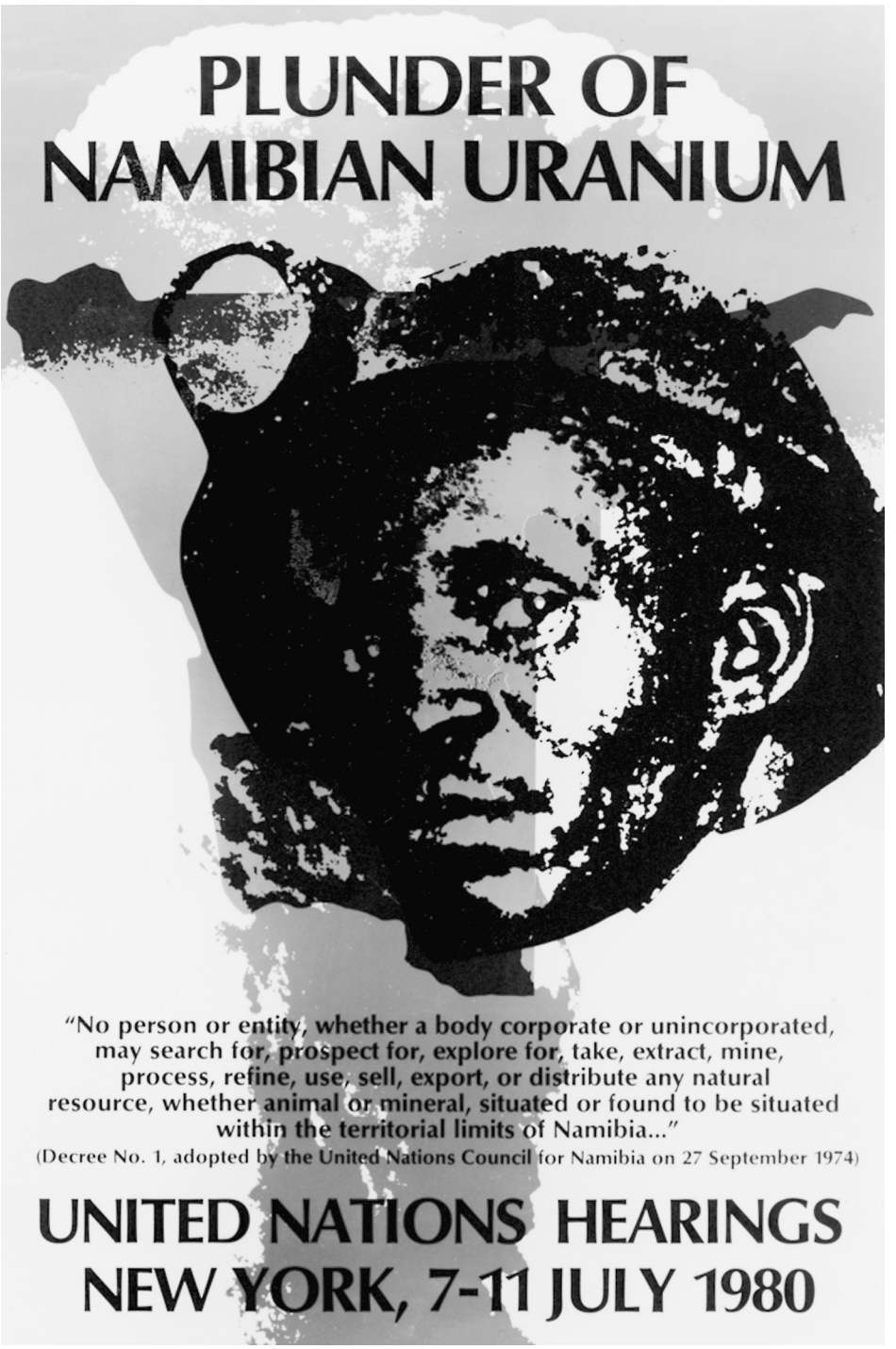

Figure 1. Poster, ca. June 1980, produced to announce the hearings held the United Nations in July 1980 on the exploitative practice of uranium mining in Namibia. Source: African Activist Archive Project at Michigan State University, http://africanactivist.msu.edu.

RETHINKING POSTCOLONIAL SCIENCE AND TECHNOLOGY

Confronting African Histories of Technology

A Conversation with Keith Breckenridge and Gabrielle Hecht

David Serlin

Since 2013, historians Keith Breckenridge and Gabrielle Hecht have held central roles in a cross-institutional initiative, supported by the Andrew W. Mellon Foundation, which fosters multidisciplinary academic scholarship about Africa. Breckenridge is professor of history at the University of the Witwatersrand, South Africa, and deputy director of the Wits Institute for Social and Economic Research. He is the author of numerous works including, most recently, *Biometric State: The Global Politics of Identification and Surveillance in South Africa, 1850 to the Present* (2014). Hecht is professor of history at the University of Michigan, Ann Arbor, where she has also served as associate director of the African Studies Center and director of the Program in Science, Technology, and Society. She is the author or editor of numerous works including *Being Nuclear: Africans and the Global Uranium Trade* (2012).

