

**Interstitial Intelligence:
Human-Rodent Sensing, Cognition, and Work in Morogoro, Tanzania**

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ABSTRACT

This dissertation is a historically informed ethnography of various human-rodent encounters in zoological research, animal training, and pest management schemes in Morogoro, Tanzania. I focus on the mobile and multiple forms of translocal knowledge production, particularly within the context of science and technology in Tanzania, and consider their entanglements with colonial legacies, global inequities, and uncertainty about the future. I investigate how rodent trappers, trainers, and researchers enact an interstitial intelligence through thinking with and athwart rodents. Drawing on both archival and ethnographic research, I argue that human-rodent encounters in Tanzania are nodes for generating critique, theorization, and speculation about thinking as the practice relates to questions of science, technology, and innovation in the global South.

In Part I, I present a history of the development of rodent science in Tanzania that began during the British colonial government of Tanganyika. I show that rodent outbreaks compelled the colonial government to launch several scientific investigations into rodent ecology. These logics persisted into the postcolonial period, during which several European-Tanzanian partnerships were established to study rodents as pests and disease carriers. I combine archival research and oral history interviews to track how these partnerships were crucial to the establishment of the Pest Management Centre at the Sokoine University of Agriculture, led by Tanzanian rodent scientists.

In Part II, I draw on ethnographic fieldwork, including participant observation and interviews, to analyze emergent forms of interspecies and interstitial thinking practiced by those who research, train, and trap rodents. I pay attention to the construction of and code-switching between Linnaean, Kiswahili, and Kiluguru rodent taxonomic systems. I provide a semiotic account of interspecies sensory co-laboring, essential to the social practice of animal training that transforms giant pouched rats into technologies for landmine detection. I then suggest that rodent trainers propose a working theory of rodent minds that contrasts with an important, Tanzanian type of intelligence called “hekima.” The final chapters situate these human-rodent encounters within larger social and political issues in Tanzania. I position rodent traps as innovative designs and examine practices of looking for buried treasure as part of thinking about resource nationalism in Tanzania.

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IKISIRI

Tasnifu hii inachunguza mahusiano kati ya binadamu na panya kwenye miradi ya utafiti wa kizoolojia, mafunzo ya wanyama, na udhibiti wa baa la panya iliyopo Morogoro, Tanzania. Lengo kuu la tasnifu hii ni kujua mchakato wa uzalishaji elimu, hasa kwenye mada za sayansi na teknolojia nchini Tanzania, ikiwemo historia ya ukoloni, ukosefu wa usawa duniani, na kiwaa cha muda ujao. Utafiti huu ulitumia mbinu tatu za ukusanyaji data ambazo ni uchunguzi shirikishi, usaili, na utafiti wa nyaraka. Ninachunguza jinsi watafiti, wanategaji panya, na wanafundishaji panya wanavyotoa nadharia na uchambuzi ikilinganishwa na vitendo vya sayansi, teknolojia, na uvumbuzi miongoni ya nchi za kusini mwa dunia.

Tasnifu hii ina sehemu mbili. Katika sehemu ya kwanza, ninawasilisha historia ya maendeleo ya utafiti wa panya nchini Tanzania kuanzia kipindi cha ukoloni wa Uingereza. Ninaonyesha jinsi mlipuko wa baa la panya ulivyoilazimu serikali ya kikoloni ya Uingereza kuanzisha uchunguzi wa kisayansi katika ikolojia ya panya. Itikadi hii ya ukoloni iliendelea hata baada ya kipindi cha ukoloni, ambapo miradi mabalimbali ya ushirikiano baina ya Ulaya na Tanzania ilianzishwa kuendeleza uchunguzi wa panya kama wasambazaji magonjwa na wadudu. Ninaunganisha utafiti wa nyaraka binafsi na mahojiano ya mdomo ya historia kufuatilia jinsi ushirikiano huu ulivyokuwa muhimu katika kuchangia uanzishaji wa Kituo cha Kudhibiti Viumbe Hai Waharibifu katika Chuo Kikuu cha Sokoine cha Kilimo, kinachoongozwa na Wanasayansi Watanzania.

Katika sehemu ya pili, ninachunguza vitendo vya kuwaza na kutengeneza nadharia vinavyotendwa na wanaotafiti, kufundisha, na kutega panya. Wanatumia mifumo ya Linnaean, Kiswahili na Kiluguru kutofautisha aina mbalimbali za panya kufuata vigezo vya jamii fulani. Wanapofundisha panya kunusa mabomu chini ya ardhi, wafundishaji wa panya wanabadilishana taarifa na panya kwa msingi wa jinsi panya wanavyofukua ardhi na mienendo mingine. Ninapendekeza kwamba wafundishaji wa panya wanatengeneza nadharia kuelezea akili ya panya ambayo ni tofauti na “hekima.” Sura za mwisho za tasnifu hii zinajadili mitego ya panya kama ubunifu na ugunduzi. Hatimaye, ninatoa nafasi ya kufikiria kitendo cha kutafuta hazina iliyofichwa kama kipengele cha majadiliano kitaifa kuhusu miliki ya rasilimali ya nchi.

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Natanguliza shukrani yangu kwa dhati. Asanteni sana.

INTRODUCTION

Mr. Rin, whose name was short for Samrin, and I were sat across from each other, eating our breakfast at one of those food stalls that occupied the interstitial space between pavement and road. Almost every other morning, our paths crossed at that food stall, he in his sand-colored uniform, and me, in a sweat-drenched t-shirt and shorts. One morning, we happened to share the same table, as was usual for such a small stall catering to morning commuters rushing to work. Over our bowls of fragrant roast pork, soup, and rice, we introduced ourselves and chatted in English about our jobs. Mr. Rin is a tour guide at the Angkor Wat temple complex in Siem Reap, Cambodia. He proudly showed me his badge, which he explained was only given out to those who were successful in the national tourism exams. He spoke English and Thai, and was learning Mandarin on his smart phone now that Cambodia has become a major destination for busloads of Chinese tourists. His eyes brightened when he learned that I was there in Siem Reap to talk to people who clear landmines using rodents trained to detect the odors of explosives.

Cambodia was one of three countries, the others being Angola and Mozambique, where giant pouched rats (*Cricetomys ansorgei*), trained in Tanzania to detect landmines, are deployed to work in humanitarian mine clearance efforts. They were part of the Rodent Biosensor Project (RBP), an international non-governmental organization founded in Belgium whose Tanzanian headquarters train rodents to become sensing technologies for landmine clearance, tuberculosis diagnosis, and other detection projects.¹

Mr. Rin had heard of these mine detection rats. He had worked as a manual deminer with the Mine Advisory Group (MAG), a mine clearance and anti-landmine campaign, famously known

¹ Rodent Biosensor Project (RBP) is a pseudonym of the actual organization. I do this distinguish the experiences of those working with rats from the organization, whose media presence obscures the daily labor of training.

for working with Lady Diana, Princess of Wales to advocate for an international ban on anti-personnel explosives in 1997. As he described it, his work required him to scan the ground with a metal detector for traces of unexploded ordnances (UXO) and other explosive remnants of war (ERW), which, when found, would later be removed by a clearance team. It was dangerous work that placed Mr. Rin in direct harm's way. But because of people like him, non-governmental organizations working with the national Cambodia Mine Action Centre (CMAC) have collectively removed more than two and a half million mines and other unexploded ordnances since 1992.

Mr. Rin's life had been significantly shaped by the many wars that have plagued Cambodia. His family fled the violence of the Khmer Rouge regime and for many years Mr. Rin grew up in a refugee camp in Thailand. This was where he learned to speak Thai, now a useful skill for bringing tourists from Bangkok to visit Angkor Wat. In the years leading to and after the fall of the Khmer Rouge, Cambodia served as a battleground for many of the proxy wars in Southeast Asia that raged between the world's most powerful nations, including Russia (USSR), the United States, China, and later, Vietnam. Between 1965 and 1973, the United States alone dropped 2.75 million tons of explosives in Cambodia. To bring this into perspective, this number was more than the 2 million tons of bombs, including those that struck Hiroshima and Nagasaki, that were—in total—dropped by Allied Forces during World War II. Many more tons of explosives were also stored and buried in Cambodia during the Cambodian-Vietnamese war that followed the Khmer Rouge, which lasted until an internationally brokered peace treaty came into effect in 1991.²

Mr. Rin was curious and wanted to see the rats in action so I took him to the RBP visitor center, where for a donation, a rodent trainer would perform a demonstration and describe the work that the organization does. Mr. Rin was surprised to learn that the rats were first trained in

² Owen and Kiernan, "Bombs over Cambodia."

Tanzania, an East African country about 5,000 miles away. I explained that my anthropological fieldwork was based in Tanzania, and that I was visiting Cambodia briefly to see the rats detect actual landmines. In Tanzania, one of the most stable and peaceful countries in the world, the rats are trained in fields where deactivated landmines are buried and have very little danger of exploding.³ I introduced Mr. Rin to Shadrack, one of the Tanzanian rodent trainers who has been living in Siem Reap to oversee the rodent training and demining work. Speaking in Khmer, Mr. Rin expressed his gratitude to Shadrack for his good work and invited us to his porch on the coming Sunday afternoon for drinks.

That weekend, over crates of beer and packets of peanuts, Mr. Rin and his friends recounted their experiences clearing landmines, which Shadrack translated into Kiswahili so that I could be a part of their budding, bubbly camaraderie. That conversation—in which stories of imperial wreckage are told by a former deminer in Khmer to a Tanzanian rat trainer, who in turn translated them into Kiswahili so that I, a Malaysian interlocutor, could participate—is emblematic of the kinds of interactions at the heart of this dissertation. In the following, I explore and discuss the mobile, roving, and unsettled practices of translocal knowledge production and practices around technology, science, human-animal relations, and the future that emerge through human-rodent encounters in Tanzania, including those of research, trapping, and training practices.

Like a majority of his fellow rodent trainers back in Tanzania, Shadrack had started looking for work after completing his primary education. He recalled how he used to walk about five kilometers to school on a road that would be filled with mud during the Masika rains. His first job after completing primary education was as a casual laborer [kibarua], slashing grass around the university campus. The pay was just under US\$30 per month, and there were times when work

³ During the post-independence era, Tanzania experienced war within its territory only once. It was the Kagera War of 1978-9, in which Tanzania declared war against Idi Amin's forces in Uganda.

was not available. One day, Shadrack and his friends, who all grew up in the same village near the Uluguru mountains, were hired to cut grass in a field. While working in the early mornings to escape the heat of the sun, they saw people and rats ambling sideways along squares marked in the ground. “It was such an odd sight!” Shadrack recalled. He soon asked one of the trainers, a Belgian man who spoke Kiswahili and who would become the organization’s CEO, about what they were up to. After learning about the landmine detecting rats, Shadrack was curious and wanted to learn more. “How can rats detect bombs? How did they come to this?” he asked himself. He continued observing the rats and their human trainers all the while making sure the fields were not overgrown with grass. Several months later in 2001, when the organization received funding from Europe to start officially operating, Shadrack and his friends were thrilled to form the first cohort of rodent trainers.

The Rodent Biosensor Project, based in Morogoro, Tanzania, was first launched by a group of Belgian product designers in Antwerp in 1997. At its core, the founding mission of the project was to develop a safer, faster way to clear landmines. The Project argues that using trained rats to sniff out the location of landmines was much faster and cheaper than using metal detectors or mine detecting dogs. This was because the rats’ olfactory capacities can solely target the odors of explosives in contrast to the metal detectors that signal the presence of nails, bottle caps, and other metallic objects in addition to landmines, requiring the manual deminer to carefully check every piece of buried metal. Unlike dogs, too, rats were easier to care for and did not require the same kind of close relations that dogs and their trainers do. The Rodent Biosensor Project hoped to eliminate some of the risks and costs of the kind of operations that people like Mr. Rin worked for.

At first, attempts at training lab rats to detect landmines failed, leading the designers to look for another species of rodent. A zoologist at the University of Antwerp recommended to the

Project a species of rodents indigenous to East Africa, the giant pouched rat, or *panya buku* in Kiswahili. The animal was ideal for its temperament, its longer life span of seven to nine years, and its size, which had it larger than most rats and was thus easily observable in the field. Subsequently, the entire project relocated to Tanzania, where these rats roamed. The zoologist, Ron Verhagen, knew about these animals because he had been working in Tanzania, as part of a Belgian-Tanzanian rodent research project, established in 1984 in the town of Morogoro. That research project had later developed into a Pest Management Center becoming, in the twenty-first century, a globally-recognized research institution for rodent-borne diseases, pest ecology, and taxonomy, led by Tanzanian scientists.

Morogoro had also been home to a Danish-Tanzanian program for rodent control in the early 1980s, which was set up to respond to Tanzania's call for assistance from the Food and Agricultural Organization of the United Nations (FAO) when it faced the threat of food insecurity. The agricultural college of the University of Dar es Salaam was also located in Morogoro, becoming an independent institution and was renamed the Sokoine University of Agriculture (SUA) in 1984, coinciding with the establishment of what is today known as the SUA Pest Management Center (SPMC). In the first half of the twentieth century, when Tanganyika, as it was then known, was under British colonial administration, Morogoro had been the site of the colonial government's Department of Agriculture. As this history makes clear, Morogoro has long operated as Tanzania's agricultural capital, a place within which rodents, rats and mice alike, have played a crucial role. Rodents in Morogoro, this dissertation argues, are not only crucial actors in Tanzania's postcolonial history but also emblemize—can be read as indicators of—the unequal exchanges and relationships between postcolonial Africa and the rest of the world.

These entangled histories of imperialism, postcolonial development, processes of knowledge making, and technological innovation, as well as their global reverberations within the demands of decolonization and racial equity, form the backdrop of the human-rodent encounters in Tanzania that I investigate in this dissertation. I ethnographically examine various technoscientific projects in Morogoro through which humans and rodents encounter each other in schemes of trapping, research, and training. I observe that researchers, trappers, and trainers make comparisons between human and rodent thinking that work as critical reflections on the political economy of knowledge production in Tanzania, amid and against legacies of colonialism and neoliberal economic policies. These epistemological speculations about thinking by those who work with rodents, I show, offer self-reflection, critique, and theories of what it means to be human and African in the 21st century.

These technoscientific projects, which include pest research, research on rodent-borne diseases, and the training of rats to do detection work, are situated within global and unequal networks of exchange, mobility, and circulation. Belgian zoologists who carried out fieldwork in Tanzania trained local scientists who in turn traveled to Europe to study and return to lead the Pest Management Center. Tanzanian rodent trainers, some of whom migrate from rural areas to the city, learn from American and European researchers to apply behavioral and cognitive psychology to their work. Many Tanzanian rodent trainers—and rats—have traveled to Mozambique, Angola, and Cambodia to work with demining teams in those places to detect and clear explosive remnants of war. Tanzanian scientists and rodent trainers have also to comprehend and navigate the complex networks of funding from international donors and the national government, while cultivating their own businesses, growing maize or raising chickens – all crucial to their ability to make a living. Given the skills and knowledge necessary for many Tanzanians to succeed in life, it is perhaps

fascinating and fitting to note that the slang word used to describe someone who is Tanzanian, especially those who can deftly navigate the rigors and rhythms of urban life, is *bongo*, that is, a brain.

In this dissertation, I argue that human-rodent encounters in Tanzania are nodes for generating critique, theorization, and speculation about thinking as the practice relates to questions about science, technology, and innovation in the global South. These questions point to matters of knowledge production as they are deeply entangled with global inequality and uncertainty about the future. The experience of working with rodents, whether to trap, identify, understand, or train them are moments of craft and contemplation. Each chapter in this thesis explores a particular type of thinking – that is, practices of reflection and speculation that are enacted along with, and sometimes athwart, the figure of the rodent. Part I, which provides the historical background for the dissertation, describes how rodent outbreaks and bubonic plague in the 1930s inaugurated the need for colonial and postcolonial governments to elaborate rodents as objects of knowledge so that they could be categorized, understood, and, within schemes for pest control and plague prevention, eradicated. In other words, rodents are “domesticated,” to borrow a term from actor-network theory, into scientific knowledge so that scientists and government officials could regulate the threat posed by rodents to upend and challenge human projects.⁴ My subsequent focus on rodents as key objects of scientific knowledge during the transition from colonial to postcolonial regimes in Tanzania also further contests the human-centric frameworks of social science analysis that have hitherto dominated the study of “capitalism, the idea of the nation, or modern science” in Africa.⁵ In following the lives of rats, mice, and other rodents as historical and social actors, I

⁴ Callon, “Some Elements of a Sociology of Translation.” See also Latour, *Reassembling the Social*.

⁵ Mitchell, *Rule of Experts*, 29.

also inherit a long tradition within East African societies, including orature (oral literature), of thinking with nonhuman animals to make sense of people's relationships with the natural world.

In Part II, I focus ethnographically on trappers and trainers who work with rodents as part of these technoscientific projects to transform giant pouched rats into sensing technology for landmine detection. Based on data collected from participant observation, I examine how rodent trainers conceptualize sensing as interspecies practices of *sensory co-laboring* during mine detection work. I also investigate how traps become deliberative machines for reflection and critique about innovation and ecology that are then worked and warped by trap makers into the material qualities of their designs. The quotidian and quixotic work of trapping and training rodents also inspire a group of rodent trainers to apply their sensuous knowledge to look for treasures buried underground, speculating on the better futures that finding these treasures might promise. Finally, I examine instances in which rodent trainers, drawing from their experiences and from concepts in psychology, discuss and debate a working theory of rodent mind.

This dissertation centers East African epistemologies and experiences by knotting together the processes and practices of human-rodent encounters that enable Tanzanians to propose theories of thinking. These speculations bear significantly on urgent questions within the humanities and social sciences about the place, privilege, and power of being human. If, as some critics argue, recent turns to animal studies, multispecies ethnography, and posthumanism risks moving too quickly beyond the very human experiences of racism and colonialism (which have often seen people excluded from the domain of the "human" in the first place), this dissertation, drawing on Tanzanian speculations emerging from human-rodent encounters, insists that the category "human" remains woefully unsettled, in need of further elaboration and contestation. I examine, by means of participant observation and archival research of human-rodent encounters in

Tanzania, the particular and powerful ways that “being human” is reworked and rethought by rodent scientists, trappers, and trainers as they contend with unequal political economies of scientific knowledge, struggle to earn a living, and imagine new futures for themselves and their communities. This dissertation, in short, proposes a “decolonization of the mind,”⁶ in the words of Kenyan author Ngũgĩ wa Thiong'o, by analyzing critical epistemological practices that emerge from human-rodent encounters in Morogoro, Tanzania.

Thinking

For the title of his 1976 book reviewing the racial and racist foundations of American psychology, the Black American psychologist Robert V. Guthrie settled on “Even the rat was white.”⁷ In calling attention to the whiteness of the lab rat in psychology research, Guthrie underscored that the founding tenets of psychology research in the United States was predicated on the need to prove and explain Black racial inferiority in comparison to white Americans. It was an institutional undertaking that at once made Black Americans, Native Americans, and other people of color the object of scientific inquiry, while also excluding them from the very processes of producing scientific knowledge.

⁶ Ngũgĩ wa Thiong'o, *Decolonising the Mind*.

⁷ Guthrie, *Even the Rat Was White*. I thank Cynthia Fast for alerting me to this book.

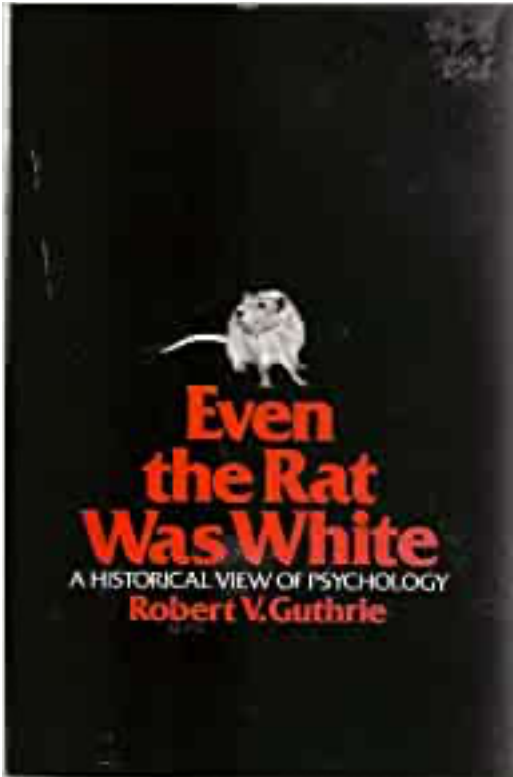


Figure 1. Cover of *Even the Rat Was White* (1976) by Robert V. Guthrie.

Guthrie points out that the history of psychology was anchored in social anthropological questions about the “primitive,” and later, African mind. Research carried out by white European and American psychiatrists were often motivated by a desire to find racial differences that would further justify either slavery or colonialism, usually as part of a larger civilizing project. These studies informed colonial governance and education policy, such as in the case of John C. Carothers, a senior medical officer and psychiatrist working for the British colonial government in Kenya. His reports on the “African mind” were instrumental in shaping colonial development policies at the United Nations and in helping the British understand the psychology of the anti-colonial Mau Mau rebellion.⁸ Like their white, male counterparts in the United States, French and British psychiatrists debated over the best ways to measure and describe the mental capacities of

⁸ Carothers, *The African Mind in Health and Disease*; McCulloch, *Colonial Psychiatry and “the African Mind,”* see Chapter 4 and 5.

Black and Asian people, often explaining intelligence and behavior in genetic, morphological terms, based on the shapes of skulls or the ability to take peculiar and inaccurate tests of intelligence. As many anti-colonial writers such as Aimé Césaire, Frantz Fanon, Boaventura de Sousa Santos, and Sabelo J. Ndlovu-Gatsheni have insisted, colonialism has always been accompanied by an invasion of the mind. This has usually involved an “epistemicide,” that is, the forced erasure of local languages, knowledges, and ideas.⁹ Psychiatry, as Fanon noted in 1961, was concerned with “curing” the colonized subject, to make him “thoroughly fit into a social environment of the colonial type.”¹⁰ Both Fanon and Carothers were writing about African mentality at a time when colonization came under severe challenge. Decolonization was thus a contestation of the mind as much as it was about political economy and sovereignty. Decolonial authors claimed then, and continue to do so now, that decolonization is about the access and capacity to produce knowledge, shape history, and imagine worlds.

In 1988, the anthropologist Philip K. Bock made two claims about the relationship between psychology and anthropology. For him, “all anthropology was psychological” and that “all psychology was anthropological.”¹¹ He argued that the two fields were mutually implicated within one another, not only by the cross-application of concepts from one field in another but also by the fact that it is impossible to separate worldviews, memories, beliefs, and intentions from the cultural practices through which they are expressed. Even Émile Durkheim, who is sometimes misread as claiming that culture exists outside of the mind, observed in 1912 that the social realm is really the

⁹ Fanon, *The Wretched of the Earth*; Karenga, “In Honor of Aimé Césaire: Thinking Clearly and Dangerously”; Santos, *Epistemologies of the South*; Ndlovu-Gatsheni, “The Cognitive Empire, Politics of Knowledge and African Intellectual Productions.”

¹⁰ Fanon, *The Wretched of the Earth*, 181-2.

¹¹ Bock, *Rethinking Psychological Anthropology*, Prelude and Postlude.

collective mentality of a society.¹² He was not alone or out-of-date. Fascination in anthropology with “mentality” would continue to frame debates about magic, religion, and science. And indeed, titular references to thinking are prominent in works by anthropologists such as Franz Boas’ *The Mind of Primitive Man* (1911), Claude Lévi-Strauss’ *Savage Mind*, or *Wild Thought* (1966), or Eduardo Kohn’s *How Forests Think* (2013).

Very few histories of psychology and anthropology acknowledge that their co-imbricated pursuit of thinking is steeped in an ideology of raciality. As “bedfellows,”¹³ the knowledge produced in these fields together reinforce anti-Black racism, and by implication, the superior intelligence of white, European men. These fields are invested in the definition and constitution of difference on two levels. On one level, psychology and anthropology served to constitute difference between white Europeans and Black Africans. In terms of mental ability, Africans and other societies in the tropics were rendered inferior to whites and “incapable of all the higher attainments of the human mind.”¹⁴ Consequently, the perception that African minds cannot rise up beyond sensuous and immediate experience became prevalent in the nineteenth century, entrenching the imaginary that African minds are unable to generate conceptual abstractions of thought. Lucien Lévy-Bruhl, in comparing primitive and Western ways of thinking, reproduced this very imaginary. In *How Natives Think* (1926), he claims that so-called primitive societies, to which Africans belonged, did not appreciate logical thinking and were thus more likely to practice mystical thinking. What he meant by mystical thinking is steeped more in ritual and bodily experience rather than in rational analysis.¹⁵

¹² “...there is a realm of nature in which the formula for idealism is almost literally applicable; that is the social realm. There, far more than anywhere else, the idea creates the reality.” See Durkheim, *The Elementary Forms of the Religious Life*, 229.

¹³ Guthrie, 30.

¹⁴ Hume, “Of National Characters,” 207. Quoted in Jackson, *Becoming Human*, 24.

¹⁵ Bock, *Rethinking Psychological Anthropology*.

On the second level, is an enduring interest in the human sciences to differentiate between the human and nonhuman, a preoccupation inherited by fields such as comparative cognition and animal studies today. Many histories of science and critical studies of race have interrogated the ways in which “the African” has been rendered subhuman or bestial, especially in Enlightenment thought.¹⁶ The bestialization or dehumanization of Black being was then mobilized to justify the violence of slavery and colonialism in Africa. Undercurrents of the discourse on animality as it conditions and constitutes Blackness persist into contemporary discussions about Africa. As Achille Mbembe observes, “Discourse on Africa is almost always deployed in the framework (or on the fringes) of a meta-text about the animal—to be exact, about the beast: its experience, its world, and its spectacle.”¹⁷

Amid the European obsession to measure and understand the mentality of the many sensual savages who were now their colonial subjects, scholars including missionaries and anthropologists began to encounter empirical evidence that gradually challenged the mental superiority of the white man. In the African context, one of the most famous of these works is E. E. Evans-Pritchard’s analysis of witchcraft as a substantial form of rationality. In *Witchcraft, Oracles and Magic among the Azande* (1937), Evans-Pritchard proposes to analyze witchcraft as “an ideational system...expressed in social behavior”¹⁸ that the Zande use to explain why unfortunate events happen at the time and place that they do. As Evans-Pritchard points out, witchcraft was not understood by the Zande in terms of the dichotomy between the natural and the supernatural, as a European would take it to be. Instead, witchcraft offers a theory of causation, a philosophy with “its own logic, its own rules of thought, [which] do not exclude natural causation. Belief in

¹⁶ Zakiyyah Iman Jackson discusses this point thoroughly, particularly in Chapter 2 of *Becoming Human*. See, also, Hegel, *Lectures on the Philosophy of World History*; Heidegger, *The Fundamental Concepts of Metaphysics*.

¹⁷ Mbembe, *On the Postcolony*, 1.

¹⁸ Evans-Pritchard, *Witchcraft, Oracles and Magic among the Azande*, 2.

witchcraft is quite consistent with human responsibility and a rational appreciation of nature.”¹⁹ Evans-Pritchard’s conclusion was astounding for its time because it introduced a radical type of relativity into how Europeans understood logic and rationality. In showing how Zande witchcraft operated with its own set of rules and was consistent with natural causes of disease, death, and accidents, Evans-Pritchard placed Zande thinking on par with European modes of thought.²⁰

Robin Horton, a social anthropologist, and later, a philosopher, followed in Evans-Pritchard’s steps to offer a comparative analysis of African and Western systems of thought. In his 1967 two-part essay, “African Traditional Thought and Western Science,” Horton argued that indigenous African religions were genuinely theoretical systems, whose purpose is to provide logical frameworks to explain, control, and predict events in the world and link them to a theory of causation that may contain natural, cultural, and mystical forces.²¹ Going further than Evans-Pritchard, Horton claims that these made African traditional thought analogical to modes of explanations found in so-called “Western” science. One key difference between the two theoretical systems for him was that African thought was a “closed” system, less capable of experimenting with alternative explanations of the world or of incorporating other worldviews. Western science, on the other hand, he considered more “open,” able to embrace new ideas and submit current ones to constant empirical testing and revision.

Horton’s analysis was subject to intense critique by several African philosophers, who showed both the empirical and theoretical shortcomings of Horton’s argument. Barry Hallen, for example, provided examples from Yoruba society where individuals subjected their traditional

¹⁹ Ibid., 30.

²⁰ It is still important to note that Evans-Pritchard’s field research was funded by the Leverhulme Foundation, and his access was facilitated by various colonial officers stationed in Anglo-Egyptian Sudan.

²¹ Horton, “African Traditional Thought and Western Science. Part I. From Tradition to Science”; Horton, “African Traditional Thought and Western Science. Part II. The ‘Closed’ and ‘Open’ Predicaments.” See also Stambach, “The Rationality Debate Revisited.”

beliefs to critical analysis.²² A major critique offered by others, such as Kwasi Wiredu, was to do with Horton's comparison of what were in fact vastly different domains of social life. To show that African religious thought was "closed" because it does not subject its own beliefs to critical analysis relative to "Western" science was problematic, and it created an unnecessary essentialism of science as only being "Western."²³ In contrast, Wiredu offered an understanding of African systems of thought as always contingent and intersubjective, not least because they had to come to terms with the history of colonialism. Through an analysis of Akan statements of fact, Wiredu's philosophy shows that truth in Akan society is established through a constant process of consensus and reconciliation, rather than on finding one-to-one relationships between language and reality.²⁴

To be clear, this dissertation is not about the philosophy of mind, much less about African philosophy. While there are many African philosophers who have contemplated the mind and practices of rationality, this dissertation focuses on non-elitist practices of thinking that emerge from the observations, lives, and work experiences of those who work with rodents in Morogoro. Nevertheless, questions raised by these complex and often contentious discussions, even among philosophers who are African, are concerned with defining and describing African philosophies and they help frame some of the key discussions in anthropology about thinking or the mind. Their reflections help us see that even as English anthropologists like Evans-Pritchard and Horton tried to challenge the bifurcation between African and Western systems of thought, their conception of African thinking is still haunted by the difference between sensuality and rationality, which continues to persist as an organizing dichotomy for subsequent anthropological work on thinking.

²² Hallen, "Robin Horton on Critical Philosophy and Traditional Thought."

²³ Wiredu, "How Not to Compare African Traditional Thought with Western Thought."

²⁴ See Hallen, "Contemporary Anglophone African Philosophy: A Survey" for a comprehensive discussion of this debate. See, also, Wiredu, "Knowledge, Truth and Fallibility"; Wiredu, *Cultural Universals and Particulars: An African Perspective*.

Indeed, postcolonial and feminist critiques of rational thinking would sometimes end up reproducing this dichotomy by attributing bodily experiences and embodied knowledge to a range of minorities, including women, queers, and Africans, leaving rational thinking within the purview of the colonial, European, and masculine. The subfield of sensory anthropology perhaps best represents this paradoxical inheritance. In striving to uncover and recuperate denigrated experiences of the world rooted in the somatic and the sensuous, proponents of this view in fact further entrench rationality as ethnocentrically European. Therefore, to be truly critical of anthropology's founding racialism, we would have to carefully interrogate contemporary anthropology's fixation and reliance on embodiment as a kind of subaltern, liberating perception of the world.

Sensing

The anthropologist David Howes begins *Sensual Relations*, a key text that brought the senses to bear on anthropology and social theory, with an account of the 1898 expedition sent by the Cambridge Anthropological Society to the Torres Strait to study the mental life of inhabitants there.²⁵ Onboard the ship were anthropologists and experimental psychologists, including A. C. Haddon, W. H. R. Rivers, and William McDougall. Along with notebooks to jot down field notes, the British researchers brought with them a host of brass instruments and equipment for measuring the sensory acuity of the Torres Strait Islanders. There were color tests, scents, whistles, musical instruments, reaction keys, taste sensitizers, and other apparatus meant to elicit and document sensory responses for analysis.²⁶

²⁵ Howes, *Sensual Relations*, Chapter 1.

²⁶ For examples of these instruments, see Kuklick, *The Savage Within*, 142; Guthrie, *Even the Rat Was White*, 39.

The resulting report reaffirmed the dichotomous view prevalent in Europe between body and mind, and savagery and civilization.²⁷ “If too much energy is expended on the sensory foundations,” as it was supposed of the Torres Strait Islanders, “it is natural that the intellectual superstructure should suffer,” wrote W. H. R. Rivers.²⁸ The claim that non-Europeans were less able to develop their mental capacities due to their sensuous natures was common throughout nineteenth-century Europe, as I noted above, but the expedition was its first attempt empirically to seek to “verify” it. By measuring the sensory capacities and body parts of those living in the Torres Strait, “anthropologists were constituting themselves as rational Europeans and their subjects as sensuous savages,” superimposing sensory difference onto a Darwinian hierarchy that privileges rational thought as an evolutionary achievement.²⁹ Those who were more given to sensuous relations with the world occupied a lower rung in that hierarchy, and therefore determined the very limits of the category of Man. Sensory inquiry, in effect, justified the goals of empire. Not only were lands, plants, and critters identified, collected, and mapped out, but so were the bodies of those who lived there. The anthropological and psychological study of the senses paved the way for the continued exploitation of land, body, and mind based on ethnological difference.

How people perceived the world was not the sole object of study for expeditions like this. As Robert Guthrie explained, the physical attributes of non-Europeans themselves became sensorially fascinating and important to the European project of demarcating essential differences between whites and other races.³⁰ Race during empire was very much a sensory quality that required a certain degree of discernment. This was certainly the case in the Dutch and Spanish

²⁷ Haddon, *Reports of the Cambridge Anthropological Expedition to the Torres Strait*.

²⁸ See Richards, “Getting a Result: The Expedition’s Psychological Research, 1898-1913,” 147. Cited in Howes, *Sensual Relations*, 5.

²⁹ Howes, *Sensual Relations*, 4.

³⁰ Guthrie, Chapter 1.

colonies, where the visual qualities of skin pigmentation became the subject of regulation and adjudication by colonial state policy and law.³¹ In the United States, this took the form of manuals for recording and discerning hair texture, lip sizes, skin pigmentation, cranial volume, and other anthropometric measures. Such sensorial discernment of race by white, colonial adjudicators became integral to schemes of discrimination, segregation, and exploitation, and in its pernicious U.S. American and South African forms, persisted as laws that mandated segregation and apartheid.³²

When read through the lens of racism, the sensuous savage comes to represent more than an evolutionarily primitive attunement to the physical world. It was certainly shorthand for the non-European's lack for abstract thought, which was considered a sign of higher order mental ability. Franz Boas challenged this view that had become so entrenched among anthropologists in Europe and the United States at the turn of the twentieth century. Years before the Cambridge Anthropological Expedition to the Torres Strait, Franz Boas traveled to Baffin Island, or Qikiqtaaluk, home to the Baffin Island Inuit, to conduct research for his doctoral thesis in physics at the University of Kiel on the nature of seawater color. There, he was frustrated by the limited physical methods available to him to determine the color of seawater, noting that the light absorption of different samples of water he collected seldom aligned with the experimenter's (i.e., his own) subjective judgement of color. Boas soon realized that situational factors affecting color perception, including the mental state of the subject, meant that the color of seawater was not only a quantitative problem but also a qualitative one. The conclusion that Boas reached, that seawater

³¹ See Stoler, *Carnal Knowledge and Imperial Power*.

³² It should be noted that the visual schemes for perceiving race were different in the United States and in South Africa, as noted by Helmreich in "Torquing Things Out". Both places nonetheless relied on systems of racial classification that included visual discernment. See Baker, *From Savage to Negro*; Bowker and Star, "The Case of Race Classification and Reclassification under Apartheid"; Posel, "Race as Common Sense."

was “encultured substance,”³³ prompted him to further study the relations “between the external and the internal, the physical and the psychic, the inorganic and the organic.”³⁴

By the time Boas wrote *The Mind of Primitive Man* (1911), he had come to understand cultural phenomena as the imposition of structures of meaning, historically conditioned and derived from the learning process, onto the flux of experiences that come with living in the world.³⁵ To this end, he offered a systematic psychological approach to lay out the basic mental organizations governing fundamental processes of experience and perception, including abstraction, inhibition, and choice. He showed that the difference between “primitive” and European modes of perception are not large enough to place them on different evolutionary stages of civilizational development. Different minds emerged not due to any significant physical or evolutionary differences but due to the “contexts” that influence the formation of thoughts and actions. “Primitive man,” whose “traditional context” teaches him that the heavens are animate, would undoubtedly “cower in superstitious fear” when he heard the sound of explosion.³⁶

The entire body of Franz Boas’ anthropological work sought to reclaim the human from the grasp of Darwinian evolutionary thought. By insisting that all humanity shared a common capacity for sensing and experiencing the world, Boas located difference in the social realm, showing instead that it was differences in history and culture that led to different ways of thinking. This insight would become important to Boas’ later anti-racist work which, as some have argued, significantly shaped how anthropologists come to critically understand the category of “race.”³⁷ Anthropological research about human difference, especially racial difference, after Boas would

³³ Helmreich, “Nature/Culture/Seawater,” footnote 4.

³⁴ Stocking, *Race, Culture, and Evolution*, 143.

³⁵ *Ibid.*, 159.

³⁶ *Ibid.*, 220-221.

³⁷ See Visweswaran, “Race and the Culture of Anthropology.”

thus be less invested in biological, genetic, or evolutionary difference. Rather, anthropologists would argue that difference, understood as culture, originated from interactions between a subject in a society and her unique environments.

