Engaging Science, Technology, and Society

Encountering Innovation, Countering Innovation

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Abstract

What could be gained by putting science and technology studies (STS) in conversation with innovation studies (IS)? These distinct fields have shared people over decades, as they build concepts, careers, institutions, and even nations. I review how this collection offers accounts of how STS and IS have been practiced in different times and locations: resisting underdevelopment, Western and middle-class assumptions about progress, or technology-centric policy. I argue, however, that it is critical to clarify the difference between innovation as an analytic and as an emic and ideological category. Neither STS nor IS should take for granted the ways political economy, class relations, racialization and gendering, and even national(ist) ideologies shape what counts as desirable forms of newness, what newness ought to be contained or criminalized, and the hierarchies of socio-technical transformation that emerge out of that. I offer three examples: San Diego's "smart streetlights" program where "innovation" as an ideology devalues or erases the creativity and knowledge already manifest among residents; Amazon® Mechanical Turk worker advocacy and the limits of doing scholarship with policy relevance when workers do not have organized power; and mid-twentieth-century Iran, where I show what IBM® throwing computers into the ocean can tell us about innovation as a form of enclosure, repression, empire, and waste of collective resources and knowledge.

Keywords

innovation; labor; empire; computing; social movements

Introduction

What could be gained by putting science and technology studies (STS) in conversation with innovation studies (IS)? These distinct fields have shared people over decades, as they build concepts, careers, build institutions, and even nations. There is a way to read this collection as an offering of how STS and IS have been practiced in different times and locations: resisting underdevelopment, Western and middle-class assumptions about progress, or technology-centric policy.

However, it is critical to clarify the difference between innovation as an analytic and as an emic and ideological category. Neither STS nor IS should take for granted the ways political economy, class relations,

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and national(ist) ideologies shape what counts as desirable forms of newness, what newness ought to be contained or criminalized, and the hierarchies of socio-technical transformation that emerge out of that.

In dialog with Irwin and this collection, I develop three provocations grounded in vignettes. My goal is to widen the set of actors STS and IS might learn from—including feminist, Marxist, Indigenous, Black, postcolonial, and community actors—in understanding and relating to innovation as a practice and as an ideology.

1. *Is innovation a problem or a solution?* I examine San Diego's projects of "innovation"-oriented urban development which, in actuality, strengthened criminalizing infrastructures. I contrast "innovation" as an ideology with the creativity and knowledge already manifest among residents devalued and erased by innovation ideologies.
2. *What can STS and IS do with a seat at the tables of policy and agenda setting?* Here, I draw on over a decade of research, activism, and policy advocacy around issues faced by Amazon® Mechanical Turk workers. I reflect on the promises of a seat at academic and policy tables, and the failures of those promises without worker and community power.
3. *What is suppressed or wasted in pursuit of innovation?* I draw on a family history of computing to ask what throwing computers into the ocean can tell us about innovation as a form of enclosure, repression, empire, and waste of collective resources and knowledge.

Is Innovation a Problem or a Solution?

In 2017, the City of San Diego in the United States borrowed $30 million dollars from GE Capital to install over 3,000 of GE's CityIQ "smart streetlights." In press conferences, marketing, and conference panels, the Mayor and city administrators touted the streetlights as a platform to empower San Diego's hackers and entrepreneurs to solve the City's problems. The streetlights gathered data from on-board cameras and microphones and used artificial intelligence (AI) to transform these surveillance streams into other kinds of data companies and municipal actors could use. The system—champions promised—could support solutions to a range of problems from public safety to food insecurity (Reuter 2019). A startup accelerator, telecom companies, and City partners—including my own university—held hackathons to encourage students and tech entrepreneurs to take a whack at these complex social problems (see Irani 2019, 109–140). These efforts were especially championed by the City's head of Economic Development. They coincided with efforts to remake downtown for tech companies, grow the city's "app economy," and brand San Diego as a Clean Tech investment hub. By 2017, however, the cameras had primarily become a tool used by the police. San Diego's history with policing included, like in many parts of the United States, the labeling of low-income youth, especially those of color, as gang members through surveillance programs (Davis 2018). It included the infiltration of spying on Muslim communities in places of worship and schooling in the ineffective but terrifying federal anti-terrorism programs (PANA & Majdal Center n.d.). At the border, it also included extensive collaboration by law enforcement at federal, state, and local levels in tracking and deporting immigrants (Koran 2017).