In this conversation, Breckenridge and Hecht discuss the status of African histories of technology since decolonization. While they have different approaches, they agree that academic interest in technology in African history began to decline in the mid-1980s and that the study of technology on the continent—with some important exceptions—was long confined to anthropology and archaeology. Histori-

Radical History Review
Issue 127 (January 2017) DOI 10.1215/01636545-3690870

ans of technology in Europe and the United States also mostly ignored African sites, even when the technologies and infrastructures they investigated had significant African histories. In recent years there has been a marked change in both fields, with historians of technology exploring the African origins of their topics and African historians turning to the study of technological infrastructures and users. By paying attention to the technological specificity of industrial production, to material and political infrastructures, and to gaps and dependencies, Breckenridge and Hecht suggest possible directions for contemporary and future African histories of technology.

David Serlin spoke with Breckenridge and Hecht via Skype in May 2016.

David Serlin: *I want to begin by asking each of you to talk about how you came to do work in African technology studies. Gabrielle, you established your reputation as a historian of French nuclear technology, and now your recent work is on uranium production in Africa. Similarly, for Keith, you were trained as an economic historian of South Africa, and now your area of research includes biometrics and surveillance technology. How did your respective research projects come about?*

Gabrielle Hecht: After I finished *The Radiance of France*, I wanted to write about technologies in colonial and postcolonial settings. I was trying very hard to get away from nuclear topics. But eventually I realized that the story of the nuclear age—where the "age" designation must be understood as a political claim, rather than a meaningful periodization—had been told almost entirely in terms of Europe and the superpowers, with Japan and India thrown in occasionally. Three-quarters of the world has been left out of these stories. Yet colonial and postcolonial territories play a crucial role, as sites of uranium production and atomic bomb testing. So the first version of the project aimed to rewrite the history of the "nuclear age" by looking at uranium production not just in African places but also on indigenous lands in Australia, the Navajo Nation in the United States, First Nations in Canada, and so on. I ended up honing in on the African story for a variety of reasons, one of which was that it hadn't been written about, despite the fact that African sites have been important uranium producers since the early part of the Cold War. Also significant: I found a much more congenial intellectual community among Africanists than I had around some of the other sites. Keith and his colleagues were an important part of that community.

Keith Breckenridge: I was trained as a historian who wanted to work on the development of corporate capitalism. The history of technology for me was, and remains, a way of understanding the links between the early twentieth-century corporations in the United States and the American engineers who came to South Africa.

They helped design a state that would nurture these very large companies, and they offered plans that went well beyond their technical expertise, designing legal systems, institutions for controlling labor systems, and an ambitious plan for social transformation matched to the long-term needs of those companies. Many of these engineers described themselves as high priests of a new American religion of technology. Borrowing from Gabrielle, and her colleagues at Michigan, I have found it extremely useful to combine the history of engineering—and the work on large technical systems and their politics from David F. Noble, Edwin T. Layton, Thomas P. Hughes—with the South African neo-Marxist interest in the political economy of segregation.

South Africa is a country that is, as they say, precociously developed. It's a society in which an authoritarian state forced the pace of industrial development using large technical systems in a way that is unusual on the African continent. These state-supported infrastructures include the building of the railway system, a ubiquitous system of grain elevators, dozens of large dams in an arid country, a massive fleet of coal-fired power stations, an impressive highway system, and a network of research universities. And all of those were force-fed by a state that was trying, unnaturally almost, to build up the viability, the power of a racially delimited political economy. I wanted to compare the way these systems were driven by deliberate government interventions in an attempt to make them resemble the more dynamic market-driven growth that happened in other places.

The South African history of technology is in most respects the opposite of the architectures of dependency that Walter Rodney described in *How Europe Underdeveloped Africa*, where telephone calls from one African city to another had to be routed through London and Paris. So my involvement in histories of technology has a strong bias toward system design and the politics of infrastructure. But I'm also interested in how South Africa, as a region, can address the larger question that Africans have been preoccupied with for the past twenty years, which is, in a postcolonial era, how do you keep this thing alive? How do you expand and sustain a racist colonial economy that was built under these strange circumstances? That's a very particular kind of research problem, different from those posed by scholars elsewhere. I think most South African social scientists—historians and others—are worried about how to keep the lights on, how to keep the water clean, how to sustain the university system, rather than a specific site, technology, or practice on which to build analysis. I see that this worry is increasingly a global one, but it is especially powerful here because of the imperatives of redress and social justice.