The subjective experience of the world that so confounded Boas on his expedition to the Arctic continued to be crucial for anthropological debates about the relationship between mind and culture. With the advent of structuralism, anthropologists began to conceive the mind and culture as structuring frameworks that shape one's experience of the world. This is perhaps most evident in the work most popularly translated as *Savage Mind* (1962) by Claude Lévi-Strauss. I opt for the newest translation of this work, which renders *La pensée sauvage* as *Wild Thought* to better reflect the author's argument. Far from the implication suggested by its earlier translation, *Wild Thought* (2021) argues against the "intellectual poverty of savages," showing that the thought of "those whom we call 'primitive'" are as abstract, rich, and distinguishing as "modern science." "In both cases," Lévi-Strauss wrote, "the universe is at least as much an object of thought as a means of satisfying needs."³⁸

Lévi-Strauss was essentially challenging the claim that local classificatory schemes are closely associated with the immediateness of their functions. He highlights several examples where ethnologists described indigenous naming systems in terms of whether a plant is useful, or an animal dangerous, or a resource exploitable in a particular way. Organisms that were not important for satisfying needs were designated by general terms, such as weed or bird. Reviewing the classificatory systems by the Fang of Gabon, the Philippine Negritos, the Luchozi of Zambia, the Nuer in Sudan, and other groups, Lévi-Strauss found vast and rich vocabularies in these various languages for denoting plant species, body parts, reptiles, bats, and distinctions for levels of

³⁸ Lévi-Strauss, *Wild Thought*, 1-3.

moisture and viscosity. Such elaborate systems of knowledge have no clear practical use because their primary object is intellectual rather than merely satisfying needs. Or as Lévi-Strauss explained in *Totemism*, animals are chosen “not because they are ‘good to eat’ but because they are ‘good to think’.”³⁹

Indeed, these systems of knowledge show a certain commitment to what Lorraine Daston called “ground-zero empiricism” in their attention to sensory details and qualities that have yet to coalesce into what Lévi-Strauss would consider scientific knowledge.⁴⁰ This ground-zero empiricism was, for Lévi-Strauss, the most arduous part of knowledge production. Being attuned to sensory qualities required painstaking work. There would have been centuries of active and methodical observation, repeated experimentation, and the creation and revision of classificatory schemes. The rearrangement of sensory qualities at different levels of perception (aesthetic, morphological, meteorological) would then form the very basis for constructing more abstract concepts. In other words, wild thought anticipated science and was the foundation on which the scientific enterprise rests. Lévi-Strauss was careful, however, to insist that he was not writing in historical terms. Wild thought is “not a beginning, a start, a sketch, part of an as yet unrealized whole.” On its own, wild thought “forms a well-articulated system, independent ... from that other system which will be constituted by science.” The argumentative crux of *Wild Thought* then is not to oppose magic and science but “to view them as parallel, as two modes of knowledge, unequal insofar as their theoretical and practical results are concerned..., but not in the kind of mental operations on which the two draw.”⁴¹

³⁹ Lévi-Strauss, *Totemism*, 89.

⁴⁰ Daston, “Ground-Zero Empiricism.”

⁴¹ *Ibid.*, 16.

This last insight is key to understanding Lévi-Strauss' own classification of different modes of thinking. To be clear, wild thought "is not the thought of savages nor of a primitive or archaic humanity, but thought in the wild state, as opposed to thought that has been cultivated or domesticated with a view to yielding a return."⁴² Wild and domesticated thought coexist and interpenetrate, and in some areas, one kind of thought flourishes more than the other. For Lévi-Strauss, the conceptual and technical apparatus that make modern science possible is more removed from the qualitative bases of thinking that is concerned first and foremost with the immediate experience of the world. Although he never explicitly concedes this fact, civilization, rather than representing progress for Lévi-Strauss, seems to get in the way of wild thought.

To bring this back to the discussion of the senses and their relation to thinking, it is important to note that both Franz Boas and Claude Lévi-Strauss turn to the sensory domain to resolve questions about thinking. For Boas, thinking is a universal condition of the relationship between a subject and her world, which is constantly being structured by ideas and beliefs that she has learned through tradition and from society. For Lévi-Strauss, thinking is an effect of how experience and perception of the world is organized. Systems of knowledge, such as magic and local taxonomies, that are more attuned to the sensory qualities of the world are considered "wild thought" whereas those, like modern science, that are more abstract and removed from sensory qualities, are "domesticated thought." In both Boas and Lévi-Strauss' theories of thinking, the sensory domain crucially mediates between subject and world. For Boas, the senses link the perceiving person with her world. For Lévi-Strauss, the person inhabits a world bursting with sensory qualities that may be intelligibly organized. The senses therefore emerge as important sites for thinking and creating systems of knowledge.

⁴² Ibid., 247.

To understand the relationship between sensing and thinking this way is not dissimilar from Tanzanian notions of sensing. In Kiswahili, the senses are collectively known as *milango ya ufahamu*. The phrase, translated literally into English, has the meaning of “the doorways of comprehension.” To see, smell, hear, taste, and touch in Kiswahili then is to comprehend the world, to render the sensory experience of the world into thought. Among rodent trainers and trappers, the senses are always explained and understood in cognitive terms. When trained rats raise and twitch their noses to smell the odors of explosives in the air, rodent trainers describe this behavior as thinking. “Look at them think,” said Majaz, one of the more experienced trainers who taught me how to train rats.

Unlike Boas or Lévi-Strauss, these rodent trainers offer observations and speculations about sensing and their relation to thought as inter-species productions. How the environment is perceived and understood, with its wafts of explosive odors, is a result of multispecies thinking that conjoins human and rodent minds. As much as the success of training rats to detect landmines rests on the trainer’s attunement to the bodily and sensory capacities of rats, these interspecies sensory experiences must always be intellectually structured within a larger social understanding of thinking, sensing, and more-than-human relations. Toward the end of the dissertation, I also explore an additional sense of intelligence recognized by rodent trainers called “hekima.” It can be roughly understood as a kind of social intelligence that enables a person to foster good relations in his community, an undertaking that requires exceptional poise and intellect.

Although I agree that the colonial privileging of rationality has erased or devalued ways of knowing that are sensuous and somatic, I insist on focusing on those very ways that people who work with rodents in Tanzania develop systems of classification, theorize relationships between body and mind, and conceptualize particular notions of intelligence. Interspecies practices of

thinking, in all their wild and generative ways, are important but frequently overlooked sites for anthropological analysis that seek to decenter the human. “What we share with nonhuman living creatures,” Eduardo Kohn writes about the semiotic worlds that both Runa people and other animals inhabit, “is not our embodiment, as certain strains of phenomenological approaches would hold, but the fact that we all live with and through signs.”⁴³ Indeed, for rodent trainers in Morogoro, rodent behaviors, marks in the landscape, and odors issuing out from invisible explosives are signs that need to be interpreted within an interspecies framework that generates meaning.

Human/Rodent

Every Tanzanian has a story to tell about rodents, or *panya*, the Kiswahili word that describes all small mammals that gnaw, including rats, mice, gerbils, and hamsters. The first stories I heard about *panya* were about their opportunistic cunning. “If you don’t wash your hands properly after you eat,” Kibwana, a man in his late twenties told me over orange Fanta, “*panya* will come and nibble the skin on your fingers at night. But as they do so, they blow onto your fingers so that you don’t wake up.” He offered a proverb that nicely captured this behavior, used to refer to people who are nice to you in person but then criticize you behind your back: “Anang’ata na kupuliza kama *panya*” or “He bites and blows like a rat.”⁴⁴

There were also many stories about rats stealing items of clothing and newspaper to build their nests. Rats and mice chew through doors and invade homes. They eat and destroy stored grain or maize. Tanzanians who grew up on a farm, or those who grow their own food, talked about *panya* that eat up their newly planted seedlings, or *panya* that climb up a maize stalk to eat corn

⁴³ Kohn, *How Forests Think*, 9.

⁴⁴ There is another Kiswahili proverb with the same meaning: “*Panya hupuliza amuapo*,” or “A rat blows where it bites.”

before it is ripe for harvesting. Younger, more urban Tanzanians often let out a soft shriek or squirmed in disgust when they heard about my research. Rats are often considered dirty, carriers of unknown diseases [wanaleta ungonjwa fulani]. Those who grow their own food, though, were less terrified. “If you live in the countryside, you will meet panya,” Rashidi, who has a small plot of land where he grows maize, commented. “You try to trap them or kill them,” he admitted, “but only when they become a problem. They are everywhere.” Rodents, for those like Rashidi, are very much part of the ecology of growing food, even if they sometimes enrage [-leta hasira] their human counterparts. For many, rodents were as common as the weather, even as they inspired stories about stolen grain and invaded cupboards. This dissertation explores these differently configured human-rodent relations in Morogoro, particularly paying attention to the ways that training is integral to constructing new natural histories of rodents that allow for close encounters between trainers and rats.

Morogoro town, where the Sokoine University of Agriculture (SUA) and various rodent projects are based, is located in a mostly rural region that also includes the Uluguru mountain range and two national parks. Even within the town itself, many homes have small plots of land which people cultivate to grow their own food. It is therefore not unusual for most people to come across a rodent, or to be in a situation where they have to trap and kill one. The chapters that follow explore how some Morogoro inhabitants think about their relationships with rodents, and how their ideas are materially incorporated into the designs of the traps or the classificatory systems that they construct and use. I interpret rodent traps and taxonomic systems as devices for thinking through how humans and rodents may live well together. They grapple with the ethics of balancing various livelihoods that are at stake in the multispecies environments of Morogoro.

Nonhuman animals have always been key figures for anthropological study. The lifeways of a large rodent, the American beaver, are at the center of Lewis Henry Morgan's 1868 book on the animal, which analyzed how the beaver's engineering feats intersected with and interrupted settler colonial industrial railway projects and Chippewa indigenous fur-trapping schemes in Michigan's upper peninsula.⁴⁵ Cattle figured prominently as an analytical framework for E. E. Evans-Pritchard's 1940 study of the Nuer people in what is today South Sudan.⁴⁶ The economic, social, and political structures of the Nuer are closely entangled with the lives of their cattle, so much so that Evans-Pritchard remarked that "The social idiom [of the Nuer] is a bovine idiom."⁴⁷ Other anthropologists including Claude Lévi-Strauss, Edmund Leach, and Mary Douglas have paid attention to the ways that animal figures come to organize kinship, taboo, status, and causality.⁴⁸ Later works by James Ferguson among the Basotho ("The Bovine Mystique"), Clifford Geertz ("Notes on the Balinese Cockfight"), and Jean and John Comaroff ("Cattle and Commodities in a South African Context") foregrounded animals as representative of social relations and as possessing symbolic value.⁴⁹ This later work is encapsulated in Molly Mullin's phrase that nonhuman animals have been employed as useful "mirrors and windows" for comprehending human cultural life.⁵⁰

In *The Postcolonial Animal* (2019), Evan Maina Mwangi shows that African literature and orature (oral literature) have a long tradition of thinking through human-animal relationships that is both intersectional and challenging to Eurocentric conceptions of the human. Animal characters

⁴⁵ Morgan, *The American Beaver and His Works*.

⁴⁶ Evans-Pritchard, *The Nuer*.

⁴⁷ *Ibid.*, 19.

⁴⁸ Reviews of anthropological attention to animals before the current turn to multispecies ethnography can be found in Tambiah, "Animals Are Good to Think and Good to Prohibit" and Ingold, "The Animal in the Study of Humanity."

⁴⁹ Ferguson, "The Bovine Mystique"; Comaroff and Comaroff, "Goodly Beasts, Bestly Goods"; Geertz, "Deep Play."

⁵⁰ Mullin, "Mirrors and Windows."

such as the sungura, or rabbit, feature frequently in various folktales throughout East Africa, many of which have been passed down from precolonial times. Many of the stories begin with a problem or a sticky situation that puts the sungura in danger, either from an environmental threat, such as flood, or from predators such as the lion. The story then recounts the usually humorous and clever ways that sungura is able to outwit and outplay his enemies, or survive through drought. “These twin struggles, against nature and other animals, reflected real-life struggles in the human world,” observes Ngũgĩ.⁵¹ These folktales are not just allegorical, too. As Thomas Beidelman has documented, the Kaguru in Tanzania told and re-told stories about sungura to imagine and grapple with the ethical dimensions of certain actions within society.⁵² Through an analysis of postcolonial African texts, Mwangi shows too that storied animals are not always parabolic. In giving animals subjectivities, African traditional orature and postcolonial writing become creative avenues for articulating ecofeminist politics, resisting post-independence dictatorships, and contending with the ravages of neoliberal globalization.⁵³ Despite the richness of thinking and imagination about humans and other animals in East Africa, few academic works have truly examined their politics and philosophies outside of those implicated by environmental conservation frameworks.⁵⁴

Recent anthropological work on multispecies relations represent a departure from earlier studies of human-animal relationships perhaps because, as Eben Kirksey and Stefan Helmreich

⁵¹ Ngũgĩ wa Thiong’o, *Decolonising the Mind*, 10. The first stories I read in Kiswahili were those about sungura.

⁵² Beidelman, “Further Adventures of Hyena and Rabbit”; Beidelman, *Moral Imagination in Kaguru Modes of Thought*. Origin stories, told by the Shambaa, tell of the Mbegha, a half man, half animal, who eventually settles down and through cultivation, becomes human. See Feierman, *The Shambaa Kingdom*.

⁵³ Mwangi, *The Postcolonial Animal*, Chapter 3.

⁵⁴ There are a few exceptions, in which anthropologists examine how communities contest and shape the meanings of conservation and public health programs that involve particular relations between humans and nonhuman creatures. See Neumann, *Imposing Wilderness*; Walley, *Rough Waters*; Kelly and Lezaun, “Urban Mosquitoes, Situational Publics, and the Pursuit of Interspecies Separation in Dar Es Salaam.” This, however, may be changing. Several theses based in East Africa that rely on a multispecies framework of analysis were recently published. See Johnson, “Fishwork in Uganda”; Mwangi, “Multi-Species Entanglement: Human-Baboon Interactions in Nthongoni, Eastern Kenya”; Thompson, “Pigs, People, Pathogens.”

observes, the “lines separating nature from culture have broken down, where encounters between *Homo sapiens* and other beings generate mutual ecologies and coproduced niches.”⁵⁵ This decomposition of previously different domains into a natureculture that is always in formation sparked a change in the methodological and analytical tools wielded by historians and anthropologists.⁵⁶ Donna Haraway, bringing to the fore feminist theoretical insights about the embodiment and situatedness of knowledge in her highly influential work, *When Species Meet* (2008), has argued that scholars attend to these continuous processes of becoming. “Beings do not preexist their relatings,”⁵⁷ she writes, adding that “becoming is always becoming *with*—in a contact zone where the outcome, where who is in the world, is at stake.”⁵⁸ The contact zone, a concept borrowed from the postcolonial literary scholar, Mary Louise Pratt, are those spaces “where disparate cultures meet, clash, and grapple with each other,” often amid unequal power differences.⁵⁹ This postcolonial insight is essential to Haraway’s project given that human-animal relations are often fraught with inequality. Whether one considers petkeeping, wildlife conservation, laboratory experimentation, eating, animal training, or agility sport, the life and death of an animal—microbial, megafauna, domestic, or otherwise—is usually in the “inept hands” of its human companion.⁶⁰

In the African context, however, scholarship about animals is dominated by European experience, usually in the context of conservation schemes that set out to protect wildlife from “natives” who are thought to be responsible for poaching or for the overexploitation of the

⁵⁵ Kirksey and Helmreich, “The Emergence of Multispecies Ethnography,” 546; see also Paxson, *The Life of Cheese*; Kirksey, *Emergent Ecologies*; Parreñas, *Decolonizing Extinction: The Work of Care in Orangutan Rehabilitation*; Govindrajan, *Animal Intimacies*.

⁵⁶ See Ritvo, “On the Animal Turn,” for a review of the questions raised about history research by an attention to other animals.

⁵⁷ Haraway, *The Companion Species Manifesto*, 6.

⁵⁸ Haraway, *When Species Meet*, 244.

⁵⁹ Pratt, *Imperial Eyes*, 6. See also Lee, “Contact Zones.”

⁶⁰ Haraway, *When Species Meet*, 216.

environment. Occasionally, writings about insects such as the locust or tsetse fly surfaces as part of eradication schemes. A more liberal position might reasonably question if lending critical scholarly attention to animals and the environment is a misplaced priority when people, including in Africa, continue to struggle with poverty and suffer under postcolonial capitalist forms of extraction and racism. This has been the position taken by a growing number of scholars, who criticize the posthuman turn as depoliticizing, in that it cherishes articulating agency in nonhuman entities at the expense of tracking the powerful ways that colonial, capitalist, and racist systems continue to oppress people.⁶¹

These critiques are even more stark when considered against the equivalence attributed to colonized people and nonhumans. Animal, when used to refer to colonized people, is not metaphor but a racializing technology that renders Africans, Asians, and indigenous folk part of a menagerie of beasts to dominate and exploit. “In plain talk,” Fanon writes of the colonized subject:

he is reduced to the state of an animal. And consequently, when the colonist speaks of the colonized he uses zoological terms. Allusion is made to the slithery movements of the yellow race, the odors from the “native” quarters, to the hordes, the stink, the swarming, the seething, the gesticulations. In his endeavors at description and finding the right word, the colonist refers constantly to the bestiary.⁶²

⁶¹ This is by no means a comprehensive list. See Wolfe, *What Is Posthumanism?*; Tallbear, “Why Interspecies Thinking Needs Indigenous Standpoints, Theorizing the Contemporary”; Jackson, “Animal: New Directions in the Theorization of Race and Posthumanism”; Fortun, “From Latour to Late Industrialism”; Kipnis, “Agency between Humanism and Posthumanism.”

⁶² Fanon, *The Wretched of the Earth*, 7.

Aimé Césaire's own experiences with colonization converge with Fanon's vivid depiction of dehumanization. "The colonizer ... in order to ease his conscience [,] gets into the habit of seeing the other man *as an animal*," Césaire writes in *Discourse on Colonialism* (1950).⁶³

Chakanetsa Mavhunga recounts how the colonial discourse of the white minority government about tsetse flies, which transmit trypanosomiasis and sleeping sickness, is closely entangled with those used to describe communist guerilla fighters working to secure Zimbabwe's (then, Rhodesia) independence from white supremacy in the 1960s and 70s. Both the tsetse fly and the African guerilla were depicted as vermin beings by the white minority government of Rhodesia, requiring eradication programs, whether by DDT pesticide, by military forces, or both.⁶⁴ Newer historical research show that the white minority government of Rhodesia used warfarin, a rodenticide, to poison the food supply of guerilla fighters, causing several to hemorrhage and die.⁶⁵ Although writers like Fanon and Césaire were published at the height of decolonization, the legacies of which they write still haunt present day relations between humans and other animals. In East Africa, Kenyans and Tanzanians who lived through the colonial era remember the use of police dogs to intimidate, chase, and attack Africans at anti-colonial protests.⁶⁶ In Morogoro, dogs are still strongly associated with policing as they are trained to be aggressive so that they can guard private property. Most of the people I know in Morogoro are usually wary of approaching dogs that they do not know.

This discomfort with bringing a more-than-human analysis to the postcolonial condition should be dispelled by works that bring together environmental history and postcolonial theory.

⁶³ Césaire, *Discourse on Colonialism*, 41.

⁶⁴ Mavhunga, "Vermin Beings On Pestiferous Animals and Human Game."

⁶⁵ See White, "Poisoned Food, Poisoned Uniforms, and Anthrax."

⁶⁶ The main character in Ngũgĩ wa Thiong'o's novel, *A Grain of Wheat* (1986), also experiences this.

Jennifer Wenzel reminds us that decolonization was often about environmental concerns. I have already described the ways in which DDT and warfarin were used not just against pestilential insects and rodents, but also against Africans who were considered vermin by colonial officials. The resort to these technologies of eradication by colonial governments are no accident. DDT, warfarin, and other pesticides were crucial to the expansion and exploitation of (neo)colonized land since they ensured, through an indiscriminate program of eradication of both people and pests, the highest profits attainable from extractive agricultural schemes.⁶⁷ These schemes of extraction would persist even after decolonization as part of a Cold War struggle to maintain or gain access to the rich resources of these newly independent nations. The same poisons, manufactured in the industrial North of the Western bloc, were now being sold to these African, Asian, and Latin American countries under the guise of technologies for development. “The spray gun,” as Wenzel’s trenchant analysis goes, “became an unconventional weapon in the Cold War: one could fight communism by killing bugs, thereby eliminating disease and uplifting the world.”⁶⁸

In Tanzania, rodents figured as main characters in the country’s colonial and post-independence years. Rodent outbreaks interrupted colonial extraction, primarily of cash crops such as cotton, in Tanganyika during the years after the Great Depression. After independence, rodent outbreaks again threatened Tanzania’s food security. This dissertation presents an analysis that engages both postcolonial critique and environmental history to attend to rodents as historical and

⁶⁷ Césaire writes, “And since you are talking about factories and industries, do you not see the tremendous factory hysterically spitting out its cinders in the heart of our forests or deep in the bush, the factory for the production of lackeys; do you not see the prodigious mechanization, the mechanization of man; the gigantic rape of everything intimate, undamaged, undefiled that, despoiled as we are, our human spirit has still managed to preserve; the machine, yes, have you never seen it, the machine for crushing, for grinding, for degrading peoples?” See Césaire, *Discourse on Colonialism*, 77. Elsewhere, Fanon writes, “This is why we should place DDT, which destroys parasites, carriers of disease, on the same level as Christianity, which roots out heresy, natural impulses, and evil. The decline of yellow fever and the advances made by evangelizing form part of the same balance sheet.” See Fanon, *The Wretched of the Earth*, 7. Quoted in Wenzel, “Reading Fanon Reading Nature,” 193. See also Suzuki, *The Nature of Whiteness*.

⁶⁸ Wenzel, “Reading Fanon Reading Nature,” 194.

social actors in the unfolding drama of colonial and decolonial politics in Tanzania. The final chapter is about a group of rodent trainers who go treasure hunting, linking postcolonial critique and resource nationalism to a political economy of sensing. Ecological concerns, now ever more pressing given the climate catastrophe that confronts Africans and the rest of the world, are in need of an engaged postcolonial analysis that tracks multispecies epistemologies from Africa.

Yet, as the literary scholar Zakiyyah Iman Jackson underscores, present-day efforts to rehabilitate the category of the “human” still fail to recognize that the term “humanity” itself in European Enlightenment thought was based on the conception that there are different “genres” of the human.⁶⁹ This becomes evident in the slippage between the terms “species” and “race” at the beginning of the twentieth century.⁷⁰ Their interchangeability suggests that the biological difference that today underpins “species” had always been operating on human beings before it was replaced exclusively with “race.” In Enlightenment thought, race sought to locate human difference in biological difference, such as through measurements of heights, skin pigmentation, hair texture, cranial volume, and other anthropometric measures. Within zoology, morphological and craniometric methods remained dominant for describing and categorizing new species of mammals, including rodents, until genetic analyses replaced them in the latter part of the twentieth century. Today, genetic analyses have once again blurred those very boundaries, entangling (and, usually, confounding) biological and social categories in terms of a chemical and bioinformatically rendered code (DNA) that becomes tethered to notions of identity and belonging.⁷¹

⁶⁹ I borrow the notion of “genres” of being human from Wynter, “Unsettling the Coloniality of Being/Power/Truth/Freedom.”

⁷⁰ W. Victor Harris, an entomologist based in Morogoro during the colonial period, wrote a paper in 1931 titled “A Short Note on the Races of Honey Bees in Tanganyika Territory.” For an interesting comparison of how ethnicity is thought through the figure of the animal in South Africa, see White, “Beastly Whiteness.”

⁷¹ See Nelson, *The Social Life of DNA*; Tamarkin, *Genetic Afterlives*.

Following these lines of questioning, I suggest, along with Zakiyyah Iman Jackson, that the category of “human” does not exclude Africans so much as it has appropriated African humanity to define the limits and limitations of humanity.⁷² The obsessions with and imaginaries of the various technologies and knowledge of producing racial difference sought not only to define and “invent”⁷³ the African as non-human, both racially and specially. Rather, the continual qualification of Black being within the category of “human” in European Enlightenment thought came to define those very limits and boundaries of humanity. This explains why Africa, African bodies, and African thought have historically served as test cases for clinical trials, rationality, genocidal violence, humanitarian intervention, development, modernity, and even futurity.⁷⁴

In this dissertation, I argue that rodent trainers, trappers, and researchers in Tanzania contest and unsettle the very category of being human. Rather than offer an account of a local form of zoology or psychology, I analyze the theories and speculations proposed by these trainers, trappers, and researchers about human-rodent cognition as contestations of the category “human.” The human, in effect, emerges as a framework through which those who work with rodents in Morogoro think about postcolonial development, economic precarity, and the future. To interpret my ethnographic data in this way is to acknowledge that for many of us living in the aftermath of colonialism, we continue to wrestle with what it means to be human. I inherit this refusal to embrace humanism from Black and ethnic studies, whose greatest contribution to critical thinking, as Alexander Weheliye notes, “is the transformation of the human into a heuristic model and not an ontological fait accompli.”⁷⁵

⁷² See also Jackson, *Becoming Human*, 23.

⁷³ Mudimbe, *The Invention of Africa*.

⁷⁴ There is a lot of current hype about how Africans can “leapfrog” into the future by embracing digital technology and preparing themselves for the Fourth Industrial Revolution. See, for example, a Brookings report by Ndung’u and Signé on “The Fourth Industrial Revolution and Digitization Will Transform Africa into a Global Powerhouse.”

⁷⁵ Weheliye, *Habeas Viscus*, 8. Quoted in Jackson, *Becoming Human*, 35.

Along with Black studies, queer theory has always cast a skeptical eye on the notion of being human. Those of us who have lived queer lives have constantly struggled against being excluded from humanity. “Queer theory,” as queer studies scholars Dana Luciano and Mel Chen writes, “emerges from an understanding of queer life as precarious life” and that under the current conditions of extreme climate change, continued imperialist extraction, and rising economic inequality, all life indeed is precarious, bordering on the inhuman.⁷⁶ Susan Stryker, describing her experiences as a transgender woman, found that she had to “forgo the human, a set of criteria by which I could only fail as an embodied subject.”⁷⁷ I fuse queer theory’s inhumanism with these emerging theoretical frameworks in Black studies to approach relationships between Black subjects and other animals not through the lens of bestialization, but as potential sites for what Joshua Bennett calls a “fugitive practice.”⁷⁸ Bennett suggests that it is in these human-animal relationships that Black subjects envision and enact alternative ways of being. Their proximity to and bond with other animals serve as potential sites for a “more robust vision of human, and nonhuman,” and its “cognitive and otherwise potential.”⁷⁹ Indeed, a more-than-human analysis of human-rodent encounters in Tanzania attends to those key and important moments where new ways of being that reject a Eurocentric model of Western man are forged.

The refusal to accept the category of human as a settled historical accomplishment that may benefit from further inclusion is best captured in another Kiswahili proverb. When several Tanzanians ask me about living in the United States, they often reflect on the saying “Nzuri uwe mbwa Marekani kuliko binadamu Tanzania,” which in English translates to “Better to be a dog in the United States than human in Tanzania.” For many, the saying points to the stark inequality that

⁷⁶ Luciano and Chen, “Has the Queer Ever Been Human?”

⁷⁷ “Theorizing Queer Inhumanisms,” 227.

⁷⁸ Bennett, *Being Property Once Myself*, 13.

⁷⁹ *Ibid.*, 8.

exists between people who live in the U.S. and those who live in Tanzania. The expressions take on another layer of reality when rodent trainers, in alerting me to the inequalities that exist between foreign and local staff at the project, noted with envy how all trained rats receive medical check-ups from a vet every week, a fact that the Rodent Biosensor Project advertises on their website. “If I fall ill in the field during training, would I get the same medical attention?” pondered Betty, one of the female trainers, “Or do I just get put on a bajaji [public transportation] and get sent to the hospital to wait?” Being human alone does not guarantee one’s humanity, as Betty and other Tanzanians realized. Shadrack, an older rodent trainer who is pessimistic about improving work conditions, shared that when Tanzanian trainers travel to Cambodia for work, they do not get the same salaries that Europeans do when Europeans travel to Tanzania for work. “Aren’t we all expats?” he wondered aloud. “I train rats because I believe in humanity, I want to help people,” he went on, “But at the rate they pay us, the way that we are sometimes treated, with the differences between Blacks and whites, I ask, where is our humanity?”

“Man,” as Foucault has noted, “is an invention of recent date.”⁸⁰ The category of the human was invented and elaborated through the human sciences that found their beginnings in the Enlightenment of sixteenth-century Europe, and is, in our current century, nearing its demise. And as the foregoing discussion has shown, the elaboration of “human” rests on the constitution of Africans and other peoples of color as inadequately human, who in the best of worlds, deserve to be civilized and developed, and in the worst, suited for oppression and exploitation. If the entire enterprise of European thought were to collapse, wagered Foucault, “man would be erased, like a face drawn in sand at the edge of the sea.”⁸¹ The task of this dissertation, and I would venture, the

⁸⁰ Foucault, *The Order of Things*, 422.

⁸¹ *Ibid.*

task of a critical social sciences, therefore, in the words of Claude Lévi-Strauss, is “not to constitute man, but to dissolve him.”⁸²

Decolonization

“I admit that it is an excellent thing to blend different worlds; that whatever its own particular genius may be, a civilization that withdraws into itself atrophies; that for civilizations, exchange is oxygen; that the great good fortune of Europe is to have been a crossroads, and that because it was the locus of all ideas, the receptacle of all philosophies, the meeting place of all sentiments, it was the best center for the redistribution of energy.

But then I ask the following question: has colonization really *placed civilizations in contact*? Or, if you prefer, of all the ways of *establishing contact*, was it the best?

I answer *no*.”⁸³

- Aimé Césaire (1950)

“...in accordance with the same revolving movement of contacts and conflicts, the Caribbean Sea is the sea that ‘diffracts.’ Since 1492, it has been a preface to the continent..., a place of passage, of transience rather

⁸² Lévi-Strauss, *Wild Thought*, 281.

⁸³ Césaire, *Discourse on Colonialism*, 33.

than exclusion, an archipelago-like reality, which does not imply the intense entrenchment of a self-sufficient thinking of identity, often sectarian, but of relativity, the fabric of a great expanse, the relational complicity with the new earth and sea. It does not tend toward the One, but opens out onto diversity.”⁸⁴

- Édouard Glissant (1995)

Bata shoes. A used, dog-eared story book, by Bessie Head. The smell of Dettol. Horlicks. Rice cooked in coconut milk. Sticky pineapples which we call “nanas(i).” Strictly twelve hours of daylight, throughout the year. The sun rises and sets like a light switch. A national language different (for most) from an ethnic one. Like many here in Tanzania, I can’t speak my ethnic language. To greet, one says Habari gani?, Apa (k)habar?, How are you? Sugar and milk in tea. Lots of sugar. And stand buckets and soap for washing your hands before eating, even at the mama ntilie (roadside stalls). These are things that make me think that I was back in Malaysia.

- Author fieldnotes (2018)

The list of items, food, sensual experiences, literary references, etiquette, and languages from my fieldnotes above are familiar to both the average, middle-class Tanzanian and the average, middle-class Malaysian. They are a result of many different kinds of exchange and contact, some

⁸⁴ Glissant, “Creolization in the Making of the Americas,” 81.

a consequence of a shared colonialism under the British, and others a result of pre- and postcolonial circulations. Édouard Glissant, drawing on his own experiences in the Caribbean, calls this sense of transience, movement, and relationality “creolization.” Befitting my origins in another archipelago, one spread across the south east of Asia, Glissant’s proposal for cultivating an “archipelagic thought” that opposes a “continental” one infuses how I make sense of the dizzying and dappled array of sameness and difference that condition my presence in Tanzania.

Given the long history of contact between the East African coast and Asia, my presence as a Malaysian man of Hakka Chinese descent in Tanzania was not as perplexing to many Tanzanians as it was for academic communities in the United States. There is already a rich body of scholarship that focuses on the histories and relations of South Asians in East Africa, but less has been written about the entanglements of Southeast Asian and East African peoples.⁸⁵ More scholars are currently turning their attention to China-Africa relations, heralding a new subfield within political science, economics, history, Asian studies, and African studies. These are importantly necessary analyses given China’s growing investment and involvement in African economies, which, in turn, have resulted in several, major shifts around how Africans are thinking about development, human rights, and democracy.

On the ground in Tanzania, I have met more young Tanzanians who have been to China than those who have traveled to Europe or the United States. Several were awarded scholarships to study in China, and others have traveled there for work or business. On the bus to Morogoro, I met a businesswoman who spoke fluent Mandarin. She travels to Guangzhou to procure electronics for sale in Dar. In Morogoro, people asked if I was from China and if had come to open a business.

⁸⁵ Quayson, “Colonial Space-Making and Hybridizing History, or ‘Are the Indians of East Africa Africans or Indians?’”; Aiyar, *Indians in Kenya*; Sheridan, “If You Greet Them, They Ignore You”; Afro-Asian Networks Research Collective, “Manifesto: Networks of Decolonization in Asia and Africa.”

They were usually not surprised by my command of Kiswahili but was curious about my willingness to take the time to chat and joke, which differentiated me from the Chinese they have encountered. The Tanzania-China relationship dates back all the way to the immediate years after decolonization, when both governments worked together on crucial development projects and supported anti-colonial fighters in southern Africa. These two goals, economic and anti-colonial, sometimes coincided with one another, as they did in the Tanzania-Zambia Railway, or TAZARA. The Chinese funded the construction of the railway, which was jointly-built by Chinese and Tanzanian workers. When completed in 1975, the railway allowed landlocked Zambia to export its copper, which was crucial for its economic development, through Tanzania rather than through Rhodesia and South Africa, which would have required Zambia to implicitly recognize their white-minority governments. As another example of Afro-Asian solidarity, Malaysia became South Africa's largest foreign direct investor after the fall of apartheid as part of an effort to show political solidarity to the empowerment of historically disadvantaged majority groups.⁸⁶

The investments and exchanges that China has made in Africa today are very different from this earlier history, and they certainly call for more critical analyses than is currently available. A more recent discourse I encountered in Tanzania about Chinese people and Chinese products was the idea of “feki,” or “fake,” a term used to evaluate the authenticity of counterfeit, Chinese-made products that usually break easily. Chinese people were also thought to carry around fake immigration documents, being illegally present in Tanzania. As a result, I was the target of covert surveillance (and racially profiled) by undercover immigration officials, some of whom were looking for a “small tip.”⁸⁷ I was usually able to wriggle my way out by telling self-deprecating jokes in Kiswahili. My positionality and the inequalities that my presence in Tanzania invoked

⁸⁶ Padayachee and Valodia, “Malaysian Investment in South Africa.”

⁸⁷ See also Sheridan, “Weak Passports and Bad Behavior.”

were therefore quite different from the power and privilege that I was supposed to possess as an anthropologist from the West. If anything, during those times that I was followed, I felt extremely vulnerable. I felt similarly vulnerable when the Tanzanian government started “rounding-up” gay men in Dar es Salaam in 2018, during which time a friend had to flee to Nairobi to escape capture. As a citizen of Malaysia, which also bans homosexuality, I could not have sought protection from my embassy if I had been caught in the raid. As a non-white, non-“native” anthropologist in Tanzania who is also non-American, there was little precedent for people like me to think about power, privilege, and the production of anthropological knowledge.⁸⁸

I bring up these histories of contact, circulation, and contestation between East Africa and (South)East Asia to offer a way for thinking about decolonization that does not propagate the type of “sectarian,” “self-sufficient thinking of identity” that Glissant observed among the different races in the United States. In Aimé Césaire’s quote above, he makes clear that he is not against “exchange” between different groups of people. Indeed, he later discourages the tendency among some decolonial thinkers to “return” to the old days of pre-colonial, indigenous civilization. “For us,” he writes, “the problem is not to make a utopian and sterile attempt to repeat the past, but to go beyond. It is not a dead society that we want to revive. We leave that to those who go in for exoticism.”⁸⁹ Césaire found contact and exchange to be essential to a thriving, multicultural society, which characterized the reality of many postcolonial states. What Césaire has trouble with are those modes of exchange—slavery, extraction, the killing of languages and knowledge, or epistemicide—that were often violently imposed through colonization. “Of all the ways of establishing contact, was [colonization] the best?” he countered.

⁸⁸ With some exceptions. See Harden, “Native like Me”; Dattatreyan, “Diasporic Sincerity.”

⁸⁹ Césaire, *Discourse on Colonialism*, 51-52.

The critical approaches I take in this dissertation disentangle contact from colonization. Like Césaire and Glissant, I recognize that my experiences and identity have been produced through colonialism and that they also surpass it. The similarities and differences that I encountered in Tanzania in the list that opened this section on decolonization are a consequence of multiple types of contact and exchange, some of them colonial. The challenge dealt by Césaire in his question is not to purge postcolonial society of its colonial legacy but to imagine and create a world—what Glissant calls “a poetics of relations”—in which colonialism becomes an unthinkable mode of exchange and contact.⁹⁰ It is in these relational poetics, these interstitial spaces of a vast archipelago, that I inhabit as an ethnographer, not unlike the imperfect mix of curiosity and adventure that inspired James Baldwin’s sojourn in Paris or Richard Wright’s visit to Jakarta.

Tanzania, after all, is in many ways an integral part of a wider archipelago of moving people, mobile ideas, and shifting identities. For at least a millennium, East Africa has been a global hub for trade, a port for the exchange of goods and people (including slaves) from the Congo basin, the Arabian Peninsula (and by extension, Europe), and Asia. Under German and British colonialism, the caravan routes that brought ivory and slaves from the continental interior were replaced with railway and road, facilitating the flow of cash crops produced by plantation labor that fueled the imperial economy. In the post-independence period, Tanzania became a crossroads of revolutionary fervor. It offered refuge and protection to anti-apartheid activists from South Africa, communist guerilla fighters from Angola, and Black civil rights advocates from the United States. Today, even as Tanzania grapples with the legacy of its previous president, John Magufuli (2015-2020), who advocated an inward-looking and self-reliant policy of development, the country

⁹⁰ Glissant, *Poetics of Relation*. As Glissant notes, “creolization...does not produce direct synthesis, but *résultantes*, results: something else, another way.” Quoted in Glissant, “Creolization in the Making of the Americas,” 83.

has embraced Chinese, Turkish, and Omani investors in the construction of high-speed trains, ports, hydroelectric dams, and oil and gas prospecting. Given these multiple, complex, and asymmetrical relations of exchange, the West for Tanzania is increasingly becoming just one cultural resource among many, as Kuan-Hsing Chen has noted of other “deimperializing” projects in Asia.⁹¹

In Morogoro, the rodent trainers, trappers, and researchers in Morogoro with whom I work are eager for any opportunity to exchange views [kubadilishana mawazo] on African politics, Black culture, globalization, race relations, U.S. hegemony, and Chinese dictatorship. In the days after Robert Mugabe was overthrown as President of Zimbabwe, trainers shared in the jubilation and hope that Zimbabweans felt and were excited to discuss new developments that they had learned from the radio. That week in November 2017, the morning greeting during training celebrated this event. The response to the greeting “Kumekucha!” or “Good Morning!” was “Kucha! Kama Zimbabwe! [Rising! Like Zimbabwe!]” Many rodent trainers have also traveled and lived abroad, including in Mozambique, Angola, and Cambodia, where they ensure that rats are well trained and taken care of. As illustrated earlier, it was Tanzanian rodent trainers in Cambodia who translated Khmer into Kiswahili so that I could participate in conversations during my visit there.