In 2019 Khalid Alexander, the founder of anti-criminalization group "Pillars of the Community," heard about the streetlights. He helped draw together organizers he knew to form the TRUST Coalition, on whose steering committee I came to serve. TRUST was able to bring racial justice activists together with civil libertarians and even middle-class enemies of "wasteful spending" to defund the "smart streetlights" (Irani and Alexander 2022)

Even with this victory, City leadership fails to recognize and fund low-tech, community solutions to problems of public safety with the same enthusiasm as "smart city" programs. In 2023, a new Mayor hopes to restart the

> *surveillance streetlights while leaving a youth center and mental health services* proposed and requested by Black and brown communities unfunded. Community organized block parties and violence interruption groups have yet to be recognized as the innovations the city needs. High-tech projects proposed and driven by working class and unemployed residents find little of the support offered to elites (Tandon et al. 2022).

Why was it so easy for those holding municipal power in San Diego to believe that the smart streetlights would generate economic development? The late historian Benoît Godin showed how social scientists cast innovation as technological change and linked it to social impact and economy growth (2016). Innovation frameworks offered a scientificity for normative policy models which linked innovation and economic growth (Brandão and Bagattolli 2023). San Diego's civic elite did not read or cite the studies that underwrote these claims, but relied on the common sense such studies legitimized—that technological authors were ideal citizens (Philip 2005).

Innovation is not just a policy framework, but a program for urban transformation that prioritizes university engineering students, technology entrepreneurs, venture capitalists, and technology firms. This is more than techno-solutionism (Sadowski & Bendor 2019; Morozov 2013). Sociologist Sharon Zukin calls this pattern of development "the innovation complex." The ideology of innovation guides urban renewal as cities compete for economic investment (Zukin 2020). San Diego wanted not only to produce tech companies, but extract data from its residents and visitors that would fuel these companies.

These dominant forms of "business-as-usual" innovation, as recognized by Alan Irwin, obscure or even deride many forms of creativity that support important ways of life. Clapperton Mahvunga draws parallels between scalable and profitable practices of Western "innovators" (see Pfotenhauer et al. 2021) and the practices of wealthy African businessmen and European traders who captured and traded in African men, women, and children as slaves (Mahvunga 2017, 11). Mahvunga writes from African history and practice to argue for an alternative understanding of "creativity, technology, and science" that comes not from innovation hubs but rather from the "transient workspaces" of hunters, iron workers, potters, and weavers (ibid., 1–10). People's knowledge of the forest, of materials, of being in good relations with spirits all shape socio-technical transformations and inform creative practices. Yet "European colonialism," he writes, "killed, disrupted, or delegitimized these sites of innovation and entrepreneurship by displacing Africans from their lands, creating farms and game reserves out of them, subjecting them to forced or miserly paid labor, and forcing Africans into cash crop production" (ibid., 13).

What practices of placemaking did San Diego's smart cities project occlude and devalue? The block parties where neighbors built relationships had no value in an innovation policy framework. Violence interruption programs to socially mediate conflict had no value in these models. The books and rap videos by which people shared stories, reflections, and lessons of their lives were not seen as "smart"; rap, talking back to police, and organizing resistance had even been criminalized (Sojoyner 2022; see also Davis 2018). These practices might transmit culture and generate safety for residents, but they do not register as profit or even exchange value (Irani 2019); as such, they are invisible within formal innovation policies and erased by techno-

fetishistic ideologies of innovation. Yet they suggest that there is another kind of intelligence that makes a city "smart," and it resides in people's relationships, tacit knowledge, practices of care, and imaginations of futures within reach.[1]

Innovation policies systematically devalue these ways of producing life and the economy. In this way, they parallel "access to computing" initiatives which, as Informatics scholar Roderic Crooks argues which justify interventions in racialized and minoritized communities, misdirect public investment, and further render people of color peripheral to computing cultures (2022, 4). Fouché argues that perception of "what 'counts' as technological activity is deeply intertwined with deleterious representations of the racialized other" that erases "black vernacular creativity" (2006, 642). Ruth Oldenziel observes that the word "technology" emerged in the US and Europe as industrial capitalists prioritized their own, machinic knowledge, over the techniques and useful arts practiced by women, racialized and colonized people (1999). Today, innovation policies valorize technoscientific knowledge—as patents, trademarks, and scalable accumulation—while devaluing production and reproduction (Irani 2019, 36–37). As countries attempt to climb higher on the value chain, they reorganize their production to control their competitive advantage while outsourcing the rest to subcontractors, often by offshoring (Kogut 1985). Those putatively non-innovative economic activities—maintenance, production labor, and reproductive labor—are subjected to global competition that diminishes their value on the market (Irani 2019, 84 and 188). Innovation, then, updates a very old, racialized, and gendered hierarchy of labor implicit in the model of economic development San Diego pursued with the smart streetlights program.