Serlin: *Let's pick up this thread about infrastructure in terms of the difference between doing African history of technology now rather than, say, during the 1970s. How have African histories of technology or science and technology studies*

(STS) focused on Africa, changed since the period of decolonization? Or, perhaps more to the point, how has decolonization changed the way histories of technology have been written?

Hecht: I would say that, broadly speaking, histories of technology and STS were long *un*affected by histories of decolonization. These areas have only come into active conversation with one another over the past two decades. For instance, in 1981 Daniel R. Headrick first published *The Tools of Empire*, a book that is still a staple for undergraduate courses on the history of empire. It examined European imperialism in Africa and Asia, focused primarily on how imperialists used technology—guns, ships, quinine, and railroads—to enact the colonizing project. This perspective was new at the time; it showed that imperial power was not just ideological but also material. But it was not informed by contemporaneous writing in African history.

Similarly, Michael Adas's magisterial 1989 book *Machines as the Measure of Men* is really an intellectual history of how Europeans thought about the scientific and technological capacities of the people whom they colonized. It looks at how European ideas about Africans as scientifically and technologically backward were formed in the colonial encounter. Saying that it doesn't take African history into account is not really a critique, because that was never the intention of the book. It's a history of *ideas* about science and technology. Still, Adas's book could have opened up more productive conversations between African historians and historians of technology or STS at the time. But such conversations have only gained momentum in the past decade.

Breckenridge: I agree. African history has been strangely isolated over the past two generations from the field in general, and this is pronounced in the history of technology. If you look at the two volumes of the recent *Cambridge History of Capitalism*—aside from the chapters by Gareth Austin and Morten Jerven—Africa seems not to have been at all involved. This is especially noticeable in the chapter on technology, and technology transfer, by Kristin Bruland and David C. Mowery. The story of technology on the African continent is confined to two footnotes at the very end remarking on the curious decline of the excellent colonial research institutions in the Congo. I think that it's fair to say that historians of technology have found Africa very difficult, almost completely impenetrable. Much of this is because there is a methodological bias toward presence and integration, where the history of technology on the African continent is often about external dependency and exclusion. On the other hand, as Gabrielle says, African historians have not done a very good job of picking up on the themes in the history of technology; an isolated exception is a 1983 essay by Ralph A. Austen and Headrick. John Thornton, especially in *Africa and Africans in the Making of the Atlantic World*, is the one African historian who has consistently written about the politics of technology in the encounters between

African societies and Europeans after the sixteenth century. My sense is that there is an interesting link between Adas, Headrick, Thornton, and Philip Curtin, who was also interested in many of the same themes around the politics of technologies, especially the constraints and possibilities of maritime trade in West Africa after 1500. Otherwise, African history became very difficult for nonspecialists to engage with, and many of the themes that were being picked up earlier by people have disappeared from currents within contemporary histories of technology or STS. I think it's changing now. There is a moral and political imperative for people to cover the world properly—and economic history is obsessed with comparisons—and that means that they're taking African history more seriously.

Hecht: Right. But I'm not suggesting that Africanists *never* engaged with technology. Scholars working on precolonial African history and archaeology have written quite a lot about technology, especially on topics like hunting—such as the very interesting recent work by Kathryn M. de Luna—or agriculture or metalworking. But very few historians of technology and STS know about this work. And, to be fair, it's a difficult literature for people interested in contemporary topics to engage with. As Keith hints, it requires considerable effort for scholars utterly unfamiliar with African societies to get past the specificities, however important these are, in order to understand the patterns of technological use and knowledge that could inform current STS thinking on knowledge, skill, and materiality. A more accessible entry point might be a now classic 1988 article by Jeff Guy and Motlatsi Thabane on the relationships between skill and ethnicity among Basotho shaft sinkers on the South African gold mines. It's a humbling read for STS scholars, especially once they realize that the authors get straight to the heart of questions about the political and cultural construction of skill without any background in the field.

My University of Michigan courses on technology and power in Africa often start with James Ferguson's *Global Shadows*. Ferguson notes that Africanists spend a lot of time debunking the idea that Africa is a single place and calling for attention to its complexities. That's important, he argues, but we must also keep in mind that the *idea* of "Africa" as a *singular* place itself does political and cultural work in the world. So I often begin by pairing Ferguson with readings from Headrick and Adas to get students thinking about how the paucity of popular and scholarly writing about technology in Africa shapes their approach to the continent in general, as well as to the question of what technology is.

