

---

# Introduction

## Materiality

Laura Forlano

STS is well known for its unique approaches to the study of materiality, a central topic for inquiry since the founding of the field. The late 1980s saw the development of actor-network theory (ANT): an approach that provocatively assumed the analytical equivalence (“symmetry”) of human and nonhuman actors (Callon 1986, 1987; Latour 1996, 2005; Law and Hassard 1999). Microbes, electrons, plants, animals, test tubes, people, and laboratory equipment therefore all played a role in scientific discoveries and technological developments. For ANT scholars, agency is not embedded in a single device, object, or person, but emerges from its distribution among this network of human and nonhuman actors. By the early 21st century, STS scholars regularly took such objects, devices, and tools as “matters of concern” (Latour 2004) by examining how they incorporate mixed agencies and politics: in other words, examining hybrid ontologies (Woolgar and Lezaun 2013).

A similar focus on materiality appeared in the work of feminist technoscience around the same time. This strand of research focuses on the ways in which gender and identity are constructed in and through science and technology, while emphasizing how knowledge is situated, embodied, and localized in such a way as to exclude minority voices (Haraway 1988). The recent development of new materialism synergizes this approach with ontologies research by paying attention to the hybrid agencies and ethics of living and nonliving things (Barad 2007; Bennett 2009; Dolphijn and van der Tuin 2012). We are asked to “meet the universe halfway” by viewing objects like quarks as imbued with both social understandings and material agencies. New materialism often takes up questions related to human relations with other beings in order to contribute to questions around climate change and the environment and has been particularly influential in multispecies anthropology (Kirksey 2014; Haraway 2008). These core approaches in STS define the field’s attention to materiality not as a static, obdurate, or objective constraint upon social life, but as hybrid matter constituted through the arrangements of people and things, talk, and practice.

Along with text-based scholarship about materiality in STS, scholars have explored the topic through research methodologies that offer new ways of thinking about and engaging publics around complex sociotechnical issues (DiSalvo 2009; Michael 2012). These projects make representations and visualizations; design things, prototypes, and experiments; create opportunities for intervention and participation; and explore the topic through art and performance (Felt et al. 2016; Latour and Weibel 2005). Examples include Natalie Jeremijenko’s Environmental

Health Clinic and Feral Robotic Dog project (Bratton and Jeremijenko 2008; Lane et al. 2006), Trevor Paglen's critical geography (2009a, 2009b; Paglen and Thompson 2007), Carl DiSalvo's adversarial design and speculative civics (2012, 2016; DiSalvo et al. 2016), Natasha Myers and Joseph Dumit's gaming and visualizations (Burri and Dumit 2008; Dumit 2014; Myers and Dumit 2011), Matt Ratto and Garnet Hertz's critical making (Hertz and Parikka 2012; Ratto 2011), and Hanna Rose Shell's films (2012a, 2012b). Within this tradition, the making of digital technologies and systems is of particular interest to this volume (Vertesi et al. 2016). As evidence for the growing interest in these more inventive and engaged forms of scholarship within STS, we have also explored design and making at workshops (Forlano et al. 2012; Loukissas et al. 2013) and in a "Making and Doing" exhibition at the Society for the Social Studies of Science conference since 2015.

Despite this focus on materiality in STS over the past several decades, emerging scholarship on the digital and the social in the 1990s initially emphasized the dematerialized, virtual nature of online human relations, rejecting earlier materialist theory. Drawing upon media studies or communication theory, the digital and material were essentialized and separated into discrete units. Digital essentialism still haunts many studies of emerging technology today, in part due to the linguistic difficulties of articulating the mutual shaping and interdependence of the material and the digital. Still, more recent work on digital systems in STS and related fields has gravitated toward more complex, even hybrid understandings of digital materiality (Blanchette 2011; Dourish and Mazmanian 2011; Pink et al. 2016). Such scholars explore the ways in which the digital can be understood to be material (Dourish 2017) or explore digital work as practical action. They also reclaim the material, social, and environmental conditions of digital production, use, and discard through investigations into maintenance (Graham and Thrift 2007), repair (Jackson 2014), failure and breakdown (Rosner and Ames 2014; Rosner and Fox 2016), and care (Mol 2008).