These ethnographic vignettes are important because they clarify the possible forms that decolonization might take in this dissertation. A decolonial project that best represents the experiences captured in this dissertation would be one that looked towards ever greater contact and exchange in ways that do not compromise indigenous thinking and independence. As Ndlovu-Gatsheni notes, decolonization in its many forms and agendas is “resurgent and insurgent.”⁹² What

⁹¹ Chen, *Asia as Method: Toward Deimperialization*.

⁹² Ndlovu-Gatsheni, “The Cognitive Empire, Politics of Knowledge and African Intellectual Productions.”

is key for Ndlovu-Gatsheni is the focus of current decolonization projects in Africa on epistemic justice, that is, a centering of knowledges previously marginalized by colonialism, asymmetrical power relations, and the global neoliberal structure of knowledge production. For this reason, many of the contestations around decolonization have happened on university campuses, where students and community leaders have called on institutions of learning to center and amplify African knowledges.⁹³ But decolonization also has other strains that take the form of a nativist or autochthonous politics that deny the reality of constant and enduring circulations throughout the continent.⁹⁴ These strains of decolonization usually coincide with a strong identification with nationalism, asserting a patriotism that simultaneously excludes women, queer people, and immigrants, including other Africans. These decolonizations forget that it was a “culture of mobility that colonization ... attempted to freeze via the modern institutions of the border,”⁹⁵ or that the segmentation of the postcolonial state along tribal or ethnic lines is an institutional colonial inheritance.⁹⁶

If this dissertation contributes to the discussion on decolonization, it does so by showing how Tanzanians who work with rodents think in ways that are mobile, that roam, and displace one another, constantly subjecting themselves and their thoughts to revision, reflection, and reflexivity. Rather than adhere to or deny the dichotomies that condition their experiences – African/global, developed/developing, colonial/decolonial, wild/domestic, modern/tradition, human/posthuman – they mobilize them as frameworks through which they articulate theories about human-rodent relations and knowledge production as Tanzanians in an ever-changing world. Altogether, this

⁹³ Mbembe, “Decolonizing the University”; Nyamnjoh, *#RhodesMustFall*.

⁹⁴ See, for instance, Comaroff and Comaroff, “Naturing the Nation.”

⁹⁵ Mbembe, *Out of the Dark Night*, 214.

⁹⁶ Mamdani, *Citizen and Subject*.

dissertation offers a partial account of an intertwining between humans and rodents that contributes to critical African thought about our contemporary era.

Interstitial Intelligence

Speculations, theories, and other epistemologies about thinking that emerge from human-rodent encounters of trapping, identifying, and training rodents in Morogoro, Tanzania are the focus of this dissertation. These epistemologies would not be considered indigenous knowledge in any essential sense because they incorporate and reconfigure concepts poached from cognitive psychology, observations of rodent behavior, travel experiences to Mozambique and Cambodia, relations with foreign colleagues and managers, and radical transformations in Tanzanian politics. But they are certainly Tanzanian, articulated through the making and design of rodent traps, the production of rodent science, and the transformation of rats into sensory technology. They form part of what Jean and John Comaroff have referred to as theorization, or theories from the South.⁹⁷ Collectively, I propose to refer to these more-than-human epistemologies from Tanzania as *interstitial intelligence*.⁹⁸ To call these practices of thinking *interstitial* is to recognize their marginality not in a peripheral sense, as if these articulations about thinking are somehow outside of or bordering on the corpus of what is considered knowledge. Rather, interstitial invokes a marginality defined in terms of its inter-relations, those invisible and usually narrow spaces in

⁹⁷ Comaroff and Comaroff, *Theory from the South*.

⁹⁸ I am inspired here by Gloria Anzaldúa's idea of *mestiza* consciousness: "As a *mestiza* I have no country, my homeland cast me out; yet all countries are mine because I am every woman's sister or potential lover. (As a lesbian I have no race, my own people disclaim me; but I am all races because there is the queer of me in all races.) I am cultureless because, as a feminist, I challenge the collective cultural/religious male-derived beliefs of Indo-Hispanics and Anglos; yet I am cultured because I am participating in the creation of yet another culture, a new story to explain the world and our participation in it, a new value system with images and symbols that connect us to each other and to the planet. *Soy un amasamiento*, I am an act of kneading, of uniting and joining that not only has produced both a creature of darkness and a creature of light, but also a creature that questions the definitions of light and dark and gives them new meanings." See Anzaldúa, *Borderlands/La Frontera*, 80-81.

between large domains of knowledge. Interstitial intelligence, therefore, is thinking about difference, exchange, and ambiguity, articulated from a location of lesser power.

The ethnographic data in this dissertation comes mainly from participant observation and interviews conducted over twenty months between 2016-2019. I first learned how to train rodents to detect landmines before transitioning to working as a rodent trainer myself for six months. During this time, I paid attention to conversations about rodents and training techniques. I attended training meetings and constantly sought out guidance from more experienced rodent trainers. I also accompanied three rodent trappers on several trapping expeditions as part of a long-term research project on the population ecology of the multimammate rat (panya shamba, *Mastomys sp.*). I interviewed 27 rodent trainers and 3 trappers, who also design and craft traps. I spent three more months reading research published by rodent scientists at the university's Pest Management Center, during which I conducted interviews with five Tanzanian rodent scientists.

The historical section of the dissertation draws significantly on research in the archives. I spent a total of three months in Dar es Salaam, usually several weeks at a time, where the Tanzania National Archive is located, to consult documents from Tanzania's British colonial era. During my visits to Dar, I was able to engage in conversations with people living in Kariakoo, Kijitonyama, and Mikocheni about their own trials and tribulations with urban rodents. My research and conversations eventually led me to the history of the SUA Pest Management Center in Morogoro, which were contained in a box of collected papers and reports kept by Prof. Herwig Leirs at the University of Antwerp in Belgium. In Belgium, I also visited the mammal collections at the Africa Museum in Tervuren, where rodent specimens from Tanzania used for taxonomic classification are housed.⁹⁹

⁹⁹ The Africa Museum was formerly known as the Royal Museum for Central Africa. The museum closed for several years so that it could reevaluate how it handles, displays, and make accessible its collections, which were

Each chapter in this thesis explores a different type of thinking. In Chapter One, rodents emerge as a scientific object to be studied and described under the British colonial government of Tanganyika so that they can be managed or eradicated. Chapter Two shows how these logics persist into the postcolonial period through European-Tanzanian partnerships that lead to the establishment of the Pest Management Center at Sokoine University of Agriculture (SUA). This chapter further examines the challenges faced by Tanzanians scientists in confronting their unequal access to global modes of scientific knowledge production.

Chapter Three presents an ethnographic account of rodent taxonomy used by rodent trappers and trainers in Morogoro, Tanzania. This is followed by Chapter Four, which explores how rodent trainers conceptualize sensory practices as interspecies co-laboring in their work to train rats to detect landmines. Reflecting on their experiences working with rats, these rodent trainers propose a working theory of rodent minds, the focus of Chapter Five. Rodent trainers speculate about how rodents think, and use their speculations to comment on and contemplate their own modes of thought, finally describing a particularly human type of intelligence, that is “hekima,” or the intelligence to cultivate good social relations.

Chapter Six leaves the rodent trainers behind and explores how rodent traps are made and designed. I propose that rodent traps are material manifestations of the cognitive work to balance multispecies wellbeing and livelihood. Chapter Seven focuses on a small group of rodent trainers and others who go about searching for buried treasures in the mountains surrounding Morogoro,

acquired through one of history’s most violent, colonial projects, the Congo Free State (1885-1908) and later, the Belgian Congo (1908-1960). These projects saw the killing of about 10 million Congolese at the hands of Belgian colonial officers, traders, and missionaries. Although there have been calls for the restitution of the museum’s collections, which includes human remains stolen from burial sites, the museum currently does not have a process or policy that allows for restitutions of the collections. See Hochschild, *King Leopold’s Ghost*, for more on the history of the Congo Free State.

likening themselves to the rodents that look for buried landmines. I suggest here, too, that treasure hunting is a critical mode of thinking about the colonial legacy of resource extraction in Tanzania.

Collectively, I make three interrelated arguments in this dissertation.

The first argument is that rodents critically and significantly re-order society. As Jonathan Burt put it in his book, *Rat*, the rat is “*a totem animal for modernity.*”¹⁰⁰ In its natural history, the rat has quickly adapted to living with and among people, taking up refuge and multiplying exponentially in the basements, sewers, attics, barns, granaries, metro stations, fields, and docks of human habitation. Rats are able to exploit human networks of travel and transport, spreading to new lands by ship, plane, and train, and yet, are also responsible for upending human projects of development and production, devastating food stocks, spreading disease, and comprising the structural integrity of the built environment. “Rats live in man’s parallel universe, surviving on the effluvia of human society... [They are] our mirror species, reversed but similar,” confesses Robert Sullivan.¹⁰¹ Together, humans and their bestial twins, rats, “have spread across the earth, keeping pace with each other and unable to destroy each other, though continually hostile...and, unlike any other species of living things—have made war upon their own kind.”¹⁰² This dissertation examines the social, political, and economic lives of Tanzanians through the figure of rodents, showing how rats and mice have not only shaped the production of knowledge and the experience of living in Tanzania from colonial to postcolonial times, but have also reconfigured them, opening new spaces for thinking critically about postcolonial science and alternative futures.

The second argument I make is that practices of sensing are always more-than-human. As sensing projects that enlist nonhuman animals proliferate, including the use of dogs to detect moths

¹⁰⁰ Burt, *Rat*, 18.

¹⁰¹ Sullivan, *Rats*, 2.

¹⁰² Zinsser, *Rats, Lice, and History*, 208-9.

that destroy artwork in museums, or the use of rodents and dogs to detect disease, including cancer and, more recently, COVID-19, it is critical to propose new frameworks in sensory studies that go beyond (human) embodiment. Furthermore, as sensing and sensibility are restructured by increasingly digitized and interfaced environments (such as teleconferencing, virtual tours, etc.), sensory experiences are becoming more mediated, either by other living beings or technologies. In effect, this dissertation provides the groundwork for a non-human-centered approach to sensing, arguing that sensing has always required mediation for any experience to “make sense.”

Finally, my proposal of the analytic of *interstitial intelligence* challenges the unreflexive definition of thinking that has come to inform “artificial intelligence” or AI in our society. Artificial intelligence is a colonizing term, firstly because it promises to take over and revolutionize places like the African continent through what is sometimes called a “digital revolution” and secondly because it replaces the wide variety of thinking around the world that has been practiced, debated, and described. The AI conception of thinking relies narrowly on the idea that thinking is about sorting and categorizing things, and that building from these categories, machines can learn to think, usually as defined by an expert designer or interpreter. While practices of classification are indeed important elements of thinking, AI overlooks the kind of thinking that is required to imagine new worlds and conceptions of the future, especially by non-elite people. Indeed, in proposing interstitial intelligence, I argue that thinking is not restricted to the mind nor the brain. Like “distributed cognition,” as Edwin Hutchins or Gregory Bateson would say, interstitial intelligence argues that thinking occurs in the very relations that people construe with other animals, objects, and ideas in the world.¹⁰³

¹⁰³ Bateson, *Steps to an Ecology of Mind*.; Hutchins, *Cognition in the Wild*.

In the conclusion of the dissertation, I show how AI has colonized our thinking today by reducing knowledge to an effect of training. Training is something that people and other animals do to learn. Trainers in Morogoro train rats to detect landmines. A dog owner trains a dog to fetch, and teachers train children to recite the multiplication table. Athletes train to improve their performance in a sport. Computer scientists train an algorithm with data sets so that it can be used for pattern recognition or prediction. Racism and sexism can also be resolved through diversity training. The solution to workplace harassment and racism, especially within the tech industries that create and train the algorithms that we depend on, is more training. I reflect on the ubiquity of “training” as a concept to describe learning, and show how insight from the rodent trainers in Morogoro might help us come up with better models of what people call “training.” These are questions situated within the interplay of colonial histories, global inequalities, and racial politics that continue to bear on how knowledge, identity, and power are conceived and contested.

I now turn to rodent trappers, trainers, and researchers in Morogoro to explore the various forms of sensing and cognition cultivated through human-rodent encounters that contest those hierarchies of expertise and unequal processes of knowledge production that have come to condition the creation of technologies in the global South.

CHAPTER ONE

1931: The Year of the Rat

By 1931, the number of rodent outbreaks in Tanganyika had become a major concern for the British colonial government charged with the administration of the East African territory after World War I. During the preceding decade, officers stationed in the various provinces occasionally sent in reports of ravenous rodents attacking cotton, millet, and maize fields. In 1930, these reports occurred with such greatened frequency that the Director of Agriculture, E. Harrison, hastily sent a telegram to the Chief Secretary to inform him of the serious “multiplication and spread of rats” reported in the Mwanza and Tabora Provinces, as well as in the Kilosa and Morogoro areas of the Eastern Province.¹⁰⁴ By the end of January 1931, it became clear to Harrison that he was confronting a potentially devastating crisis. Planters in the Morogoro area complained that they had lost fifty to seventy per cent of their cotton due to rodents. In a letter to the Chief Secretary, Harrison pleaded for aid from the Crown Agents. “TRANSMIT IMMEDIATELY,” he commanded in upper case letters, “A SUPPLY OF VIRUS OR INOCULANT IN DEALING WITH A PLAGUE OF FIELD MICE AND RATS.”¹⁰⁵ Infecting rodents with a lethal pathogen, such as “Rat Virus,” “Liverpool Virus,” “Danysz Virus,” or “Pasteur Virus,” was a promising if experimental method of rodent control at the time.

Meanwhile, in the north of the country, another crisis was brewing. Health officers were sending in reports about locals falling ill with severe pneumonia. They were feverish and coughed up thick blood-stained sputum. Other officers had reported seeing gravely ill people with swellings of pus under their neck and arms. Between December 1930 and January 1931, nine people,

¹⁰⁴ TNA J.10/12704/1037/6. Telegram from Director of Agriculture to Chief Secretary, 26 September 1930.

¹⁰⁵ TNA 12704/1037/18-19. Letter from Director of Agriculture to Chief Secretary, 27 January 1931.

including one child, had died of pneumonic and bubonic plague.¹⁰⁶ Scientists in Asia were able to work out that transmission of the “plague bacillus” occurred when fleas feeding on blood from rodents subsequently fed on human blood. As fleas suck human blood, they regurgitate infected blood containing the bacteria *Yersinia pestis*, which then spreads through the lymph nodes of a person causing swells and tissue death. Either the flea or the rodent could be the carrier of *Y. pestis*. When news of plague began emerging all across the northern area and lake shores of Tanganyika, this spurred the Department of Medical and Sanitary Services to take quick and drastic action against rodents. Medical officers sent requests to the Secretariat in Dar es Salaam, asking for funds for rodent traps and poison. By May 1931, plague had spread as far south as Nzega and Shinyanga Districts, threateningly near the Central Railway Line, which could then transport stowaway infected rodents and fleas all the way to the ports at Kigoma and Dar es Salaam that connected Tanganyika to the global economy.

1931 thus marked the year in which rodents became a focal point of concern for the colonial government in Tanganyika. Although written records of rodent outbreaks and plague in Tanganyika and East Africa exist as early as the 1880s,¹⁰⁷ 1931 was, I suggest, a crucial turning point for the scientific treatment of rodents as a matter of colonial state policy. It signals the beginnings of attempts to determine and monitor rodent populations, an approach that marked the shift from killing rodents to leveraging their ecological relationships with other organisms such as

¹⁰⁶ TNA 11901/v1/30-32. Report from Senior Health Officer, Northern Province to Director of Medical and Sanitation Services, 11 January 1931.

¹⁰⁷ See, e.g., J. I. Roberts, “The Endemicity of Plague in East Africa,” *East African Medical Journal* 12 (1935): 200–219; A. S. Msangi, “The Surveillance of Rodent Populations in East Africa in Relation Plague Endemicity,” *Dar Es Salaam University Science Journal* 1 (1975): 6–20; Rhodes Makundi, T.J. Mbise, and Bukheti Kilonzo, “Observations on the Role of Rodents in Crop Losses in Tanzania and Control Strategies,” *Beitrag Zur Tropischen Landwirtschaft Und Veterinarmedizin (Journal of Tropical Agriculture and Veterinary Science)* 29 (January 1, 1991): 465–74; Bukheti S. Kilonzo et al., “The Role of Rodents and Small Carnivores in Plague Endemicity in Tanzania,” *Belgian Journal of Zoology* 135, no. (supplement) (December 2005): 119–25; Michael H. Ziwa et al., “Plague in Tanzania: An Overview,” *Tanzania Journal of Health Research* 15, no. 4 (2013): 252–58.

crops, fleas, and humans in the environment in order to limit the disease and destruction that rodents wrought on human lives.

The year 1931 is significant as a confluence of several disruptions to previously stable global and colonial systems of exchange and knowledge. In the wake of the 1929 worldwide depression, Tanganyika's dependency on the industrial economies of the UK and the US severely decimated its own economy. Export prices for many of Tanganyika's cash crops such as sisal, coffee, and cotton cratered between 1929 and 1932. The selling price of seed cotton for a Sukuma grower in Bukoba fell seventy per cent from 40 to 12 cents per kilogram,¹⁰⁸ leading many planters to reduce cultivation and move on to longer-term cash crops, such as sisal. Just outside of Morogoro town in Kimamba, a major center for cotton growing, crop production dropped from 124,925 centals in 1929 to 48,030 centals in 1932.¹⁰⁹ The decrease in total areas of cotton growing meant that planters experienced rodent attacks on their production with ever more acuteness.

In terms of scientific knowledge, 1931 marks a turning point in the slow but certain shift of biology toward ecological frameworks. Ecological understandings of disease and organisms had begun to take hold among the scientific community in Britain and North America, further informing government policy in London and in the colonies. The idea for a Bureau of Animal Population, founded in 1932, emerged in 1931 at the Matamek Conference on Biological Cycles in the Gulf of St. Lawrence, Canada, driven by investor and scientist concerns over dwindling populations of economically important fish and game.¹¹⁰ It is on account of these political, economic, and scientific concatenations, centered in part on rodents in Tanganyika, that 1931 emerges as a crucial year in the history of colonial East Africa.

¹⁰⁸ Iliffe, *A Modern History of Tanganyika*.

¹⁰⁹ TNA J.10/12704/1037/141-142. Director of Agriculture, 'Statement on the Reduced Output of Cotton from the Kimamba Area,' n.d. 1 cental of cotton is equivalent to 1 pound of cotton.

¹¹⁰ Crowcroft, *Elton's Ecologists*.

Historian Karen Sayer has argued that the interwar period saw an increasingly systematic and quantitative approach to the rodent problem in Great Britain.¹¹¹ The shift from “destruction” to “control” of rodents not only recognized the mammal’s indefatigable ability to maintain their omnipresence in human lives, but also acknowledged the ecological imperatives that have come to shape wildlife management. Increasingly, agricultural and medical officers agreed that rodent populations might be controlled by managing their ecological relationships rather than eradicating them. In the colonies, this acquiescence to co-existing with rodents meant that colonial policy increasingly placed the blame and responsibility for rodent outbreaks on planters, villagers, and shopkeepers. If, as biologists in Britain and the colonial government increasingly believed, fluctuations in rodent populations were a natural effect of its ecology, then any outbreak—any failure to track this process—would be the fault of human behavior. Following this logic, Tanganyika’s colonial government advocated for social solutions to the rodent problem, condemning “slovenly methods of farming” and “dark unsanitary native dwellings.”¹¹² The rodent, in its ability to transgress and invade human notions of private property and economy, offered a figure through which colonial discussions about indigenous habits and character were articulated. The rodent’s presence in farms, dwellings, train cars, and shophouses became a flashpoint for social contestations over the modernizing, capitalist project of colonization.

Animal historians, including Harriet Ritvo and Etienne Benson, maintain that animals play significant roles in the histories of many human practices and institutions, including environmental activism, petkeeping, ethics for animal experimentation, and livestock breeding.¹¹³ Research into

¹¹¹ Karen Sayer, “The ‘Modern’ Management of Rats: British Agricultural Science in Farm and Field during the Twentieth Century,” *BJHS Themes*, June 2017, 1–29.

¹¹² TNA J.10/12704/1037/88. Letter from Director of Agricultural Research Station at Amani to Chief Secretary, 20 January 1932; TNA 11901/v1/27-29. Letter from Acting Director of Medical and Sanitary Services to Provincial Commissioner Northern Province, 11 December 1930.

¹¹³ Ritvo, *The Platypus and the Mermaid, and Other Figments of the Classifying Imagination*; Ritvo, *Noble Cows and Hybrid Zebras*; Benson, “Animal Writes: Historiography, Disciplinarity, and the Animal Trace.”

animal histories, however, is rarely straightforward. Documentation and archival sources regarding animals are categorized according to anthropocentric categories, and nonhuman animals themselves do not leave behind a written historical record. Despite such linguistic prejudice against animals whose modes of communication humans have yet to understand, Benson insists that animals, including humans, still leave behind traces of their movements and behaviors. Carlo Ginzburg, whom Benson cites, describes hunting and its associated skills of tracking footprints, excrement, odors, and other “infinitesimal traces” as precursors of writing, and hence, of recording history.¹¹⁴ Benson seizes upon this venatic quality of historical research to show all the possible ways that embodied traces of animal lives might inhabit and shape archives, and to consider less conventional kinds of archives, such as data from ice cores or from ethology.

To write a history of rodents in colonial Tanganyika requires a certain degree of tracking and hunting. In the colonial context, the disregard for recording animals lives also extends to human Tanganyikans, whose lives only appear, if at all, as data. The exclusion of Tanganyikan experiences and rodent lives from the historical record belies the silences that subtend the colonial archive.¹¹⁵ Leaving out both indigenous human and nonhuman animal voices maintains the power that colonial recorders wield over their African subjects, placing the African human in the same natural environment as their nonhuman animal counterparts.¹¹⁶ The colonial practices of archiving often cast the figure of the African, along with other immigrant, non-British European planters,¹¹⁷ as unhygienic farmers responsible for the spate of rodent outbreaks. Nonetheless, there exist

¹¹⁴ Ginzburg, “Clues: Roots of an Evidential Paradigm.”

¹¹⁵ Trouillot, *Silencing the Past*.

¹¹⁶ See, e.g., Wynter, “Unsettling the Coloniality of Being/Power/Truth/Freedom”; Mavhunga, “Vermin Beings On Pestiferous Animals and Human Game.”

¹¹⁷ Many of the cotton growers in Kimamba, outside of Morogoro, were Greek. There were also a number of Italian and Afrikaner growers, the latter having left South Africa as refugees of the Boer War. They employed Tanganyikans as laborers. See TNA J.10/12704/1037/133 for newspaper cutting (possibly from *The Tanganyikan Standard*), “Killed by Rats,” 1932. On non-British settlers in Tanganyika, see Iliffe, *Tanganyika*, 142-143.

crucial moments in the records when colonial officers described how village elders dealt with plague, and I include such recorded histories here as evidence that Tanganyikans were as concerned and involved as the colonial officers when it came to rodents as disease carriers.

The archival sources in this chapter come mainly from the colonial records of the Tanzania National Archives in Dar es Salaam. Although folders on livestock animals, rinderpest, and tsetse flies were ample, those on rodents were harder to come by. I did, however, find references to rodents in folders compiled by the Department of Medical and Sanitary Services, the Secretariat, and the Department of Agriculture. As these sources imply, the rodent problem in Tanganyika often moved unpredictably between discussions of rodents as carriers of plague disease and as agricultural pests, sometimes within the same folder! This suggests that colonial administrators themselves were uncertain as to what kind of epistemic thing rodents were. Colonial archives, Anne Stoler would agree, “are records of uncertainty and doubt in how people imagined they could and might make the rubrics of rule correspond to a changing imperial world.”¹¹⁸ Government departments constantly dawdled and shifted responsibility for the rodent problem to one another, finally deferring to the emergent expertise of biologists who, in turn, refused to intervene in the regular, natural, fluctuating periodicity of rodent populations.

In the following, I first introduce the rodent problem in the Kilosa, Kimamba, and Morogoro areas of Tanganyika, where continuous rodent attacks on crops forced European settler planters and colonial officers to find solutions to the “rodent menace.” Here, the ecological logic of rodent control emerged over time, gradually reproducing and reinforcing colonial ideas about agricultural hygiene among local and settler agriculturalists. I then reconstruct the spate of plague outbreaks in 1931, which caused alarm in the colonial government and threatened to further

¹¹⁸ Stoler, *Along the Archival Grain*, 4.

devastate an economy already reeling from global depression. Here, plague prevention was predicated on changing local behaviors around the practices of husbandry, house building, and hygiene through laws and propaganda. Emerging ecological research into the natural periodicity of rodent population fluctuations further reinforced the location of responsibility for plague prevention in the realm of the social.¹¹⁹ Rather than devise strategies and technologies to kill rodents, pressure was placed on farmers, shopkeepers, and villagers to maintain sanitation by “building out the rat.” 1931 therefore serves as a key juncture for considering how the rodent problem, once it was recognized as an economic, agricultural, and medical problem for colonial Tanganyika, would be transformed by subsequent ecological work into a matter of social policy.

A Rodent Menace

At the end of January 1931, the Director of Agriculture in Tanganyika, E. Harrison, wrote a sternly worded letter to urge the colonial government to immediately supply a lethal virus that could be used by officers to infect rodents that would develop a kind of typhoid fever causing them to die in large numbers. Reports of rodent attacks on the cotton crops in Kimamba and Kilosa, just outside of Morogoro, were incessant. The Acting Director of Agriculture, H. Wolfe, before Harrison was appointed to the post in 1930, had as early as October of that year requested the Medical Department to investigate the “new rat virus developed by the Pasteur Institute, Paris” as a rapid means of destroying these rodents.¹²⁰ To his and Harrison’s dismay, the Director of Medical and Sanitary Services (DMSS) refused to help, because “the spread of rats was not accompanied by disease,” although this reasoning would be later dropped when the two departments jointly

¹¹⁹ This conclusion provides an interesting, colonial confirmation of David Bloor’s thesis on the social production of scientific knowledge.

¹²⁰ TNA J.10/12704/1037/14, Letter from Ag. Director of Agriculture to Chief Secretary, 6 October 1930.

requested funds for rodent research.¹²¹ The Chief Secretary had to intervene, noting that supplying any kind of rat poison should not be the responsibility of either the agricultural or medical department, but that if “a poisoning campaign is to be undertaken” then it should be carried out through the Native Administration.¹²² The matter would remain unresolved, leading Harrison to cable an urgent request to London, pleading for rat virus.

At Whitehall in London, the Secretary of State responded curtly to Harrison’s pleas for “rat virus.” “I am advised that it is not possible to recommend effective virus which would be harmless to human beings,” he wrote, and sent the message to the Governor of Tanganyika, Sir Donald Cameron.¹²³ The “Rat virus” was possibly a culture of *Salmonella typhimurium*, which when introduced to a rodent population, would spread widely and kill the rodents rapidly with typhoid fever. The Rat virus was one of several experimental methods of killing rats that companies were releasing to the market during the interwar years when rodent control became a European and colonial priority. As with most experimental methods, the research was inconclusive as to whether the Rat virus was harmless to human beings or to domestic animals. A circular distributed by the Ministry of Health in the UK discourages the use of the virus near food because the virus was identical “with that found in many outbreaks of food poisoning.”¹²⁴ The Director of Medical and Sanitary Services, A. H. Owen, agreed with the Ministry’s circular. He upheld a ban on importing the virus to Tanganyika and expressed anxiety about Harrison’s eagerness to obtain such an experimental virus. “Until scientific evidence is produced that satisfactory practical results may be

¹²¹ TNA J.10/12704/1037/15, Handwritten notes.

¹²² TNA J.10/12704/1037/16, Handwritten notes.

¹²³ TNA J.10/12704/1037/26, Telegram from Secretary of State, London to Governor, Dar es Salaam, 6 Feb 1931.

¹²⁴ TNA J.10/12704/1037/25, Circular from Ministry of Health, transmitted to Tanganyika, 12 Jan 1931.

reasonably expected from the use of [the virus] I regret that I am unable to recommend the waiving of the restrictions against their import,” Owen wrote.¹²⁵

Given the risks and the government’s reluctance to import the experimental virus, Harrison had to resort to other means of resolving the rodent problem. But a lack of funding and staff hampered his department’s work. The department did not have the funds to purchase sufficient quantities of sufficient barium carbonate rat poison. Harrison instead had to tell planters to go to Dar es Salaam to buy their own, blaming the DMSS for the lack of aid.¹²⁶ The rodent attacks continued relentlessly, and desperate representatives of European planters’ associations insisted on a meeting with the Department of Agriculture. At the meeting in April 1931, planters told Harrison that they had seen the severity of rodent attacks on their matama (millet), maize, and cotton crops increase over the years.¹²⁷ They were very worried about what might happen if the government did not take any action. By September 1931, their fears were realized. The rodent problem had become a menace, slashing Kimamba’s annual cotton production from 4,000 to 5,000 bales to between 500 and 1,000. This 90 per cent loss was so alarming that the Chamber of Commerce threw in their support with the planters and called the government to act immediately. “Sympathy [from the government] alone will not destroy this pest,” they complained and added that “more practical steps were needed and also monetary assistance.”¹²⁸ These European planters believed that their losses amounted to something between £40,000 and £50,000.¹²⁹ Soon, the Tanganyika Ginneries’ Association was also calling for action.¹³⁰ The President of the Tanganyika

¹²⁵ TNA J.10/12704/1037/37-40, Letter from Acting Director of Medical and Sanitation Services to Director of Agriculture, 8 May 1931.

¹²⁶ TNA J.10/12704/1037/52, Newspaper cutting, “Kimamba Infested by Rats,” *The Tanganyika Standard*, 1 Oct. 1931.

¹²⁷ TNA J.10/12704 /1037/46-47, Letter from Director of Agriculture to Chief Secretary, 15 Sept. 1931.

¹²⁸ TNA J.10/12704 /1037/61, Memorandum of the Chamber of Commerce, Dar es Salaam, 25 November 1931.

¹²⁹ TNA J.10/12704/1037/51, Newspaper cutting, “Rats,” *The Tanganyika Standard*, 1 Oct. 1931.

¹³⁰ TNA J.10/12704/1037/70, Letter from Tanganyika Ginneries’ Association to Chief Secretary, 11 Dec 1931.

Planters' Association warned the government at a special general meeting convened to address the situation that if nothing is to be done about the rodent "menace," it was "the fear of planters in the Eastern Province that the most important cotton producing area—Kimamba—might experience ... disaster."¹³¹

Amid the tumult and uproar at the Department of Agriculture, Harrison, who could not supply poisons or staff for killing rats, looked elsewhere for a solution. He tried again to assign responsibility for the rodent menace to DMSS, but this time framed the problem as a scientific, rather than a practical, one. "Would it be possible," he wrote, "for the Department of Medical and Sanitary Services to have this important rodent studied from the point of view of the Zoologist?"¹³² A. H. Owen, Director of DMSS, agreed with Harrison's suggestion. "Any serious attempt to deal with the rodent population of the whole Territory should, I consider, certainly be preceded by a scientific investigation into their habits, breeding grounds, etc. and this would have to be carried by out a trained Zoologist," he concurred. Harrison's idea came at an opportune moment when Owen, as the next section will show, was himself dealing with multiple outbreaks of plague spread by rodents in the northern areas of Tanganyika. A scientific investigation at the Territorial scale would lay the foundations for a more coordinated and effective response. "Our present methods of poisoning, trapping and rat drives etc. merely deal with the local problem in an area which may be threatened by plague or where damage is being done to agricultural products," Owen added.¹³³ In other words, a scientific study could unify the goals and interests of the agriculture and medical departments, and hopefully end the bureaucratic blame game. Harrison was enthusiastic and added

¹³¹ TNA J.10/12704/1037/52, Newspaper cutting, "Kimamba Infested by Rats," *The Tanganyika Standard*, 1 Oct. 1931.

¹³² TNA J.10/12704/1037/46-47, Letter from Director of Agriculture to Chief Secretary, 15 Sept. 1931.

¹³³ TNA J.10/12704/1037/50, Letter from Acting Director of Medical and Sanitary Services to Chief Secretary, 24 Sept. 1931.

in another letter that such a study would yield benefits for all of Britain's East African Territories, as well as the greater Empire, including the Federated Malay States, where rice crops were frequently attacked by rats.¹³⁴

Harrison and Owen soon realized that they did not know anyone in the Tanganyika Civil Service who was trained as a zoologist, let alone anyone with scientific training in the ecology of rodents. The Chamber of Commerce as well as the Planters' and Ginneries Associations did not have anyone to recommend. In the following weeks, Owen sent a sanitary superintendent, C. W. Manton, to Pretoria, South Africa, to learn about rodent destruction from experts there.¹³⁵ South Africa's network of research stations, museums, and agricultural experiments have made it a center of British colonial science about disease, pest control, and wildlife protection on the continent. Harrison, meanwhile, reached out to the East African Agricultural Research Station in Amani in the north of Tanganyika for further advice. Its director, W. M. Nowell, agreed that a systematic study of rodents would be necessary and promised that he would be willing to oversee the research. External funding for such an undertaking would be needed, however, and this would require that the government first prepare a detailed preliminary report on the present rodent situation in Tanganyika.¹³⁶ Scrambling together what resources he had, Harrison finally assigned W. Victor Harris, the Assistant Entomologist at his department's offices in Morogoro to investigate the rodent problem in Tanganyika.

W. Victor Harris was more familiar with the ways of the borers, weevils, termites, and other insect pests. But he would apply his entomological training to the collection and dissection of rodents, beginning a six-month study in December 1931 at the request of the colonial

¹³⁴ TNA J.10/12704/1037/58-59. Letter from Director of Agriculture to Chief Secretary, 9 November 1931.

¹³⁵ TNA J.10/12704/1037/52a. Handwritten note. Author and date unknown but probably end of September 1931.

¹³⁶ TNA J.10/12704/1037/67-68. Letter from Director of East African Agricultural Research Station to Chief Secretary, 3 December 1931.

government. Systematizing rodent trapping, collection, identification, and population numbers, Harris's study marked the beginning of a long history of scientific rodent research in Morogoro. His regular trap-and-release experiments to estimate rodent populations in agricultural areas would set the scene for later, post-independence research work that would develop, in the twenty-first century, into the Sokoine University of Agriculture Pest Management Centre located in Morogoro town, a global center for rodent research.

To Wage a Great War Against These Enemies

The great lakes region of East Africa has long been a place where plague, an infectious disease caused by the *Yersinia pestis* bacteria, is endemic. British missionaries like Robert Ashe encountered plague in the central provinces of Uganda on the shores of Lake Victoria as early as 1887, documenting reports of a disease known as “kaumpuli” that decimated huge swathes of the population in the Buganda kingdom long before the arrival of the British.¹³⁷ Just south and across the border from the Buganda kingdom, the earliest reports of plague in Tanganyika were recorded in Kiziba in Bukoba (1897) and further south in Iringa (1886). There were further reports of outbreaks in Shirati in Mwanza (1901) and Rombo in East Kilimanjaro (1912).¹³⁸ A plague outbreak in Nairobi, Kenya in the first decade of the twentieth century is also well-documented.¹³⁹ Collectively, these incidences of plague lend further evidence to support the historical argument that the *Yersinia pestis* branch in East Africa may have originated in the European Black Death of the 14th century and arrived via the Arabian Peninsula. Memory of this epidemic history is

¹³⁷ Ashe, *Two Kings of Uganda*. See also MS Coll 59, Series II, Box I, Folder 22, Harvey Cushing Medical Historical Library, W. J. Simpson, *Report on Sanitary Matters in the East Africa Protectorate, Uganda and Zanzibar* (1914).

¹³⁸ See Msangi, “The Surveillance of Rodent Populations in East Africa in Relation Plague Endemicity”; Roberts, “The Endemicity of Plague in East Africa.”

¹³⁹ Roberts, “Plague Conditions in an Urban Area of Kenya (Nairobi Township)”; Achola, “Colonial Policy and Urban Health.”

inscribed in the Kiswahili word for plague, “tauni,” which comes from “ṭā‘ūn,” the Arabic word for the disease. Furthermore, the fact that these outbreaks predated the arrival of railway lines into the continental interior suggests that they were independent of the plague strains from pandemics in Hong Kong and Bombay at the end of the 19th century.¹⁴⁰

Many of these same places in Tanganyika would experience plague outbreaks again in the 1920s and 1930s, causing a significant number of deaths among the local population. In Uganda alone, 5,199 people died from plague in 1929.¹⁴¹ Fortunately, the number of fatalities from plague in Tanganyika would never come close to this number. The mortality data, however, is unreliable. Reporting officers often could not confirm if these deaths were due to plague or a disease with similar symptoms (such as anthrax) or malaria. Clinical confirmation of the bacillus through a test known as bipolar staining sometimes indicated that there was no plague, despite the observed patterns of infections and deaths. There is therefore no clear data for the total number of people who died from plague in Tanganyika under the British mandate, but archival sources consistently documented plague outbreaks through to the 1950s. During the postcolonial period, plague would flare up again in the 1970s and 1980s in the same places as those at the turn of the 20th century for reasons that are still unknown.¹⁴² Based on my own tally from archival records, 1931 saw approximately 90 official deaths. Despite the low mortality rate of plague in Tanganyika, the

¹⁴⁰ Monica H. Green, “Putting Africa on the Black Death Map: Narratives from Genetics and History,” *Afriques. Débats, Méthodes et Terrains d’histoire*, no. 09 (December 24, 2018). Currently, there has not hitherto been an attempt to study a large enough sample of genetic sequences of *Y. pestis* in East Africa that would provide additional evidence that indicate when branching might have occurred. For a preliminary genetic study of *Y. pestis* in Tanzania, see Ziwa et al., “Evidence of Yersinia Pestis DNA in Rodents in Plague Outbreak Foci in Mbulu and Karatu Districts, Northern Tanzania.”