What Can STS and IS Do with a Seat at the Table? Alone, Very Little.

> *Those that Mary Gray and Siddarth Suri call "ghost workers" (2019) used to be my coworkers. I worked at Google® in the mid-2000s and noticed that projects like advertisement moderation and search algorithm tuning required the help of workers who I never met, but who worked for Google® through its External Workforce Optimization Quality (EWOQ) "ratings" platform (Irani 2015b). These were workers who pitched in when the automation failed, or helped to train the automation algorithms in the first place (Irani 2015a). They make ever changing cultural symbols and categories legible to computers.*
>
> *When Amazon® launched its Mechanical Turk platform in 2006, it spurred the expansion of such invisibilized cultural data work—spawning Computer Science research in "crowdsourcing" and making data labeling workers available to employers on demand, with no minimum wage or due process. As a PhD student animated by feminist STS commitments to situated knowledge, I set about to understand how Turk workers felt about the work they did in our industry and how I might act in solidarity. From surveys and conversations with workers, I learned that workers broadly struggled with employers who communicated and paid poorly, and withheld pay on a whim. With Six Silberman, I built tools and a website called Turkopticon to allow workers to engage in mutual aid by sharing information, especially warnings, about employers seeking workers on the platform. With*

[1] I thank Louise Hickman for making the observation, in context of a smart transportation planning, that smart cities champions misapprehend the nature of intelligence.

> *a broad community of Turk workers and tech workers from elsewhere in the industry, that system we built in 2009 continues operating in 2023.*
>
> *Over the last decade, policy makers, foundations, and academics began to energetically investigate and speculate into "the future of work," of which gig work seemed to be a part. Because of my work, I was invited to many symposia, workshops, and conferences put on, variously, by universities, philanthropies, Canadian and US national academies, the White House Office of Technology Policy, and the International Labour Organization. I had been invited to a range of proverbial tables. I also worked to get workers themselves invited to these tables.*
>
> *After a decade of coming to the table, I found that working conditions and policies for Amazon® Mechanical Turk workers had not improved. Wage theft had not gone away. Workers earnings had not gone up. The AI economy had only expanded and grown flush with money, but Turk workers did not have any power in discussions of policy makers, employers, or at Amazon. Our mutual aid intervention, Turkopticon, seemed to bandage a broken and exploitative corner of the academic-industrial complex while endless "future of work" workshops and "critical AI" workshops drained time that I should have, in hindsight, been spending organizing with Turk workers (Goldenfein et al. 2022). Perhaps critical contributions even offered tech company representatives clues on public messaging to neutralize critique. Perhaps keeping critical voices at the table served to contain us from becoming part of more troubling forms of collective demands and direct actions.*
>
> *Since 2019, I reoriented my efforts to support organizing and direct action by Amazon® Mechanical Turk workers themselves. A committee of Amazon® Mechanical Turk workers have taken leadership of Turkopticon supported by grants and community fundraising, as well as programmers, lawyers, and academics in solidarity. I seeded these efforts through fundraising, networking, peer support, and tactical research to counter Amazon® accounts that do not seem to explain why workers face mistaken account suspensions or find themselves algorithmically shut out in other ways. As an STS scholar and an ex-tech worker, I work from an analysis of how their liberation and mine are tied when large tech companies attempt to control our intellectual labor and devalue our skills.*

What happens when STS has a seat at the policy table? Maja Horst (2023) found herself invited into seats of European science and technology policy, creating bespoke interdisciplinary knowledge to inform policy conversations. Sebastian Pfotenhauer (2023) notes that after the "techlash," even the relatively conservative Organisation for Economic Co-operation and Development has created a policy hunger for "better innovation." Sitting in the United States, I see some of this transformation as US politicians once committed to supporting US economic exceptionalism through technology company boosterism began to question the role of those technology companies in disrupting the stability of their political coalitions. However, there quickly comes a time that the demands of communities and workers exceed the tolerance of companies and their armies of lobbyists. An STS or even IS policy offering—however contextually informed, as proposed by Parthasarathy (2023) in this issue—will hit the limits of political acceptability without engaging with the problems of power, pressure, or making one's perspective hegemonic.