The chapters in this section serve to advance and deepen our understanding of digital materiality. Rather than offering generalizations about the properties of materiality or digitality, the essays explore how digital materialities emerge in their sites of inquiry. Alexandre Camus and Dominique Vinck, for example, offer an ethnographic account of the digitization of the extensive concert archives of the Montreux Jazz Festival over the past 50 years. For the archives, "becoming digital" is a dynamic and interactive process of digital craftsmanship that requires the embodied, material labor (physical, cognitive, visual, and aural), time, and effort of engineers. In this case, the digital materiality of music takes on specific qualities such as tangibility and fluidity as well as textures such as softness, thickness, weight, boundaries, spatiality, relations, and networks. As the concerts are digitized—rather than becoming immaterial—they are rematerialized into new forms such as individual songs, playlists, and setlists. These new material forms are clickable, taggable, searchable, and indexable; as such, they have new associations with one another as well as with networks. The authors thus illustrate the ways in which the digital is distributed into networks that "do and undo the concerts," thereby saving the archives and allowing them to circulate. They also demonstrate how the digital and the material are not discrete categories or properties, but emerge locally in dynamic relation to each other.

Yanni Loukissas's interactive visualization and essay, which is presented as an online "data documentary," complements this volume. The piece investigates the "life and death of data" through engagement with the plant collection of Harvard

University's Arnold Arboretum, which includes 71,250 accessions between 1872 and 2012. This project draws on social and cultural research as well as the making of a longitudinal digital visualization in order to inquire into the social, material, and institutional histories of data. It also questions how to study the institutions that create, maintain, and share large digital collections. The visual and literal dimensions of this piece inspire us to examine data differently, developing notions of "hybrid materialities." Specifically, Loukissas highlights the tension between the virtual, ancillary, freely accessible, open, and transparent qualities that are often attributed to digital data on the one hand, and their materiality, centrality, locality, and situated significance on the other.

David Ribes considers the methodological implications of studying digital materiality by drawing on four intellectual traditions: ethnomethodology, actor-network theory, the anthropology of classification, and historical ontology and epistemology. Specifically, he asks, "How do we approach studies of things, objects, stuff, and materials, their agencies and interrelations, in action and across time?" Drawing on empirical cases from two large ethnographic studies, the Multicenter AIDS Cohort Study (MACS) and Long-Term Ecological Research (LTER), Ribes argues that researchers must "discover" the digital and the material through fieldwork. In these cases, blood and water samples as well as related datasets exhibit tremendous flexibility, allowing them to be understood as either digital or material in nature depending on the specific context. As a result, Ribes argues that interpretations about the nature of materiality must be read through multiple, sometimes competing, theoretical traditions.

Nerea Calvillo deploys digital visualizations as an inventive research method (Lury and Wakeford 2012) for "thinking with the environment." Across two projects—*In the Air* and *Pollen In the Air*—Calvillo describes the process of hands-on collaborative making of visualizations as a means of investigating the materiality of invisible gases and the politics around public air quality datasets. The visualizations are speculative in that they bring to life new imaginaries and worlds that engage with environmental issues. The resulting airscapes—airial maps that present "air as a landscape that can be inhabited"—are a form of ethnographic engagement with the air. Calvillo's visualizations do not merely represent scientific data about air, but also reimagine the relations between humans and gaseous nonhumans through embodied, affective experiences. Most significantly, these projects reconfigure the politics around "air as a harm" to humans in favor of a feminist, multi-species encounter predicated on collective values and environmental justice.

As a group, then, these essays offer a perspective upon digital encounters that embraces the material without essentializing its properties. This requires engaging with digital materiality as hybrid, shifting, and situated; an emic category to be analyzed in context; and a property to be played with and ultimately troubled.

