the head of the mining unit from the engineering firm, and my collaborators in the think tank for their support of this project. Elizabeth Roberts, Kedron Thomas, the anonymous reviewers, and the journal editors provided valuable feedback and suggestions.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: The think tank was sponsored by the engineering firm. Support for writing this article was provided by the NOMIS Foundation, although the author takes sole responsibility for the views expressed here.

ORCID iD

Stuart Kirsch https://orcid.org/0000-0002-3448-1979

Notes

1. This article focuses on design anthropology rather than other forms of design research, such as "design thinking" or "human centered design."
2. Even though Cantarella et al. (2019: xi) stress design anthropology's contribution to "social understanding" rather than "solving the problems of the day," Otto and Smith (2013: 12) refer to design anthropology as a mode of intervention and Joachim Halse (2013) argues that these practices should contribute to social transformation rather than just provide a description of it.
3. Akama et al. (2018: 127) suggest that disruptive encounters, such as the group exercise they facilitated in the cavernous, dark space of the undercroft in an abandoned industrial building, can "catalyse generative processes in groups."

4. Although the label “design ethnography” was previously used to describe corporate use of ethnographic methods (Otto and Smith, 2013: 8–9), today such activities are ordinarily included under the rubric of “business anthropology” (Moeran and Garsten, 2012).
5. The anthropologists had contracts with the engineering firm that protected their intellectual autonomy, including a clause prohibiting the convenor from interfering with our deliberations or influencing the content of our final report. I also negotiated a separate intellectual property agreement that protected my ability to write about my experiences.
6. At our first meeting with the executives from the engineering firm, we presented PowerPoint slides depicting our completed diagrams. In subsequent presentations, however, we decided that I would start with an empty whiteboard and gradually fill in the diagrams with information we wanted to share, as we had initially done on our own. To some extent, this resembles what I do in classroom teaching. Melissa Caldwell has similarly noted how she has a tendency to slip into “professor mode,” facilitating her interactions with corporate executives (Clark and Caldwell 2016: 178).
7. Although gold can be separated from other materials without using mercury, this ordinarily requires large crushing and grinding machines that need to be centrally located because of their cost and size. However, small-scale gold mining activities tend to be geographically dispersed, which makes it difficult to transport raw materials to a central location. Centralized processing would also prevent the mining crews from being able to observe the processing of the finds, limiting the value of this technology for artisanal gold miners.
8. The re-design of the gold machine also addressed concerns about the recent global ban on mercury use by small-scale gold miners (UNEP, 2019: Article 7). But eliminating mercury remains largely aspirational rather than realistic, as most miners are unlikely to stop amalgamating their gold finds with mercury in the absence of a proven, affordable, and persuasive alternative (Esdaile and Chalker, 2019).

References

Akama Y, Pink S and Sumartojo S (2018) *Uncertainty and Possibility: New Approaches to Future Making in Design Anthropology.* London: Bloomsbury.

Anastassakis Z and Szaniecki B (2016) Conversation dispositifs: towards a transdisciplinary design anthropological approach. In: Smith RC, et al. (eds) *Design Anthropological Futures*. London: Bloomsbury, pp. 121–138.

Anand N (2017) *Hydraulic City: Water and the Infrastructures of Citizenship in Mumbai*. Durham, NC: Duke University Press.

Andreoni M and Casado L (2021) Vale mining company to pay $7 billion in compensation for Brazil dam collapse. In: *The New York Times*. February 4. https://www.nytimes.com/2021/02/04/world/americas/vale-brazil-dam-collapse-7-billion-compensation.html?referringSource=articleShare&fbclid=IwAR3jJDoIgwRGj6RTA2c8PHK3ad7_axaWggXUTuWbz8-On1pxc-R4RZbmHLA

Beamish TD (2002) *Silent Spill: The Organization of an Industrial Crisis*. Cambridge, MA: The MIT press.

Benson P (2009) El campo: faciality and structural violence in farm labor camps. *Cultural Anthropology* 23(4): 589–629.

Benson P (2011) *Tobacco Capitalism: Growers, Migrant Workers, and the Changing Face of a Global Industry*. Princeton, NJ: Princeton University Press.

Binder T (2016) The things we do: encountering the possible. In: Smith R, et al. (eds) *Design Anthropological Futures*. London: Bloomsbury, pp. 267–281.