Parthasarathy (ibid.), offers a vision of innovation informed by STS understandings of context and culture, but also engaged with existing activist movements. This offers a promising way forward—a way forward proposed by Sasha Costanza-Chock's Design Justice as well (2020). Costanza-Chock learns from the history of disability activism's mantra "nothing about us without us" but also its histories of militancy to argue that

directly impacted communities and their social movements must guide the course of innovation, not only informing the STS mediator but directing them.

This implies that neither STS nor IS can offer solutions for people in the world. STS and IS practitioners might offer analyses and perspectives, to combine with those of others, and be part of identifying possible ways forward. But to the perennial question of "well, now that you've pointed out the problem, what should we do about it?"—that is not, I argue, for academics to say. To do so would be to substitute the recommendations of an expert—however culturally informed—for what I argue must be a political, democratic process of collective problem solving, decision making, and struggle. We can offer one kind of knowledge to these processes of formulating a collective will, but we must accept that our situated knowledge (Haraway 1988) does not supersede other forms non-expert, accountable, situated knowledge. With the smart streetlights, community organizers organized a coalition that guided my participation as a researcher. In the Turkopticon project, there were no worker organizations oriented towards changing legal frameworks, Amazon's® policies and designs, or employer practices. I joined with workers to create and fund an organization that gave them time and support to canvass other workers, identify shared issues, and organize campaigns to improve working conditions. I did so not as an act of charity or "giving back" to others different than me, but to "stand with," as formulated by anthropologist Kim Tallbear, in offering critiques of Amazon® Mechanical Turk that also offer care through collective work (2014).

What is Repressed or Wasted in Pursuit of Innovation?

> *My mom grew up in Iran and worked at IBM® in the 1970s. Amidst her stories about office relationships and learning to program, she told me one day "IBM® threw computers into the sea." Their goal, she speculated, was to keep computers out of the hands of the Soviet Union, or perhaps to keep Iranians from learning how to make the machines domestically (Guity Irani, personal communication). To make sure, IBM® workers and security details would haul room sized computers by truck and boat for hours to deliver them into watery, hidden graves.*
>
> *IBM's® archives on Iran are thin (James Cortada, personal communication) so I cannot confirm the story, but IBM® dumped computers into the ocean in other countries as well. One Lebanese IBM® employee reported to historian and IBM®-alumnus James Cortada that his first work assignment was being sent to dump brand new computers into the Mediterranean (personal communication). That was in the same decade my mother worked at IBM®. Another historian of IBM® told me of hearing a Finnish worker speak of dumping computer parts into the Baltic Sea (Petri Paju, personal communication).*
>
> *During the Cold War, the US government wanted to keep computers out of the hands of the Soviet Union. The world of Soviet computer research had been rich with exchange with Western scientists, mathematicians, and engineers (Cortada 2012, 304). Soviet bloc countries had even designed and built functioning computers. However, the Soviet Union decided it wanted to acquire 'IBMs' or build systems that worked like them. 'IBMs' were widely used and there was an ecology of software and manuals to support them. Inventing computers anew may have seemed a waste of resources and efforts when they could be reverse engineered or appropriated already built. Why reinvent the wheel or exert energy that could be used elsewhere when you might adapt the wheel and enhance it to suit your needs?*
>
> *The US government sought to stop them. Where trade embargos failed, the FBI tracked computers claimed as lost to catch those smuggling them (James Cortada, personal communication). And then there was the ocean. That*

> *watery grave would ensure that the Soviets couldn't get their hands on IBM® parts or their eyes on system designs.*

Sea-bottom computers haunt us with questions of what is discarded, blocked, and criminalized to secure innovation for some while blocking access for others.

This was a period of decolonization for many countries struggling to form newly independent states and economies. Though Iran was not formally colonized, it was not separate from this ferment. 1960's Iran was ruled by the Shah Reza Pahlavi, installed after the Anglo-Iranian Oil Company and the United States organized a coup against a Prime Minister, Mohammed Mossadegh, who sought to nationalize the oil industries with broad public support. Iran's first mainframe computers managed the oil industries nearly a decade after Mossadegh's ouster (Heidari et al. 2022). Control over computers was part of a delicate dance of exercising sovereignty. Why, from the perspective of Iranian political and economic independence, should Iran depend exclusively on a US-based company to manage an industry critical to its national sovereignty? The selective absorption of new ideas, technologies, and practices was central to many decolonizing transformations (Prieto Ñañez 2022; Menon 2018; Tyabji 2004). Import substitution was one approach. Debates on import substitution considered how countries could transition out of underdevelopment that restricted production to the needs of colonizers, through for example—single crop economies (Prashad 2012, 19–21). Import substitution policies built domestic production capacity for domestically consumed goods. They also aimed to make underdeveloped countries producers of higher "value add" commodities for trade. Counter to today's innovation ideology, import substitution required reverse engineering (da Costa Marques 2005; Irani 2019, 36) and technology transfer (Tyabji 2004) rather than primarily the creation of unique or novel systems. This approach sought to seize back from multi-national corporations, understood as new kinds of colonizers, the means to create, trade, and consume higher value-add products (Perold 2020; Prashad 2012, 19–21).