## Works Cited

- Barad, Karen. 2007. *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Durham, NC: Duke University Press.
- Bennett, Jane. 2009. *Vibrant Matter: A Political Ecology of Things*. Durham, NC: Duke University Press.
- Blanchette, Jean-François. 2011. "A Material History of Bits." *Journal of the American Society for Information Science and Technology* 62 (6): 1042–57.
- Bratton, Benjamin H., and Natalie Jeremijenko. 2008. *Suspicious Images, Latent Interfaces*. New York: Architectural League of New York.

- Burri, Regula Valérie, and Joseph Dumit. 2008. "Social Studies of Scientific Imaging and Visualization." In *The Handbook of Science and Technology Studies*, edited by Edward J. Hackett, Olga Amsterdamska, Michael Lynch, and Judy Wajcman, 297–317. Cambridge, MA: MIT Press.
- Callon, Michel. 1986. "The Sociology of an Actor-Network: The Case of the Electric Vehicle." In *Mapping the Dynamics of Science and Technology*, edited by Michel Callon, John Law, and Arie Rip, 19–34. London: Macmillan.
- . 1987. "Society in the Making: The Study of Technology as a Tool for Sociological Analysis." In *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, edited by Wiebe E. Bijker, Thomas P. Hughes, and Trevor Pinch, 83–103. Cambridge, MA: MIT Press.
- DiSalvo, Carl. 2009. "Design and the Construction of Publics." *Design Issues* 25 (1): 48–63.
- . 2012. *Adversarial Design*. Cambridge, MA: MIT Press.
- . 2016. "The Irony of Drones for Foraging: Exploring the Work of Speculative Interventions." In *Design Anthropological Futures*, edited by J. H. Rachel Clark and Kapser Tang Vangkilde, 139–54. New York: Bloomsbury.
- DiSalvo, Carl, Tom Jenkins, and Thomas Lodato. 2016. "Designing Speculative Civics." Paper presented at the CHI Conference on Human Factors in Computing Systems, San Jose, CA.
- Dolphijn, Rick, and Iris van der Tuin, eds. 2012. *New Materialism: Interviews and Cartographies*. Ann Arbor, MI: Open Humanities Press.
- Dourish, Paul. 2017. *The Stuff of Bits: An Essay on the Materialities of Information*. Cambridge, MA: MIT Press.
- Dourish, Paul, and Melissa Mazmanian. 2011. "Media as Material: Information Representations as Material Foundations for Organizational Practice." Paper presented at the Third International Symposium on Process Organizational Studies, Corfu, Greece.
- Dumit, Joseph. 2014. "Writing the Implosion: Teaching the World One Thing at a Time." *Cultural Anthropology* 29 (2): 344–62.
- Felt, Ulrike, Rayvon Fouché, Clark A. Miller, and Laurel Smith-Doerr, eds. 2016. *The Handbook of Science and Technology Studies*. Cambridge, MA: MIT Press.
- Forlano, Laura, Dehli Hannah, Kat Jungnickel, Julian McHardy, and Hannah Star Rogers. 2012. "Experiments In (and Out of) the Studio: Art and Design Methods for Science and Technology Studies." <https://www.hastac.org/opportunities/4seasst-workshop-experiments-and-out-studio-art-and-design-methods-science-and>.
- Graham, S., and N. Thrift. 2007. "Out of Order: Understanding Repair and Maintenance." *Theory, Culture & Society* 24 (3): 1–25.
- Haraway, Donna. 1988. "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective." *Feminist Studies* 14 (3): 575–99.
- . 2008. *When Species Meet*. Minneapolis: University of Minnesota Press.
- Hertz, Garnet, and Jussi Parikka. 2012. "Zombie Media: Circuit Bending Media Archaeology into an Art Method." *Leonardo* 45 (5): 424–30.
- Jackson, Steven J. 2014. "Rethinking Repair." In *Media Technologies: Essays on Communication, Materiality, and Society*, edited by Tarleton Gillespie, Pablo Boczkowski, and Kirsten Foot, 221–39. Cambridge, MA: MIT Press.
- Kirksey, Eben. 2014. *The Multispecies Salon*. Durham, NC: Duke University Press.
- Lane, Giles, Camilla Brueton, George Roussos, Natalie Jeremijenko, George Papamarkos, Dima Diall, . . . Karen Martin. 2006. "Public Authoring & Feral Robotics." *Proboscis*, no. 11:1–12.
- Latour, Bruno. 1996. "On Actor-Network Theory: A Few Clarifications." *Soziale Welt* 47:369–81.
- . 2004. "Why Has Critique Run Out of Steam? From Matters of Fact to Matters of Concern." *Critical Inquiry* 30 (2): 225–48.
- . 2005. *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford: Oxford University Press.
- Latour, Bruno, and Peter Weibel, eds. 2005. *Making Things Public: Atmospheres of Democracy*. Cambridge, MA: MIT Press.
- Law, John, and John Hassard. 1999. *Actor Network Theory and After*. Oxford: Blackwell.
- Loukissas, Yanni, Laura Forlano, David Ribes, and Janet Vertesi. 2013. "digitalSTS and Design." <http://stsdesignworkshop.tumblr.com>.
- Lury, Celia, and Nina Wakeford. 2012. *Inventive Methods: The Happening of the Social*. New York: Routledge.
- Michael, Mike. 2012. "'What Are We Busy Doing?' Engaging the Idiot." *Science, Technology, & Human Values* 37 (5): 528–54.
- Mol, Annemarie. 2008. *The Logic of Care: Health and the Problem of Patient Choice*. London: Routledge.