¹⁴¹ *Plague in Tanganyika Territory: Notes on the History, Dangers, and Prevention of the Disease* (Dar es Salaam, 1931), pp. 2-3.

¹⁴² Kilonzo and Mhina, “The First Outbreak of Human Plague in Lushoto District, North-East Tanzania”; Kilonzo and Mtoi, “Entomological, Bacteriological and Serological Observations After the 1977 Plague Outbreak in Mbulu District, Tanzania”; Kilonzo, “Plague Epidemiology and Control in Eastern and Southern Africa during the Period 1978 to 1997.”; Ziwa et al., “Plague in Tanzania.”

severe death toll in Uganda caused alarm among colonial officers in Tanganyika when they started receiving reports of possible plague outbreaks in Tanganyika's Northern Province.

There were three recorded plague outbreaks in Mbulu district, about 100 miles southwest of Arusha, in 1930. During each outbreak, a senior medical officer or surgeon would be dispatched by the provincial administration to evaluate the situation. He would make hasty arrangements to travel, bringing along supplies to collect samples so that he could clinically determine the disease.¹⁴³ Based on the diagnosis, he would then coordinate a response with the Native Administration while keeping the government, in this case, the Department of Medical and Sanitary Services (DMSS), informed. I draw on these reports and letters to reconstruct how the colonial government in Tanganyika managed plague outbreaks in the late 1920s leading up to 1931, when the scale of outbreaks threatened to spill out from their rural locations and onto the port city of Dar es Salaam.

In December 1930, when the first of a series of serious plague outbreaks erupted in Mbulu, Amnai Inge, an Iraqw Court Elder who worked for the Native Authority and was highly-respected in his village, lost a child to bubonic plague. After the death of his child, Amnai set fire to his entire house, isolated himself, and sent in a report to Moshi, which was received by R. Nixon, the Senior Health Officer. Nixon was immediately sent to Mbulu to investigate the situation. Upon his arrival, Nixon learned that several more deaths had occurred, totaling nine at the end of January 1931. He also learned that under Amnai's direction, the entire village of 420 people would voluntarily go into quarantine for 10 days after the last notified case of plague. After the ten-day quarantine, they would burn their entire village and then move to and settle in a new area. Amnai requested that the Native Authority begin building 80 houses in the new area, located across a

¹⁴³ For an example of such usually haphazard trips, see the anonymously written article FAG, "The Pursuit of Pestis," *East African Medical Journal* 22 (1945), pp. 298-302.

stream, which would act as a natural barrier against rats. At the stream crossing, the Iraqw villagers would remove all their clothing, which would then be sprayed with paraffin to kill any fleas. The DMSS refused to provide any funds for this endeavor, saying that it was not the responsibility of the medical department to buy soap and paraffin oil. The Native Authority had to step in and pay for disinfectant using tax money collected from the villagers. The miserliness of the colonial government so clearly embarrassed the acting district officer, L. S. Greening, that he wrote to the provincial commissioner in Arusha to see if he could authorize any funds to buy disinfectant and “Amerikani” cloth that villagers would use once they have stripped off their clothing at the stream.¹⁴⁴

At this point, the colonial government of Tanganyika did not yet have the knowledge or a strategy for dealing with plague. It would be another few months before the government consulted experts and began adopting policies from South Africa to quell the scourge. This timeline suggests that Amnai’s quarantine and relocation strategy to prevent the further spread of plague in his village was based on knowledge circulating locally and in experiences of the disease. The history of plague’s endemicity in this part of the world and the fact that I did not come across another quarantine and relocation strategy in the archive strengthens this claim. As an officer in the Native Authority and a village elder, Amnai would have been literate, well-respected, and well-connected. He was certainly engaged in thinking deeply about the social and economic changes that were unfolding before him, and was a proponent of encouraging his fellow Iraqw in Mbulu to build their houses out of brick rather than mud, wattle, and grass.¹⁴⁵ Amnai’s leadership represents a tiny but crucial part of a larger group of experiences that, unlike Amnai’s, are not recorded in the archive.

¹⁴⁴ TNA 11901/v1/30-32. Letter from Senior Health Officer to Director of Medical and Sanitary Services, 11 Jan 1931; TNA 11901/v1/41-42. Letter from Ag. District Officer of Mbulu to Provincial Commissioner of Northern Province, 16 Jan 1931.

¹⁴⁵ TNA 11901/v1/34. Handwritten note. Signed by “Provincial Commissioner.” 26 January 1931.

His strategy to quarantine and relocate is evidence that at least some Tanganyikans possessed knowledge about plague and its transmission yet are usually only ever portrayed as victims of the disease, whose habits are blamed for spreading it (as I shall soon show).

Amnai's quarantine and relocation measures were insufficient for Nixon. For Nixon, these measures resolved the immediate threat of the disease but they were inadequate in preventing future outbreaks of plague. Colonial officers at DMSS, based on their consultations with London and South Africa, wanted to ensure that "native dwellings" be as inhospitable and inaccessible as possible to house rats, which were seen as the primary vector of the disease because they carried infected fleas into a dwelling. These fleas would bite and infect the dwelling's human inhabitants and cause plague. To this end, Nixon advised district officer to "encourage the natives to keep cats" since "Wambulu dogs appear to have no value as ratters." Additionally, the resettlement of the Iraqw, or Wambulu, in a new area means that the government can "get the Wambulu out of their tembe huts into dwellings from which it is possible to exclude the rat."¹⁴⁶ Tembe hut is the term colonial officials used to describe rectangular houses built low into the ground, made with wooden frames, thatched roof, and mud walls typical of the Iraqw homestead in the 20th century. To colonial officials, these structures permitted a porosity between the house and its environment that encouraged rodents from the wilderness and the farm to enter the house, carrying fleas infected with *Y. pestis*. In other words, colonial measures against plague were as much about changing Iraqw ways of life as about stopping the transmission of disease. The plague outbreak in Amnai Inge's village became an experimental system for changing how the Iraqw lived, further incorporating them into the modernist and capitalist project of colonialism.

¹⁴⁶ *Ibid.*

In discussions among officers at the district office and DMSS, the rat very quickly became more than just a disease carrier. The rat's threatening presence, crossing from wilder places into the domestic space, came to index indigenous backwardness and foolishness. As the resettlement approached, colonial officers schemed and discussed different ways to get the Iraqw to adopt rat-proofing strategies in their new village. A provincial commissioner sent in a note, describing them as "very wasteful" because they "invariably abandon a dwelling in which a death has occurred, using the poles for firewood." Such "superstition" would prevent them from building better houses given their "habit of evacuating and destroying a house when one of the inmates dies."¹⁴⁷ L. S. Greening, the acting district officer, was even more condescending. Encouraging the Wambulu to keep cats was not "practicable" because the "natives...would never think of feeding a cat." He then revealed that "I personally destroy any surplus kittens rather than give them to a native." Greening reported that the Wambulu's "outlook" was that "fed cats will not hunt" and therefore they refused to feed any cats, resulting in "poor half-starved creatures [that] are too weak to hunt and [that] live by scavenging."¹⁴⁸ For these officials, the modernity, or its lack, of the Iraqw was measured by how the Iraqw configured their multispecies relations among rodents, cats, and dogs.

Although Amnai Inge's village did not experience any more deaths in 1931, the efforts may have come too little too late to stem an epidemic. By May 1931, there were reported outbreaks of plague in Nassa town (3 deaths), Tabora town (several deaths), Maswa district (15 deaths), Nzega district (40 deaths), Shinyanga district (15 deaths), and Maswa town (15 deaths). Notices were sent to the League of Nations Health Organisation's Eastern Bureau in Singapore as part of reporting requirements under the International Sanitary Convention of 1926, which instituted an

¹⁴⁷ TNA 11901/v1/34. Handwritten note. Signed by "Provincial Commissioner." 26 January 1931.

¹⁴⁸ TNA 11901/v1/63. Letter from Ag. District Officer of Mbulu to Provincial Commissioner of Norther Province, 20 Feb 1931.

international surveillance system of epidemic diseases.¹⁴⁹ As the death tally from plague in Tanganyika continued to rise in the northern, central, and lake regions of the country, the colonial government started to worry that the locations of these outbreaks were too close to the Tabora-Mwanza line of the Tanganyika Railway.¹⁵⁰ What happens when plague-infected rodents and fleas hitched a ride on the train and ended up as far east in Dar es Salaam? What if rodents were accidentally smuggled onto a cargo ship bound for Marseilles or Macau?



Figure 2. Map of Tanganyika Territory (1933), Maps and Geospatial Data, Princeton University Library.

¹⁴⁹ TNA 11901/v1/52. Report from Provincial Commissioner of Mwanza Province, 25 February 1931; TNA 11901/v1/69-100. Various reports by Ag. Director of Department of Medical and Sanitary Services, March-May 1931. The League of Nations Health Organisation is the precursor of the World Health Organisation (WHO).

¹⁵⁰ TNA 11901/v1/102. Report by Chief Secretary, 10 June 1931.

R. R. Scott, who was Director of DMSS in 1931, immediately consulted the General Manager of Tanganyika Railways, going over several possibilities for implementing “disinfestation,” which included inspecting train loads of agricultural produce, gassing train trucks, and rat-proofing the warehouses near the railways. At the same time, Scott instituted regular “deratisation” efforts on all vessels on Lake Tanganyika, where cargo from the Belgian Congo usually crossed to make their way to the port of Dar es Salaam by rail. In June, the DMSS drafted, published, and distributed a pamphlet on plague in Tanganyika to aid in these efforts. The pamphlet would streamline the various anti-plague measures that the colonial government had been receiving from London, South Africa, and Uganda, and would serve as a resource for medical officers at the district and provincial levels as well as the Native Authorities tasked with enforcing anti-rat measures. The DMSS sent out the pamphlet with a circular, that came in English and an abridged version in Kiswahili, along with broadsheets that could be posted in village squares, schools, and administrative offices as part of a nascent anti-plague campaign.

The pamphlet provided a brief history of plague in East Africa, its modes of transmission, the effects of the disease (including death), and measures for preventing it. Given the early history of plague in the region, the pamphlet went on to describe the disease as endemic to Tanganyika. Designating plague as endemic is a way to say that it would be impossible to eradicate the disease entirely. Instead, the disease should be monitored, managed, and minimized as much as possible. “It may, therefore, be expected that further outbreaks will occur from time to time, and although unlikely to reach epidemic proportions in the sparsely populated districts, infection of the rodents in the neighbourhood of, or inhabiting more densely populated centres or towns will give rise to serious alarm, cause considerable dislocation to trade and communications, and result in numerous

deaths.”¹⁵¹ This implication would be further reinforced by rodent research that would commence at the end of 1931. The pamphlet identified the rodent, particularly the common black rat, as the “usual immediate source of infection” because they live “in close association with man.”¹⁵²

The best way to prevent plague, according to the pamphlet, is to “break the chain connecting rat to man.” It warned against “extensive rat-killing campaigns in the absence of actual infection” because they do not actually reduce rat populations due to their rapid rate of breeding. However, during an outbreak, “such campaigns are valuable” because they reduce the probability of infected rats that are carrying fleas to come into contact with people. The most “practicable” anti-plague measure is to “build the rat out.” This means improving existing buildings or constructing new ones that adhere to new building rules introduced by the government in 1930.¹⁵³ The enforcement of these building regulations, however, was confined to urban areas. The issue of “native dwellings” in rural areas, which represented much of the building structures in Tanganyika, required a different response. In cases where building out the rat were impossible, such as in tembe houses, measures must be taken to prevent rats from making their homes and obtaining food in these houses.¹⁵⁴

Measures regarding “native dwellings” were given little priority in the eight-page English pamphlet but they took up almost half of the abridged version of the pamphlet that was printed in Kiswahili. The Kiswahili version is titled as a government order (“amri serikali”). The order invokes the language of military service to recruit people to fight a “great war” against rodents:

¹⁵¹ Plague in Tanganyika Territory: Notes on the History, Dangers, and Prevention of the Disease (Dar es Salaam, 1931), p. 4.

¹⁵² *Ibid.*, p. 5.

¹⁵³ *Ibid.*, p. 6. The Township (Building) Rules of 1930, including Section 13, dedicated to rat-proofing was adopted from similar regulations that were introduced in South Africa in 1927. These building rules are still in use in modern-day Tanzania.

¹⁵⁴ *Ibid.*, p. 6-7; TNA 11901/v1/123, “AMRI YA SERIKALI: TAUNI,” abridged Kiswahili version of the pamphlet. 1931.

Basi yapasa kila mtu kupigania vita vikubwa na hao adui waambukizao ugonjwa; na vita vipigwe hivyo:- 1) Kuweka akiba ya vyakula katik vyombo visivyoweza kuingiliwa na panya, kama mitungi au madebe. 2) Kufunika mitungi na mapipa ya maji manyumbani, panya wasipate maji ya kunywa. 3) Kutoa kila kitu cha nyumbani, kisha mwaga maji kidogo chini na kufagia, na kuchoma moto takataka zote zilifagiliwa. 4) Kupeleka pamba na sufi na karanga na mavuno ya namna hizi upesi madukani, yasiwekwe siku nyingi manyumbani.

Everyone must thus wage a great war against these enemies who spread the disease; and the war would be fought in this way:- 1) Keep stores of food in rat-proof vessels such as clay pots or tin cans; 2) Cover water jugs and barrels to prevent rats from getting water to drink; 3) Put everything out of the house, splash some water on the floor and sweep, then burn the sweepings; 4) Make sure that cotton, kapok, groundnuts, and the like are sent to the shop quickly; do not keep them for many days at home.

These plague prevention methods were all targeted at breaking the connection between people, rodents, and lice. There was little attention paid in any of the Kiswahili materials about identifying symptoms or seeking medical help when there is a suspected infection.

Accompanying the government order are several printed broadsheets in Kiswahili with instructions for district officers and Native Authorities to post them in public places, such as at markets, meeting places, village leaders' homes, and administrative buildings. As with the

government order, the purpose of these broadsheets was not to educate people about plague so that they would be able to identify symptoms of the disease and seek immediate treatment. Rather, the colonial government was concerned with economic impacts of the disease, affecting crop production and decimating the labor force. As such, these broadsheets explained that plague was a disease spread by rodents and fleas to humans and included measures that people can take to reduce human-rodent and human-flea interactions in their homes.



Figure 3. Broadsheets in Kiswahili about plague disease (“tauni”), rodents (“panya”), and fleas (“kiroboto”).

Additionally, the language used in the broadsheets suggests that the success of these anti-plague measures depended on crafting villainous profiles of the nonhuman animals involved. The language differentiates between rodents, fleas, and humans by performing a shared humanity between colonial official and local inhabitant through the use of the pronoun “our.” One broadsheet declares “The Danger of Rodents!” with an image of a *Rattus rattus* (black rat) on top. It goes on

to describe the rat as “our enemy, who brings disease, steals our food and destroys property.” The other broadsheet declares that the flea is a “villain, who sucks our blood, brings disease, and breeds in dirt.” That shared humanity created between colonial and colonized person, however, dissipates toward the end of the broadsheets, where instructions take on the pronoun “your.” “Banish [rodents] from your home by withholding food and keeping a clean house,” directed one broadsheet while the other tells its readers to “sweep your houses and burn the sweepings.” These instructions differentiated colonized Tanganyikans from colonial officers, admonishing local habits of hygiene and upkeep.

By the end of 1931, the threat of further plague outbreaks had subsided. Colonial officials were relieved and took the opportunity to conduct further research on the rodents themselves. Up until 1931, medical and district officers assumed that the main vector of plague was the *Rattus rattus*, or the common black rat, also known as the house rat (*panya nyumba* in Kiswahili). Because these rats mostly lived close to human habitation, fleas infected with *Y. pestis* must have entered the homestead and settled on the house rat through some other vector. What rodents or other small mammal this was no one was certain, but many officials recorded suspicions about field rodents. As was the dominant view in South Africa, field rodents were thought to carry infected fleas from sylvatic rodents to house rodents.¹⁵⁵

When the Director of Agriculture in Morogoro suggested a zoological study of rodents as disease carriers and agricultural pests, the Director of Medical and Sanitary Services agreed. More information about the species, behaviors, and ecology of rodents in Tanganyika causing crop damage and plague disease would be helpful to better shape government policy and distribute funds for poisons, traps, and other methods for rodent control. After the multiple outbreaks of

¹⁵⁵ TNA 11901/v1/27-29. Letter from Director of Medical and Sanitary Services to Provincial Commissioner of Northern Province, 11 December 1930.

plague and rodents of 1931 in Tanganyika, the colonial government made some funds available to conduct several preliminary studies of rodent species and population. These studies, even as early as 1931, had begun incorporating ecological frameworks (or “bionomics” as it was also known then) to explain rodent outbreaks and, therefore, design policy for controlling rodent populations.

A Futile and Soothing Approach

When several tins from Tanganyika containing the preserved bodies of various rodents, stuffed with cotton, wrapped in gauze, numbered, and soaked in a Formal saline solution arrived in the office of Austin Roberts, a senior assistant in the higher vertebrates section of the Transvaal Museum in Pretoria, South Africa, Roberts was not at all pleased. “The specimens were not prepared in the usual way,” he complained, “very incomplete and therefore not readily identifiable.”¹⁵⁶ Roberts valued precision and it was his commitment to the orderliness of nature that made him a well-known ornithologist and mammologist. But it was his experience with plague-carrying rodents that was being sought by the colonial government in Tanganyika. Roberts was well-recognized by the South African government for his efforts to determine which species of rodents harbored plague during outbreaks in the Orange Free State during the 1920s.¹⁵⁷

In the immediate wake of the multiple outbreaks of plague and rodents in 1931, rodent bodies and body parts began circulating up and down the eastern seaboard of the African continent. Specimens were being transported north to the British Museum or south to the Transvaal Museum for identification as part of efforts to understand the behavior and ecology of rodents. The ecological view of nature began to revolutionize research methodology and biological theory in

¹⁵⁶ TNA 450/106/9/4. Letter from Senior Assistant for Higher Vertebrates, Transvaal Museum, Pretoria to Director of Medical and Sanitary Services, Tanganyika, 16 November 1932.

¹⁵⁷ “Roberts, Mr Austin.”

Britain beginning in the 1930s. This paradigmatic shift was further helped when *Animal Ecology* (1927) was published by Charles Elton, who would also later establish the Bureau of Animal Population at Oxford in 1932. In the introduction to the book, Julian Huxley enthusiastically endorsed the work of his former student's work, calling "the subject of animal numbers" a field that is of "fundamental importance" to the field of biology.¹⁵⁸

The various rodent studies launched in Tanganyika at the end of 1931 envisioned that rodent bionomics would provide solutions to the growing rodent menace that threatened to damage crops and spread disease. The Director of Agriculture assigned W. Victor Harris, an assistant entomologist at the department's office in Morogoro to conduct a six-month study to gather data about rodent numbers, behavior, and parasites. These studies had two main goals. The first was to establish which species of rodents were harboring plague or causing damage, since taxonomy would help clarify the organization of relationships between behavior, environment, and organism. For this reason, Harris sent several specimens to the British Museum in London for identification. Other specimens were also sent to the Transvaal Museum in Pretoria. The second goal is to offer a Territory-wide strategy for eradicating rodents. This strategy would rely on disrupting the breeding and migratory patterns of rodents. A "different system is required to deal with [rodent] migrations and their prevention," wrote the Director of Agriculture in an update to the press, and added, "Such a system can only be arrived at by a study of the problems, and finding where the mice multiply."¹⁵⁹

Harris completed the six-month study in May 1932. In his report, he was able to identify 17 species of rodents. He trapped and released hundreds of mice and rats every four weeks, whose

¹⁵⁸ Huxley, "Editor's Introduction." It is worth noting that the word "ecology" was in use in Britain before the publication of *Animal Ecology*, most notably by Arther Tansley. See Hagen, *An Entangled Bank*, particularly Chapter 5.

¹⁵⁹ TNA J.10/12704/1037/104-105. Letter from Director of Agriculture to Editors of the Press, 25 February 1932.

numbers provided the first data points for establishing the periodicity of rodent populations in the plantations surrounding the Morogoro area. Harris selected 42 rodents for examination. He combed their furs for ectoparasites, collecting any fleas and ticks that fell out. The rodents were then dissected so that internal parasites could be collected from their organs for identification. In the report, Harris noted that there were several species that formed what was known as “grey field mouse,” including *Praomys tullbergi* and the multi-mammate *Mastomys sp.* mouse. Harris also identified the common black rat, or *Rattus rattus* as responsible for attacking crops. Occasionally, he caught a “Giant Rat,” or *Cricetomys gambianus*, which Harris noted is a species known to attack maize fields in the Uluguru mountains. He concluded the report with a guide on preparing poison baits and suggested that the four-weekly catch and dissection be continued to develop a good understanding of the “inter-relations of the species grouped together.”¹⁶⁰

Studies such as Harris’ were conducted regularly in 1932 and 1933. In the northern areas of Tanganyika, medical officers arranged tours to trap, collect, and identify rodents and their parasites, with the goal of elaborating an ecology of plague. Unlike Harris’ studies, which were focused on population numbers, the studies that reported to the Department of Medical and Sanitary Services were more concerned about determining which rodent species were “plague reservoirs.” One such tour was led by Dr. A. R. Lester, a senior health officer based in Shanwa district. His tour covered a wide area, from Mwanza on the shores of Lake Victoria to Tabora, near the central region of Tanganyika. Lester and his team trapped over 1500 rodents and dissected over 700, sometimes preserving whole specimens and other times keeping just their skins. They tested the 700 spleen smears for *Y. pestis* and found that they were all negative for plague.¹⁶¹ Select

¹⁶⁰ TNA J.10/12704/1037/113-118. Report by Victor Harris: Rodent Investigation. 25 May 1932.

¹⁶¹ TNA 450/106/9/4B-4I. Report by A. R. Lester, Acting Senior Health Officer, Mwanza, 28 October 1932.

specimens from this tour and another one in Dar es Salaam were then forwarded to Pretoria, where Austin Roberts would be charged with identifying their species.

Despite the shoddy preservation of the rodent specimens, Roberts identified *Rattus rattus*, *Tatera swaythlingi* (a gerbil known for spreading bubonic plague in South Africa), *Mastomys coucha microdon* (a multimammate mouse “with no striking characteristics”), *Lemniscomys barbarus albolineatus* (or striped mouse, “frequenting cultivated ground, not usually entering houses”), *Arvicanthus abyssinicus muansae* (or Abyssinian Rat, whose “genus does not extend into S. Africa”), and *Elephantulus ocellaris* (elephant shrews, “not rodents nor potential plague carriers”).¹⁶² The conclusion was that only two or three species of rodents caught in Tanganyika were known to be carriers of plague, and they were sylvatic, that is they would usually not enter homes and pass the plague to their inhabitants. Additionally, there had been no reported epizootic rodent deaths in that year. All of this made it difficult to say for certain whether plague was dormant or even endemic to the region. Additionally, all of the 700 samples of spleen smears from domestic, semi domestic and wild rodents were negative for plague. The study essentially failed to produce any useful information that would help the colonial authorities prevent future outbreaks of plague.¹⁶³

¹⁶² TNA 450/106/9/4. Letter from Senior Assistant for Higher Vertebrates, Transvaal Museum, Pretoria to Director of Medical and Sanitary Services, Tanganyika, 16 November 1932.

¹⁶³ TNA 450/106/9/4B-4I. Report by A. R. Lester, Acting Senior Health Officer, Mwanza, 28 October 1932.

Disappointing results also came in from the Morogoro area. As Harris' rodent study continued into 1933, it failed to show that there were any outbreaks in rodents nor plague. In June 1933, planters including a manager at Rudewa Estates Ltd. (formerly the Tanganyika Cotton Company) said they have not seen a rodent in months. Harris also reported that when he immediately examined the bodies of rodents after they were killed, he had not found any fleas.¹⁶⁴ Yet, when outbreaks occurred, they seemed to happen swiftly without warning, causing great damage. By 1937, these studies had yet to bear fruit in the form of a concerted strategy for dealing with pest or pestilence in Tanganyika. As in 1931, a wave of plague outbreaks rippled across the same areas in the first half of 1937. There were two cases of plague reported in Mbulu, sixty cases and sixteen deaths in Singida, and eight deaths in Mwanza.¹⁶⁵ The disease had struck within the urban areas of Mwanza town this time. As a result, town residents, most of whom were Indian traders, evacuated and fled to the coastal areas.¹⁶⁶

Despite their inefficacy in preventing future rodent and plague outbreaks, these studies continued through to the post-independence era. Even in the absence of any clear results from these studies, colonial administrators in Tanganyika internalized the ecological assumption inherent in these studies. This assumption held that rodent and disease outbreaks would occur at regular intervals according to the relationships between a population of animals and their environment. "It may, therefore, be expected that further outbreaks will occur from time to time," read the official circular from the colonial government in reference to both rodent populations and the incidence of plague.¹⁶⁷ The best prevention methods seemed to be disrupting those ecological

¹⁶⁴ TNA 450/106/9/16. Letter from Medical Officer, Kilosa to Director of Medical and Sanitary Services, 19 June 1933.

¹⁶⁵ TNA 11901/v2/220-221. Letter from Director of Medical and Sanitary Services to Chief Secretary, 6 March 1937.

¹⁶⁶ TNA 11901/v2/225. "Plague in Mwanza," newspaper cutting from *The Tanganyika Herald*, 9 March 1937.

¹⁶⁷ *Plague in Tanganyika Territory: Notes on the History, Dangers, and Prevention of the Disease* (Dar es Salaam, 1931), p. 4.

relationships. Since so little was known about the rodents themselves, despite the ongoing studies, the colonial government focused on changing the environment by enforcing strict separations between humans and rodents, usually placing the burden and responsibility for carrying this out on local Tanganyikans, laborers, and non-British immigrant planters. Although district offices often kept a supply of traps and poison, along with manuals for baiting, these were often insufficient to contain the kinds of outbreaks that caused severe damage to crops or spread disease. In other words, both the Departments of Agriculture and Medical and Sanitation Services placed the responsibility for managing rodent outbreaks on those who bore the greatest brunt of rodent attacks, as I conclude below.

As the colonial government increasingly took the position that rodent outbreaks and plague were part of a natural order, their response began to focus on ensuring that urban areas, ports, railways, and homesteads were inhospitable environments to the rodent. As a result, many of these were social interventions, usually involving significant changes to existing or local ways of life. In the case of plague, we have seen earlier how the tembe house of many Tanganyikans were derided as being “insanitary.”¹⁶⁸ The colonial government also adopted new regulations that mandated that buildings in townships be sufficiently rat-proof. These rules would also prevent the storage of grains in places where people slept and set out conditions for the hygienic maintenance of bazaar areas.¹⁶⁹

In the cotton planting areas of Kimamba and Kilosa, the “dirty” harvesting practices of Tanganyikans who worked on the plantations were eventually blamed for any rodent outbreaks. “The rat plague in the Kimamba district is due almost entirely to the fact that Kimamba farmers

¹⁶⁸ TNA 11901/v1/27-29. Letter from Director of Medical and Sanitary Services to Provincial Commissioner, 14 July 1931.

¹⁶⁹ TNA 11901/v1/117-119. Letter from Director of Medical and Sanitary Services to Chief Secretary, 14 July 1931. The Township (Building) Rules of 1930, Section 13.

are ‘dirty’ farmers, that is to say, they leave food in the fields and fail to harvest their crops, both of which attract rats in large numbers,” wrote D. J. Jardine, the Chief Secretary to the Tanganyika government.¹⁷⁰ Leaving the cotton unharvested, however, was a strategy that Tanganyikan workers and immigrant planters used to assert some level of control over the commodity’s depressed market price, which was slowly recovering after the Great Depression.¹⁷¹ Indeed, such “slovenly methods of farming” gradually justified the government’s lack of interest to address the rodent problem. “I am decidedly of the opinion that in such circumstances it is the duty of the agriculturalist to help himself, so far as it lies within his power to do so by maintaining a reasonable standard of farming practice,” W. M. Nowell, the Director of the East Africa Agricultural Research Station in Amani wrote in a letter to the government to voice his opposition to using any government funds to hire a rodent “specialist.”¹⁷² These notes and letters would inform later government policy to encourage, and sometimes enforce, “clean” farming methods, including the storage of harvested crops in rat-proof containers as part of a larger “building out the rat” strategy.¹⁷³

By changing farming practices to reduce the probability of future rodent outbreaks, the colonial government hewed closely to the emergent ecological paradigm that was also taking hold in Britain. This view is best summarized in Huxley’s introduction to *Animal Ecology*:

...it may often be found that an insect pest is damaging a crop; yet that the only satisfactory way of growing a better crop is not to attempt the direct

¹⁷⁰ TNA J.10/12704/1037/69. Note by Chief Secretary, 16 December 1931.

¹⁷¹ TNA J.10/12704/1037/90. Note by Chief Secretary, n.d. but probably early 1932.

¹⁷² TNA J.10/12704/1037/88. Letter from Director of the East Africa Agricultural Research Station, Amani to Chief Secretary, 20 January 1932.

¹⁷³ TNA J.10/12704/1038. Letter from Game Warden, Arusha to the Territorial Medical Headquarters, n.d. but probably sometimes in April or May 1952.

eradication of the insect, but to adopt improved methods of agriculture, or to breed resistant strains of the crop plant.¹⁷⁴

Huxley then referred particularly to the issue of rodent outbreaks, and he would most certainly have been familiar with the rodent outbreaks in both Tanganyika and South Africa.¹⁷⁵ “It is a familiar fact that serious plagues of mice, rat, and other rodents occur from time to time in various parts of the world, often causing a great deal of damage,” Huxley continued. It is worth quoting in full how this ecological paradigm has begun to significantly influence a biologically informed understanding of rodent outbreaks:

Readers of Mr. Elton’s book will discover that these violent outbreaks are but special cases of a regular phenomenon of periodicity in numbers, which is perfectly normal for many of the smaller mammals. The animals, favoured by climatic conditions, embark on reproduction above the mean, outrun the constable of their enemies, become extremely abundant, are attacked by an epidemic, and suddenly become reduced again to numbers far below the mean...The organisers of the anti-rodent campaign claim the disappearance of the pest as a victory for their methods. In reality, however, it appears that this disappearance is always due to natural causes, namely, the outbreak of some epidemic; and that the killing off of the animals by man has either had no effect upon the natural course of events, or has

¹⁷⁴ Huxley, “Editor’s Introduction.” p. xv.

¹⁷⁵ Tilley, for example, notes that both Julian Huxley and Charles Elton discussed establishing a Bureau of Ecology of Africa in 1931. Tilley, “Ecologies of Complexity.”

delayed the crisis with the inevitable effect of maintaining the plague for a longer period than would otherwise have been the case!¹⁷⁶

It is worth highlighting from this long quotation that measures taken against rodent outbreaks were not only ineffective but could potentially prolong the problem by delaying what was supposed to be an inevitable explosion in rodent numbers.

Despite the growing dominance of this ecological view, the approach did attract criticism and derision, especially when rodent outbreaks and plague disease continue to riddle the economic activities of colonial settlers. In a complaint letter sent by a British barrister living in Mwanza during an outbreak of plague, he derided this official obsession with scientific knowledge. “Having some knowledge of present time Bureaucratic Methods,” he wrote to the provincial Senior Medical Officer, “I expect [the Director of Medical and Sanitation Services] has asked you to furnish a scientific treatise on the Origin of the Flea and its present day method of propagating its species...or something equally futile and soothing to the Official Mind.”¹⁷⁷ Little did he know that this “futile and soothing” approach of understanding disease and pest in ecological terms would, by the twenty-first century, become the dominant view.¹⁷⁸

Conclusion

The increasingly ecological approach to rodent outbreaks and plague disease in colonial Tanganyika represented a wider shift in the biological sciences towards multi-causal and

¹⁷⁶ Huxley, “Editor’s Introduction.” p. xvi.

¹⁷⁷ TNA 11901/v2/308. Letter from A. A. Willis to Senior Medical Officer of Health, Mwanza Province, 11 May 1937.

¹⁷⁸ Singleton et al., *Ecologically-Based Management of Rodent Pests*.

systematic understandings of infectious diseases and their animal vectors.¹⁷⁹ The biological sciences became a tool of the state to order, improve, and govern society. They informed methods for controlling pests, increasing agricultural output, managing epidemics, and extending the reach of the state into the everyday lives of its subjects. In colonial Tanganyika, the eradication, and later, control of rodent outbreaks and plague was thoroughly entangled with colonial notions of development and modernity. The state sought to change local ways of life as solutions to the rodent problem through the use of propaganda, public health campaigns, and the enforcement of new laws. Under these colonial initiatives, the rodent became more than just a biological organism whose behaviors and reproductive cycles needed to be studied. The presence of rodents upended stable notions of private property and sanitation, threatening disease and destruction by trespassing into farms, granaries, stores, and train wagons. By locating the cause of rodent and plague outbreaks in the social realm, colonial administrators paradoxically assigned rodents to the realm of nature. In relegating the rodent's appearance to the natural rhythms of ecology, the colonial state focused on putting the blame on, and ultimately changing, the unsanitary, backward, and slovenly habits of their colonial subjects as part of the larger incorporative project of colonial capitalist extraction.

What is gradually becoming clear in this chapter, and will continue in the following chapters, is the role that rodents play in reordering society. Rodents transgress human categories and projects, refusing to respect private property or other forms of boundaries that are crucial to social life, such as the difference between field and house. The figure of the rodent itself, in the hands of colonial health and agricultural officers, marked the distinctions between “native” and European ways of life given that Tanganyikan homes, farming practices, and sanitary habits were

¹⁷⁹ See, e.g., Tilley, “Ecologies of Complexity”; Sayer, “The ‘Modern’ Management of Rats.”

identified as “slovenly” and were thereby gradually subject to new regulations that sought to stem outbreaks of rodents and plague. The burgeoning field of population ecology located the cause of these outbreaks in the social realm. Given the natural periodicity of rodent populations and the endemicity of plague in Eastern Africa, it was left to human enterprise—or better, human fortitude or folly—to keep rodents at bay.

CHAPTER TWO

Decolonizing Science?

Anyone who visits the Pest Management Center at the Sokoine University of Agriculture (SUA) in Morogoro in 2018 for a meeting with its director will have to pass by a wall of photographs that shows every past director. One portrait is larger than the rest, mounted above the others, showing the face of a smiling white man with twinkling eyes under a safari hat and sporting a white beard. If you get close enough, you will be able to make out the fading name plaques under each portrait. There are portraits of Prof. Kilonzo, Prof. Machang'u, Prof. Makundi, and Prof. Massawe, all former directors, and Dr. Mnyone, the current director. The larger portrait above them is of Prof. Dr. Walter N. Verheyen, credited with being the founder, in the 1980s, of the SUA Pest Management Center (SPMC), when it was then known as the Rodent Research Project. This chapter focuses on the early history of SPMC, focusing on the postcolonial period between 1975 and 2020.

The history of the Sokoine University of Agriculture Pest Management Center (SPMC) dates back to the late 1970s, at a time when Tanzania's socialist experiment was being eclipsed by turbulent economic and political changes in the world that would devastate the development of many African countries. The project began as a Belgian-Tanzanian effort to control rodent populations that were destroying crops and spreading diseases. Established during a time of high inflation and economic crisis, the Tanzania-Belgium Rodent Research Project, as it was then known, was set up amid fraught circumstances. The Project, propelled by Belgian scientists from the Antwerp area, had to compete with other aid agencies, bureaucratic intransigency, and an

economic recession. With the promise of funds, technical training, research partnerships, and equipment, the Belgians were able finally to set up the Project in 1986 in collaboration with scientists at the Sokoine University of Agriculture.

The purpose of this chapter is two-fold.

First, I argue that the colonial framing of rodents as a scientific problem of population ecology endures into the postcolonial period. Although Tanganyika gained political independence from the British in 1961 and formed a United Republic with Zanzibar in 1964, the Tanzanian government remained economically dependent on Britain and Europe, continuing to implement a colonial model of development. Conflicts over Tanzania's support for other liberationist movements on the continent also impeded investment and aid from global North countries.¹⁸⁰ The Arusha Declaration, announced by Tanzania's president Julius Nyerere in 1967, sought to cultivate Tanzanian economic independence through a national comprehensive strategy, called Ujamaa, for equitable and humane development. One of the key aims of Ujamaa was to challenge the capitalist model of development that was being promoted—and imposed—by global North countries and multilateral organizations at the time. Under Ujamaa, the resettlement of millions of rural Tanzanians into planned villages meant to increase agricultural production and national revenue had proven to be too fast and too disruptive. Policy mismanagement and drought reduced grain production in the 1970s by as much as 30 per cent while the country's exports of cash crops, key to maintaining its foreign reserves, by 1983 was down to a third of what its volume had been in 1961.¹⁸¹ The end of the 1970s saw dire threats of widespread famine in Tanzania and it was crucial that the government minimized any types of harvest lost, including to rodent pests.

¹⁸⁰ Kimambo, Maddox, and Nyanto, *A New History of Tanzania*.

¹⁸¹ Kahama, Maliyamkono, and Wells, *The Challenge for Tanzania's Economy*. Quoted in Kimambo, Maddox, and Nyanto, *A New History of Tanzania*.