Huey Newton, co-founder of the Black Panthers, argued that the control of technology was the expropriation and control of people. Technology, he argued in 1972 (2002), was essential to consumption; consumption was a key site where people, especially the unemployed, related to politics. For capitalists, control over the technology allowed them an upper hand in production and trade. They then used their wealth to "discredit socialism and communism" via foreign aid in the form of money, technology transfer, and consumer goods. "They raise the standard of living through transistors in order to further rip-off/sell its goods to the workers and the people of the world," Newton wrote (ibid., 262). Newton argued that technology had to be understood as a tool of empire—market expansion, consumption, and labor discipline and displacement (Narayan 2020, 190). But in "revolutionary intercommunalism," shared ownership of technology combined with rational resource distribution could benefit all (Johnson 2021, 184). The US's advanced research activities, he argued, were sustained by "expropriation from the people, including slavery proper but also chattel slavery followed by wage slavery" (Newton 2002, 256).

Companies and governments, however, criminalized reverse engineering to block or repress socio-technical change. Reverse engineering is the process of examining existing systems to understand how they are built and using that knowledge to build similar systems. In the 1980s, Brazilian technology policy encouraged local manufacturers to create domestic computers by reserving local markets for them. When Unitron® created a Mac "clone"—a computer that could run Apple®-compatible software—Apple® lobbied Brazil to change its intellectual property (IP) laws to render the import substituted Mac illegal (da Costa Marques 2005). Apple®, da Costa argues, repressed the "rights of creation" (ibid.). In the early 2000s, India similarly made certain kinds of reverse engineering illegal to bring its intellectual property regimes in line with US and European interests as pushed by the World Trade Organization (WTO). Prior to harmonization, Indian laws allowed engineers to figure out novel processes to produce what was considered critical for national sovereignty: food, drugs, space technologies, or atomic energy. WTO harmonization significantly shrank these rights, while cultural discourses of "piracy" legitimized it (Irani 2019, 36).

The case of Iranians and Soviets trying to access IBM® computers reminds us that sometimes people do not want something new, but they want to plug into larger systems. They want something that connects them to a system with others, whether that system is modernity, the internet, or an iPhone consumer experience. Christian Sandvig highlights the efforts of Kumeyaay youth and engineers connecting their communities to the internet in the San Diego border region. Tribal engineers bristled at untested novelty; they "didn't deserve to be guinea pigs of the networking world . . . They aspired to just plain internet'" (Sandvig 2012, 190). Getting "just plain internet" is not only a matter of problem solving, These Indigenous internet projects, information scientist Marisa Duarte shows, are practices of asserting and creating infrastructures for tribal sovereignty (2017). Similarly, Lilly U. Nguyen shows how Vietnamese hackers "jailbreaking" iPhones are less interested in innovating than they are in overcoming Apple's® legal and technical restrictions so they can connect to transnational digital networks (2016). Soviets and middle eastern people seeking IBM® computers in the 1960s did not want the new; they wanted what others already had and used.

Pankaj Sekhsaria (2023) argues that "jugaad"—a Hindustani concept indicating "reconfiguring materialities," "overcoming obstacles," and "working the system to one's advantage"—can decolonize how we understand socio-technical change. However, *jugaad* itself is also often criminalized. Media scholar Amit Rai writes of *jugaad* practices by which working class Indian women copy media and "steal" electricity, though he recovers these illegalized activities as a form of organic commoning (Rai 2019).