Cantarella L, Hegel C and Marcus GE (eds) (2019) *Ethnography by Design: Scenographic Experiments in Fieldwork*. New York: Routledge.

Clark B and Caldwell ML (2016) Design anthropology on the fly: performative spontaneity in commercial ethnographic research. In: Smith R, Vangilde KT, Kjærsgaard MG, et al. (eds) *Design Anthropological Futures*. London: Bloomsbury, pp. 169–182.

Clarke AJ (ed) (2018) *Design Anthropology: Object Cultures in Transition*. London: Bloomsbury.

Cornot-Gandolphe S (2019) *Status of Global Coal Markets and Major Demand Trends in Key Regions*. French Institute of International Relations (Ifri), June. https://www.ifri.org/en/publications/etudes-de-lifri/status-global-coal-markets-and-major-demand-trends-key-regions.

De León J (2015) *The Land of Open Graves: Living and Dying on the Sonoran Desert Migrant Trail*. Berkeley, CA: University of California Press.

Dos Santos RSP and Milanez B (2017) The construction of the disaster and the “privatization” of mining regulation: reflections on the tragedy of the Rio Doce Basin, Brazil. *Vibrant* 14(2): 127–149.

Drazin A (2013) The social life of concepts in design anthropology. In Gunn W, Otto T and Smith RC (eds) *Design Anthropology*. London: Bloomsbury, pp. 33–50.

Egenter S and Wehrmann B (2019) German commission proposes coal exit by 2038. *Clean Energy Wire*. https://www.cleanenergywire.org/factsheets/german-commissionproposes-coal-exit-2038.

Escobar A (2019) *Designs for the Pluriverse: Radical Interdependence, Autonomy, and the Making of Worlds*. Durham, NC: Duke University Press.

Esdaile LJ and Chalker JM (2019) The mercury problem in artisanal and small-scale gold mining. *Chemistry—A European Journal* 24: 6905–6921.

Fortun K (2012) Ethnography in late industrialism. *Cultural Anthropology* 27(3): 446–464.

Gatt C and Ingold T (2013) From description to correspondence: anthropology in real time. In: Gunn W, Otto T and Smith RC (eds) *Design Anthropology*. London: Bloomsbury, pp. 139–158.

Gunn W and Clausen C (2013) Conceptions of innovation and practice: designing indoor climate. In: Gunn W, Otto T and Smith RC (eds) *Design Anthropology*. London: Bloomsbury, pp. 159–179.

Gunn W, Otto T and Smith R (eds) (2013) *Design Anthropology*. London: Bloomsbury.

Halse J (2013) Ethnographies of the possible. In: Gunn W and Donovan J (eds) *Design Anthropology*. London: Bloomsbury, pp. 180–196.

Halse J and Boffi L (2016) Design interventions as a form of inquiry. In: Smith R, Vangilde KT, Kjærsgaard MG, et al. (eds) *Design Anthropological Futures*. London: Bloomsbury, pp. 89–103.

Henare A, Holbraad M and Wastell S (2007) Introduction: thinking through things. In: Henare A, Holbraad M and Wastell S (eds) *Thinking through Things: Theorising Artefacts Ethnographically*. New York: Routledge, pp. 1–31.

Ingold T. (2014) That’s enough about ethnography! *HAU: Journal of Ethnographic Theory* 4(1): 383–395.

Kilbourn K (2013) Tools and movements of engagement: design anthropology's style of knowing. In: Gunn W and Smith OT (eds) *Design Anthropology*. London: Bloomsbury, pp. 68–82.

Kirsch S (2014) *Mining Capitalism: The Relationship between Corporations and their Critics*. Berkeley, CA: University of California Press.

Kirsch S (2018) *Engaged Anthropology: Politics beyond the Text*. Oakland, CA: University of California Press.

Kirsch S (2020a) Between the devil and the deep blue sea: objectivity and political responsibility in the litigation of the Exxon Valdez oil spill. *Critique of Anthropology* 40(4): 403–419.

Kirsch S (2020b) Running out? Rethinking resource depletion. *The Extractive Industries and Society* 7: 838–840.

Kjaersgaard MG, Halse J, Smith RC, Vangkilde KT, Binder T and Otto T (2016) Introduction: design anthropological futures. In: Smith R, Vangilde KT, Kjærsgaard MG, et al. (eds) *Design Anthropological Futures*. London: Bloomsbury, pp. 1–16.