- Myers, Natasha, and Joseph Dumit. 2011. "Haptic Creativity and the Mid-embodiments of Experimental Life." In *A Companion to the Anthropology of the Body and Embodiment*, edited by Frances E. Mascia-Lees, 239–61. New York: Wiley-Blackwell.
- Paglen, Trevor. 2009a. *Blank Spots on the Map: The Dark Geography of the Pentagon's Secret World*. New York: Penguin.
- . 2009b. "Experimental Geography: From Cultural Production to the Production of Space." *Brooklyn Rail*, March 6.
- Paglen, Trevor, and Adam Clay Thompson. 2007. *Torture Taxi: On the Trail of the CIA's Rendition Flights*. London: Icon Books.
- Pink, Sarah, Elisenda Ardevol, and Debora Lanzeni, eds. 2016. *Digital Materialities: Design and Anthropology*. New York: Bloomsbury.
- Ratto, Matt. 2011. "Critical Making: Conceptual and Material Studies in Technology and Social Life." *Information Society* 27 (4): 252–60.
- Rosner, Daniela K., and Morgan Ames. 2014. "Designing for Repair? Infrastructures and Materialities of Breakdown." Paper presented at the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing, Baltimore.
- Rosner, Daniela K., and Sarah E. Fox. 2016. "Legacies of Craft and the Centrality of Failure in a Mother-Operated Hackerspace." *New Media & Society* 18:558–80. doi:10.1177/1461444816629468.
- Shell, Hanna Rose. 2012a. "Blind: The Phenomenology of Camouflage." *Sensate*, December. <http://sensatejournal.com/hanna-rose-shell-blind-on-the-phenemology-of-camouflage/>.
- . 2012b. "Locomotion in Water." *Journal of Short Film*, Spring.
- Vertesi, Janet, David Ribes, Laura Forlano, Yanni Loukissas, and Marisa Cohn. 2016. "Engaging, Designing and Making Digital Technologies." In *The Handbook of Science and Technology Studies*, edited by Ulrike Felt, Rayvon Fouché, Clark A. Miller, and Laurel Smith-Doerr, 169–94. Cambridge, MA: MIT Press.
- Winner, Langdon. 1986. "Do Artifacts Have Politics?" In *The Whale and the Reactor: A Search for Limits in an Age of High Technology*, edited by Langdon Winner, 19–39. Chicago: University of Chicago Press.
- Woolgar, Steve, and Javier Lezaun. 2013. "The Wrong Bin Bag: A Turn to Ontology in Science and Technology Studies?" *Social Studies of Science* 43 (3): 321–40.