Following postcolonial STS tactics, we might ask what work is out of bounds of emerging technoscientific regimes? (Philip et al., 2012) Here, we find innovations born of scarcity (Sutz 2023), innovation attempted by violating imperial property norms, and innovation in pursuit of national sovereignty. Different "styles" of innovation rest on different moral economies, legal regimes, and material conditions. When it seems innovations seem somehow uniform—when alternative modes of innovation are repressed—that is an effect, Sutz observes, of "the exertion of economic and ideological power" (ibid.). What kinds of socio-technical change might we find and even cultivate when we refuse to criminalize the sharing or even scavenging of knowledge?

Conclusion: Towards Socio-Technical Justice

In San Diego, in AI production, and in Iran, I've shown how "innovation" as an emic concept does important work, updating old classed, racialized, and gendered hierarchies of labor, knowledge, and people and renewing extraction. I concur with Becerra and Thomas (2023) that innovation as analytical concept does not work. There is no "there" there. We must contend with innovation as policy and ideology, but I prefer fighting for "rights of creation" (da Costa Marques 2005) than the moral and economic imperative to "innovate" to be an ideal citizen (Irani 2019; Philip 2005).

We can research, teach, and write in ways that encounter and counter innovation in solidarity with movements for justice and liberation. Here, I found tremendous inspiration and in the work of Sally Wyatt (2023) and her colleagues countering innovation in feminist classrooms in working class communities of London. The Department of IS at the University of East London was staffed by faculty from the radical science movement. They claimed "innovation" to counter Thatcherite assumptions that innovation belonged to private enterprise, free of regulatory and union constraints. There, countered innovation by teaching students to claim worker power of technologies, by struggling for institution-wide changes to pedagogy. In pursuit of liberatory knowledge, we ought to recover hidden histories of teaching, community work, and shop floor struggles over socio-technical change that might not scale but do root. Let us do so in a way that takes stock of what privilege props up our own expertise claims (McGee 2020), what power we do and do not have, what knowledge we do and do not have, and the burdens we might impose if we run towards collaboration without understanding how to act in solidarity (Pierre et al. 2021; Walia 2012).

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References

Becerra, Lucas, and Hernán Thomas. 2023. "Innovation Doesn't Work: The Explanatory Power of a Socio-Technical Approach." *Engaging Science, Technology, and Society* 9(2): 66–74. https://doi.org/10.17351/ests2023.1395.

Brandão, Tiago, and Carolina, Bagattolli. 2023. "Bringing Fences Down: The Role of Critical Innovation Studies in Engaging STS with Innovation and the Contribution of Benoît Godin." *Engaging Science, Technology, and Society* 9(2):57–65. https://doi.org/10.17351/ests2023.1373.

Cortada, James W. 2012. "6 Limits of Diffusion: Computing in the Soviet Union, German Democratic Republic and Eastern Europe." In *The Digital Flood: The Diffusion of Information Technology Across the U.S., Europe, and Asia*, edited by James W. Cortada, 238–306. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199921553.003.0006.

Costanza-Chock, Sasha. 2020. Design Justice. Cambridge, MA: MIT Press.

Da Costa Marques, Ivan. 2005. "Cloning Computers: From Rights of Possession to Rights of Creation." *Science as Culture* 14(2): 139–160. https://doi.org/10.1080/09505430500110887.

Crooks, Roderic. 2022. *Toward People's Community Control of Technology: Race, Access, and Education*. https://doi.org/10.35650/JT.3015.d.2022.

Davis, Kristina. 2018. "Rapper 'Tiny Doo' and College Student Arrested under Controversial Gang Law Get Day in Court Against Police." *San Diego Union-Tribune*. Accessed August 1, 2023. https://www.sandiegouniontribune.com/news/courts/sd-me-tiny-doo-20180522-story.html.

Duarte, Marisa Elena. 2017. *Network Sovereignty: Building the Internet Across Indian Country*. Seattle, WA: University of Washington Press.

Fouché, Rayvon. 2006. "Say It Loud, I'm Black and I'm Proud: African Americans, American Artifactual Culture, and Black Vernacular Technological Creativity." *American Quarterly* 58(3): 639–61. https://doi.org/10.1353/aq.2006.0059.

Godin, Benoît. 2016. "Technological Innovation: On the Origins and Development of an Inclusive Concept." *Technology and Culture* 57(3): 527–56. https://doi.org/10.1353/tech.2016.0070.

Goldenfein, Jake, Lilly Irani, J. Khadijah Abdurahman, and Alex Hanna. 2022. "'Dropouts': An Interview." In *Economies of Virtue: The Circulation of "Ethics" in AI*, edited by Thao Phan, Jake Goldenfein, Declan Kuch, and Monique Mann, 160–74. Amsterdam: Institute for Network Cultures. Accessed August 1, 2023. https://networkcultures.org/blog/publication/economies-of-virtue-the-circulation-of-ethics-in-ai/.