As the location of the colonial government's Agricultural Department and later the site of the University of Dar es Salaam's agricultural college, Morogoro retained a history for carrying out rodent research work, especially in terms of pest management. The idea of building a Rodent Control Center in Morogoro began in the mid-1970s when the Tanzanian government sent requests to the Food and Agricultural Organization of the United Nations (FAO) to help with serious rodent outbreaks that threatened the nation's food security. In 1979, the Danish International Development Agency (Danida) offered personnel, equipment, and funds to Tanzania to set up a Rodent Control Center (RCC) that would help the country develop an effective pest management program. In 1984, a more academic-oriented Rodent Research Project (RRP) was set up at the university by a group of Belgian zoologists, including Walter Verheyen, funded through a bilateral cooperation agreement with the Belgian government. The Belgians, too, were attracted to Morogoro because academic staff at the agricultural college had some training in taxonomy and microbiology; the latter would be key for studying rodent-borne disease. In 1997, the RRP became the SUA Pest Management Center (SPMC), and by then, the priorities of the research and work at the center were led by Tanzanians.

The second purpose of this chapter is to show how the language of cooperation and partnership used to describe Tanzania's relationship with Europe in the postcolonial period obfuscates sharp global inequalities in the access to and production of scientific knowledge. I examine the challenges faced by Tanzanian rodent scientists who at one point or another also served in key leadership positions of the rodent research project. The chapter examines the ways that these Tanzanian scientists conceptualize their role in producing scientific knowledge about rodents. I discuss these conceptualizations by using tools crafted within renewed scholarship in the social studies of science that centers the production and practice of indigenous knowledges.

The impulse to value local knowledges has a long history in anthropology, serving sometimes as justification for the discipline's value, and perhaps even, compensation for its role in past colonial conquests. Yet, I was frequently chided by fellow middle-class, educated, young Tanzanians at the university during fieldwork who scoff at my casual fascination with local herbal remedies (*dawa lishe*) or Uluguru stories about animals. They bemoan the number of deaths and suffering caused by an inadequate healthcare system, finding my interest in local knowledges to be careless when the need lay in creating solutions to the lack of quality care. Taking this criticism to heart, I thus hope to complicate the urge to look for local, "African meanings and practices" (Mavhunga 2017, 7) of science and technology.¹⁸² As the life paths of several Tanzanian and Belgian rodent scientists below will show, the production of scientific knowledge in Africa is a tale of aspiration for and negotiation with modernity and globalization, a reckoning at once with colonialism and global inequality.

This chapter tracks how those who work at SPMC in Morogoro, Tanzania, which includes scientists, rodent trappers, and rodent trainers, turn the wheels of science at the scale of the global. I ask how this center not only came to be but how it became a global research center for rodent science. My material is historical, based on oral history interviews and archival research, yet framed by an ethnographic present. I use the past to help me navigate the concerns and politics of an urgent present, one that worries over Africa's capacity for producing science and technology. I approach the question of "African science," inflecting history with ethnography, to show that "science" is an ongoing concern in Africa, and that indeed, to a large extent, institutions such as the SUA Pest Management Centre (SPMC) in Morogoro have always been justified in developmentalist terms that encourage "capacity building" and "technology transfer." The stories

¹⁸² Mavhunga, *What Do Science, Technology, and Innovation Mean from Africa?*, 7.

I tell highlight several moments in the careers of these scientists, which I recount based on recorded interviews with scientists in Tanzania and on archival research done in Belgium at a private collection held at the University of Antwerp. These shed light on the stakes and compromises involved in so-called research partnerships between European and African scientific institutions. I conclude this chapter by reflecting on a conversation with one of the rodent scientists I met about the call to “decolonize science,” and I meditate upon what such calls mean for those working as scientists in Tanzania.

“Droppings as Numerous as the Grains”

In 1984, when Walter N. Verheyen and Ron Verhagen arrived from Antwerp, Belgium to begin discussing plans to set up a rodent research project in Morogoro, they found one already up and running. On the road leading from town to the main campus of the agricultural college, which was then a satellite location of the University of Dar es Salaam, the scientists found a newly built complex with a lab, several offices, and a library. The library contained several small mammal field guides, copies of a zoology journal, and rodenticide manuals. The Rodent Control Center (RCC), as they learned, had been running a population study of the Shamba rat, or field rat, and was conducting training for extension officers in the Morogoro and Mbeya regions to know how to respond to rodent outbreaks. The center also provided bait and rodenticide, as well as guides on how to set traps and make effective bait.

The RCC was established through an agreement signed in November 1979 between the Danish International Development Agency (Danida) and the Tanzania Ministry of Agriculture to spearhead a rodent control project with the long-term goal of creating a national control program. Danida’s involvement in rodent control in Tanzania came at the end of a turbulent decade. Global

commodity prices had fallen dramatically, slashing revenue from the coffers of many developing nations. Tanzania's villagization program (Operation Vijiji) as part of Ujamaa, the world's largest social engineering experiment under which millions of people were resettled in planned villages to intensify agricultural production, was beginning to show cracks and meet dissent.¹⁸³ Bumper harvests and efficient food distribution promised by the operation never materialized. When huge outbreaks of rodents began destroying stored grain in 1976, the nation moved closer to the brink of a famine.

As a result, government officials sent a flurry of letters seeking technical advice and aid to counter the rodent outbreaks. A few letters reached the FAO in Rome, Italy.¹⁸⁴ The overseas or international development agencies of the United Kingdom, Denmark, Belgium, and United States also received letters. Twenty to forty percent of the total grains were being lost to rodents during and after harvesting.¹⁸⁵ Denmark immediately sent a rodent control expert, Mogens Lund, based at the Danish Pest Infestation Laboratory to Tanzania to assess the situation. Lund toured villages in the Rukwa valley and saw for himself how serious the problems were. At night, "numerous rodents were observed running on the gravel roads or spotted with torch light in adjacent fields." So many were the rodents that their "droppings were almost as numerous as the grains"; many "children and adults showed fresh wounds caused by rodent-bites, or just marks of teeth on fingers and toes." Lund concluded that what he witnessed was a community "very close to the limit of

¹⁸³ Scott, *Seeing like a State*, Chapter 7.

¹⁸⁴ Taylor, "Letter to Mogens Lund," September 12, 1977; Drummond, "Letter to Mogens Lund," February 1, 1978; Lund, "Letter to DC Drummond," January 27, 1978. Rodent Research Project Papers, Personal Collection of Herwig Leirs, Antwerp, Belgium.

¹⁸⁵ Gunze, "Post-Harvest Grain Loss."

survival, threatened by starvation due to rodent damage to stored food, and constantly stressed by attacks from hungry rodents.”¹⁸⁶

He recommended a research program that would first determine the biology, ecology, and population dynamics of the rodent pest in question, to study their ectoparasites, the susceptibility of the rodents to poison, and the relationship between farming practices, crop type, and rodent outbreaks. As I detailed in Chapter One, this approach to rodent control had already been established in 1931 in colonial Tanganyika. The research program recommended by Lund would be followed by more experimental research into different baits and efficiency of rodenticides, local control methods, models for forecasting outbreaks, and methods to make storage facilities rodent-proof. In the shadow of the collapse of the East African Community on July 1, 1977, Lund urged Danida to establish a rodent control project in Tanzania to find a long-term solution to the problem. The FAO also dispatched a fact-finding mission in 1978 and recommended a similar course of action.¹⁸⁷

Meanwhile, Bukheti S. Kilonzo, a young scientist from Usangi in Kilimanjaro region, had just returned from the United Kingdom. Arriving at Amani, where the East African Agricultural Research Station had been established by the Germans and British during the colonial period, he looked forward to joining the research program on malaria at what was now called, after Tanzania’s independence, the East African Medical Research Council. He had completed his Master’s degree in parasitology at the London School of Hygiene and Tropical Medicine in 1974 and was eager to start working on mosquito-borne diseases. When he returned, however, the director of the East African Medical Research Council where he was employed said to him that

¹⁸⁶ Lund, “Report on a DANIDA-Consultantship Concerning Rodent Problems in Chunia District, Mbeya Region, Tanzania, 1977, October 23 - November 9,” 3-4. Rodent Research Project Papers, Personal Collection of Herwig Leirs, Antwerp, Belgium.

¹⁸⁷ *Ibid.*, 7.

they needed someone to work on plague, and he was the only person at the time with microbiological experience. He was given an empty, “big room, just like a meeting hall” and was told to “design the hall into a plague laboratory.” In my interview with him, Kilonzo chuckled and shook his head when he recalled this, “Believe it or not, it was not an easy job!”

While his efforts were underway, the collapse of the East African Community in 1977 meant that Kilonzo’s plague research would be repatriated to Tanzania. Working now for the Tanzanian government, he conducted a national survey of plague, visiting different regions and trapping rodents, and then testing them for plague. He found a few plague cases in rodents in Mbulu, near Arusha in the north, and several cases in Chunya, in the Rukwa Valley to the south. Just as he was wrapping up his national survey, Kilonzo was suddenly called to visit Lushoto in the Tanga region to investigate an unknown disease which had killed two people in April 1980. Accompanied by a regional medical officer, Kilonzo visited Shume-Nywelo village where 49 people had the plague, mostly bubonic, and 11 people would die, including children.¹⁸⁸ When he first arrived, he found that several people were exhibiting swollen glands around their necks. He and his assistant trapped a few rats and investigated their spleens, livers, and other organs. Plague was clinically confirmed in these samples and the bacterium, *Yersinia pestis*, was found in both humans and rats.

Before Kilonzo could cement a national plague research program, having now set up a lab with some equipment and technicians, he was ordered to pack up his things and make preparations to work in Morogoro as the national director of the Danida-funded Rodent Control Center (RCC). Leading up to Kilonzo’s arrival in 1983, construction work on the premises had made little headway. A plot of land had not even been granted as of December 1981, two years after the

¹⁸⁸ Kilonzo and Mhina, “The First Outbreak of Human Plague in Lushoto District, North-East Tanzania.”

agreement had been signed, as a consequence of a disagreement between the Tanzania Ministry of Agriculture and the University over which area with precious access to water and electricity to give up.¹⁸⁹ The collapse of the East African Community and the war with Uganda had plunged Tanzania into inflation, so that the project now cost twice as much as when it was first put in place. It was also increasingly difficult to obtain building materials and supplies in Tanzania. Danida had to ship in supplies directly from Europe.

Danida also faced challenges hiring a new project coordinator who would work in Morogoro. This person would work alongside the National Director, the Tanzanian counterpart, who would be Kilonzo. Many rodent experts from across Europe and the United States found the living conditions unacceptably harsh, and any amount of pay could not persuade them to live in Morogoro. They finally hired Dr. Sam R. Telford, an American vertebrate zoologist, ecologist, and parasitologist for the project who arrived in Morogoro in June 1981. I was able to track down the letters between Telford, Lund, Danida, and Kilonzo in a private archive in Antwerp, Belgium. They document the following sequence of events.

Telford's acceptance of the job was not without coaxing or the promise of additional perks. Just a month before traveling to Morogoro, he had already written to the Danish Ministry of Foreign Affairs with concerns about his future employment. He was concerned by the "very restricted cultural and commercial environment [of Morogoro] in which to establish a home for two or more years." His letter lists a litany of things lacking in Tanzania and demands that he be granted additional support to ship more of his personal items to Morogoro, warning "If I am going to establish a home in a country such as Tanzania...it must be of a satisfactory standard to ensure

¹⁸⁹ Pedersen, "Note on Project Progress," December 1981. Rodent Research Project Papers, Personal Collection of Herwig Leirs, Antwerp, Belgium.

that the boredom and despair induced by cultural isolation do not exceed a tolerable level.”¹⁹⁰ Funds, equipment, and labor were difficult to come by during Telford’s tenure as Project Coordinator at what was now called the Rodent Control Center (RCC). He wrote letters and reports noting construction delays, personnel issues, and the lack of expertise in Tanzania; he was so frustrated with Danida, the university, and the Tanzanian government that he took matters into his own hands and hired his own son, a graduate student in zoology, to work on a project to determine the population dynamics of the Shamba rat. Due to the delays, Telford had to settle for trapping these rats around the university campus instead of in the fields of the villages facing serious rodent infestations.¹⁹¹

When the Belgians arrived in 1984 to set up their own rodent project, they sought quickly to assure Telford that there would be “no competition between the two Projects.” Prof. Verheyen, a zoologist specializing in small mammals from the University of Antwerp, generously offered Telford the use of the Belgian diplomatic pouch to ship rodent specimens collected by the RCC in exchange for retaining some of them for Verheyen’s own taxonomic work. Verheyen also offered to place the data that had been collected on a “computer tape” at no cost in order to facilitate easier data analysis, an expensive procedure at the time. Telford also valued the importance of having data collected by the Danish and Belgians stored in a single database, because it would form a “basic data bank on *Mastomys*,” the species of rat that was under considerable interest for its role as an agricultural pest.¹⁹²

When his contract with Danida ended in 1985, Telford did not seek renewal and secured a job in another international agency. He left Morogoro in April 1985 without having a successor in

¹⁹⁰ Telford, “Letter to Ove Elvekjar,” May 13, 1981. Rodent Research Project Papers.

¹⁹¹ Telford, “Letter to Olve Elvekjar,” May 13, 1981. Rodent Research Project Papers.

¹⁹² Telford, “Letter to DANIDA Mission,” February 21, 1985. Rodent Research Project Papers.

place. Again, Danida encountered problems trying to hire a new project coordinator and sent Arvo Myllymäki, a Finnish rodent control expert, to assess the situation on the ground. Like Telford before him, he was frustrated and angry with the situation on the ground. In 1985, Kilonzo had already worked for the RCC for two years. He had gained his PhD, submitting a dissertation on plague distribution and endemicity in Tanzania. At the request of the Ministry of Agriculture, he was transferred from Amani to Morogoro in 1983 to act as the National Director for the Denmark-Tanzania project and to work with Telford.

Kilonzo did not appreciate this change of environment, and he felt, rightly, that his plague research at the National Institute of Medical Research (NIMR) had been interrupted. Despite being the National Director, it was clear to Kilonzo that the research agenda was being set by the project coordinator, Telford, and that project priorities and equipment use were being determined by Danida. Kilonzo wanted very much to continue focusing on plague research, which was the most serious rodent-borne disease in Tanzania at the time. Outbreaks of plague continued to occur in the northern regions of the country and yet very little had changed in terms of the country's capacity to investigate plague endemicity, forecast outbreaks, and build a national response strategy. In spite of the constraints of the new project, Kilonzo seized on the opportunity to improve scientific infrastructure at the university that would be his new home. He insisted that the project should buy more scientific equipment. Kilonzo also wanted the project to value and improve Tanzanian scientific capacity, both by training Tanzanians to be scientists and valuing local knowledge of rodent repellents. He envisioned that the facility would grow into a "training center for rodent control education in East and Central Africa."¹⁹³

¹⁹³ Smythe, "Comments on the Ecology Proposal of Professor N. C. Stenseth to Dr. S. R. Telford." Rodent Research Project Papers.

As the National Director, Kilonzo felt that he should have free use of the project vehicles, and he frequently used them for research as well as for non-research purposes. After all, he reasoned, he was the Tanzanian counterpart of what was supposed to be a Denmark-Tanzania development cooperation and felt entitled to the same trappings of expatriate access to equipment and vehicles. To the foreign directors of the RCC, this attitude made Kilonzo difficult to work with and this became even more evident when Myllymäki arrived in Morogoro to conduct an evaluation of the RCC. In confidential reports written for Danida, Myllymäki described Kilonzo as a contemptible character, “an unscrupulous, arrogant and corrupted upstart.” Myllymäki clearly saw Kilonzo’s actions and aspirations as a misappropriation of project funds and equipment, and vehemently disagreed with Kilonzo’s research vision. “For instance, his recent ‘experiments’ for ... old-fashioned insecticide as rodent control agents, are something one could expect from a village witchdoctor rather than from a Director of a National Institute supposed to lead development in the field of rodent control in Tanzania!” Myllymäki wrote. Like Telford, he also complained about the backwardness of Morogoro. He wrote, “... a lonely expatriate expert could do a lot for the development of [rodent] control strategies in the course of a year or so,” and continued, “This, however, necessitates liberating the Expert from daily caretaking of commonplace bagatelles (vehicle service and repair, fueling and other shopping, driving in the capacity of a driver alone, keeping record on small effects and materials, etc.) that all take considerably more time in Tanzania than in European conditions.”¹⁹⁴

In this and many other sentences throughout the report, Myllymäki conflates the categories of “expatriate” and “expert.” For him – and many others – the expert and expatriate are usually one and the same person. Knowledge possessed by Tanzanian farmers and scientists is perceived

¹⁹⁴ Myllymäki, “Interim Report, End June, 1985.” Rodent Research Project Papers.

to be less important, erroneous, or not credible compared to expatriate expert knowledge. Myllymäki discredits Kilonzo's experiments on villagers' techniques of rodent control by comparing Kilonzo, a Tanzanian scientist with a PhD in microbiology, to a "village witchdoctor." To Myllymäki, Kilonzo's interest in local preventive strategies of rodent outbreaks was more fetish than fact.¹⁹⁵ Myllymäki saw himself as distinctly different from his Tanzanian colleagues. He complained, as Telford did, of the impoverished condition of life and work in Morogoro. He was irritated by the amount of menial labor that he had to do, adding that there were no competent Tanzanians to help chauffeur him, purchase equipment, or service vehicles. His time was precious and should not be wasted on trifling chores. This was, to a certain extent, how Kilonzo felt, too. As the National Director, he wanted access to a car and a chauffeur, wanted someone to whom he could delegate smaller tasks. However, Kilonzo's demands for a similar status and the comforts that came with it made him, in the eyes of Myllymäki, "an upstart."

In the end, Myllymäki recommended that the project should be discontinued unless it were able to find a different partner organization. If the project cut off its ties with the university and worked with the Ministry of Agriculture, then it would not have to work with Kilonzo. Myllymäki was appointed the new project coordinator and the RCC became a subdivision of the Ministry of Agriculture, cutting ties with the University. Ongoing talks to establish a joint rodent research center between the Danish, Belgians, and the University administration came to an immediate halt. For the time being, it would seem, the Belgians would have to establish a rodent research project on their own.

The Tall Blond Giant and the Witchdoctor

¹⁹⁵ I borrow this phrasing from Latour, *On the Modern Cult of the Factish Gods*.

Walter N. Verheyen was born to a Flemish family familiar with biology. His father was a well-known ornithologist and his brother, Rudi Verheyen, was respected and remembered for his contributions to environmental conservation in Flanders, Belgium. Walter Verheyen himself was an imposing figure in the field of zoology. Colleagues in Belgium and Tanzania recall his gargantuan presence, a “tall, blond giant,” as one of his former students and later colleagues described him.¹⁹⁶ He described scores of new species from Africa, particularly small mammals, and played a major role in maintaining state support for the field of zoology through his work at the Royal Belgian Institute of Natural Sciences and the Africa Museum.

Verheyen and his colleague, Ron Verhagen, found it difficult at first to find any interest in their proposal to set up a research project on rodent ecology in Morogoro. Furthermore, the Belgians needed to convince Sokoine University to host them because the Ministry of Agriculture was not interested and was already committed to Danida. At the time, Robert Machang’u, who was employed at the Department of Veterinary Science as a junior academic, was asked by the university administration to liaise with the Belgian scientists who had now come to the University to host a rodent research unit. “At the time, Tanzania didn’t have any interest at all in rodent (ecological) research. It was only interested in all the outbreaks and what to do with them,” he explained. The Belgian scientists, Verheyen included, wanted instead to determine rodent species, measure them, weigh them, and identify them, something Machang’u was not excited about. “We didn’t know what to do with [the Belgians],” he said, chuckling. An ecological research project about rodents with taxonomic goals seemed absurd to Tanzanian scientists who were battling crop destruction and disease brought about by rodents.

¹⁹⁶ Hulselmans, “Samenwerken Met Walter: Paus of Grote Roerganger?”

Nonetheless, Machang'u did not want to turn them away. Verheyen and Verhagen argued that an understanding of the taxonomy, behavior, and ecology of specific rodent types is crucial for creating effective control programs. Finally, an agreement was signed in 1984 between the Belgian and Tanzanian governments to establish a Rodent Research Unit under the Department of Veterinary Science at Sokoine University. Machang'u recalled that the Belgians arrived with two large shipping containers with all their equipment, along with hundreds of traps as part of an envisioned study into rodent species distribution in Tanzania. Machang'u helped them look for housing and found a space for their containers. In 1973 he received a scholarship to study in Romania, as a result of the international socialist links forged at the time by the Tanzanian government abroad. After obtaining a bachelor's degree in veterinary medicine in Cluj-Napoca, Machang'u ran off – in his words – to West Germany and convinced the authorities there to offer him a scholarship to conduct his Master's studies in microbiology, which he completed in 1983, heading, in 1986, to Toronto, Canada to obtain his doctorate. Since those early days he has also worked in Burkina Faso and Uganda on a World Health Organization (WHO) tobacco control program. By the time the RRP finally started in 1986 after some construction delays, Machang'u had to leave to Canada for his PhD training.

Conveniently for the University, however, given the skirmishes at the Denmark-Tanzania project, they could transfer Kilonzo to the Belgium-Tanzanian Rodent Research Project (RRP). Like the earlier project, the RRP was envisioned as a development cooperation. The agreement contained articles that promised scientific training for Tanzanians, scholarships for Tanzanians to pursue higher education in Belgium, the establishment of rodent control methods suited to Tanzania, and the guarantee of trained staff with particular technical skills. The RRP recruited the relatives of some of the cleaners, guards, and groundskeepers of the Department of Veterinary

Science to work as rodent trappers, sample preparers, and lab assistants. They set up offices in the old vet building and started to collect rodents in various parts of Tanzania, bringing specimens back to Morogoro for identification. Some of these specimens were later shipped to Antwerp, where Verheyen and other scientists could consult collections at the Africa Museum or the British Museum to identify new species. Subsequently, they began trapping and releasing Shamba rats, or what were now known as *Mastomys natalensis* for a population dynamic study. The goal was to collect long-term data to observe the influence of the rain and planting seasons on rodent populations.

Elsewhere, in Antwerp, Belgium, Herwig Leirs was a struggling PhD student. The project on which he worked, about a viral infection of Belgian voles, had to be shut down because his supervisor had been infected and hospitalized. The university closed the lab and Leirs was left with neither data nor a healthy supervisor. But Leirs had also been working with Verheyen and knew that Verheyen was trying to set up the necessary laboratory infrastructure for a new Rodent Research Project in Morogoro. In a parallel to the story of Kilonzo's beginnings as a plague researcher, Verheyen asked Leirs to go to Tanzania to help him set up the lab since he had experience with serological work, which Leirs could then easily apply to studying infections in rodents. Leirs completed the task in one month instead of three, and with the extra time on his hands, he was invited to join Verheyen on a trapping expedition to identify rodents in southern Tanzania.

When Leirs returned from the expedition, Verheyen handed him some data from the ecological study he had been conducting with a few assistants, trapping and releasing Shamba rats, or *Mastomys* over a period of time. "I analyzed the data, made a report, and Walter was really happy with it," Leirs recalled, smiling, "He then asked me why don't I do my PhD on this topic."

For the next two years, Leirs traveled back and forth between Morogoro and Antwerp, spending about three months at a time in each place. He did not have a grant at the time but he was getting paid a per diem for his time in Tanzania. “I could save a lot of money because in Morogoro living is cheaper and I could stay in Walter’s house,” he explained. Leirs enjoyed Morogoro. “I was very excited to go there; everything was new of course. There were problems, like with the water...but it was part of the romantic atmosphere of Africa,” he explained. The Belgians, including Leirs, lived in houses on the university campus, about three kilometers from town. They rarely ate, shopped, or hung out at the same places as the Tanzanians. At the time, Tanzanians had very little money. No one could own a car as the country was still reeling from its socialist experiment. Unlike the other Belgians, however, Leirs wanted to explore. He had planned to attend a party organized by one of the Tanzanian students at the university but one of the Belgian technicians warned him against doing so, saying that the Tanzanians would not like him there. “In hindsight, this was bullshit,” Leirs said.

While Leirs was in the final stages of data collection, tensions between Kilonzo and Verheyen started to boil over. The issues that had strained the relationship between Kilonzo and the Danish rodent experts were now straining his relationship with the Belgians, especially Verheyen. They were similar problems. As a professor and the Tanzanian counterpart of the project, Kilonzo felt that he should have unfettered access to project equipment, including the vehicles which were used to travel to the bush for trapping rodents. However, the stipulation of the agreement made it so that the vehicles could only be used by a Belgian. If a Tanzanian were to use a vehicle, he or she would have to be accompanied by a Belgian. According to documents and interviews, this was explained as a policy matter, due to the fact that the cars were property of the Belgian Embassy. Leirs recalled his discomfort when he noticed how Kilonzo, an older professor,

had to ask Leirs, who was at the time in his twenties, for permission to use one of the drivers and cars so that Kilonzo could take a personal friend home in the evening when the cars were not in use.

To his credit, Verheyen tried to rectify this problem by suggesting to the Embassy that the cars be made the full property of the project so that any staff, Belgian or Tanzanian, could use them. The changes were too little too late and by 1988, relationships were so strained that Verheyen had stopped attending meetings or replying to messages. There was also another issue. Kilonzo was furious that many of the rodent specimens were being sent to Antwerp, some of them ending up at the Royal Museum of Central Africa (now the Africa Museum) outside of Brussels. Kilonzo wrote about feeling embarrassed when it came to teaching his Tanzanian students because they had no rodent specimens for doing live demonstrations.¹⁹⁷

One day in 1989, Verheyen and a few other Belgian scientists and technicians packed everything up and left without notice. “It was all very hush hush,” recounted Kilonzo. “It was as if they had left at night,” said Machang’u. The friction between Kilonzo and Verheyen became too much to bear to the extent that each side accused the other of sabotaging the project. Several Belgian students were not able to travel to Morogoro to conduct their research because their permits from the Tanzanian government were not ready. Thinking that this was a purposeful act of sabotage, Verheyen canceled a PhD scholarship for one of the Tanzanian students to study at Antwerp. Leirs left for Belgium and hunkered down to analyze the data and write his dissertation. Kilonzo, exasperated by the entire affair, left for Nairobi to work at Moi University. Very suddenly, the Belgium-Tanzania Rodent Research Project came to a screeching halt.

¹⁹⁷ “Minutes of the 4th Meeting of the Steering Committee.” Rodent Research Project Papers.

Turning the Wheel of Science

Tanzania transitioned to become a multi-party democracy in 1992, allowing political parties other than the ruling party, Chama cha Mapinduzi, to compete in the general elections. The elections fulfilled a liberalization program required by the World Bank in exchange for much needed development loans. At this time of neoliberal restructuring on the African continent, Leirs was nearing the completion of his dissertation back in Belgium. He wanted to present his findings in Morogoro, Tanzania and seek feedback from the people with whom he had collaborated.

Upon his arrival, he expected to find the building in disrepair, lab supplies and equipment abandoned, but was instead astounded to see something quite the opposite. A new professor had been appointed to continue the research, and it turned out that this was Robert Machang'u, who had returned from Canada, armed with a PhD. The same technicians were still working and were now being paid out of the University's budget. "The university thought that the work was worthwhile enough that they decided to continue funding it," Leirs remarked. He was impressed and excitedly told Verheyen about it. Verheyen was skeptical when he had heard Leirs' account of the center. He had expected everything to have been abandoned.

Leirs and Verheyen both decided that they would like to re-establish the relationship. Although Verheyen would continue as the nominal leader of the project, Leirs, a newly minted doctor of rodent biology, would be the main person on the ground. Leirs, now splitting his time between Morogoro and Antwerp – and for several years in the mid-2000s, Copenhagen – collaborated with Tanzanian scientists, many of whom had started as graduate students at the Rodent Research Project. Through their collaborations, the RRP was able to receive several European Union grants for research. In 1997, funding was reestablished with Belgium through a

joint-universities scheme, where Flemish universities could partner with non-Flemish universities on research and technical knowledge sharing.

Gradually over the next fifteen years, the rodent research project became an independent center of the University. The Pest Management Center, as it is now called, was able to secure its own grants, with Tanzanian scientists leading the research and receiving technical support from Antwerp. Leirs chuckled when he recalled a time when his administrative assistant came to his office to remind him that they were waiting on invoices from Morogoro so that they could be reimbursed. “I had to correct him,” Leirs laughed and explained, “It is *us* who have to send Tanzania the invoice. They manage the money now!”

In 1997, data collected through the ecological study of Shamba rat populations made it into *Nature* for publication.¹⁹⁸ Leirs fondly remembered the reaction of his colleagues back in Antwerp. “Suddenly the chemists and physicists who say these biologists are always on holiday in Africa sat up and recognized our work,” he said with satisfaction. “They realized that oh, you can do real science even in a developing country and they now saw our requests for money to buy a car as a request for scientific equipment, even though a car is not a scanning electron microscope,” he added. The realization that “real science” could be done in a “developing country” hinged on a common perception among European scientists that saw many postcolonial places in terms of absence and lack, especially when it concerned science. This perception found further, unfortunate reinforcement, however, since the *Nature* article did not list any of the Tanzanian technicians (who are now professors at SPMC) as authors of the project, although they were thanked in the acknowledgements.

¹⁹⁸ Leirs et al., “Stochastic Seasonality and Nonlinear Density-Dependent Factors Regulate Population Size in an Africa.”

These inequalities did not just involve name recognition but were deeply and materially felt by rodent scientists at SPMC, who would readily admit that they faced immense challenges in their scientific work. Scientists in Tanzania have to contend with outdated or faulty equipment, a complex bureaucracy, the lack of government research funding, and a shortage of skilled workers. Both Kilonzo and Machang'u highlighted the limited funding for research that comes from the Tanzanian government. Resorting to funds from donor countries usually mean following the priorities and agenda of donor countries. "Tanzania scientists and foreign scientists are always working together, always!" Kilonzo emphasized when I asked him to reflect on research partnership between Tanzania and European countries. "But," and here he paused, trying to find the appropriate words, "Whether we like it or not, whoever has the money has the upper hand." This is why, he went on to explain, diseases such as malaria and AIDS secure so much funding, and other kinds of biomedical research, including plague, do not given their globally low occurrence. Another scientist, Dr. Michael Ziwa, who worked under Kilonzo on plague research in Tanzania also described the hurdles he faced as a research scientist. He told me that he had been invited to present at conferences in Europe but was not able to attend. First, it was because he had no funds and his current job as an agricultural extension officer working for a municipality government could hardly fund any travel outside of Tanzania. Second, even once he had secured a grant to travel, he found that his visa to visit an European country had been denied.

The history of SPMC and subsequent ethnographic fieldwork I conducted offers a snapshot of how the cogwheels of scientific knowledge production turn in a place like Morogoro, Tanzania, revealing a larger story about the continued legacies of colonialism in Africa. The fraught relationships caused by disputes over access to resources and equipment, or by the lack of infrastructure and technology may easily be blamed on personalities. It would be easy to paint the

Belgian researchers with the taint of neo-colonialism, or to call out a Tanzanian researcher's use of project resources for personal use as typical of postcolonial corruption. However, these relationships are situated within a reality that has been conditioned by ongoing structural inequalities that were fashioned by colonial exploitation. In *How Europe Underdeveloped Africa* (1972), Walter Rodney convincingly showed how the industrialization of European economies depended on an international division of labor, where raw materials extracted from Europe's African colonies at low cost, fueled the advancement of technology and mechanization in the metropolises. These developments in technology added more and more value to the processed material that gradually accrued as wealth in Europe at the expense of Africa's economies. The pressures of both wars in the twentieth century also meant that African labor and resources were transferred in large quantities to Europe in order to fund the construction of warheads, weapons, and other military industries.¹⁹⁹ A colonial economy of extraction meant that there was very little investment in Europe's colonies that would support post-independence development, such as institutions of higher education, hospitals, electric grids, and railways. If any of these infrastructures exist (such as railways), it was to facilitate the unencumbered exploitation of raw materials.

Claude Ake documents that in the two or three decades after decolonization, many African economies were still dependent on industrialized and capitalist countries in Europe and North America for their technology. The twentieth century also saw technological development gradually become the monopoly of private corporations, which have no incentive to transfer technology at zero profits, let alone develop technologies suiting the developmental needs of African economies. "What passes as transfer of technology occurs not because the technology transferred is

¹⁹⁹ Rodney, *How Europe Underdeveloped Africa*.

appropriate but rather because it is available,” Ake concludes, showing how transferred technology is often “not integrated into the local culture and system of production so its ability to stimulate further technological development is severely limited.”²⁰⁰ Even when countries like Tanzania try to implement economic policies that would allow them to be self-sufficient, Ake argues that they are subject to subversion by global capital (by destabilization, economic sanctions, and other means).²⁰¹

Ake’s political economic analysis raises an important question for the myriad of research partnerships between European and African universities for its actual ability to transfer technical skills and technology, as stated in the bilateral memorandum of understandings that Tanzania signed with Denmark and with Belgium. As many medical anthropologists²⁰² and historians of science²⁰³ have since argued, the “partnerships” between European and African countries often insist on an equivalence that has long been rendered non-existent by a global capitalist economy. The challenges faced by both European and Tanzanian rodent researchers are then products of this extractive political economy that has rendered many African institutions of higher learning as “lacking” in skills and technology. This was followed by the World Bank’s negative attitudes throughout the 1980s towards developing universities in Africa, deeming them a private good and unworthy of government and international support. Instead, mirroring colonial policy, the World Bank, through its aid, demanded that secondary education be prioritized.²⁰⁴

The political economy of knowledge production in Africa, conditioned by a history of colonial extraction and impinged upon by a capitalist developmental agenda set by multilateral

²⁰⁰ Ake, *A Political Economy of Africa*, 109.

²⁰¹ *Ibid.*, 188-9.

²⁰² See, for example, Livingston, *Improvising Medicine*; Crane, *Scrambling for Africa*.

²⁰³ See, for example, Hecht, *Being Nuclear*; Tilley, *Africa as a Living Laboratory*.

²⁰⁴ See Amin, *Eurocentrism*; Arowosegbe, “African Scholars, African Studies and Knowledge Production in Africa”; Ndlovu-Gatsheni, “The Cognitive Empire, Politics of Knowledge and African Intellectual Productions.”

organizations and donor countries, sets the stage for the awkward and asymmetrical partnerships that led to the formation of the SUA Pest Management Center. Taking a political economic view of knowledge production helps us frame the relationships cultivated between European and Tanzanian rodent researchers in Morogoro not as necessarily neocolonial ones, but a gradual figuring out of new collaborations that are cognizant of the global inequities that condition them. It is this cognizance that helps explain conversations I had with Prof. Robert Machang'u about decolonization, and what it could mean for the production of scientific knowledge by Tanzanians.

Decolonizing Science?

The whirr of an air-conditioning unit filled the thick hot March air as Robert Shadrack Machang'u, a professor of microbiology, considered my question carefully. On one wall of his office at the Sokoine University of Agriculture Pest Management Center (SPMC) in Morogoro, Tanzania, he had thumbtacked photographs of his wife and children; on another wall, staff, lab technicians, and students at the research center beamed and waved from their sunny perch. Machang'u's curriculum vitae was represented on a third wall: conference posters featuring silhouettes of rodents, sometimes other small mammals like bats, fan out, commingled with university bulletins, a United Nations insignia, and newspaper clippings about anti-smoking campaigns across Africa, an initiative Machang'u led for the World Health Organization (WHO).

Machang'u had been pondering a question that I had asked earlier about what he thought of a 2018 *Nature* article, which had recently been published and discussed the “decolonization of South African science.”²⁰⁵ The article grapples with ongoing efforts to address the underrepresentation of Black South Africans in science and academia, recognizing, too, the scientific racism of these institutions that had underpinned the white supremacist policies of

²⁰⁵ Nordling, “How Decolonization Could Reshape South African Science.”

apartheid. Gesturing to the student protests opposing tuition fee hikes and that called for changes to curriculum and culture at South Africa's major universities – Cape Town, Johannesburg, Witwatersrand, and Stellenbosch – the author of the *Nature* article wonders what decolonization might, and could, mean for science in South Africa. Its publication signaled a conversation that was afoot on the continent: can there be a decolonized science?²⁰⁶ Can there be an African, or even, a Tanzanian science, one that would value the experiences of Tanzanian knowledge producers? I posed this question to Machang'u, whose more recent research focuses on leptospirosis, a zoonotic disease that humans contract when they come in contact with the urine of other animals including rodents.

After considering my question for some time, Machang'u shook his head. "I wouldn't use the term African technology nor African science," he said, "because you end up with voodoo or something like that. The science that is being done by us [Africans] is no different from the science that is being done elsewhere." Here, he paused to reconsider the intention behind my question, one that tried to identify Tanzanian contribution to producing scientific knowledge. "Perhaps," he finally added, "the difference and perhaps the false naming of science as African is that it is done by Africans themselves... We use existing technologies and adapt it to suit our problems, that's what I [would] call African science ... local solutions for local problems."

Machang'u's response captured a persistent tension in scholarly accounts about science and scientists in Africa and in other places considered part of the global South.²⁰⁷ On the one hand, scholars point out that science in Africa is exactly *that*, research practices and experimentation that

²⁰⁶ Mahmood Mamdani would ask the same question later that same year. See, Mamdani, "The African University."