I also have students read some of the literature on iron and copper metalworking, by scholars such as Shadreck Chirikure, Eugenia W. Herbert, Colleen Kriger, Peter Schmidt, and others. Those historians and archaeologists show the complexity of the technologies that smelters and blacksmiths in precolonial Africa deployed. Students learn about the complex relationships between technologies and environments. We also talk about the relationship between monetary currency

and religious rituals in order to get at the complexities of precolonial economic and political life. And we debate the meanings of these rituals and their relationship to secular activities and production. There's a lot of potential for STS scholars to learn from those debates.

It's also worth noting the newly flourishing literature on firearms in colonial Africa, which goes well past Headrick's initial sketch in bringing together themes from the history of technology and African studies. Scholars such as William Kelleher Storey, Clapperton Chakanetsa Mavhunga, and Giacomo Macola have shown that firearms were far more than European tools of oppression and death: Africans also used them as currency, as sites of knowledge making, as symbols of political power, and more.

Breckenridge: I also think Gabrielle and I are both drawn to the political work that the history of technology, perhaps especially in African history, performs through absences and voids. I've called this power without knowledge or the failure of the will to know, but in general it's about the usefulness of a constrained, scientific curiosity, and, in African history, these constraints have been racist. In Gabrielle's case, defining the labor, and the lives, of African workers as not falling within the scientific domain of the nuclear was a key part of what made the global uranium industry viable. Something similar happened with the history of biometrics, which gave colonial states a tool that allowed them to ignore almost all of the most basic information about the health and reproduction of African populations. Understanding these voids—how they emerged and what they have done—in the past can also help to orient us to what's happening now; reconstructing the historical processes around the limits on the will to know can help to explain the political problems of the present and the future on the continent.

Serlin: *For many scholars who are approaching postcolonial and/or postcolonial STS topics, there's interest in both the region or nation and the forms of power that are exercised there, as well as interest in the material stuff of history, whether it be technology or infrastructure or the labor tied to or exploited through those material forms. Can you walk us through the relationship between these two aspects of postcolonial STS—place and technology—as you've explored them in your respective works?*

Hecht: Keith comes to many of these questions as a historian of South Africa, so his starting point is trying to understand place. I was trained in STS; my starting point is technology. In approaching the history of uranium production in South Africa or Namibia or Gabon or Madagascar, I wanted to know how looking at these places changes how we understand nuclear systems—and even what counts as a nuclear "thing" in the first place.

In my book *Being Nuclear*, I retrace these histories to unpack "the nuclear"

as an actor category. I try to understand how uranium was made into a nonnuclear material over and over again through various acts of marginalization. How, for example, did uranium go from a highly sensitive material of superpower national security to a tradable commodity? I also trace nuclearity in the mines themselves. I've learned a lot from Keith, who's written some wonderful stuff connecting the political economy of gold with everyday politics on the mines, and others who have worked on mining in African contexts, including the stunning book by T. Dunbar Moodie and Vivienne Ndatshe on South African gold miners. Whether uranium mining gets treated as a nuclear activity or not makes a huge difference in how working conditions are governed and in what hazards are made visible or kept invisible. When you compare how mining works in different places, you see different technopolitical configurations that produce different political, health, and social outcomes. The power of technology does not work everywhere in the same way.

Breckenridge: We should also probably acknowledge the influence of anthropology on the study of technology on the African continent, now and in the past. Many of the people writing on technology between, say, 1975 and 1995 used symbolic analysis to treat the organization of cultures in a structuralist way. That's why anthropologists like Jack Goody became very influential in making theoretical arguments about the place of technology in Africa. Similarly, many Africanists—like Herbert, Jan Vansina, and even Luise White—write about technology from the perspective of its ritual or symbolic function rather than from the political economy one would conventionally associate with technology. This is one reason why Thornton's work has become important: he wants to simplify writing about technology in order to construct arguments about political power. For example, he discusses how different types of boats operate in different kinds of water; he draws political conclusions from the technical limits on the weapons available to Africans and Europeans; and he compares the technologies of cloth making available on the continent with those in Europe to make points about the terms of trade. I'm not sure that these secular interpretations of technologies have carried the field, but they have been widely influential.

Serlin: *Given these important interpretive differences between historians, archaeologists, and anthropologists in writing about technology in Africa, what's the role of methodology here? Are these simply problems of discipline, and is there something new that scholars of STS bring to the table?*

Breckenridge: In African history, the methodology question ends up quite often being about the limits or the viability of the claims that can be extracted from quite limited sources, either in the colonial record or in oral history. People line up on either side of big themes—the economic and political effects of colonialism, demography or disease, for example—and they then assemble their historiographical

allies and their enemies rather than choose a more specific problem. The field isn't divided up into subspecialties in quite the way of European and North American history. Headrick argues, for example, that the development of technology aided and abetted the expansion of European imperialism in ways that were unimaginable before 1850. Those that argue against him, like Paul Zeleza, think of themselves as defenders of an Africanist position that situates late nineteenth-century colonialism as just another episode in a centuries-long conflict. His concern—which is widely shared—is to draw out the integrity and flexibility of African society.