Gray, Mary L., and Siddharth Suri. 2019. *Ghost Work: How to Stop Silicon Valley from Building a New Global Underclass*. Boston: Houghton Mifflin Harcourt Publishing Company.

Haraway, Donna. 1988. "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective." *Feminist Studies* 14(3): 575–99.

Heidari, Arash, Nima Jafari Navimipour, and Mehmet Unal. 2022. "The History of Computing in Iran (Persia)—Since the Achaemenid Empire." *Technologies* 10(4): 94. https://doi.org/10.3390/technologies10040094.

Horst, Maja. 2023. "Dissolving Boundaries in the Policy System." *Engaging Science, Technology, and Society* 9(2): 112–117. https://doi.org/10.17351/ests2023.1371.

Irani, Lilly. 2015a. "The Cultural Work of Microwork." *New Media & Society* 17(5): 720–39. https://doi.org/10.1177/1461444813511926.

———. 2015b. "Justice for 'Data Janitors.'" Blog. *Public Books.* http://www.publicbooks.org/nonfiction/justice-for-data-janitors.

———. 2019. *Chasing Innovation: Making Entrepreneurial Citizens in Modern India*. Princeton, N.J.: Princeton University Press.

Irani, Lilly, and Khalid Alexander. 2022. "The Oversight Bloc." *Logic(s) 15.* https://logicmag.io/beacons/the-oversight-bloc/.

Irwin, Alan. 2023. "STS and Innovation: Borderlands, Regenerations and Critical Engagements." *Engaging Science, Technology, and Society* 9(2): 41–56. https://doi.org/10.17351/ests2023.1363.

Johnson, Cedric. 2021. "Huey P. Newton and the Last Days of the Black Colony." *Dissent* 68(3): 173–86. https://doi.org/10.1353/dss.2021.0069.

Kogut, Bruce. 1985. "Designing Global Strategies: Comparative and Competitive Value-Added Chains." *MIT Sloan Management Review* 26(4): 15–28.

Koran, Mario. 2017. "Sheriff's Department: Yes, We Called Border Patrol on Undocumented Couple; No, We Didn't Violate Policy." *Voice of San Diego.* https://voiceofsandiego.org/2017/08/02/sheriffs-department-yes-we-called-border-patrol-on-undocumented-couple-no-we-didnt-violate-policy/.

Mavhunga, Clapperton. 2017. *What Do Science, Technology, and Innovation Mean from Africa?* Cambridge, MA: The MIT Press. https://doi.org/10.26530/oapen_631166.

McGee, Ebony Omotola. 2020. "Interrogating Structural Racism in STEM Higher Education." *Educational Researcher* 49(9): 633–44. https://doi.org/10.3102/0013189X20972718.

Menon, Nikhil. 2018. "'Fancy Calculating Machine': Computers and Planning in Independent India." *Modern Asian Studies* 52(2): 421–57. https://doi.org/10.1017/S0026749X16000135.

Morozov, Evgeny. 2013. *To Save Everything, Click Here: The Folly of Technological Solutionism*. New York, NY: PublicAffairs, Hatchett Press.

Narayan, John. 2020. "Survival Pending Revolution: Self-Determination in the Age of Proto-Neo-Liberal Globalization." *Current Sociology* 68(2): 187–203. https://doi.org/10.1177/0011392119886870.

Newton, Huey. 2002. "The Technology Question: 1972." In *The Huey P. Newton Reader*, edited by David Hilliard and Donald Weise, 256–66. Seven Stories Press.

Nguyen, Lilly U. 2016. "Infrastructural action in Vietnam: Inverting the techno-politics of hacking in the global South." *New Media & Society* 18(4): 637-652.

Oldenziel, Ruth. 1999. *Making Technology Masculine: Men, Women and Modern Machines in America, 1870–1945*. Amsterdam: Amsterdam University Press.

Parthasarathy, Shobita. 2023. "A Tale of Two Perspectives on Innovation and Global Equity." *Engaging Science, Technology, and Society* 9(2): 97–106. https://doi.org/10.17351/ests2023.1369.

Partnership for the Advancement of New Amercians (PANA). n.d. *Countering Violent Extremism: Surveillance of San Diego's Muslim Refugee Communities*. San Diego, CA: Majdal Center. https://www.panasd.org/cve-brief.