²⁰⁷ Droney, "Ironies of Laboratory Work during Ghana's Second Age of Optimism"; Geissler et al., *Traces of the Future*; Ghyselen et al., "Scenes of Amani, Tanzania"; Tousignant, *Edges of Exposure: Toxicology and the Problem of Capacity in Postcolonial Senegal*; Elliott and Koech, *Reimagining Science and Statecraft in Postcolonial Kenya Stories from an African Scientist*.

take place *in* an African country under particular material conditions, but nevertheless producing knowledge that is universal and authoritative regardless of its place of production. On the other hand, the very same scholars recognize that scientists based in the global South, including Africa, strive against many challenges in having their work resourced and recognized adequately in comparison with those in the global North, their ability to determine the direction of their research frequently constrained by philanthropic organizations. Johanna Crane, for instance, describes both the rarely acknowledged and long history of AIDS research in east Africa and the difficulty that Ugandan doctors face in trying to obtain visas to present their work at conferences in the United States.²⁰⁸ Damien Droney argues that Ghanaian plant scientists prefer to “disentangle themselves” from the designation “African science,” which often refers to national and pan-African scientific projects from a bygone era, one that no longer seems relevant to how sciences is produced today.²⁰⁹ Katherine Centellas, writing about state-sponsored scientific endeavors in Bolivia, contends that these are “Bolivian science,” not “science in Bolivia” due to their explicit mission to root scientific practice and knowledge in local problems and conditions.²¹⁰

Indeed, Machang’u staked his position on the insistence that scientific work in Africa should be viewed similarly to any other scientific work from “elsewhere” but that this work should also be led by Africans to address local needs. Maintaining a science that is “global” and led by “local” priorities, his position illustrates what Anna Tsing has called “friction,” describing the many “awkward, unequal, unstable, and creative qualities” that characterize globalization.²¹¹ Friction focuses attention on the specific encounters and interconnection that enact, enforce, or imperil global power. Globality and locality, for Tsing, are projects of imagination and scale-

²⁰⁸ Crane, *Scrambling for Africa*.

²⁰⁹ Droney, “Ironies of Laboratory Work during Ghana’s Second Age of Optimism,” 378.

²¹⁰ Centellas, “The Localism of Bolivian Science Tradition, Policy, and Projects.”

²¹¹ Tsing, *Friction*, 4.

making; “[they] come into being in part through the contingent articulations into which they are pushed or stumble.”²¹²

I argue, however, that it is not enough to think of Machang’u’s scientific position as only a project of “scale-making” but as the construction of a particular *kind* of scale. If the utility of Tsing’s framework helps us track how categories of the global and local are practiced, it nevertheless assumes an undifferentiated kind of global and local, even if they are underpinned by power differentials. The following experiences of scientific work at the Sokoine University of Agriculture in Tanzania, however, reveal practices of constructing, and more importantly, desires for being part of, a *particular* kind of globality, that of universal science. In asserting a universality to their scientific work, rodent scientists in Tanzania insist upon viewing the global through the frame of inequality, pointing out the challenging material conditions of their own scientific work. The practice of science in Tanzania, during a time of renewed efforts at a second industrialization under the current government, offers a glimpse into how Tanzania negotiates its position in the world, staking its place at once at global and local scales through a discourse of inequality.

The model of partnership envisioned by the Belgians was one of “development cooperation,” a term that captured the geopolitical transformation that had at the time recently swept the region. Former African colonies of European powers were now recast as “developing,” sometimes even “underdeveloped countries.” It was a time when “colonial” was quickly replaced by “cooperative” – both by European and African nations, one eager to condemn the allegations of violence to history and the other fervently chasing futures promised by newfound independence. What such cooperation entailed, as we have seen in this chapter, depended on constant contestation

²¹² Ibid., 57-8.

and negotiation over issues of research priority, ownership of scientific equipment and material, and divisions of labor, often between foreign and Tanzanian scientists.²¹³

Anthropologists of development have shown that such “cooperative” technical projects constitute new kinds of knowledges and communities. Economic problems had to be translated into a framework of technological and technical solutions, which in turn required particular forms of decontextualized expertise aimed at improving infrastructure, social services, education, agriculture, and manufacturing.²¹⁴ Indeed, such projects framed as development have usually taken on the language of science to align development with the global capitalist economy. Whether such technoscientific developmental schemes are led by former colonial powers or by newly independent nationalist governments, they are touted as avenues for African nations to emerge as potent players on the international scene. One of my aims in this chapter has been to recontextualize the development of rodent science in Morogoro within a gradual unfolding of events that cut across the global North-global South divide, raising questions about science as a global practice in an unequal world.

Development projects such as the Tanzania-Belgium Rodent Research Project (RRP), even when embedded within unequal networks of workers, technical standards, and international institutions such as the Food and Agriculture Organization (FAO) of the United Nations, transformed society and their relationships with the state and environment. Tanzanian rodent scientists at SPMC deeply respect Walter Verheyen for his role in establishing the center and hold Herwig Leirs in high-esteem. In a festschrift honoring Verheyen’s career, Machang’u praised

²¹³ As Crane notes in *Scrambling for Africa: Aids, Expertise, and the Rise of American Global Health Science*, global health science practitioners in the burgeoning Aids care work of the 2000s in the global North and the global South have given little consideration to what “partnership” actually means. Such lack of attention “[obscures] the diversity of arrangements [between Northern and Southern entities] and complex power dynamics at stake,” 163.

²¹⁴ See, for example, Ferguson, *The Anti-Politics Machine*; Walley, *Rough Waters*.

Verheyen's dedication to the center, which "has given me in person and my colleagues at Sokoine, Morogoro a lot more self-accomplishment than perhaps Walter will ever know." Machang'u also added that "Walter has become part of each one of us, as a 'father' to some, a 'brother' to many and a leader and a colleague to all of us."²¹⁵ At the same time, these sentiments do not discount the sometimes awkward and always unequal interactions that Tanzanian scientists encounter in working with the Belgians.

"Perhaps the difference and perhaps the false naming of science as African is that it is done by Africans themselves," Machang'u had said about "decolonizing science." For him, if there was something recognizable as African science, it would not be as a field of knowledge based on geography or on epistemology; in other words, his concerns are not for a science originating in or from Africa, nor one that begins from an African standpoint or experience. It is worth repeating how Machang'u understood African science, if he were to adopt the term: a science practiced and led by Africans themselves and addressing African problems. Like Kilonzo and other rodent scientists, Machang'u poses African science as a question of politics. It is for a science led by Africans, albeit without precluding collaboration with other scientists or dismissing scientific knowledge. These were questions about who has power over which institutions rather than about the priority of specific knowledge systems from postcolonial places.

Conclusion: The Whirr of Universal Science

Today, the SUA Pest Management Center is a world-renowned research center especially on topics related to rodent control and ecology. The center's scientists are often invited to present at international conferences and the center attracts several students a year from Europe and across

²¹⁵ Machang'u, "Walter Norbert Verheyen: Appreciations and Regards."

Africa who are interested in conducting pest research. This impressive research output and training capacity earned it the designation as an “African Center of Excellence” by the World Bank in 2017, accompanied by generous funding for physical expansion and research work. One of the center’s subunits trains giant pouched rats to detect landmines and tuberculosis in far-flung places including Cambodia, Ethiopia, and Mozambique. The SPMC is a shining example of Africa-based science and technology, hailed as such in interviews I conducted with Tanzanians scientists who work there.

In many places on the African continent, science and technology remain a universal aspiration, a beacon of modernity, and a driver of development. Soon after Ghana gained independence, the country’s first head of state, Kwame Nkrumah, extolled the promises of science and technology in his first speech to the summit of the Organization for African Unity in 1963: “We shall accumulate machinery and establish steel works, iron foundries and factories; we shall link the various states of our continent with communications; we shall astound the world with our hydroelectric power; we shall drain marshes and swamps, clear infested areas, feed the undernourished, and rid our people of parasites and disease. It is within the possibility of science and technology to make even the Sahara bloom into a vast field with verdant vegetation for agricultural and industrial developments.”²¹⁶

This very same quote graces the opening pages of the Science, Technology, and Innovation Strategy for Africa 2024, commissioned and published by the African Union in 2014, more than fifty years since Nkrumah’s speech. Today, countries such as Rwanda, Sierra Leone, and Tanzania continue to look to build up their technoscientific capacity. The last five years have seen the Tanzanian government, under the tenure of the previous president, John Pombe Magufuli, embark

²¹⁶ “Science, Technology and Innovation Strategy 2024 | African Union,” 5.

on an industrial development plan, enshrined in the slogan “Tanzania ya Viwanda,” which has spurred the construction of infrastructural megaprojects, such as a planned 700 km high-speed electric rail line and the biggest hydroelectric dam in East Africa.

Many of the Tanzanian rodent trappers, trainers, and scientists I spoke to, however, are skeptical that such ambitious plans would transform Tanzania into a science-producing nation. Cheche, the groundskeeper who has worked twenty years at the project, illustrates this anxiety with a technologically appropriate metaphor. “Imagine a car,” he said to me in Kiswahili, conjuring one of his characteristic analogies to describe life. “Let’s say we think of technology from the developed [*zilizoendelea*] countries as the front wheel and technology from Africa as the back wheel. No matter how far or how fast the car drives, the back wheel is always behind [*nyuma*] the front wheel,” he explained. *Nyuma*, the Kiswahili word for “behind” or “at the back” can also mean “backward.” The insistent churning of the back wheel could not take Africa out of its backwardness. This sentiment was echoed by Machang’u when he acknowledged that the fast pace of technological development, especially when it comes to research apparatus, worries him.

This incessant but never changing churning of the wheel recalls Anna Tsing’s realization that global connections are made in sites of “friction,” where differences in tactics and vision are what makes global networks hum with international trade, capitalist speculation, and transnational activism. “A wheel turns because of its encounter with the surface of the road; spinning in the air it goes nowhere,” she writes.²¹⁷ For Tsing, universal categories emerge through practices of power that extend their use. This was certainly the case for Leirs and Machang’u, who draw upon global networks of scientific research and resource to extend their collaboration and build up a global center of rodent research. Such extension of universal science denies the possibility that their

²¹⁷ Tsing, *Friction*, 5.

knowledge production is merely local or unique to Tanzania. Loth Mulungu, a scientist who works on identifying and isolating the active ingredients from plants that farmers use to repel insect pests, describes his research to me in exactly those terms: “My research takes the knowledge that the farmer has and I transform it into science.”²¹⁸ Mulungu’s contribution, as he sees it, renders local knowledge universal, and thus legible and useful to a global network.

Claiming an unmarked, universal science displayed more clearly the hurdles that scientists like Machang’u, Mulungu, and others have to overcome in order to be considered a significant player in producing universal scientific knowledge. Machang’u’s refusal to identify with African science is an act of scale-making, of staking a belonging in universal science while making plain the unequal conditions that accompany knowledge production in the global North and South. I suggest, then, by way of a conclusion, that Machang’u’s refusal of the term “African science” is a political claim. By claiming a position within universal science, Tanzanian scientists in fact argue that science is a question of political and material inequality, a demand to belong to a larger, global story of science.

The transformation of a small rodent research project in Morogoro, Tanzania into a globally renowned Pest Management Center is a case in point. Throughout its history, both Tanzanians and Europeans had to navigate who had access to the materials and technologies that enable the production of scientific knowledge, even if the projects were deemed a “development cooperation.” It would be difficult to attribute the term “African” to the rodent sciences that were being produced in Morogoro, and yet, unmistakably, scientists like Machang’u and Kilonzo forged their scientific careers within the conditions of possibility enabled by Danish and Belgian interest and funding in rodent biology. I concede, however, that my narrative here has privileged

²¹⁸ Mulungu et al., “Evaluation of Botanical Products as Stored Grain Protectant Against Maize Weevil, *Sitophilus Zeamays* (L.) on Maize.”

technoscience as that which is made of “measurable things and experiments in the built laboratory performed only by those with mastery over them,” a conception that, in Chakanetsa Mavhunga’s critique, “constitutes not just an epistemological exclusion, but also an ontological and sociological one.”²¹⁹ My more limited consideration of rodent research here therefore ignores a rich tapestry of African technoscience present in traditions of invention and adaptation, as the examples in Mavhunga’s edited volume and Laura Twagira’s discussion show.²²⁰

Nevertheless, it is this understanding of technoscience that Machang’u and other scientists subscribe to, fully aware of the power that lies in the capacity to be able to invent technologies and produce scientific data. Machang’u and other rodent scientists’ refusal to identify with African science attaches their practice of knowledge production to the scale of universal science and to the kinds of power and access that is associated with the universal. Yet at the same time, by wielding the promises that comes with the universal, and by drawing attention to the need for science to be also produced by Africans toward African goals, they make bare the unequal distribution of a global scientific project. “Friction gets in the way of the smooth operation of global power,” Tsing write,²²¹ and it is this, the encounters between European and Tanzanian scientists, and their subsequent struggle over research priorities and privilege, that allows me to chart the emergence of a global scientific research center in Africa.

The history of the SUA Pest Management Center tracks the challenges and contingencies – the frictions – that characterize producing scientific knowledge in Morogoro, Tanzania. We have seen several kinds of scientific “cooperative” relationships between Tanzania and Europe: in the Danish project, Tanzania was seen as a country in need of help. Denmark sent their experts to

²¹⁹ Mavhunga, *What Do Science, Technology, and Innovation Mean from Africa?*, 4-5.

²²⁰ Ibid. See also Twagira, “Introduction.”

²²¹ Tsing, *Friction*, 6.

assist Tanzania manage its rodent problem. In the Belgian project, the inequalities of power and capacity were still present in terms of who could access what equipment and determine research priorities; however, Tanzanian scientists like Machang'u and Kilonzo were able to contest the priority of rodent zoological work in favor of research that benefitted the daily lives of Tanzanians. Kilonzo also used his position to gain access to resources, even if this did not ingratiate him to the Belgian scientists.

My impulse thus to investigate the production of rodent science in Morogoro is not merely an attempt at symmetry, a quest to find a science and technology originating in Africa that mirrored those originating in the metropolises of the former colonial powers. I do not wish either to merely add to a growing list of scientific and technological projects in Africa but, as Warwick Anderson writes, to “understand the ways in which technoscience is implicated in the postcolonial provincializing of ‘universal’ reason.”²²²

Put differently, Machang'u and others' refusal of African science is a provincializing act even as it aspires to steer the wheel of modern, universal science. Theirs were not demands for a local version of science but for a science led by and prioritized by Africans. This is what Mamdani meant when he wrote that the alternative to theory imported from Western academies are theories that “strike the right balance between the local and the global,” where the “local production of knowledge unfolds in relation to a complex of social forces, and takes into account of a society's needs and demands, its capacities and aspirations.”²²³ Perhaps, then, to decolonize science does not necessarily have to mean a return to a kind of nationalistic science or a revivalist science. For scientists in Morogoro working with rodents over the past four decades, decolonizing science

²²² Anderson, “Postcolonial Technoscience,” 643.

²²³ Mamdani, “The African University.”

means taking charge of the process of scientific knowledge production. They wanted a say above the whirrs of universal science.



Figure 6. A drawer of rodent skull specimens collected in Tanzania held by the Africa Museum, Tervuren, Belgium. Photo by author.

CHAPTER THREE

A Rat By Any Other Name

“The naming of cats is a difficult matter.” – T.S. Eliot (1982)²²⁴

For an entire week, people had approached me in order to say, with some regret, that Jia, a young rat in training, had to be released. Jia had been acting very aggressively, threatening to bite trainers, and had to be “returned” to the wild (*porini* in Kiswahili). “We can name another rat after you,” one of the trainers apologized. For many rat trainers, naming a rat after a person is an act of honor, and now that Jia was to be released, Betty, a trainer, wanted to make sure that I was not too saddened by my namesake’s ill fate.

Naming these African giant pouched rats after favorite musicians, friends, historical figures, lovers, and athletes is just one of many naming practices to which these rats, trained to detect landmines and pulmonary tuberculosis (TB) at the Rodent Biosensor Project in Morogoro, Tanzania, are subject. Indeed, even the name of the species to which these organisms belong has undergone some debate. For several decades, these rodents were known as *Cricetomys gambianus*. In 2012, a study based on mitochondrial DNA analysis argued that these Morogoro rats actually belonged to the species *Cricetomys ansorgei*, resulting in subsequent name changes at the Project and at the Africa Museum’s collection of rodent skulls and specimens in Tervuren, Belgium.²²⁵

On savannah plains, in forests, city alleyways, and crop fields, meanwhile, these rats are easily recognizable by their giant size and are often called *panya buku* (meaning literally “giant

²²⁴ Eliot, *Old Possum’s Book of Practical Cats*.

²²⁵ Olayemi et al., “Taxonomy of the African Giant Pouched Rats (Nesomyidae: Cricetomys): Molecular and Craniometric Evidence Support an Unexpected High Species Diversity.”

rat”). Unlike other types of rodents, however, panya buku occupy an ambiguous—perhaps, even amphibious—place in Kiswahili rodent classifications. Panya buku slip easily between different habitats; their sightings in towns and homesteads clash with common understandings of these animals as primarily rodents of the bush. They occupy several categories such as wild animal, pest, food, and technology, dramatically expanding the categories proposed by the anthropologist Birgitta Edelman. In her overview of human-rat relations, she outlines three types of relationships that humans cultivate with rats within a Euro-American cultural context: as pets, as pests, and as laboratory animals.²²⁶ This schema is limited in the case of many southern and east African places for it overlooks the many other roles that rodents play there. If found in the mountains or on crop fields, rats may be considered edible. Giant pouched rats are also trained and deployed by humans for work, searching for landmines or detecting the presence of tuberculosis-causing bacilli.

This chapter offers a glimpse into the investments that rodent trappers and trainers make in different murid classificatory systems where the panya buku, or giant rat, figure. In the 1930s, British agricultural and medical officers scrambled to understand what seemed like numerous and incessant outbreaks of rats in crop fields and towns by trying at first to identify their species scientifically, which provided a template for subsequent rodent taxonomic work in East Africa. I pay closer attention to the panya buku, showing how its status as a Linnaean species continues to change since it was first described in 1840. The next section of the chapter moves away from this Linnaean system of classification and looks instead to how people in Morogoro classify rodents in Kiswahili, which I show is based on behavioral and morphological observation. I include any additions from Kiluguru, the language spoken by many in Morogoro, where possible. A final section compares these two naming practices, taxonomic and behavioral, Linnaean and Kiswahili,

²²⁶ Edelman, “Rats Are People, Too!”

showing how rodent trainers and trappers readily switch between them. At the heart of the matter is a practice of taxonomic code-switching performed by people working with rodents, which I argue is a practice that reflects particular social demands.

In making this claim, I am mindful of a passage from Claude Lévi-Strauss who insists that practices of naming are embedded in a set of pre-existing classes, that is, that new names must always adhere to roles or positions that have been set out by custom. Even the decision to name creatively, in an attempt to subvert the classificatory system, so to speak, is still a statement of putting the named entity in a non-class.²²⁷ Proper names, particularly, exemplify this double-bind since they “constitute the margin of a general system of classification: they are at once its continuation and its limit.”²²⁸ A proper name accorded to a being or thing is at once to denote its uniqueness while also placing it within a larger class of entities that share some significant similarity. Names of people, plants, and other animals work in this way, regardless of whether the classificatory system is based on zoology or other kinds of indigenous systems. As Lévi-Strauss asserts,

... the indigenous sage—and sometimes the indigenous scientist—who also practices these modes of classification, extends them by the same mental operation to individual members of the social group, or, more precisely, to the singular positions that individuals—each one of whom forms a subclass—can occupy, simultaneously or in succession. From a formal point of view, there is thus no fundamental difference between the zoologist, or the botanist assigning a recently discovered plant the position *Elephantopus spicatus* Aubl., which was set up for it by the system (even if

²²⁷ Lévi-Strauss, *Wild Thought*.

²²⁸ *Ibid.*, 243.

it was not inscribed there in advance), and the Omaha priest defining the social paradigms of a new member of the group by conferring on him the available name: Old-buffalo's-worn-hoof. In both cases they know what they are doing.²²⁹

I show that these rodent trainers “know what they are doing” when they switch between the various systems of classification to refer to the same type of rodent, and that their decision to use one system over the other depends on the value that each classificatory system confers upon the speaker.

Placing these rodent taxonomic systems side-by-side, I show that the Linnaean system of classification is far from settled history, even if it has indeed come to dominate the systematization of nature. On the contrary, this chapter tracks the traffic and inertia between Linnaean and Kiswahili rodent taxonomy and elaborates an analysis of their simultaneous use. I argue that the way rodent trappers and trainers switch between taxonomic systems is informed by the social relations people have with rodents and the value attributed to a particular multispecies encounter. In the conclusion, I return to those rats named after famous or beloved people, a naming practice that suggests that classificatory practices are as much about human imagination and desire as they are about the order of things. Whether Linnaean or Kiswahili, the naming of rats, to paraphrase T.S. Eliot, is no simple matter.

Beyond Ethnotaxonomy

Classificatory concerns have long been a staple of anthropology stemming from a preoccupation with social structure as the basic unit of culture. The concern with social structures and their

²²⁹ Ibid., 244.

function in shaping kinship, language, and religion was especially robust during the very same decades (1950s-1970s) of decolonization in Africa, Asia, and Oceania. Influenced by the work of Émile Durkheim, scholars based at the University of Oxford during this time, including E. E. Evans-Pritchard, A. R. Radcliffe-Brown, and Mary Douglas, contributed to a way of understanding culture based on how people structure and organize their worlds. Mary Douglas, for instance, argues that beliefs about dirt and pollution are enacted through rituals and taboos that maintain social order.²³⁰ Practices of eliminating what is perceived by society as dirty has the social function of systematically classifying matter, as “effort[s] to organize the environment.”²³¹ Douglas nonetheless acknowledges that there is symbolic value to things and creatures with no clear place in a classificatory system. And it is this view that Edmund Leach would apply to animal categories with regards to determining edibility and verbal abuse in English and Kachin society.²³²

Arguing against the binary structuralism of Lévi-Strauss in *La Pensée Sauvage*, or *Wild Thought*, Leach argues that language—his essay focuses on the English language—obscures a continuous environment by dividing the world into discrete, separate things. The classification of things “molds our environment, it places each individual at the center of a social space which is ordered in a logical and reassuring way.”²³³ The “social distance” between an individual at the center of a classificatory system and a thing or creature determines which category something might occupy. His argument is concerned with the ambiguous continuum between these discrete categories. These ambiguous spaces are what inspire taboo and practices that are governed by rituals. To illustrate, animal categories geographically close to the self or house, such as pets, are considered absolutely inedible, as are those found far away from the self, in the “wild.” In the

²³⁰ Douglas, *Purity and Danger*.

²³¹ *Ibid.*, 2.

²³² Leach, “Animal Categories.”

²³³ Leach, “Animal Categories,” 155.

intermediary space between “pet” and “wild animal,” there exists an ambiguous class of livestock and game animals whose edibility, Leach points out, is highly regulated by ritual and taboo as evident in the particular English aversion to some kinds of livestock meat like horse and the enforcement of fixed hunting seasons. Linguistically, Leach observes that the names of these “anomalous animals,” as Douglas calls them,²³⁴ may be used as verbal abuse, such as cock, ass, and swine.

Leach claims that the theory of ambiguous animal categories governing edibility and insult in English society may be homologized to other societies, such as the Kachin in the Burmese Highlands. Indeed, among the Lele in the south of present-day Democratic Republic of Congo, Douglas shows that this homology holds true.²³⁵ But other examples from Oceania contradict Leach’s continuum of social distance from the self. In an ethnography of bird and mammal classification by the Kalam of Papua New Guinea, Ian Saem Majnep and Ralph Bulmer observe that commensal rodents that eat and live in human dwellings are often considered categorically separate from other rodents mainly in terms of their edibility.²³⁶ The Kalam category, or taxon, *kopyak* refers to these animals as “dirty rats” that should not be eaten. These rats live in homesteads or near latrines and consume trash, rendering them categorically different in spite of morphological resemblances to the taxon *kmn*, which refers to large rats and marsupials usually hunted as game. The Nage of central Flores in Indonesia meanwhile categorize the edibility of rodents in a similar way. Gregory Forth finds that the Nage will generally “eat murids that have been killed in traps set outside habitations” but “disdain eating specimens encountered inside houses” since these murids could have possibly “consumed human body waste and detritus.”²³⁷

²³⁴ Douglas, “Animals in Lele Religious Symbolism.”

²³⁵ Douglas, *Purity and Danger*, 167-68; Douglas, “Animals in Lele Religious Symbolism,” 46–58.

²³⁶ Majnep and Bulmer, *Birds of My Kalam Country*.

²³⁷ Forth, “Of Mice and Rats: The Place of Murids in Nage Animal Classification and Symbolism.”

The framework of social distance conceived by Leach do not quite generalize to these Oceania examples. House murids are in no way considered pets despite, or even because of, their close proximity to humans and human filth. John Halverson seizes on this moment to call Leach's continuum of edibility "specious," showing that the problem of classifying animals for their edibility is independent of their social distance.²³⁸ Halverson shows that the vermin category, which may include rodents, does not actually determine edibility and indeed some vermin may be eaten just as well as not. But Halverson's dismissal of Leach's social distance continuum is perhaps too hasty. In fact, I suggest that what Leach mistook for social distance from the self in *geographical* terms, whether close to or far from the self, is really social distance in *social* terms. This is understood as the quality of a social relationship or encounter between humans and other animals that meaningfully determines the distance of these animals from the human self. In Morogoro, Tanzania, distance from the self alone *does* inform rodent classification. Rather, it is social distance of rodents, defined in connection with a rodent's ability to interrupt or enrich human lives, the form the basis of rodent classificatory systems. In other words, it is the proximity to humans in *social* terms rather than *geographical* ones that determine, among other relationships, the edibility of rodents among people who work and live with rodents in Morogoro.

A multispecies ethnographic approach to the social dimensions of human-rodent encounters in Morogoro is therefore fitting, attending not only to how categories of social life structure the "natural" but also to how relationships among humans and other species, in this case, rodents, structure social life. Multispecies ethnographers have taken on this approach, focusing their research on the intricate churns of social interactions among humans and other life forms. Some ethnographers examine how some animals, plants or bacteria are subject to surveillance,

²³⁸ Halverson, "Animal Categories and Terms of Abuse."

control, and exploitation within complex systems of scientific capitalism.²³⁹ Others pay attention to new forms of socialization that emerge from human encounters with nonhuman creatures, tinged by but also reconfiguring prevailing social concerns about gender, race, colonialism, and the environment.²⁴⁰ Fundamentally, they share an interest in exploring how “the human” is formed and transformed through encounters with bacteria, plants, animals and other life forms, including those in the speculative future.²⁴¹ I draw on these multispecies ethnographies to explore the use of Linnaean and Kiswahili rodent classification systems in Morogoro, showing particularly the role that social relations among humans and rodents play in the shaping and wielding of these taxonomies.

Scholars in history and anthropology have long been attentive to the historical and political contingencies of classificatory schemes in biology.²⁴² The anthropologist Stefan Helmreich notes that Latinate names of bacteria and human, for example, are teeming with rhetoric. Their putative objectivity sometimes masks an idiosyncratic origin, as in the name of the bacterium *Convolvata roscoffensis*, that is “rolling-around thing from Roscoff, Brittany,” or it reinforces specific social conceptions of the universal human (“Why never *Femina sapiens*?” Helmreich asks).²⁴³ Or take the case of Hawai'i, where Helmreich explores debates among scientists about the classification of aquatic species, particularly algae, into categories of “invasives” or “natives.” Such classificatory work, Helmreich acknowledges, entangles biology with politics—and in fact requires it—in a place like Hawai'i where the word “native” marks the identity claimed by indigenous people and

²³⁹ For example, see Raffles, *In Amazonia*; Paxson, *The Life of Cheese*; Wanderer, “Biologies of Betrayal.”

²⁴⁰ See Haraway, *When Species Meet*; Parreñas, *Decolonizing Extinction: The Work of Care in Orangutan Rehabilitation*; Suzuki, *The Nature of Whiteness*.

²⁴¹ See Helmreich, *Alien Ocean*; Benson, *Wired Wilderness*; Messeri, *Placing Outer Space*.

²⁴² For debates about biological taxonomy in the field of philosophy, see Dupré, *Humans and Other Animals*; Ereshefsky, *The Poverty of the Linnaean Hierarchy*; Wheeler and Meier, *Species Concepts and Phylogenetic Theory*; Kirksey, “Species.”

²⁴³ Helmreich, “Homo Microbis: Species, Race, Sex, and the Human Microbiome,” 66-68.

is linked to demands for using Native Hawaiian names to refer to species of living creatures there.²⁴⁴

Meanwhile, environmental historian Harriet Ritvo questions the inevitability and eventual dominance of the Linnaean system by charting the cacophony of competing taxonomic theories in nineteenth-century Britain, which she calls “a Babel with no dominant voice.”²⁴⁵ In the context of nineteenth-century United States, D. Graham Burnett examines a court case filed by a merchant who refused to pay the mandatory fee for the inspection of his three casks of spermaceti oil, claiming that it was “whale oil” rather than “fish oil,” disputing a New York State statute that subjects all incoming casks of fish oil to certification.²⁴⁶ The resulting case pitted the views of, on one hand, sailors and whalers who for all purposes of their work understood whales to be fish and hence caught them in similar ways, against those, on the other, of natural philosophers who on the basis of anatomical examination, insisted that whales were not fish. Burnett maintains that sailors and whalers had a detailed understanding of whale behavior, for instance, in the visible shapes made by whales that surface to replenish their supply of air.

While comparative zoologists back in Victorian Britain puzzled over how to sort beasts like the perplexing platypus into available Linnaean classes, hunters used and developed their own classificatory schemes. Game hunters prioritized prized animal traits for hunting in their classificatory system, organizing Britain and her Empire’s beasts into classes of game and vermin. During British colonial rule of Kenya, baboons, zebra, and hyena were regularly listed as “vermin” by the Game Department, and could be shot on sight, whereas elephants and rhinoceros were game

²⁴⁴ Helmreich, “How Scientists Think; About ‘Natives’, for Example. a Problem of Taxonomy Among Biologists of Alien Species in Hawaii.”

²⁴⁵ Ritvo, *The Platypus and the Mermaid, and Other Figments of the Classifying Imagination*, xiii; See, also, Ritvo, *The Animal Estate..*

²⁴⁶ Burnett, *Trying Leviathan*.

animals protected by hunting limits and expensive licenses. Even the mighty lion was at times classed as “vermin” before 1927 due to the beast’s pestilential threat to farmers and landowners.²⁴⁷ Such classificatory systems existed alongside the biological taxonomic system and were relied upon by those whose livelihoods and—in the colonial context—claims to power, depended on them.

Together, these findings demonstrate that questions about the order of nature are closely tied with social questions about work, class, and nation, themes I return to throughout this dissertation. Anthropologists like Majnep, Bulmer, and Forth, whose rodent classifications I explored earlier, assume a mutually exclusive relationship between cultural and scientific classification, reflected in that word “ethnotaxonomy.” This way of thinking about taxonomy and ethnotaxonomy overlooks the range of classificatory systems that people do use, and switch between. Forth himself points to the way Nage people sometimes code-switch between the Nage and Malay language in their naming of rats, calling our attention to the island’s political and geographical location as a part of a much larger Indonesia. While this chapter is indebted to the work of documenting ethnotaxonomies, it also seeks to follow very closely the demographic and social realities of Morogoro, in which rodent trainers, working alongside foreign researchers, city dwellers, and relatives, draw simultaneously on several systems of rodent classification.

The panya buku and the rodent trainers live within and in close proximity to Morogoro town, a bustling urban area of over 315,000 people. Morogoro is the site of the majestic Uluguru Mountains, home to the Uluguru people, a matrilineal ethnic group who speak Kiluguru.²⁴⁸ But many of Morogoro’s inhabitants also immigrated and settled for work and marriage, coming from

²⁴⁷ Steinhart, “Hunters, Poachers and Gamekeepers.”

²⁴⁸ For more on the Uluguru people, see Pels, *A Politics of Presence: Contacts between Missionaries and Waluguru in Late Colonial Tanganyika*.

all parts of Tanzania. As a university town, Morogoro is home to students and researchers, mostly Tanzanian, although a significant number also come from across Africa and the rest of the world. This means that while I pay close attention to rodent classifications, whether in Kiswahili, Kiluguru, or in the Linnaean idiom, and recognize connections between these classificatory schemes and the cultural contexts in which they are embedded, I also recognize that these classificatory schemes are constantly in flux, negotiated along with the demands of work, whether it is training rats, trapping rodents, or farming, incorporating influences of English and other local languages.

For these reasons, rather than describing a specific taxonomy of rodents, the chapter focuses on the exact ways people I met classify panya buku and other rodents. It highlights the moments when people switch from Kiswahili to the Linnaean system or when they insert words from Kiluguru. I pay attention to these moments because decisions to figure rodents in a certain taxonomic system illustrate the thought processes of the speakers themselves. These instances of code-switching depend largely on the kinds of relationships that trappers and trainers have with work and with rodents, and the values they assign to those relationships. These taxonomic code-switches can be thought of as rapid acts of translation, from Kiluguru to Kiswahili and to Linnaean terms, for a species of rat. Translation, Umberto Eco points out, requires marshalling vast cultural resources to the translator's aid. In his collection of lectures titled *Mouse or Rat?* (2003), he tries to distinguish between “topo” and “ratto” in the Italian language when translating from English (mouse, rat), French (souris, rat), or Latin (mus). To do so effectively, Eco notes that translators possess the knowledge that “topo” is used in everyday language to describe all rodents, even large rats, whereas “ratto” may either be found in technical texts or used as an insult for a contemptible person. In Eco's view, it is not linguistic competence nor merely a competence in biological

classification that is key to successful translations of the word “rat” or “mouse” but rather a general knowledge of the world that we live in.²⁴⁹ Moments of multilingual rodent taxonomies in Morogoro then, *pace* Eco, are rendered in this chapter alongside the social situations and demands in which they are used.²⁵⁰ Following linguistic anthropologists, I bring my ethnographic observations of Morogoro daily life to the aid of comparing and decoding the language of Linnaean and Kiswahili taxonomies.²⁵¹

Finally, this chapter asserts that classificatory systems make sense only within a particular set of assumptions about the goals of doing a type of classificatory work. In a collection of fleas from the Pacific Northwest prepared by C. Andresen Hubbard in the 1940s at the Museum of Comparative Zoology of Harvard University, for example, “appropriate gaps [in the display] are left in the case for additional kinds [of fleas] which Dr. Hubbard intends adding from time to time to this set.” Hubbard, who would later go to Tanzania to investigate and collect rodents, arranged his flea set according to Linnaean principles, revealing both the phylogeny of hitherto collected specimens and, with gaps not unlike Mendeleev’s periodic table of chemical elements, anticipating future finds.²⁵² Whether a classificatory system is based on morphology, phylogenetic genealogy, ecological niche, behavior, or distance from the homestead, classificatory systems say a lot about how the natural world is categorized “with respect to different kinds of causal ontologies [and] different fields of possibility.”²⁵³ The task, therefore, of analyzing and comparing classificatory schemes of rodents in Tanzania is to pay attention to the conceptions of history and possibility that undergird them. A rat by any other name evokes another view of nature.

²⁴⁹ Eco, *Mouse Or Rat?*

²⁵⁰ Eben Kirksey calls this a “praxiographic study” of species. See Kirksey, “Species.”

²⁵¹ On this note, see Silverstein, “‘Cultural’ Concepts and the Language-Culture Nexus.”

²⁵² Bequaert, “The C. Andresen Hubbard Collection of Fleas of the Pacific Northwest.”

²⁵³ Helmreich and Roosth, “Life Forms.”

Colonial Taxonomy of Rodents in Tanganyika

While officers in Colonial Kenya's Game Department were classifying animals as protected game or vermin, British colonial officers in Tanganyika's Department of Agriculture and the Medical and Sanitary Services were preoccupied with a specific kind of creature they took to be obviously verminous: rats. In Chapter One, I described how by the end of the 1920s rat outbreaks had become a vexing problem for the colonial government of Tanganyika, attacking cotton fields and causing the bubonic plague. As Tanganyika entered the 1930s, urgent, hastily written telegrams and letters had become the norm for the Chief Secretary's office in Dar es Salaam. "Multiplication and spread of rats becoming most serious. Reported from Mwanza South through Tabora Province. Very bad. Kilosa Morogoro area where cotton badly attacked and maize crop now in danger," read one telegram in 1930.²⁵⁴ By the end of the year, the Director of the Department of Agriculture, based in Morogoro, estimated that farmers in the Kilosa-Morogoro area had lost between 50 and 75 per cent of their cotton crops.²⁵⁵

In the following years, planters continued to lose large numbers of cotton bales to "rat infestation" and were desperate for a solution. Members of the Planters' Association, the Chamber of Commerce, and the Tanganyika Ginneries' Association also demanded action, specifically that "an expert should be obtained immediately to investigate."²⁵⁶ So severe was the problem that the Chief Secretary reached out to William M. Nowell, director of the East African Agriculture Research Services at Amani, for his help in leading an investigation. With funds in short supply and a prevailing view among colonial officers that the pest issue was due more to the "slovenly

²⁵⁴ TNA J10/12704/1037/6. Telegram from Director of Agriculture to Chief Secretary, 26 September 1930.

²⁵⁵ TNA J10/12704/1037/18-19. Letter from Director of Agriculture to Chief Secretary, 27 January 1931.

²⁵⁶ TNA J10/12704/1037/70. Letter from the Tanganyika Ginneries' Association to Chief Secretary, 11 December 1931.

methods of farming” by “natives and planters,”²⁵⁷ an assistant entomologist, W. Victor Harris, based at the Entomologist Lab of the Department of Agriculture in Morogoro, was dispatched to investigate the rat problem in the Kilosa and Kimamba districts of the Morogoro area.

Harris conducted his investigation over six months between 1931 and 1932. He collected 43 skins, some of which were sent to the British Museum, and identified 17 species among them. The most commonly identified species was one that many Uluguru farmers already knew, the Mbuku, or as Harris called it, the Grey Field Mouse, drawing a comparison between the field mouse of Britain and Tanganyika (they are in fact different).²⁵⁸ The report also contained ecological observations that saw reduced populations of “grey field mouse” during rainy seasons with recommendations for Barium Carbonate to be used as the poison of choice, “in a simple mixture with meal.”²⁵⁹ The most significant contribution of Harris’ report is to correct the prevailing view at the time that rats were destroying crops and stored grain. Field mice, not rats, were the real rodents responsible for the infestations, although Harris notes that there were reports of one “epidemic” of the giant rat, *Cricetomys gambianus*, occurring in the Uluguru Mountains.