Mazé R (2016) Design and the future: temporal politics of "making a difference. In: Smith R, Vangilde KT, Kjærsgaard MG, et al. (eds) *Design Anthropological Futures*. London: Bloomsbury, pp. 37–54.

Miller C (2017) *Design + Anthropology: Converging Pathways in Anthropology and Design*. New York: Routledge.

Moeran B. and Garsten C. (2012) What's in a name? - Editors' introduction to the Journal of Business Anthropology. *Journal of Business Anthropology* 1(1): 1–19.

Mining.Com (2021) Responsible Mining Foundation concerned about thousands of abandoned, at-risk tailings facilities worldwide. Mining.Com. January 22. https://www.mining.com/responsible-mining-foundation-worried-about-thousands-of-abandoned-at-risk-tailings-facilities-worldwide/

Mol A (1999) Ontological politics. A word and some questions. *The Sociological Review* 47(1): 74–89.

Morse I (2020) Down on the farm that harvests metal from plants. *The New York Times*. February 26. https://www.nytimes.com/2020/02/26/science/metal-plants-farm.html

Mumford L (1934) *Technics and Civilization*. San Diego, CA: Harcourt.

Murphy KM (2016) Design and anthropology. *Annual Review of Anthropology* 45(1): 433–449.

Murphy KM and Marcus GE (2013) Epilogue: ethnography and design, ethnography in design . . . ethnography by design. In: Gunn W and Smith OT (eds) *Design Anthropology*. London: Bloomsbury.

Otto T and Smith RC (2013) Design anthropology: a distinct style of knowing. In: Gunn, et al. (eds) *Design Anthropology*. London: Bloomsbury, pp. 1–29.

Petersen MK (2018) Contributions from techno-anthropological ethnography to innovation and design projects. In: Børsen T and Boltin L (eds) *What is Techno-Anthropology?* Aarhus, Netherlands: Aalborg University Press, 365–382.

Rabinow P, Marcus GE, Faubion JD, et al. (2008) *Designs for an Anthropology of the Contemporary*. Durham, NC: Duke University Press.

Rees T (2008) Introduction. In: Rabinow P, Marcus GE, Faubion JD, et al. *Designs for an Anthropology of the Contemporary*. London: Bloomsbury, pp. 1–12.

Samarakwickrema N (2020). *Speculating Sapphires: Mining, Trading, and Dreams that Move Gems across the Indian Ocean*. Unpublished Ph.D. dissertation, Stanford University.

Shryock A (2016) Ethnography: Provocation. Correspondences, *Fieldsights*, May 3. https://culanth.org/fieldsights/ethnography-provocation

Smith RC, TangVangkilde K, Kjaersgaard MG, et al. (eds) (2016) *Design Anthropological Futures*. London: Bloomsbury.

Smith RC and Otto T (2016) Cultures of the future: Emergence and intervention in design anthropology. In: Smith RC, Vangilde KT, Kjærsgaard MG, et al. *Design Anthropological Futures*. London: Bloomsbury, pp. 19–36.

Star SL and Griesemer JR (1989) Institutional ecology, `translations' and boundary objects: amateurs and professionals in berkeley's museum of vertebrate zoology, 1907-39. *Social Studies of Science* 19(3): 387–420.

Stewart K (2010) Atmospheric attunements. *Rubric* 1: 1–14.

Taylor EB and Horst HA (2018) Designing financial literacy in Haiti. In: Clarke AJ (ed) *Design Anthropology*. London: Bloomsbury, 179–199.

Thomas K (2016) *Regulating Style: Intellectual Property Law and the Business of Fashion in Guatemala*. Oakland, CA: University of California Press.

United Nations Environment Programme (UNEP) (2019) *Minamata Convention on Mercury: Text and Annexes*. http://www.mercuryconvention.org/Portals/11/documents/Booklets/COP3-version/Minamata-Convention-booklet-Sep2019-EN.pdf

Wasson C (2014) Ethnography in the field of design. *Human Organization* 59(4): 377–388.

Author Biography

Stuart Kirsch is a Professor of Anthropology at the University of Michigan. His current research focuses on the transition to a post-carbon economy, which he hopes to study in part by employing the methods of design ethnography described in this article.