Perold, Colette. 2020. "The Empire of Informatics: IBM in Brazil Before Modern Computing." *ProQuest Dissertations Publishing*.

Pierre, Jennifer, Roderic Crooks, Morgan Currie, Britt Paris, et al. 2021. "Getting Ourselves Together: Data-Centered Participatory Design Research and Epistemic Burden." In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, 1–11. New York, NY: Association for Computing Machinery. https://doi.org/10.1145/3411764.3445103.

Pfotenhauer, Sebastian, Brice Laurent, Kyriaki Papageorgiou, and and Jack Stilgoe. 2021. "The Politics of Scaling." *Social Studies of Science* 52(1): 3–34. https://doi.org/10.1177/03063127211048945.

Philip, Kavita. 2005. "What Is a Technological Author? The Pirate Function and Intellectual Property." *Postcolonial Studies* 8(2): 199–218. https://doi.org/10.1080/13688790500153596.

Philip, Kavita, Lilly Irani, and Paul Dourish. 2012. "Postcolonial Computing A Tactical Survey." *Science, Technology & Human Values* 37(1): 3–29.

Prashad, Vijay. 2012. *The Poorer Nations: A Possible History of the Global South*. London; New York: Verso.

Prieto Ñañez, Fabian. 2022. "Assembling a Colombian-Cloned Computer: National Development and the Transnational Trade of Electronics Parts in the 1980s." *IEEE Annals of the History of Computing* 44(2): 55–64. https://doi.org/10.1109/MAHC.2022.3163202

Rai, Amit. 2019. *Jugaad Time: Ecologies of Everyday Hacking in India*. Durham, NC: Duke University Press.

Reuter, Elise. 2019. "Hackathon Enlists San Diego Developers to Find Smart Solutions for City Problems." Blog. *San Diego Business Journal*. Accessed August 1, 2023. https://www.sdbj.com/uncategorized/hackathon-enlists-san-diego-developers-find-smart/.

Sandvig, Christian. 2012. "Connection at Ewiiaapaayp Mountain." In *Race After the Internet*, edited by Lisa Nakamura and Peter Chow White, 168-200. New York, NY: Routledge.

Sadowski, Jathan, and Roy Bendor. 2019. "Selling Smartness: Corporate Narratives and the Smart City as a Sociotechnical Imaginary." *Science, Technology, & Human Values* 44(3): 540–63. https://doi.org/10.1177/0162243918806061.

Sekhsaria, Pankaj. 2023. "What is Innovation in the Non-English Languages?" *Engaging Science, Technology, and Society* 9(2): 75–81. https://doi.org/10.17351/ests2023.1375.

Sojoyner, Damien M. 2022. *Joy and Pain: A Story of Black Life and Liberation in Five Albums.* 1st ed. Berkeley: University of California Press. https://doi.org/10.1525/9780520390430.

Sutz, Judith. 2023. "Frugal Ground for STS and IS: Problems of Innovation and their Commonalities." *Engaging Science, Technology, and Society* 9(2): 82–86 https://doi.org/10.17351/ests2023.1401.

TallBear, Kim. 2014. "Standing With and Speaking as Faith: A Feminist-Indigenous Approach to Inquiry." *Journal of Research Practice* 10(2): 1–7.

Tandon, Udayan, Vera Khovanskaya, Enrique Arcilla, Mikaiil Haji Hussein, et al. 2022. "Hostile Ecologies: Navigating the Barriers to Community-Led Innovation." *Proceedings of the ACM on Human-Computer Interaction* (CSCW2). 6(443):1–26. https://doi.org/10.1145/3555544.

Tyabji, Nasir. 2004. "Gaining Technical Know-How in an Unequal World: Penicillin Manufacture in Nehru's India." *Technology and Culture* 45(2): 331–49. https://doi.org/10.1353/tech.2004.0097.

Walia, Harsha. 2012. "Decolonizing Together." In *Organize! Building from the Local for Global Justice*, Aziz Choudry, Jill Hanley & Eric Shragge, 240–53. Oakland, CA: PM Press.

Wyatt, Sally. 2023. "A Journey through STS and Innovation Studies." *Engaging Science, Technology, and Society* 9(2): 112–117. https://doi.org/10.17351/ests2023.1367.

Zukin, Sharon, ed. 2020. "Imagining Innovation." In *The Innovation Complex: Cities, Tech, and the New Economy*. Oxford, UK: Oxford University Press. https://doi.org/10.1093/oso/9780190083830.003.0001.