Hecht: Perhaps it is precisely because the disciplines of archaeology and anthropology use methodological tools that are unfamiliar to historians who focus on Europe and America that precolonial African history seems so inaccessible. But let me add something to what Keith said about the concern to preserve the integrity of African history. Showing complexity and dynamism in African history works against preconceptions about "tradition," ideas that "African knowledge" is somehow static. It works against the belief that by looking at smelting, or iron smithing, or hunting, you can capture centuries of history by examining a single moment in time. Historians of Africa put considerable methodological effort into showing the complexities and contradictions of trade routes, of politics. They show, for example, how kings seek out people with particular forms of expertise in order to shore up their own power. This complicates the standard "knowledge is power" argument, showing how leaders arrange their networks of power by consciously recruiting knowledgeable people into their communities in order to accumulate wealth.

Africanists are now starting to attend to such themes in more contemporary settings. A good example is Emily Osborn's work on how aluminum pots generate mobile networks of skill in West Africa.

Serlin: *Isn't the emphasis on "preserving the integrity" of African technology studies by some academics a form of reductive thinking that could be interpreted as a legacy of colonialism?*

Breckenridge: It's a very complicated problem. Yes, the destructiveness of colonialism, and the forms of authoritarianism it encouraged, is a big part of the story of technologies—the old Marxist argument about the liberatory possibilities of colonial rule has gone. But the very widely held emphasis on colonialism, in general, also collapses the differences between countries as diverse as Congo, especially after 1920, or Tanzania, or Liberia, or Senegal. So it's not a single story, and it never has been. They're such completely different political economies, and the fates of each of those places in terms of what people can expect from infrastructure and from the large technical systems that they can support in order to improve the quality of their lives are also different.

More to the point, however, is the way that Africa as a continent suffers in making science and technology systems function in the contemporary period. Some of those things relate back to colonialism and the long delay by the colonial powers in establishing universities, which really only began in the 1950s. Now, though, the most compelling explanations relate to failures of governance and policy, whether imposed by the World Bank or sourced locally. The fundamental problem is the large number of the finest African scholars, technicians, and doctors who leave the continent. There are many countries on the continent that lose more than half the people who train in their universities. The one million Nigerians, for example, who live outside of the continent, are the best-educated professionals—especially doctors, engineers, and other scientists. African universities are hemorrhaging all the time. So this isn't just a common history or even a history of the failure of infrastructure. It's also a story about the fact that, if you're a skilled person, you don't necessarily think of Africa as a viable place in which to live your life. Thinking about how that can change requires a break with the argument that colonialism is the source of African technological weakness and dependency.

Hecht: Scholars working at the intersection of anthropology and history have begun to examine the complexities that Keith mentions. People such as Allen Isaacman, Stephan Miescher, Stephen Sparks, Julia Tischler, Antina von Schnitzler, and Tanja Winther are exploring the technopolitics of energy and electricity, from large-scale hydroelectric dams to conflicts around electric meters. Miescher's work, for example, does a nice job showing the tensions between the social injustices engendered by displacing thousands of households to build Ghana's Akosombo dam and the opportunities generated by even limited access to electricity. Some of these Africanists have been taking cues from STS's attention to the micropolitics of material arrangements. STS scholars, in turn, can learn from the ways in which Africanists are situating specific technological projects in larger political economic contexts and networks. These histories of electricity and energy bear important differences—and sometimes odd similarities—to the now familiar stories of Thomas P. Hughes and David E. Nye.

Going back to the topic of mining, consider this example from Robyn d'Avignon's recent dissertation about gold production in eastern Senegal. Today in this region, numerous multinational corporations are laying claims to goldfields through state-issued permits. Gold in this region is often close to the surface, which for centuries made gold extraction a dry-season activity—what you did, in other words, when you couldn't plant crops. Today, however, regional residents who mine gold from those fields get labeled as illegal, "artisanal" miners. But they argue that the gold–and knowledge about its presence and the most efficient extraction techniques–is theirs. So d'Avignon explores what happened when the French first came to this region and how the colonial state appropriated local knowledge in order to

dig bigger and deeper mines, which actually turned out to be *less* profitable than the smaller-scale mines that West Africans were already exploiting. She traces how African technological knowledge became circumscribed by law and how colonial regimes permitted Africans access to certain kinds of mining technologies and not others. Over the long term, this produced a dynamic in which African technological knowledge and practices were criminalized first by colonial states and then by national and postcolonial states.