During this time, bubonic plague raged in the lake region of Tanganyika, in districts like Maswa, Nzega, and Mwanza, causing many deaths among humans and rodents. In Mwanza, the scare of plague had even emptied out the city center in 1937.²⁶⁰ Many of the city’s Indian business owners had boarded up their shops and moved out of town, creating panic among merchants in the coastal city of Dar es Salaam, given its urban, rodent-prone environment. Adding to the panic was

²⁵⁷ TNA J10/12704/1037/88. Letter from Director of the East African Agriculture Research Services to Chief Secretary, 20 January 1932.

²⁵⁸ Based on the archival materials available, I am almost certain that the Grey Field Mouse identified by Harris is today known as *Mastomys natalensis* or Mbuku in Kiluguru, the rodent responsible for most of the damage to agriculture in Tanzania. In Britain, the grey field or house mouse is usually *Mus musculus*.

²⁵⁹ TNA J10/12704/1037/113-118. Report by W. V. Harris, “Rodent Investigation,” 25 May 1932.

²⁶⁰ TNA 11901/v2/225. “Plague in Mwanza. Trade Dislocation Continues,” *Tanganyika Herald*, 9 March 1937.

the scarcity of information coming from the government.²⁶¹ The response of the Director of the Medical and Sanitary Services, R.R. Scott, to these outbreaks was to order an immediate investigation into the rodents responsible for spreading plague and into whether these areas were foci of plague. The task fell to Dr. A.R. Lester, who was the Senior Health Officer of Mwanza district. He set off on an expedition in 1932 around Mwanza province and several districts, trapping a total of over fifteen hundred rodents. Lester and his Tanganyikan assistants then skinned them, dissected them, and collected any mites or fleas on their pelts. A few skins were sent to the Transvaal Museum in Pretoria, South Africa for identification. Lester was no taxonomist but he made initial attempts to classify the rodents and made sure to include their names in Kinyamwezi or Kisukuma, the languages spoken in the areas of the expedition. The assistants also collected the spleen for smear microscopy examination to determine if any bacteria were present. In his report to Scott, Lester was brief about the results, writing that there was no evidence of “cocco bacilli” in the spleen smears of the rodents, but went on to elaborate at length about the species of rodents he had caught.

For the first time, a picture emerged of the diversity of rodent species in the Lake, Western (Tabora), and Eastern (Morogoro) provinces of Tanganyika. In Lester’s report, he suggested that among his 1500 specimens, there were nine species of rodents. His descriptions included morphological descriptions and tail, body, and ear measurements. One such rodent described by Lester is a large sized rat with “red brown hair on dorsum, white venter. Long hind legs. Female had four pairs of mammae... teeth, upper grooved, lower ungrooved. Native name, Fukuzi. Thought to be Tatera Dundasi. Found in fields and open plains.”²⁶²

²⁶¹ TNA 11901/v2/236. “A Reticent Department,” *Tanganyika Standard* 13 March 1937.

²⁶² TNA 450/106/9/4B-I. “Report on an inspection of and investigation in certain villages in Mwanza Province and Nzega District where plague or a high rodent mortality has in previous years been reported,” by Senior Health Officer of Mwanza District, sent to Director of Medical and Sanitary Services, 28 October 1932.

Lester soon went on another trapping expedition in 1932, also ordered by the Director of Medical and Sanitary Services, at an aerodrome. Among the many rodents he had trapped, one in particular stood out to Lester that merited special mention in one of his personal letters to R.R. Scott, who was vacationing in Maputo, Mozambique at the time. He noted that one of the rats he caught was maimed by the trap, and had tried, without success, to escape, a testament to the rat's size and strength. He had sent the skin to H. J. O'D. Burke-Gaffney, the officer in charge of a laboratory in Dar es Salaam, who then consulted "German books" in the lab's holdings, and came up with a name "something like Hamster Rat." Later, Dr. James Corson, a bacteriologist working in Tabora, who was also consulted, identified it as *Cricetomys gambianus*.²⁶³

"Hamster Rat" was indeed the neo-Latin meaning of the genus name *Cricetomys*. "Cricetus" refers to hamsters, while "mus" denotes both rats and mice. The *Cricetomys* are a genus of large rodents that have pouched cheeks for storing food and resemble the common rat, straddling both hamster and rat in behavior and appearance. At a meeting of the Zoological Society of London in 1840, the British naturalist George R. Waterhouse exhibited the skull of a rodent, whose morphology, he told his audience, "constitutes a most interesting link between the genera *Mus* and *Cricetus*."²⁶⁴ He had collected this specimen near the River Gambia, bestowing the name of the river onto the species *gambianus*.

In 1904, a British zoologist working at the Natural History Museum in London, Oldfield Thomas, examined a large collection of about two hundred specimens at the British Museum that had been collected by W.J. Ansorge, a British-Polish medical officer who took many opportunities

²⁶³ TNA 450/106/9/5C-D. Letter from Senior Health Officer of Mwanza to Director of Medical and Sanitary Services, 30 November 1932. Descriptions of the strength and power of the *C. gambianus* regularly appeared in conversations during fieldwork. At the time, Maputo was known as Lourenço Marques. C. A. Hubbard, a medical entomologist based at Amani from 1961-1966 also described a male and female rat in his study which "succeeded in cutting and tearing their way through the half-inch wire mesh of their enclosure." See Hubbard, "Observations on the Life Histories and Behaviour of Some Small Rodents from Tanzania," 427.

²⁶⁴ Yarrell, "January 14, 1840."

of his job posting in Angola to explore and collect the surrounding fauna. Thomas noticed that Ansorge's specimens of giant rats had a few significant differences from the *gambianus* of Waterhouse. These specimens, said to be found as far as the south of Angola, were even larger than the *gambianus*, their drab-brown pelage a shade paler. Their tails, too, had a sharper contrast of black towards the body and white at the terminus. Thomas wrote that these giant rats constituted a "special Angolan species," which he named *Cricetomys ansorgei*, after the intrepid doctor who could not resist collecting.²⁶⁵ What made *C. ansorgei* significantly different from *C. gambianus*, however, would not be settled for at least another century as new systems of taxonomic classification took hold within the discipline of zoology.

Linnaean and Kiswahili Categories of Rodents

While *C. gambianus*, the oldest described species of *Cricetomys*, remained a recognized species, *C. ansorgei* has been continuously disputed. Influential publications on *Cricetomys* taxonomy denied *C. ansorgei* the status of its own species, subsuming it as a subspecies under *C. gambianus*.²⁶⁶ Other authors recognized only two species, *C. gambianus* and *C. emini*.²⁶⁷ A 2015 taxonomic reference on African mammal species lists the *C. ansorgei* as one of four recognized species among *C. gambianus*, *C. emini*, and *C. kivuensis*.²⁶⁸ These taxonomies depended on morphological and ecological analysis. A 2012 study which combined a phylogenetic analysis of mitochondrial DNA sequences with extant craniometry records of *Cricetomys* collections at the Royal Museum of Central Africa (now renamed the Africa Museum) in Tervuren, Belgium and at the Muséum National d'Histoire Naturelle in Paris, France, however, further complicated the

²⁶⁵ Thomas, "On Mammals from Northern Angola Collected by Dr. W. J. Ansorge."

²⁶⁶ Genest-Villard, "Revision Du Genre *Cricetomys* (Rongeurs, Cricetidae)."

²⁶⁷ Rosevear, "The Rodents of West Africa."

²⁶⁸ Kingdon, *Field Guide to African Mammals*, 263.

picture. The study distinguished six different species, including *C. gambianus* and *C. ansorgei*, that have little overlap in their geographical distribution.²⁶⁹ Olayemi and his colleagues argue that the giant pouched rats found in Morogoro and throughout East and southern Africa are most definitely species of *C. ansorgei*, which, they also maintain, should be elevated to its own species based on the molecular data they have produced. “Our phylogenetic and craniometrics results show that *C. ansorgei* is separate from *C. gambianus* and even more distantly related to it than expected,” they write, even despite “phenotypic similarities.”²⁷⁰

The taxonomic revisionism around the classification of giant pouched rats presents a lucid example of the material, theoretical, and technological changes affecting the production of scientific knowledge since the description of the *C. gambianus* by Waterhouse in 1840. By the time the nineteenth century drew to a close, scientific endeavor had begun gradually to shift from the forests of the Gambia or Amazonia to the laboratory bench of universities.²⁷¹ This shift, although long preceded by organic biochemists of the late 1800s, was further crystallized by the elaboration of DNA replication and the possibilities that knowledge about DNA granted for the field of genetics, gene editing, and synthetic biology. This increasingly molecular view of biology has granted *C. ansorgei* its own taxonomic status as species.²⁷² Indeed, the authors of the 2012 study explicitly acknowledge this shift, claiming that previous studies relied on “phenotypic characters” such as snout width, pelage color, and ecology. “Species distinctions based on morphological features only are ... difficult,” they insist, leading to the conflation of different

²⁶⁹ Olayemi et al., “Taxonomy of the African Giant Pouched Rats.”

²⁷⁰ *Ibid.*, 712, 715.

²⁷¹ This argument is clear when reading the two, foundational works in the history of biology by Coleman and Allen. See Coleman, *Biology in the Nineteenth Century*; Allen, *Life Science in the Twentieth Century*. For a more recent overview, see Rheinberger, “Recent Science and Its Exploration: The Case of Molecular Biology.”

²⁷² This “molecular vision of life” has been examined by many historians and anthropologists of biology. See Myers, *Rendering Life Molecular*; Kay, *The Molecular Vision of Life*; Chadarevian and Kamminga, *Molecularizing Biology and Medicine*.

species in previous classifications of *Cricetomys*. Molecular techniques, conversely, can “elucidate the taxonomic statuses and relationships of many populations of *Cricetomys* that currently lie in doubt.”²⁷³

In contrast to Olayemi and his colleagues’ insistence for classification based on genetic evidence, Kiswahili rodent taxonomy is more closely tied with ecology and behavior, and is more closely informed by how a rodent’s presence in human social life. The Kiswahili word “panya” is perhaps most similar to the English word “rodent,” denoting all kinds of critters and small mammals that gnaw and live underground in burrows. The names of rodent species in Kiswahili sometimes contain information about a species’ habitat or certain behavioral qualities. *Panya wa mchangani*, or sand rodent, are known as gerbils (*Tatera* spp.) in English. They are so named because they are often found in arid habitats where the ground is often sandy and dry. *Panya mraba*, or the square/rectangle rodent (*Lemniscomys* spp.), is known to create polygonal shapes in the ground as it runs between its burrows and foraging sites.

Rodents may be classed into categories based on their interactions with—and interruptions of—human activity. There is *panya shamba*, meaning field rodent, commonly found around farms, grain stores, and homesteads. *Panya shamba* (or Mbuku in Kiluguru) almost always refers to the multimammate rat in many instances because it is the type of rodent responsible for a large percentage of crop and grain destruction in Tanzania. Nevertheless, it can also stand as a category for a few species of rodents most commonly found in Tanzanian crop fields, namely grass rats (*Arvicanthis* sp.), giant rats (*Cricetomys* sp.), cane rats (*Thryonomys* sp.), and the common roof rat (*Rattus rattus*).

²⁷³ Olayemi et al., “Taxonomy of the African Giant Pouched Rats,” 702.

This category stands in relation with two other categories, *panya nyumba* and *panya wa porini*. *Panya nyumba* are house rats, including the *Rattus rattus* and the *Rattus norvegicus*, the latter being the most common urban rat in the world. Occasionally this category also includes various species of *Mus*, or mice. Lastly, *panya wa porini*, or bush rodents, usually refers to cane rats (*ndezi* in Kiswahili), giant rats (*buku*), and hyraxes (*pimbi*). Based on my conversations with people who work with rodents in Morogoro, I find that this latter category is the most loosely defined. *Panya wa porini* can sometimes become a crop pest (*panya shamba*) but is generally considered an animal in the bush that frequently requires hunting for its capture.

When it comes to edibility, it is the *panya shamba* (field rodents) and *panya wa porini* (bush rodents) that are usually eaten. *Panya nyumba* (house rats) are always avoided because of their proximity to human waste. One man, who works as a *bodaboda* ferrying people across town on his motorcycle, extolled the delicious taste of barbecued rat in his home town of Mtwara. Bwumbwe is forty-two years old and used to live in Mtwara, in the coastal south of Tanzania, before moving to Morogoro for work. “Life is calmer here, that’s why everyone moves to Morogoro,” he told me. When I asked him if *panya* are only eaten during a drought, he shook his head and said, “No, we eat them all the time.” Rodents are not food for hard times (*chakula cha ugumu*). What about house rats? In response to this question, Bwumbwe made a screeching sound with his tongue and teeth. “No, no, no! We don’t eat them at all,” he emphasized. “Those rats, they go into people’s houses and eat filth [*uchafu*], and their bodies are also dirty, containing worms [*minyoo*]. But field rats eat corn, they eat sorghum, rice. They are clean and their meat is good,” he added. Bwumbwe’s view was echoed in other conversations I had with Morogoro inhabitants who consume rodents as meat.

A Mluguru man from Kisosa village in the mountains confirmed this. He used to work at the university and is familiar with the rodent research projects undertaken there. He told me that he eats only bush rodents, “the kind that you hunt [*winda*],” he explained. “You eat it with some ugali [a Tanzanian staple made of corn flour], as a meat dish [*kitoweo*]. Dah! It is so delicious [*kitamu*]!” he added. So palatable are some of these bush rodents, such as the *ndezi* or cane rat, that the university had at one point, in 2009, floated a *ndezi* rearing scheme for meat production, though this never took off. The man also admitted that very few people in the valleys (*mabondeni*) actually eat rodents. “I have to travel to towns like Kinole and Mgeta to find people who eat rats,” he said as he gestured toward the peaks in the Uluguru Mountains.

The journey to reach these towns high up in the Uluguru mountains can take several hours by bus and may involve long treks. In towns like Mgeta, Matombo, or Kinole, the latter being the seat of the Uluguru chiefdom and the site of rainmaking rituals, people frequently use Kiluguru names to describe rodents, including the giant rat (*nzulu*), or hyrax (*merere*), which, according to Linnaean taxonomy is not in the rodent family. Waluguru people who live closer to Morogoro town, such as in villages like Magadu and Kididimo, where the population is more mixed with neighbors who are Pare, Chagga, Sukuma, and the occasional Mzungu (foreigner), always redirected me to Mgeta when I asked them about Kiluguru rodent names.

Returning to Leach’s theory of social distance as a measure of animal edibility, it is possible now to sketch a rough diagram that summarizes rodent classification in Morogoro, Tanzania (see Diagram 1). Like Leach, I structure the diagram according to the geographical social distance from the self, showing how rodents are categorized in terms of their distance increasing from the household (*nyumba*), toward the field (*shamba*) and bush (*porini*). In each category, I list those rodents (using, where possible, all their Linnaean, Kiswahili, and Kiluguru names) that are most

commonly reported as belonging to that category. Rodents that appear in more than one category appear with an additional asterisk mark (*). I also mark commonly eaten rodents with an upward arrow symbol (↑). If you look for edible types of rodents in the diagram, you will see that they straddle all three categories, although the types of rodents that are actually eaten (↑) are only those captured from the field or bush. If we look to the types of rodents that appear in more than one category, we find that they more or less coincide with edible rodents (*↑).

Diagram Showing Rodent Classification Based on Increasing Distance from Self in Morogoro, Tanzania

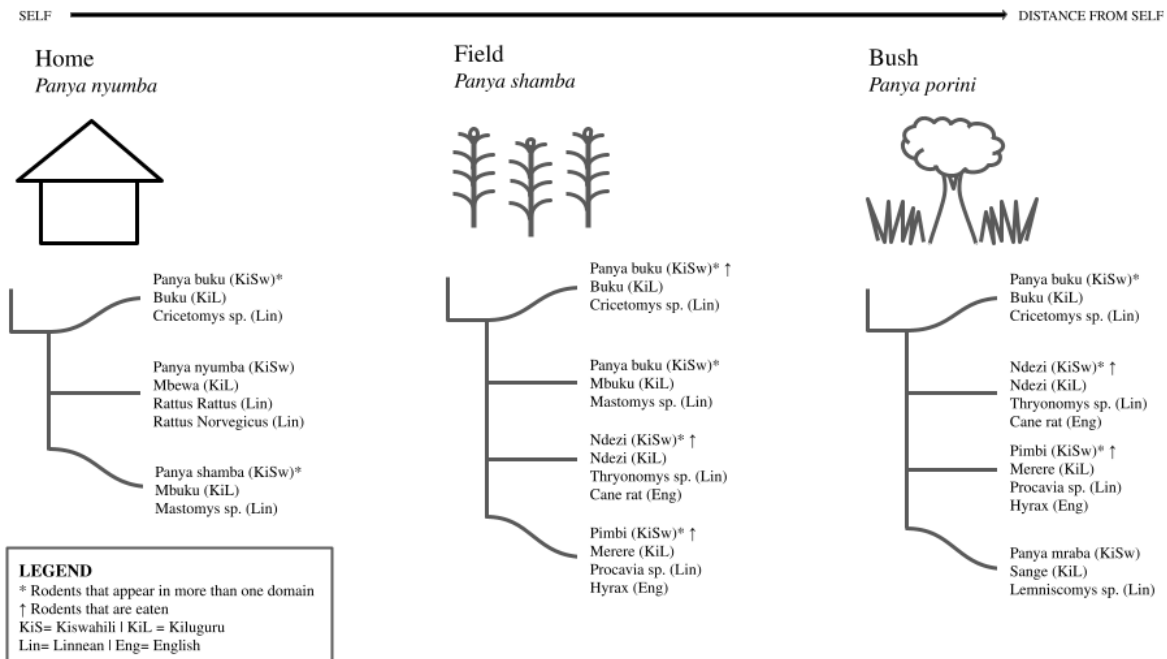


Diagram 1. Rodents (*Panya* in Kiswahili; *Mbewa* in Kiluguru) arranged according to “distance from the self” and organized by domains “home,” “field,” and “bush”.
Illustrated by Steven Gonzalez.

This diagram contradicts Leach’s theory of social distance in two ways. First is that the “social distance from the self” does not actually apply in terms of determining the edibility of rodent types, as Leach would suggest. As the diagram shows, the same rodent type may be eaten

or not depending on where the animal has been captured. Second is that the edibility of these rodents is not dependent on their distance from the self, but on the conditions of where an animal is found, that is whether or not it has been in close contact with humans and their waste. Rather than conceiving of social distance in geographical terms, the diagram makes more sense when conceived as social distance that focuses on the kinds of social relationships that exist among humans and a type of rodent, rather than their geographical distance from the self.

Verminous rodents that invade the household and consume stored grain are considered dirty and inedible, their relationship with humans being both an intimate and antagonistic one. Rodents that occasionally destroy seedlings or unripe fruit, or those found in the bush, however, have a more distant relationship with humans, making them more frequently the subject of hunts and human consumption. This conception of social distance, as a measure of how close human lives are entangled with rodents rather than merely how close or far rodents live from humans, works if we consider panya buku trained for detecting landmines and tuberculosis. Like verminous household rodents, the training of panya buku requires daily intimate encounters between trainers and rats, making panya buku categorically inedible to all trainers, even if a few have eaten these rodents that were trapped in the bush. Putting it succinctly, instead of distance in geographic terms, I am arguing that rodent edibility is determined by their distance with the geometry of social life. A rat entangled intimately, whether as home invader or bomb squad hero, with the daily lives of humans are less likely to be edible.

And what about other animals such as dogs, goats, chickens, and cows? How do rats compare to them? Once again, when asked about what relationships people have with animals in or around the home, the most common answer is “Well, what are they used for?” I have refrained from using the word “domestic” because its English meaning does not fittingly describe the

Tanzanian context. A rough translation of domestic animals in Kiswahili is “wanyama wafugwa,” which, when translated back to English, means “reared animals” or husbanded animals. Sometimes, the word “shepherd” is used for livestock such as cattle [anachunga ng’ombe]. Pets, too, fall under this category. To say that someone has a pet dog is to say that they rear a dog in Kiswahili [anafuga mbwa]. There is thus no difference between pets and domestic animals, only animals one rears or shepherds. Dogs are reared to keep guard at night and they are trained to be fierce and vicious to any intruder or thief. Chickens are animals one rears for meat or eggs. “Rear” implies a relationship of care, ownership, and work. When describing her work as being responsible for rearing rats, Betty, a female rodent trainer, described how she cleans and feeds the rats so that they would perform well during training. What is crucial here is the social relationship. As Alex notes, “Not all rats are the same. It depends how you use them,” adding, “Those that we use to find landmines, we do not eat them. It is like killing an expert [mtaalam]!” As my sketch of rodent classification should have now made plain, it is the very texture of a relationship, and not the distance from home, that determines the status of a rodent as food, vermin, or even expert.

But what this outline of rodent classification still lacks are the associations people make between modernity and rodent consumption. Instances that relegate a diet of rodents to people living far up in the mountains show that Kiswahili categories not only delineate which kinds of rodents may be found in what kinds of spaces (household, field, or bush) and which are edible based on their social proximity, or intimacy, with human activity. Rodent dietary practices are additionally delineated by notions of development and modernity. When inquiring about rodent consumption, I was almost always given the same answer: “Go to Mgeta.” Mgeta is fifty kilometers away from Morogoro town, tucked in the Uluguru Mountains, where, as one trapper put it to me, “if you go there as a foreigner, they would come with machetes [panga] to kill you at

night. They think that foreigners will steal their blood.” Alongside other towns perched high up in the mountains, Mgeta is associated with a backwardness that is also linked to the consumption of rodents. Indeed, these same places are often described by town folk as isolated and backward, where people have lower levels of education and continue to practice rituals that go against the Abrahamic faiths, such as Christianity and Islam, professed by those who live in town.

Among the thirty rodent trainers who live close to town, only three have openly admitted that they have eaten rodents. One trainer mentioned privately to me that he used to eat rodents “in his youth,” but only the ones he hunted in the bush with a pack of dogs. Other trainers only offered only gossip: “I know that Mogera eats rats, you should ask him about it.” When I showed trainers a photo of me trying to eat a barbecued rat, they took an interest in asking how I liked the taste. Yet, when I returned the question, they very quickly insisted that they did not eat rats but only knew people who did. “I see them [people who eat rats] when I go for my niece’s *mwali* up in the mountains,” Abdul, one of the trainers explained, referring to an initiation rite for Waluguru girls at puberty. The trainers who live close to Morogoro town often bemoan the lack of religion and education of those who live in the mountains, sometimes using the derogatory term “mshamba,” which literally means “of the field,” to describe them.

It must be said that rodent names in Kiswahili or Kiluguru did not appear readily in conversations. During fieldwork, I realized that speakers readily switched between local taxonomies and Linnaean terms depending on the context of speech, and with me, they would first use Linnaean ones. Kiswahili and Kiluguru terms only appeared when I specifically sought them out or when rodent researchers spoke among themselves or with lay people about their work. With me, the default tendency was to use their Latinate names, sometimes to the extent that I was corrected for just referring to mice as *panya shamba*. “Yes, the *Mastomys*,” a trapper insisted. The

demands of their work required that they know which rat is a *Mastomys* and which a *Lemniscomys*. Trappers who work with researchers, some of whom visit from universities in Belgium and the Netherlands, have been trained to identify these rodents by their Linnaean names. During a conversation in English in which a trapper, a Belgian researcher, and I were having about exploratory behaviors of the *Mastomys natalensis*, the trapper suddenly switched to Kiswahili to tell me that these were the rodents farmers catch to barbecue in Pangawe, using the term panya shamba, and then without a beat, switched to speaking in English, defaulting back to using *Mastomys*.

The same trapper, Ramadhani, who has trapped, dissected, and measured rodents for over thirty years, rattled off rodents by their Latin names during our interview while explaining their morphology and habitat to me in Kiswahili. When I asked how he would call these rodents in Kiswahili, he hesitated, and then offered a few names: panya shamba, panya mchanga, before saying, “People don’t really know, they just say these names. It is not always correct.” Ramadhani’s answer hewed to the precision required by his work at a research center. When a foreign researcher requires specimens of a certain species, it was usually left up to trappers like him to know which species was being referred to and where to trap them.

Rodent trainers are also routinely subject to interviews by journalists from abroad and are featured in nature documentaries for their work. These media appearances accustom the trainers to refer to the rats they train as *Cricetomys*. “Of course we know this rat is a buku but in our work we meet so many people from outside. They don’t know what a buku is, so we have to say *Cricetomys*. But if you go out to town, no one will know what *Cricetomys* is,” Abdul said. He took a very practical approach to his code-switching and this became evident when I tried to push him further. “Do you think it is important that visitors should all learn the Kiluguru names for rats?”

To this question, he hesitated for a few seconds and replied, “No, because they have no use for it. Even us, we only know the names because we see them or we need to kill them. Some rats, I won’t know their name because you never need the name.”

To both trappers and trainers, the language of Linnaean taxonomy, rather than being associated with objectivity, is preferred in social interactions that require translation, whether that is between groups of people who speak different languages or for the purposes of conducting research amid several epistemes. For rodent trappers, mastery of Linnaean taxonomy displayed competency. For trainers, it has minimal impact on the work of training rodents but enables them to communicate with international audiences. When the zoologists agreed to reclassify *C. gambianus* in Tanzania to *C. ansorgei*, most of the trainers were not aware or did not think that the change mattered much to how they would work. “Whether we train this panya or another, the important thing is we know their behavior,” Abdul explained, preferring to highlight the character of an animal that was most crucial to his work, and by extension, to the security of his livelihood. To many trainers, it was experience—what Donna Haraway calls “encounter value”²⁷⁴—that counted. “If something is going wrong, for example, if a panya refuses to work, I can understand why by looking at their behavior,” he told me. The species change was nominal, reflected only in the changes on the project’s website and publication materials.

The Ambiguity of Panya Buku

Unlike other rodents, the *Cricetomys* rat, or *panya buku*, inhabits many categories. They are considered bush rodents, pests, food, and technology. Mostly described as creatures that inhabit mountainous forests, panya buku are also known to sometimes, albeit rarely, attack entire fields of

²⁷⁴ Haraway, *When Species Meet*, see Chapter 2.

vegetables overnight. They live in burrows, often close to a source of fresh water, and they are known to hoard grain, tubers, and fruit in their burrows. Trappers tell me that these rats usually live alone except during breeding and reproduction when pairs of rats may occupy the same burrow until pups are born. Trapping them is difficult and they are known for their strength, destroying cages and traps to escape.

Rodent researchers and trainers at the university describe trained panya buku as a technology, a tool for detecting landmines. In meetings with the public, representatives of the project often used the word technology to describe these rats in both English and Kiswahili. In Chapter Four, I further examine these training practices that transform rats from animals into detection tools, and reporting on how this kind of technological becoming may be different from other kinds of nonhuman animal labor (oxen for ploughing, dogs as guards). News stories in Tanzanian media about the kinds of work undertaken by these “Tanzanian rats” usually evoke admiration and amusement. On the popular online social media platform, JamiiForums, Tanzanian users jokingly described the panya buku as educated given their ability to detect landmines, which they acquired at the university. “Aaah, these are rats with degrees!” one contributor posted.²⁷⁵

In parts of Tanzania, the Democratic Republic of Congo, and all the way in Nigeria, panya buku is well-sought after for their meat. Their culinary qualities are well-known, eliciting constant humorous suggestions about kidnapping rats from the university for a tasty feast. But as discussed earlier, beyond humorous talk, people in Morogoro, even trainers and trappers, often deny that they eat rats and only describe others as doing so. The panya buku, despite its nocturnal, reclusive habits, and the absence of outbreaks, are yet some of the more popular rodents in Tanzania, despite their ambiguous place in Kiswahili taxonomy.

²⁷⁵ “Jinsi Panya Wanavyofundishwa Kugundua Mabomu SUA Morogoro | JamiiForums.” JamiiForums

Species description of the giant pouched rat in zoological publications describe their habitats as upland forests, such as areas surrounding the Usambara and Uluguru mountains, away from densely populated urban areas.²⁷⁶ Although panya buku are frequently considered *panya wa porini* (bush rodent), people recall occasional sightings around their homes, in farms, and in town. At an exhibition of the project, I volunteered to explain the training process to members of the public who came to learn about how these rats were trained. At the end of a demonstration, a middle-aged woman came up to me after the presentation to ask a question: “Mdogo [young one], there are three panya buku in my garden. How much will you pay for each if I caught them for you?” I shook my head and answer, “Mama, we are not buying any.” Others have also reported sightings in town and I have twice seen them as roadkill, rolled over by a vehicle the previous night. In a conversation with Mahmudi, the rodent trapper of almost thirty years of experience, I was surprised to find that when he goes trapping for panya buku, he could trap forty of such a reclusive species in a week. I asked if he could show me where he sets the traps to catch so many so quickly.

Mahmudi is from Morogoro and grew up in town, just off the road to Msamvu, the main bus terminal. He invited me to his home one day and after we greeted his family, he gestured to me to follow him to the back of his house. “Here,” he said, pointing to a hole in the ground. “And there,” he pointed to a spot about fifty meters away, across a stream. “And come,” he gestured again, this time moving to an area between the stream, a bridge, and the side of the road. “There’s one here, too,” he added, pointing to a slightly larger hole. These were the entrances to the burrows of panya buku. “How do you know these are not empty?” I asked, remembering that rodents can sometimes occupy used burrows when they have been abandoned, including burrows dug out by

²⁷⁶ Hubbard, “Observations on the Life Histories and Behavior of Some Small Rodents from Tanzania.”

termites. “Like this,” he answered without a beat and took a large rock and placed it over the hole, leaving a small gap the size of a few fingers. He explained: “If there’s a panya buku inside, he is going to make the entrance bigger tonight so he can get out. Or you can also use a long stick to poke it, but sometimes the stick is not long enough.” Mahmudi traps panya buku within a few hundred meters of his house, sometimes paying house inhabitants a little bit of money to keep an eye on the traps that he has set so that they do not get stolen overnight. These panya buku are not just rodents of the bush but are very much present in the urban landscape of Morogoro town.

Sensing my surprise, he clarified that unlike house rats, panya buku do not enter homes. “If you leave the door open, they might come in and quickly steal pieces of a corn cob or a banana, but they would never hide and live in the house with humans,” he explained. I asked how frequently they are seen. He said, “We don’t see them. At night you see them running around and they sometimes like to hide in the toilet because they like cool, wet walls, so the only times you really encounter them is when you leave the house to go to the toilet.” These observations of panya buku behavior thus place the rats in a very ambiguous position, where they are both of the bush and of town, hunted for in the mountains but mostly out at sight near homes.

Could this ambiguity be explained by changing ecologies of the area? As the human population of Morogoro and the surrounding areas grow, humans become increasingly in contact with these rodents, whose habitats are increasingly constricted by farming and other human activities. It is not surprising that these rats have adapted so quickly to a suburban life abroad, as they have already done in southern Florida in the United States. At one time imported as pets, giant pouched rats are now considered an invasive species threatening the endemic flora and fauna of southern Florida.²⁷⁷ I tried to confirm with Shabani whether he thought panya buku have become

²⁷⁷ Peterson et al., “Native-Range Ecology and Invasive Potential of *Cricetomys* in North America.”

more present near farms and homes. In his thirty years of rodent trapping, have panya buku populations changed in terms of where you would find them? He nodded. “In the past, I would maybe find one rat here,” he said showing his homestead by the stream, “and how many holes did we see today?” If it is true that the incongruence between experience and the Kiswahili classification of panya buku as a “bush rodent” is caused by ecological changes and human impact, this is a clear reason for conservation work to better incorporate local classification systems into efforts to monitor and alleviate environmental degradation.²⁷⁸

Conclusion: A Rat Named Céline

On top of these naming systems exists another, more playful one. Rodent trainers at the Rodent Biosensor Project enjoy bestowing names on young rats whom they would later train. A quick survey of rat names at the project provides a snapshot of the trainers’ friends, lovers, biblical figures, footballers, and musicians. Glancing through the names of a cohort of rats reads like a playlist of popular music in Tanzania, filled with artists famous in the Democratic Republic of Congo, South Africa, Tanzania, and the Americas: Papa Wemba, Kofi Olomide, Lucky Dube, Lady Jaydee, CeCe Winans, and Céline Dion. They include musical genres such as bolingo (or soukous), reggae, Gospel, pop, and bongo flava, whose tunes can often be heard in buses, backyards, and bars.

Occasionally, more personally significant names are given to rats. Paul, the resident playboy, decided to name his four rats after four different women he has dated. Majaz, who fancies one of these women, constantly asked Paul about Nuru, the rat, and about her progress throughout training. “Majaz wants to marry Nuru, that’s why,” Paul joked. In the mornings, while trainers

²⁷⁸ For an overview of climate change impacts in the Morogoro region, see Paavola, “Livelihoods, Vulnerability and Adaptation to Climate Change in Morogoro, Tanzania.”

brought out the rats to the simulated mine fields, Paul would call out to Majaz, “Hey Majaz, come say hi to Nuru before she starts training!” Another trainer, Abdul, named his rats after Lucky Dube and Papa Wemba. “They are my favorite musicians,” he explained. I frequently heard Reggae blaring from his cell phone speaker in the cool, early mornings as he set up for work.

In some circumstances, the names of rats had to be changed, especially in situations where the person after whom a rat is named has fallen from grace. In early 2018, one of the rats named after the road racing cyclist champion, Christopher Froome, had his name changed to Andy Murray when newspapers reported that the cyclist had failed a drug test. Despite the Union Cycliste Internationale clearing Froome of doping charges given his exacerbated asthma and need for medication at the time of the drug test, the rat’s changed name remained. These naming practices form part of the project’s own fundraising schemes. Photos of cute rats with attention-grabbing headlines such as “Harry Potter to locate landmines in Cambodia” help the organization raise funds in a global economy increasingly based on the commodification of attention. The project’s Facebook page, for instance, is constantly updated with photos and videos of individually named rats being “cute” as they play, eat, and train. As comments and views go up, the expectation is that so will donations.²⁷⁹

Seen in a broader context, this naming practice bears some similarities to the Linnaean practice of describing and naming a species. While *C. gambianus* is named after the locality where it was first found, *C. ansorgei* honors the collector W. J. Ansorge. A study conducted by Verheyen *et al.* and published in 2007 described and named five new species of *Lophuromys* rodents after various professors at the Pest Management Center of the university, including *L. kilonzoii*, *L.*

²⁷⁹ See Beller, *The Cinematic Mode of Production*; Dale, *The Aesthetics and Affects of Cuteness*.

makundii, *L. machangui*, and *L. sabunii*.²⁸⁰ This tradition has continued. While some names are bestowed on critters in honor of someone, some others are bestowed to maintain a stream of funds that continue to fund their work. Practices of naming are thus always functioning within a political economy of value.

Abdul Ally, a rodent trainer who named one of his rats Lucky Dube, also explained his reasons for doing so. He had spent almost a year in 2010 overseeing the mine clearance operations in Mozambique, the first time he had ever traveled outside of Tanzania. He described the impact of his time in Gaza province, Mozambique, clearing landmines: “You learn to speak some Portuguese, you joke and drink with them. You see that all humans breathe. When you cut them, they bleed the same color, even if your skin and my skin have different colors.” Lucky Dube’s songs reminded Abdul of this all-embracing, inclusive worldview of diversity. “The cats and the dogs have forgiven each other, what is wrong with us?” go one of Lucky Dube’s anti-apartheid songs, booming from Abdul’s old Nokia 8210 mobile phone. “We’ve got to come together as one,” the refrain goes.

If, as anthropologists and historians have argued, classificatory systems are imbued with particular conceptions of nature and social order, is it possible that naming rats could also hint at political aspirations or visions of an ideal world? Abdul’s keen interest in experiencing other cultures shapes his taste in music and his optimism for the future. When Jia the rat was released, trainers chastised themselves. “We shouldn’t have named him after you, of course he would go on a long journey (*safari ndefu*) to see the world!” Paul said jokingly, almost as if my own character had foreshadowed the rat’s future. What futures are being foretold in these naming practices? What

²⁸⁰ Verheyen et al., “The Characterization of the Kilimanjaro *Lophuromys Aquilus* True 1892 Population and The Description of Five New *Lophuromys* Species (Rodentia, Muridae).”

futures are being anticipated and shaped through these human-rodent training encounters? It is to some of these futures that we turn in Chapter Seven.

This chapter has tracked the many different practices of naming in which humans and rats participate, and shown how they are animated by cultural, historical, and scientific considerations. Linnaean classification of rodents is limited to its use as a tool for cross-cultural and multilingual communication. Whether it is collaborating with foreign researchers, publishing in international journals, or explaining concepts to the media, Latinate names seem to offer the promise of immutability and universality. Yet, as this chapter argues, there is as much social contingency to the construction of Linnaean taxonomy as there is in Kiswahili. As Linnaean names shift over time in pursuit of changing determinants of taxonomy (morphological, genetic, etc.), Kiswahili ones shift to demarcate social practices of edibility and ecological behavior of the rodents themselves.

This unrelenting uncertainty in species designation reflects foundational tenets of the theory of evolution rather than merely revealing cracks and shortcomings of taxonomic and classificatory systems. The theory of evolution proposes that a population of a species may change genetically and phenotypically over time. Even within a species, there is room for variations in morphology and behavior. Any classificatory system has to contend with the mutability of species, especially in an age of accelerated environmental change. Rather than take the view, then, that one classificatory system is better than another, or even, more useful or reflective of the circumstances, this chapter notes how these two systems are used and negotiated by those who work with rodents in Morogoro, even as they contain ambiguities. Knowing which classificatory systems to draw on, then, is another mode of an interstitial intelligence. Code-switching between Kiswahili and Linnaean categories for ordering nature, rodent trainers and trappers in Morogoro mobilize the ambiguity of shifting ecologies and knowledge systems to enact expertise and intimacy with rodent

taxons. In these instances, rodent classification is almost always an act of negotiation, dependent on changing technologies, ecologies, and the value of particular human-rodent encounters.

CHAPTER FOUR

Sticky Matters

One morning, while assigned to work with young rodents only several weeks into their training, Omary, the supervisor, chided me: “You are confusing the rat. You’re damaging him [*unamharibu*]!”

I had made a rookie mistake.