Scholars are also reworking our understanding of large-scale colonial development projects; Laura Ann Twagira, for example, examines how women in the French Sudan (present-day Mali) used resources from the Office du Niger to design their own production systems. Such work speaks to some of the larger issues that Keith raised. Why aren't Africans more involved in these large-scale systems? What is this permanent state of inequality? Where does it come from and what can we do about it?

Breckenridge: Yes, again, we agree. It's also important that many African societies are going through very, very rapid demographic growth now. Nigeria now has some 175 million people, a figure that's probably doubled over the past twenty-five years. The United Nations predicts that the number will grow to one billion people by the end of the century. Most African societies are looking at very similar kinds of demographic pressure. States and, especially, banks are moving to develop systems that will allow them to track people and either extract tax from them or sell them credit—or both. Scholars of STS are increasingly studying how these technologies of financialization develop. The problem is that the states and the people gathering information really make no effort at all to foster the forms of public education and administration that would produce reliable and universal understandings of these societies. They quite often try to turn these technological shortcuts—especially mobile phones and biometric devices—into objects of administrative virtue. Companies and politicians make a virtue of this stripped-down state. So some technologies are developing with great pace, but the old void of understanding who people are, where they come from, and how they live, remains.

Hecht: One of the things that STS can bring to the study of infrastructure is a new interest in repair and maintenance. Many STS scholars focused on Africa are now coming to this topic. Joshua Grace, for instance, has studied cars in Tanzania from the colonial period through to the postcolonial period, examining the emergence of informal garages. Some repair garages and mechanic training programs are sanctioned by the state; many more aren't sanctioned at all but serve as important centers of technological training for young African men. Anyone who's traveled around rural Africa knows how important these skills are to sheer survival, let alone to mobility—a theme also addressed by the likes of Kurt Beck and Jan-Bart Gewald, as well as a forthcoming book by Jennifer Hart on automobility in Ghana. These

historians look at how young men develop creative skills and technical knowledge precisely under conditions of scarcity.

This is important work; by focusing on the ability to make things with the materials at hand, it demonstrates a cognitive equivalence in intelligence and sophistication. But as these scholars also show, it's important not to be seduced by the romance of creativity. We mustn't overlook conditions of scarcity. Those conditions matter. Inequality matters, to these mechanics and to many others. It's not that they *prefer* this state of affairs. It's that they're making do with what they have at hand. That's a delicate interpretive balance, which both Africanists and STS scholars have to walk when they're traveling down this path in conversation with each other.

Serlin: *What you're describing seems to resonate with a lot of current scholarship in American and European STS on "maker culture," focused on forms of artisanal or improvised approaches to technology, including hacking into or subverting existing infrastructures. Most of the time, however, these kinds of interventions are not done under the same conditions of scarcity seen in parts of Africa. They're rarely about making do with detritus.*

Hecht: There is so much that can be learned from examining these conditions of scarcity. The so-called Uber-ization of the economy—the phrase *du jour* that now describes the rise of microscale entrepreneurship—actually obscures these conditions. Many of the people involved in such activities are out of work. There are many different reasons why people drive cars for Uber, of course, but some of them mirror the so-called informal economic activities that are a much bigger part of life on the African continent than they are in a place like the United States. Yet if we accept the argument made by Jean Comaroff and John L. Comaroff in their *Theory from the South*, making-do entrepreneurship is where the global future lies. So rather than seeing Africa as a place of stagnant (or romantic) tradition, STS scholars should be looking to African cases as sentinels of a collective future.

Breckenridge: I agree that the key problems that many Africans face of surviving in a world of very limited and collapsing public infrastructures, and of the need to be thrifty and resourceful, are increasingly global problems. But I also think that the problems of dependency and exclusion—and corruption—shape much of what happens with technologies, especially infrastructurally. There are also new forms of large technical systems, some of them potentially beneficial, which act far beyond the reach of ordinary people. A lot of the research on these new infrastructures is being done by anthropologists, such as Richard Rottenburg, who have been studying new forms of order that are developing on the continent, many of them routinely privatized. There are French and Indian companies involved in developing these systems in Africa, which makes them global, or transnational, fields of inquiry rather than exclusively national ones. But they seem to be premised quite strongly on the

Figure 2. A man descends into a hand-dug "artisanal" mining pit in Siguiri, Guinea, 1953. In colonial French West Africa, African subjects mined over 90% of the federation's gold exports using locally forged handpicks. Today, gold corporations listed on the stock exchanges of South Africa, Australia, and Canada hold exclusive exploration permits for the region of Siguiri, rendering mining by rural households illegal. Photograph by Savonnet, reprinted courtesy of the Institut Fondamental d'Afrique Noire, Senegal.

Figure 3. Women "artisanal" miners process gold in the village of Tinkoto in Senegal. For generations, regional residents have mined Tinkoto as a complement to rain-fed agriculture. Since the late 1990s, the exploration permit of a South African company encompasses the village, rendering mining by Tinkoto's residents illegal. Villagers negotiate with the state and the company to continue mining within the permit. Photograph courtesy of Robyn d'Avignon.

fact that the systems will be built on the African continent without the constraints of property rights, privacy, or identity to which most people in other places—even in Asia—have customarily had access.

Hecht: Yes, but it is also worth mentioning the long tradition of work in STS that examines how systems are shaped by the concept of "tacit knowledge." Examinations of formal and informal economic practices have been a theme of African studies for three or four decades now. But we haven't (yet) seen African STS thoroughly explore the concept of tacit knowledge as part of its critical vocabulary. We're now starting to see these two in real conversation—in the work of scholars such as Mavhunga, for instance, who has shown how people invest material things with power and how material things and technologies sometimes produce unexpected politics. These two dynamics—the strategic and the unexpected—need to be in conversation with each other in order for us to understand how people move through the world. They offer Africanists a new set of tools with which to understand the questions that they have been struggling with all along.

Of course, one could argue that there's nothing particularly African about the ways that people make do with discards and live among ruins; it's just that Africa's interactions with the world have made it particularly prone to being poisoned. Nevertheless, we're all living among ruins, as scholars of the Anthropocene are showing with increasing ferocity. We must all grapple with what it means to be living in a world where the power of poison is invisible, acts across generations, and persists in a variety of structural ways. History matters for understanding this, but so does work on the contemporary moment: we need to find relatively short-term ways of dealing with the politics of toxicity as well. That's the future of our planet. Whether it ends up also being a future of the intersection between STS and African studies remains to be seen.

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References

Adas, Michael. 1989. *Machines as the Measure of Men: Science, Technology, and Ideologies of Western Dominance*. Ithaca, NY: Cornell University Press.

Austen, Ralph A., and Daniel R. Headrick. 1983. "The Role of Technology in the African Past." *African Studies Review* 26, nos. 3–4: 163–84.

Beck, Kurt. 2009. "The Art of Truck Modding on the Nile (Sudan): An Attempt to Trace Creativity." In *The Speed of Change: Motor Vehicles and People in Africa, 1890–2000*, edited by Jan-Bart Gewald, Sabine Luning, and Klaas van Walraven, 151–74. Leiden: Brill.

Breckenridge, Keith. 1995. "'Money with Dignity': Migrants, Minelords, and the Cultural Politics of the South African Gold Standard Crisis, 1920–33." *Journal of African History* 36, no. 2: 271–304.

———. 1998a. "The Allure of Violence: Men, Race, and Masculinity on the South African Goldmines, 1900–1950." *Journal of Southern African Studies* 24, no. 4: 669–93.

———. 1998b. "'We Must Speak for Ourselves': The Rise and Fall of a Public Sphere on the South African Gold Mines, 1920 to 1931." *Comparative Studies in Society and History* 40, no. 1: 71–108.

———. 2014. *Biometric State: The Global Politics of Identification and Surveillance in South Africa, 1850 to the Present*. New York: Cambridge University Press.

Bruland, Kristin, and David C Mowery. 2014. "Technology and the Spread of Global Capitalism." In *Cambridge History of Capitalism*, vol. 2, edited by Larry Neal and Jeffrey G. Williamson, 82–126. New York: Cambridge University Press.

Chirikure, Shadreck. 2015. *Metals in Society: Indigenous African Metallurgy in a Global Perspective*. New York: Springer.

Comaroff, Jean, and John L. Comaroff. 2011. *Theory from the South; or, How Euro-America Is Evolving toward Africa*. St. Paul, MN: Paradigm.

D'Avignon, Robyn. 2016. "Making 'Artisanal' Miners: Nature, Knowledge, and Subterranean History in Senegal." PhD diss., University of Michigan.

de Luna, Kathryn M. 2012. "Hunting Reputations: Talent, Individuals, and Community in Precolonial South Central Africa." *Journal of African History* 53, no. 3: 279–99.

Ferguson, James. 2006. *Global Shadows: Africa in the Neoliberal World Order*. Durham, NC: Duke University Press.

Goody, Jack. 1980 [1971]. *Technology, Tradition, and the State in Africa*. New York: Cambridge University Press.

Grace, Joshua. 2013. "Modernization *Bubu*: Cars, Roads, and the Politics of Development in Tanzania, 1870s to 1980s." PhD diss., Michigan State University.

Guy, Jeff, and Motlatsi Thabane. 1988. "Technology, Ethnicity, and Ideology: Basotho Miners and Shaft-Sinking on the South African Gold Mines." *Journal of Southern African Studies* 14, no. 2: 257–78.

Hart, Jennifer. Forthcoming. *Ghana on the Go: African Mobility in the Age of Motor Transportation*. Bloomington: Indiana University Press.

Headrick, Daniel R. 1981. *The Tools of Empire: Technology and European Imperialism in the Nineteenth Century*. New York: Oxford University Press.

Hecht, Gabrielle. 1998. *The Radiance of France: Nuclear Power and National Identity after World War II*. Cambridge, MA: MIT Press.

———. 2012. *Being Nuclear: Africans and the Global Uranium Trade*. Cambridge, MA: MIT Press.

Herbert, Eugenia W. 1983. *Iron, Gender, and Power: Rituals of Transformation in African Societies*. Bloomington: Indiana University Press.

Hughes, Thomas P. 2000. *Rescuing Prometheus: Four Monumental Projects That Changed the World*. New York: Vintage.

Hughes, Thomas P., and Renate Mayntz, eds. 1988. *The Development of Large Technical Systems*. Frankfurt am Main: Campus Verlag.

Isaacman, Allen F., and Barbara S. Isaacman. 2013. *Dams, Displacement, and the Delusion of Development: Cahora Bassa and Its Legacies in Mozambique, 1965–2007*. Athens: Ohio University Press.

Kriger, Colleen. 1999. *Pride of Men: Ironworking in Nineteenth Century West Central Africa*. Portsmouth, NH: Heinemann.

Layton, Edwin T. 1971. *The Revolt of the Engineers: Social Responsibility and the American Engineering Profession*. Cleveland: Case Western Reserve University Press.

Macola, Giacomo. 2016. *The Gun in Central Africa: A History of Technology and Politics*. Athens: Ohio University Press.

Mavhunga, Clapperton Chakanetsa. 2014. *Transient Workspaces: Technologies of Everyday Innovation in Zimbabwe*. Cambridge, MA: MIT Press.

Miescher, Stephan. 2012. "Building the City of the Future: Visions and Experiences of Modernity in Ghana's Akosombo Township." *Journal of African History* 53, no. 3: 367–90.

Miescher, Stephan, and Dzodzi Tsikata. 2009–10. "Hydro-Power and the Promise of Modernity and Development in Ghana: Comparing the Akosombo and Bui Dam Projects." *Ghana Studies* 12–13: 15–53.

Moodie, T. Dunbar, and Vivienne Ndatshe. 1994. *Going for Gold: Men, Mines, and Migration*. Berkeley: University of California Press.

Neal, Larry, and Jeffrey G. Williamson, eds. 2014. *The Cambridge History of Capitalism*. 2 vols. Cambridge: Cambridge University Press.

Noble, David F. 1977. *America by Design: Science, Technology, and the Rise of Corporate Capitalism*. New York: Oxford University Press.

Osborn, Emily. 2009. "Casting Aluminum Cooking Pots: Labour, Migration, and Artisan Production in West Africa's Informal Sector, 1945–2005." *African Identities* 7, no. 3: 373–86.

Rodney, Walter. 1972. *How Europe Underdeveloped Africa*. Washington, DC: Howard University Press.

Rottenburg, Richard. 2009. "Social and Public Experiments and New Figurations of Science and Politics in Postcolonial Africa." *Postcolonial Studies* 12, no. 4: 423–40.

Schnitzler, Antina von. 2008. "Citizenship Pre-paid: Water, Calculability, and Techno-Politics in South Africa." *Journal of Southern African Studies* 34, no. 4: 899–917.

Sparks, Stephen. 2012. "Apartheid Modern: SASOL and the Making of a South African Company Town, 1950–2009." PhD diss., University of Michigan.

Storey, William Kelleher. 2008. *Guns, Race, and Power in Colonial South Africa*. New York: Cambridge University Press.

Thornton, John. 1998. *Africa and Africans in the Making of the Atlantic World, 1400–1800*, 2nd ed. New York: Cambridge University Press.

Tischler, Julia. 2013. *Light and Power for a Multiracial Nation: The Kariba Dam Scheme in the Central African Federation*. New York: Palgrave Macmillan.

Twagira, Laura Ann. 2014. "Robot Farmers and Cosmopolitan Workers: Technological Masculinity and Agricultural Development in the French Soudan (Mali), 1945-68." *Gender and History* 26, no. 3: 459–77.

Vansina, Jan. 1990. *Paths in the Rainforest: Toward a History of Political Tradition in Equatorial Africa*. Madison: University of Wisconsin Press.

White, Luise. 2000. *Speaking with Vampires: Rumor and History in Colonial Africa*. Berkeley: University of California Press.

Winther, Tanja. 2008. *The Impact of Electricity: Development, Desires, and Dilemmas*. New York: Berghahn Books.