I stepped back from the table on which Alikiba, the young rat, had been training. There were six tea eggs buried in some soil on the table. Tea eggs are those egg-shaped metal containers used for infusing loose-leaf tea. But here at the project, they were used to train rodents to look for explosives. Of the six tea eggs, three contained the debris of crushed landmines and were therefore “positive” for trinitrotoluene, or TNT, an explosive material. The other three were “negative” for TNT, containing palm nuts, cardboard, and a torn piece of sock.

During this training stage, Alikiba’s task was to walk up and down the table while being leashed to a rope stretched taut across the table’s length. While walking, he was expected—as trained—to correctly identify the three buried tea eggs that were “positive” for TNT. Alikiba, who was about ten-weeks old, had been training for just over a fortnight. In these earlier stages, Alikiba was successfully able to scratch at a buried tea egg containing TNT. This scratching, a frantic and eager pedaling action of his front two paws, is the sign that trainers use to infer the presence and location of landmines and other explosive remnants of war (ERW) in the ground. Having successfully identified the odor of TNT in a tea egg, Alikiba’s subsequent task was to “discriminate”—in the parlance of olfaction detection work—between positive and negative tea eggs. This meant that when Alikiba came across a buried tea egg containing TNT, he would scratch

at the soil and ignore those other tea eggs that did not have TNT. The trainer would confirm Alikiba's TNT-positive (TNT+) scratch by clicking a clicker. This clicking sound communicates to Alikiba that his actions were correct and that he would receive a food reward of avocado, banana, and peanut. The association of food with the presence of TNT reinforces the scratching behavior, so that Alikiba would be motivated to look for more TNT+ tea eggs. To describe this in terms of signs, rats were being trained to produce signs of TNT by translating odors imperceptible to the human into visible signs that point, by way of scratching, to the presence of a buried landmine.



Figure 7. Alikiba training on the soil table with author standing on the side closer to the camera. Photo by author.

As Alikiba gobbled down the fruits of his labor, I quickly re-buried all the tea eggs in a random order using the same spade for Alikiba's next practice. It was this action that Omary reprimanded. "No, no, no! Use the red spade for the positive tea eggs and the blue spade for the negative ones," he explained. Of course, I already knew this having read the Standard Operating Procedures (SOP), or training protocols that were contained in a manual. But in the frenzy of trying to keep the entire session running smoothly, and my hands juggling between the rope, the clicker, and food reward, I had absent-mindedly used the red spade (i.e., TNT+) to re-bury *all* of the tea eggs.

TNT is a sticky material. Each time the spade comes into contact with tea eggs containing TNT, traces of explosives would transfer from the debris of landmines onto the *red* spade and gradually accumulate. This sticky residue would be in danger of sticking to the negative tea eggs (TNT-) if the *red* spade were to come into contact with those non-explosive eggs. That meant that, over time, negative tea eggs could amass enough traces of TNT to be perceived by the rat as positive, blurring the distinction between positive and negative tea eggs. This would, in Omary's words, confuse the rat and damage its ability to discriminate positive from negative tea eggs since both tea eggs, TNT+ and TNT-, would smell similar. It could even unintentionally train the rat to notice *other* kinds of qualities that were not TNT that now distinguished the TNT+ and TNT- tea eggs, such as rust, or the moisturizer from a trainer's hand. "What happens when Alikiba goes to the mine field and looks for *those* other qualities?" Omary did not have to answer his own question for me to understand the severe and dangerous implications of mixing up the spades.

In this instance and many others during the six months I trained African giant pouched rats, or *panya buku*, in Morogoro, *stickiness* became a salient quality that structured human-rodent relations. While training, I was constantly reminded about TNT's sticky materiality, which

threatened to contaminate the training and “damage” the rats. As trainers, we were to ensure that TNT+ spades, tea eggs, containers, and soil did not come in contact with TNT- ones. During training, we were told not to develop too close a relationship, or stick too closely, with the rodents we trained. Because it is paramount that rodents rely *only* on the odor of TNT to identify and locate a buried landmine, trainers are expected to cultivate a certain detachment from rats. The supervisors explained that the rats should be drawn solely by the scent of TNT, free from the influence of human encouragement, sounds, food, or petting. Unwanted TNT contamination and close human-rodent relations would teach rodents to detect qualities other than TNT, which endangers human lives. Too much stickiness gets in the way. There was another way in which stickiness came to inform the day-to-day work of rodent training. Many trainers revealed that they felt “stuck” to their jobs. Training rodents has given many trainers a modest income and job security. However, the specific skills required of them to be adept at knowing and modifying rodent behavior “traps” them from easily seeking other kinds of work.

Sticky human-rodent labors interrupt the ability of trainers and their rats to detect landmines, and must therefore be controlled during training work. I argue that the training protocols that mandated, for example, that red and blue spades should not mix, are crucial to regulating the stickiness of human-rodent training. Trainers are taught and surveilled to impose a detachment between TNT+ and TNT- settings, and between themselves and the rats. Such a detachment serves two functions: first, it maintains the integrity of the training by ensuring that TNT is the targeted compound for detection, and secondly, it ensures that the operation is portable across large geographical distances. Although Morogoro serves as the training site for these rodents, fully trained rodents with standardized behaviors are expected to work in entirely different environments and

with different trainers when they are deployed to places like Cambodia and Angola for mine clearance work.

Detachment can thus be thought of as a genre of what historians of science have called *mechanical objectivity*. The training protocols guarantee this mechanical objectivity by requiring that trainers are constantly vigilant about maintaining standards across large geographical and social difference. Like scientists, accountants, and others whose professions prioritize producing authoritative knowledge about the world, rodent trainers are expected to practice a self-restraint bounded by rules.²⁸¹ Strict controls for measuring, rigorous methods for training, and enforcement by disciplinary colleagues are enlisted to the cause of mechanical objectivity in the hopes of attaining knowledge “untainted by subjectivity” and “untouched by human hands.”²⁸²

Yet many scholars remind us that practices of detachment, whether in the field of engineering, photography, or even Tibetan Buddhism, rely on constant, deliberate engagements and focused self-cultivation.²⁸³ The detachment imposed and practiced among rodent trainers is no different. To successfully train a rodent to locate landmines, trainers develop intimate knowledge about the rodents with whom they work. Trainers know the identities of each rat based on the creature’s gait and behaviors in the field. Trainers are also expected to notice signs of rodent well-being and address illness and discomfort as quickly as possible. Every encounter between rodents and their human trainers are suffused with a constant exchange of sensory meaning among bodies, objects, and signs: rodents communicate to trainers the presence of TNT odor, trainers communicate to rodents the sound of a ‘click’ and reward the rodents with food, while both come into close contact during feeding, weighing, cleaning, and playing.

²⁸¹ Porter, *Trust in Numbers*, 4.

²⁸² Daston and Galison, *Objectivity*, 43.

²⁸³ Yarrow et al., *Detachment*.

Like the materiality of TNT, human-rodent relations during training are necessarily *sticky*. Stickiness is a mode of being not-quite-together yet still in close contact. It encapsulates the different modes of engagement and detachment that human trainers cultivate with respect to their rodent collaborators. Training, therefore, is a social process through which humans and rats collaborate to produce visible signs of underground explosives that enable further action, such as removal or destruction. *Sensory co-laboring* best captures this sticky process of training by emphasizing that landmine detection work requires the productive mobilization of interspecies sensing.²⁸⁴ Critical studies of sensing have often focused on the active aspects of sensory practices, that “taste,” for example, is a skill of aesthetic judgment that a person has to acquire through practice, social experience, and the use of specific vocabularies. Christy Spackman and Jacob Lahne remark that this focus on the active cultivation of the sensorium has often overlooked the productive aspects of sensing, particularly the ways in which “mouths, noses, eyes, fingers, and tongues” are enrolled “in processes of value production.”²⁸⁵ They point to the sensory labor that people on sensory panels do as part of industrial food production processes. Sensory panelists give up their mouths and noses to capture sensory data that go into the evaluation and standardization of particular flavors that confer a food commodity its unique identity. The sensory labor performed together by rats and humans that enable the olfactory detection of buried explosives mobilize various sensory capacities—smell, sight, touch—to produce value, whether that value is tied to cleared land safe for agriculture and other productive uses, or to the Rodent Biosensor Project’s ability to fundraise and garner recognition. This sensory labor mutually transforms the rats and the trainers, who must each shift

²⁸⁴ I borrow the term sensory co-laboring from separate conversations with Christy Spackman and Diana Pardo Pedraza, both whose work have been influential in my own.

²⁸⁵ Spackman and Lahne, “Sensory Labor,” 149.

their sensory perceptions in order to create a shared framework, through co-laboration, for making meaning out of the signs of buried landmines.

Below, I offer a semiotic account of rodent training as a certain kind of sticky relation, requiring trainers to know when and where to engage with or detach from their rodents. Such stickiness is required so that trainers can be at once closely involved with their rodent collaborators while also ensuring that these very same rodents are transformed into “detection technology,” so that they can work in faraway places with other trainers. I conclude this chapter with a reflection on another experience of stickiness that rodent trainers confront, that is the feeling of being stuck to their jobs, given the very few opportunities for other kinds of gainful employment in Tanzania.

Stickiness

“Stickiness,” Sara Ahmed points out in her work on emotion, is not merely a quality of a surface but “*an effect of the histories of contact between bodies, objects, and signs.*”²⁸⁶ Ahmed writes about the way some kinds of bodies signal certain kinds of deviant behavior, and her framework is useful for our consideration of sticky human-rodent relations. “Stickiness,” she writes, “involves a form of relationality, or a ‘with-ness’, in which the elements that are ‘with’ get bound together.”²⁸⁷ Human and rodent bodies, through long-term, painstaking practices of training, stick certain behaviors (scratching) and objects (TNT) together into an ecology of meaning that stands for the presence of buried landmines.

To describe human-rodent training practices as sticky helps circumnavigate a bipolar view of detachment and engagement as opposite types of human-animal relations. In his research with meerkats, Matei Candea challenges the implicit valuation of engagement over detachment found in

²⁸⁶ Ahmed, *The Cultural Politics of Emotion*, 90.

²⁸⁷ *Ibid.*, 91.

many anthropologies of multispecies relations, which in their efforts to challenge an assumed Western, Cartesian distancing of the human from nature, tends to privilege relations, connections, and engagement between humans and other animals. Among documentary filmmakers and their meerkat subjects in the Kalahari, Candea instead finds that detachment is an ethical orientation required to “reproduce as far as possible the truth-value” of laboratory science.²⁸⁸ The reproduction of mechanical objectivity in nature documentary films required forms of human detachment from meerkats that Candea shows paradoxically requires deep engagements with meerkat behaviors.²⁸⁹

I claim, in contrast to Candea, that rodent trainers must often oscillate between detaching from and engaging with their rodents. The ability to know when to detach or engage is acquired over long periods of time, during which a shared field of signs meaningful to both rodents and trainers emerge. In contrast to “mechanical objectivity,” the same authors have described the cultivation of “trained judgment”²⁹⁰ and “expert knowledge”²⁹¹ as requiring a deeper engagement with the objects and processes of knowledge production when compared to the detachment or self-restraint of mechanical objectivity. *I want to suggest instead that it is such expert training that actually produces mechanical objectivity.* Rodent trainers must know when to detach from or engage with a rat in order to transform these rats into a landmine detection technology that, unlike other detection animals such as dogs, are much more portable across the world. It is precisely the trainers’ skills of “trained judgment,” resulting from deliberate, continuous, and long-term cross-species social practices that turn a sticky human-rodent relationship into a mechanically objective, standardized technology.

²⁸⁸ Candea, “I Fell in Love with Carlos the Meerkat.”

²⁸⁹ *Ibid.*, 251.

²⁹⁰ Daston and Galison, *Objectivity*, 309-62.

²⁹¹ Porter, *Trust in Numbers*, 213-16.

Stickiness connotes a difficulty to distinguish, or to tell apart. It is a quality that resists clear distinctions and classifications, nicely capturing the difficulty that comes with prying apart the various sensing modalities that happen during rodent training. Rodents actively smell and navigate the odors of their environments while being attentive to the sound of the click. Human trainers observe rodents' behaviors, being alert to scratching as well as other behavioral signs for TNT. As Donna Haraway has insisted, all signs are "material-semiotic" in that meaning emerges from both material and discursive qualities of an object.²⁹² In other words, the rodent scratch is rooted in its physical behavior to forage for food, digging out insects and roots. Yet within particular social relations with humans and objects, such as TNT odor, scratching also becomes meaningfully indicative of explosive material.

The conflation of these different bodies and senses, such as smell, touch, sight, movement is captured in the ambiguous phrase "to make sense," which calls our attention both to the active work of taking in an experience of the world (or sensing) and creating meaning out of those experiences (i.e., making sense). This way of understanding sense-making more closely resembles Kiswahili descriptions of sensory experiences. A Kiswahili speaker would say "hear hunger [*kusikia njaa*]," "hear an odor [*kusikia harufu*]," "see a struggle [*kuona mateso*]," or "feel that there is a possibility [*kuhisi uwezakano upo*]." These Kiswahili expressions cut across sensory modalities to express ideas and states of being that refuse distinct modes of sense-perception found in English. Indeed, Kiswahili speakers have pointed out that describing sensory experiences in Kiswahili involves simultaneously drawing on notions about perception, emotion, and cognition.

This perhaps explains why the senses collectively are described as "milango ya ufahamu" or "doorways of understanding" in Kiswahili. This is markedly different from the term perception in

²⁹² Haraway, *When Species Meet*.

English, which relegates sensing to the action of capturing (from the Latin *percipere* or “to seize”) sensory information in the world separate from the cognitive, internal practices of making sense of them. The word “apprehend” comes closest to the Kiswahili notion of sensing that entangles sensing and understanding simultaneously. For example, when referring to odors in the air, trainers often say “nasikia” or literally “I hear,” highlighting the ways that odors gradually suffuse an environment, in the same way that sounds do. One weekend, during a stroll with one of the trainers, I passed by a memorial service for a Muslim neighbor who had passed away several weeks ago. “Nasikia [*I hear*] ubani,” the trainer remarked of the scent of frankincense wafting through the stiff evening air, just as the voices of mourners chanting from the Qur’an began. Seldom do trainers ever use the verb “kunusa,” which literally means “to smell.” I gradually realized that the only occasions when trainers do say “nusa” is when they talk about what rodents do during work. When I asked why, trainers have answered, “Because the rats are detecting [*wanagundua*] TNT.”

Nusa, therefore, as an act of smelling separate from the other senses is only used in situations where the sensory action is intentionally and purposefully restricted to a singular way of perceiving. Nusa, when explained as detection, is a way of showing that the goal of sticky training is to produce rodents who can “unstick” and detach from the rich world of odors to specifically and only “detect” TNT. For these trainers, the act of training rodents is to teach rodents how to “sense” in a way that is different from the full-bodied experience of gaining understanding about one’s environment. Through a series of engagements and detachments, the rodents are taught by trainers to smell in a way that more closely resembles “perceiving” in English, that is to capture and seize upon the odor of explosive material.

Sensing and Socialization

When anthropologist David Howes asserts that “sensual relations are also social relations,” he wants to draw our attention to how the senses might be experienced differently according to social distinctions of class, gender, age, and race.²⁹³ His colleague Constance Classen agrees, insisting that “sensory perception is a cultural as well as physical act,” a social in as much as it is a bodily experience.²⁹⁴ Their views are a response to what many anthropologists of the senses felt was an over-reliance on structural, functionalist, and discursive explanations of human experience. Rituals, social encounters, and religious practices in all their rich sensual dimensions were frequently discussed in terms of their functions to resolve conflict, disseminate ideology, or organize reality. Lévi-Strauss, writing about sensory qualities in Gê myths, had argued that different modalities of the senses and their experiential qualities are homologous to one another, presenting a logical structure that later anthropologists would critique as leaving “the charms of mundane experience far behind.”²⁹⁵

The structural-functionalist and discursive approaches, Howes contends, constitute “a trap that has effectively cut off anthropologists and anthropology from the world outside the text.”²⁹⁶ Michael Jackson, whose ethnographies describe West African sensoria, echoes this same concern, writing that anthropology should “describe the human consciousness in its lived immediacy, before it is subject to theoretical elaboration or conceptual systematizing.”²⁹⁷ These authors emphasize that human culture and meaning emerge from being-in-the-world. From this standpoint, a perceiver who moves through and perceives the world is in an act of constituting both herself and the world

²⁹³ Howes, *Sensual Relations*, XI.

²⁹⁴ Classen, “Foundations for an Anthropology of the Senses,” 401.

²⁹⁵ Farquhar, *Appetites*, 2002.

²⁹⁶ Howes, *Sensual Relations*, 26.

²⁹⁷ Jackson, *Things as They Are*, 2.

together, within a particular set of social histories. As Tim Ingold explains, “the world emerges with its properties alongside the emergence of the perceiver in person, against the background of involved activity.”²⁹⁸

More recent accounts of the sensory in science and technology studies have moved away from an exclusively human project to reposition sensing as distributed across an array of technologies, environments, and other entities, including remote sensors and sentinel species.²⁹⁹ For authors like Gabrys and others, “the sensory is not only encapsulated within the body as an internal capacity or power, but it is also dispersed out there on the surface of things.”³⁰⁰ The focus on sensory practices that are distributed across and reliant on nonhuman sensory organs, however, runs the risk of reproducing a dichotomy between the person and the environment that many earlier anthropological works challenged.

These more recent studies of sensing practices readily admit that their focus is not on embodied articulation but on the technologies that mediate sensory encounters. These studies maintain a separation between sentinel species and sensors from the interpretive labor undertaken by humans. In so doing, they in fact detach sensors, animals or machine, from a particular ecology of meaning by assuming that the data produced by these non-human sensors are self-evident. To separate the capturing of sensory data from the interpretive labors of sensory experience ignores the cultural production of meaning shared by a multispecies, multisensory community.

In contrast to such an approach, I treat human-rodent relations in landmine detection labor as sticky. I argue that in order for trained rodents to circulate globally within a framework of global peacebuilding efforts of landmine clearance, trainers and rodents must first cultivate shared, sticky

²⁹⁸ Ingold, *The Perception of the Environment*, 168.

²⁹⁹ Gabrys, “Sensors and Sensing Practices.”

³⁰⁰ Seremetakis, *The Senses Still*, 6.

experiences so that signs of TNT may become meaningful to both humans and rodents. Attending to rodents' olfactory ability must be done alongside trainers' own interpretations of rodent behaviors; to examine the formation of new sensory capacities is to pay attention to the cognitive and communicative work that humans and rodents undertake together to produce and interpret signs of TNT.

Unlike sentinel fish and canaries in coalmines, trained rodents are not mere extensions of the human sensorium even as they work at the behest of humans. My study suggests that the production of sensory knowledge is a result of a shared cultivation of meaning between human trainers and trained rodents. Sensing is indeed a sticky matter. In what follows, I explore how both humans and rodents together undergo a social transformation through practices of training that enable them to draw on each other's sensory and cognitive abilities. Rodent bodies do not serve merely as sensors, taking in sensory data from the world that then has to be interpreted by human minds. Rather, through a continuous process of working together, human trainers and rodents participate in a sticky multisensory practice of smelling, touching, seeing, hearing, and thinking that produces knowledge about landmine location and presence under the condition of cross-species communication and cognition.

Sticky Training

One clear way through which training transforms trainers and rodents so that they share a field of signs is the way trainers differentiate trained rodents from their wild counterparts. Trained rats are considered by trainers to be ontologically distinct. The training practices I observed began when a young rat, about four weeks after birth, opened her eyes. From this moment, rodents were weaned from their mothers. Usually this was done by one of the trainers, Alex, who oversaw and performed

much of the socialization. Socialization, Alex explained to me, is the process through which young rodents become familiar with their human trainers. During a refresher workshop for new trainers, Omary explained that the process of socialization is important because it “reduces the rats’ *uhalisi* [kupunguza uhalisi].” The Kiswahili word *uhalisi* usually denotes a genuine or authentic quality. People have used *halisi* to refer to “original” goods, such as smart phones, to contrast them with the “fake” knock-offs that are usually made in China. Rodents whose *halisi* have been reduced are different in quality and ontology from their wilder counterparts. Wild rodents, Omary told me, were “aggressive in nature”; they need to be socialized before being able to train with humans.

Through socialization, young rodents are exposed to the human world, including smells such as coffee, flowers, fabric, gasoline, and smoke. Trainers pet, stroke, and hold young rats, letting them crawl up their arms, explore the ground, or sit cozily in the palm of their hands or in their uniform pockets. Socialized rodents are less likely to act aggressively or startle at human-made noises, such as loud footsteps, engine sounds, bumpy roads, and human conversation. This is important so that rodents develop a temperament conducive to training. Non-socialized rats, or bush rats, are spoken about in diametrically opposite terms. Bush rats were to be left alone and any close encounters could prove dangerous. “They can bite you and draw blood,” said Alex.

The transformation of these rodents into trainable creatures also helps with transforming their image as pests. “When I first saw people training rats, I said to myself, These people are crazy! Rats should be killed, not petted or held like a baby!” a trainer recalled to me of his initial encounter with the project, when he used to work as a grasscutter in the simulated mine fields. His experience was echoed by several others, who described the disgust that they had felt and had to overcome when first told to hold a rat. “At first, I was afraid but now I treat them a like a cat or rabbit,” Rose, a young female trainer offered. “To me, they are gentle and cute now that I have become used to

them [*nimeshazoea*],” Mabula, another trainer, said. Socialization works both ways. As rodents become more amenable and tamer, trainers also gain familiarity with the movements and behaviors of the rodents. Vincianne Despret calls this process “anthropo-zoo-genetic practice,” whereby the multispecies social act of training proposes a “new manner of becoming together,” bringing into existence “new identities” for trainers and rats.³⁰¹ This process of becoming together is crucial for trainers to respond to rodent behaviors, finetuning training procedures to the idiosyncratic responses that rats show in the training relationship. It is such “anthropo-zoo-genetic” practices among rodents and their trainers that make the training process sticky, binding together human and rodent into a system that enables the detection of landmines.

Pendo, one of the more respected trainers, walked me through a welfare check one morning. During a welfare check, Pendo visits every rodent in their cage to make sure that they are healthy. She opened Mona Lisa’s cage and gently scooped her up from the underbelly, bringing Mona Lisa close to her chest. With the other hand, Pendo stroked Mona Lisa’s back. The rat’s eyes narrowed while the twitching of her whiskers quickened. Pendo said that Mona Lisa was having a good time. “You do this,” Pendo explained, running her fingers and palms along Mona Lisa’s back and all the way to the tip of her tail, “and you can know if she is in pain or sick.” How do you know? I asked. Does she make a sound? Pendo shook her head. “Not really. Sometimes. Depends on the rat. Sometimes they squeak when they are happy, too,” she added. Sensing that her answer did not satisfy my question, she continued, “Usually, you just know. You feel it.”

Such a “feeling” that a trainer has for rats develops over time spent together with different rats. Many of the trainers found it difficult to explain to me how they interpret rodent squeaks, bodies, and behaviors. “You just know. I will show you,” I was often told. These sounds and

³⁰¹ Despret, “The Body We Care For,” 112.

movements become signs only after trainers have spent significant time with them and within specific contexts of training. When trainers showed me how to interpret these signs, they insisted that the sounds and movements on their own seldom carried any meaning except when interpreted along with other behaviors and in specific environments, a phenomenon that the linguistic anthropologist Webb Keane calls “bundling.”³⁰² For signs to have meaning, Keane argues, they require acknowledging the materiality of the sign itself, which makes different signs co-present, or stick. A rat scratch, for example, which is usually how a rat forages for food can only come to mean the location of the landmine within the particular temporal and spatial contexts of a training relationship.

My own training experience illustrates how such “feeling” operates among trainers and rodents in the simulated mine fields. After learning to discriminate between TNT+ and TNT- tea eggs, the rodents have to pass a test after each stage and score 100 per cent before they are allowed to train on the mine fields. The mine fields in Morogoro are simulated; they contain real but deactivated landmines that the Tanzanian army, whose base is just several kilometers south of Morogoro, buried for rodent training. There are several types of landmines in the fields, including types produced by the U.S., Russia, China, and Italy. Many of these mines are anti-personnel, meaning that they are triggered usually by the pressure placed on the mine by human weight such as by walking. Several are larger anti-tank mines, which are activated by large vehicles and contain enough power to blow through metal. We are told by the upper management that there is no risk working in fields with deactivated mines but that we should at all times follow safety procedures that are practiced in real mine fields, such as walking only in safe lanes.

³⁰² Keane, “Semiotics and the Social Analysis of Material Things.”

Mine field training involves two trainers, each holding the ends of a rope on which a rat is leashed. The field is divided into 5m x 40m boxes, each box containing between zero and three landmines, depending on the difficulty level. The location coordinates of landmines are written on metal plates staked into the margins of each box. Some boxes, however, are unmarked. The location of landmines is not known to the trainers to ensure that trainers do not “accidentally” communicate the location of landmines to the rodents. I will discuss this aspect of the training at the end of this article. For now, it is important to understand that training here works according to the same established pattern. Rodents locate a landmine and scratch the ground if they detect the scent of TNT. The trainers match this physical location to the coordinates on the metal plates. If they match, a trainer clicks to signify that the rat has correctly located the landmine and proceeds to feed the rat food as a reward. Each time a rat is rewarded, their actions are reinforced so that they are more likely to seek out TNT odor to obtain the food reward.



Figure 8. A trainer holds a leash while training a rat in the mine field. A supervisor oversees the training and takes notes. Photo by author.

Training begins early in the morning just when the sun is about to rise. During the rainy season, the fields would still be covered in mist as we would unfurl measuring tapes along the perimeter of the box so that we could more exactly record the coordinates of where the rats scratch. During the first few weeks of training, I found it difficult to know whether or not a rat's scratch was a sign of TNT's presence. I wondered if the scratch just meant that the rat was curiously exploring the soil and its tangled habitat of roots, insects, and seeds. For over two weeks, I either clicked prematurely ("*mapema!*" or "early!" the supervisor would sometimes call out) or too late (this was usually met with a slight sigh of disappointment). Some trainers were more forgiving and reassured me, "Don't worry, you'll get it!"

Confused and frustrated, one morning I decided to ask for guidance from my training partner, whom I could see was growing impatient. "Majaz, how do you know that that was a sign [*dalili*]?" I asked after he clicked on what seemed to me an ambiguous scratch when the rodent was at meter 3, 12.5. Majaz answered, "You have to become used [*zoea*] to the rat. It's not just the scratch that we look for." My confused expression must have been obvious. "Here, let me show you the next one," Majaz offered.

We took several steps along the box. Shiva, the rat with whom we trained, scuttled up and down along the width of the box, occasionally pausing as if he had suddenly heard (or smelled) something. Several meters later, Majaz called my attention to look at Shiva, "Ok, ok, now look. He is pausing." Shiva's pause was a fraction of a second longer than his other ones. During those moments, Shiva's nose twitched furiously and his ears stood up, tense. "He is now thinking," Majaz continued with his commentary, "he knows that there is TNT close by." Shiva made another brief pause, this time within 1 meter of the indicated coordinates of the landmine. He continued with a

light trot through a clump of grass, bounding quickly toward the location of the buried mine, and then scratching. “CLICK!” Majaz confirmed Shiva’s find.



Figure 9. Majaz feeds Shiva a reward of banana during training. Photo by author.

The clicker enables trainers and rodents to communicate with one another in the absence of speech (similar to some human-dog communication). The sound of the click is a sign that indicates approval, reward, and reinforcement to a trained rat. Simultaneously, the clicker also distances the human from the rodent by standing in for other forms of engagement. Trainers are not allowed to pet or stroke their rats during training. The rope that links the trainer to the rodent cannot be tugged to hold back or lead the rat during training. Talking during training is strictly discouraged. The only way a trainer communicates with a rat is through the clicker. This sign comes to be interpretively shared between trainers and rodents through training and being together.

Shiva trotted towards Majaz now and stood on his hind legs to receive his reward of well-ripened mountain banana. “Isn’t he smart? He knows even before he arrives,” Majaz praised, smiling. “Now, it is of course different for different rats. You will see. You’ll learn to notice soon. With me teaching you, you will be an expert,” he added. What I was being taught to notice during this encounter were the little gestures and behaviors, what the trainers call “secondary signs,” that preceded the scratch. “Some rats will look up to the heavens [*mbinguni*] or circle the landmine. Some will backtrack a little or perk [*tega*] their ears up,” he explained. The ability to read and interpret these secondary signs produces the “feeling” of knowing what rodent bodies and behavior mean. In Majaz’s words, it was a feeling of “knowing before arriving,” an almost intuitive ability that one achieves only with repeated practice. Through repetitive acts of training over a significant period of time among trainers and their rodents, I “knew before a rat arrives.”

In my interviews with trainers, it was clear that the duration required to forge rodent-human relations during training played a crucial role, permitting trainers and rats to read each other’s signs in landmine detection work. When I asked trainers what advice they would give to new trainers about the work of training rodents for landmine detection, almost half of those interviewed said “*uvumilivu*” or “patience.” Reading my fieldnotes, I noticed that the word came up in conversations as early as the first week of fieldwork in Morogoro. Trainers had told me that if I were to train rodents with them, I must have *uvumilivu*. At the time, I did not know what the word meant and asked for an English translation. I wrote it down as “passion,” a mishearing on my part, instead of “patience.” Passion was a surprising word because it contradicted the conversations and affective dimensions of rodent training that I then experienced.

Rodent training turns out to be slow, painstaking, and boring work. After spending 20 to 40 minutes per rodent in boxes that sometimes did not have any landmines, my mind would frequently

begin to wander. I admired the cloud-covered peaks of the Uluguru mountains or the grandiose foliage of msufi trees (sometimes known as kapok or *Bombax sp.*). “You must use a lot of your mind [*unatumia akili sana*] for this work,” Majaz reassured me, when I admitted that I was bored and easily distracted. “You have to do this every morning so you have to be patient [*uvumilivu*], focused. It requires concentration!” Such feelings are certainly more characteristic of patience rather than passion, a cultivated habit that better endures the repetitive and gradual nature of rodent training.

I mention the error in my fieldnotes of mishearing patience as passion to illustrate the important role that patience and, as we shall see, experience play in rodent training work. Patience and experience are required to cultivate the kinds of stickiness that allow human-rodent communication and cognition. To the rat, the odor of TNT issuing from buried landmines is a sign for *reward* to the rat, who then scratches and produces a sign for *landmine* to the human, who in turn responds and clicks, signing to the rat that the job was well-done. To produce and maintain this chain of meaning, humans and rodents must repeatedly train to gain familiarity with each other and with the signs they each produce. This is clearly reflected in the other common Kiswahili word used by trainers during training. In conversations with trainers about training, I often heard them explain that I would need to be “familiar” (*inabidi uzoe*) with the procedures and the rodents in order to interpret rodent signs. The verb “kuzoea” indicates gaining familiarity and is also used to describe something habitual. As a noun, “uzoefu” means experience. Such a premium placed by trainers on rodents are not very different from Pierre Bourdieu’s description of the connoisseur whose competence is:

an unconscious mastery of the instruments of appropriation which derives from slow familiarization and is the basis of familiarity with works. [It] is an ‘art’, a practical mastery which, like an art of thinking or an art of living,

cannot be transmitted solely by precept or prescription. Learning it presupposes the equivalent of the prolonged contact between disciple and master . . .³⁰³

Put differently, the prolonged contact between trainers and rodents created new habits or behaviors for signification. It is such experience and the slow, prolonged process of gaining familiarity with one another that makes human-rodent relations in landmine detection work possible and sticky.

Within two months of beginning my training, I was able to notice secondary signs and could more confidently tell which rats were training just by the way they signed and moved. I had been training the same four rats for two weeks at one point, filling in for another trainer who went on leave. One morning, I noticed something odd about Celine, one of my trainee rats. From the way she walked – too slowly and frantically – she was either sick or not Celine. I voiced my suspicions to Majaz, who immediately agreed. We continued training nonetheless and decided to check Celine’s ID tag with a scan once we were back in the kennels. Indeed, someone must have placed the wrong rat into the transport cage used for bringing rats to the mine field. It turned out we had not been training Celine after all but Mona Lisa!

³⁰³ Bourdieu, *Distinction*, 66.



Figure 10. Above: Harnesses for rodents. Below: Transport cages for rodents, with their names, ready for the trip to the mine field. Photos by author.

Mechanical Rats

In spite of the care and time taken to become familiar with each other during landmine detection training, training procedures are designed to keep trainers and rodents apart so that they do not become *too* familiar with one another. As the opening vignette of this article shows, good training is achieved when different entities do not mix or stick to one another. TNT+ tea eggs should not come in contact with TNT- spades, tea eggs, and preparation tools for this would “damage” the rat and train her to detect a quality *other than* TNT that differentiates a positive tea egg from a negative

one. Instead of the odor of TNT, let us assume that the rat notices that human conversation stops just when the rat is about to scratch at a TNT+ tea egg. She notices again that there is a sudden interruption in human voices when she approaches a buried landmine while training in the mine field. The rat now interprets the cessation of human voices, rather than the odor of TNT, as a sign for landmines. In Cambodia, the trainers, working under a perpetual risk of an explosion, are quiet throughout the operation. The rodent would become confused and is bound to miss an actual landmine.

The behavioral researchers and psychologists who author the protocols for training name these dynamics “experimenter effects.” Experimenter effects are the unintentional and unwanted influence of experimenters over the outcomes of an experiment. In the case of rodent training, human conversation becomes an interfering influence because it teaches rodents to detect an absence of human voices rather than the odor of TNT. To prevent this problem, the protocols require that trainers do not talk during training. Trainers are also discouraged from forming too close of a relationship with rodents. When a rat struggles during training, we are told to let the rodent fail and fail again until she is able to “understand” the rule of the game: scratch only when the odor of TNT is present. I watched with anguish when the rat Celine had stopped at a landmine but did not scratch, forfeiting her food reward. Yet Celine anticipated food and walked towards me only to be turned away because she had not correctly identified the landmine. “You cannot encourage her by giving her food,” Omary explained when I asked if I could encourage Celine by feeding her. “If you reward her, she thinks she’s done a good job. If we want her to succeed, we follow the protocols, which means rewarding her only when she shows correct behavior.”

The protocols are based on the principles of positive operant conditioning, which is a set of experimental methods for conducting behavioral analysis and modification designed by B. F.

Skinner and his colleagues. In many of Skinner's writings and experiments, he argues that an organism's behavior may be explained by the organism's past experiences. Animals, including humans, are more likely to act in a certain way because that behavior has been reinforced or rewarded in the past. For example, a rat follows and seeks out the scent of peanut butter because the rat had in the past consumed peanut butter and found the experience satiating or rewarding. New behaviors, such as scratching in the presence of TNT odor, can be learned by repetitively associating the odor of TNT with similarly satiating experiences. Here, again, it is important to note that the Kiswahili word for experience and behavior, *uzoefu* and *tabia*, imply notions of repetition. As with *uzoefu* above, *tabia* is translated as "behavior" but it could also mean habit or character. "Ni *tabia* yake kusikiliza radio akipiga kazi [It's his habit to listen to the radio when he works]," someone could say, or "Ni *tabia* ya panya kuishi karibu na maji [It is common (or natural) for rats to live close to water." Like Skinner, these Kiswahili words possess an appreciation for the plasticity of organisms. All organisms are not limited by their biology and can, through habit, modify their own behaviors. This view challenges the genetic determinism that define species based in their DNA (as described in Chapter Three).

Skinner relied on an experimental apparatus to test his theories. To show quantitatively how a behavior of an organism might be modified by changing the reward structure, Skinner invented a problem box, which is a modular apparatus that can be easily altered to vary the stimulus, actions, and reward structure while cumulatively recording the behavior graphically to illustrate the relationship between reward structure and behavior. An organism, let's say a rat, might be placed into a problem box by a behavioral researcher and allowed, by the rat's own volition, to act in response to stimulus and reward. A rat who pushes a lever for food is not coerced to do so but does so as a "free organism." By learning that pushing a lever delivers a reward, or food, the rat is more

likely to repeat the action on his own. Skinner believes that the problem box counters any experimenter effects and ensures that the human experimenter does not interfere in the behavioral modifications of an organism. This kind of detachment became operationalized once Skinner's ideas were adapted by the U.S. military to pilot a training program in which pigeons directed missiles to their targets during the Cold War. Ensuring the mechanical objectivity of the pigeon training was crucial to avoid any misfiring.³⁰⁴

The training protocols and the cultivated detachment that trainers maintain from rodents they train are well captured by the aims of mechanical objectivity. As I described earlier, mechanical objectivity prioritizes self-restraint and a rigorous adherence to rules to ensure that the knowledge produced is not tainted by subjectivity, and hence, is authoritative because it is free from human influence. There is also another key reason for ensuring that humans and rodents are *un-stuck* from one another. Sally, the behavioral neuroscientist who oversaw all research, training procedures, and standards at the project, explained that “the rats have superior capabilities of olfaction to humans even though we still do not fully understand how they work. It is important that the rats are only discriminating TNT odors and making their own decisions whether or not to scratch, without human influence.” Trained in psychology and neurosciences in the United States, Sally emphasized the distinct roles trainers and rodents have during landmine detection work. “The rats have a lot more information than we do because they smell things we cannot see. It is the trainer's job to teach the rats to communicate what they discover, not to interfere in how they smell,” she said.

The mechanical objectivity imposed and cultivated by trainers in their rodent training work ultimately allows the project to argue that using rodents to detect landmines is more cost effective than using dogs. With dogs, an advisor visiting from the Swiss offices of the Geneva International

³⁰⁴ For a further discussion of Skinner's principles of operant conditioning, see Schneider and Morris, “A History of the Term Radical Behaviorism”; Capshew, “Engineering Behavior”; Rutherford, *Beyond the Box*, 2009.

Center for Humanitarian Demining (GICHHD) told me, “you run into the problem of the handler having a super close relationship with the dog. They know each other’s gestures, calls, and emotions that the dog can only work with one handler. This is not cost effective, because for every dog you pay for, you also have to pay the salary of the handler.” In the rodent training organization’s pitch at conferences and fundraising events, they use the term “technology” to describe the trained rodents, which, they tout, require fewer animal handlers and greater portability. A trained rat works just as well in Tanzania as in Cambodia, and can travel to Cambodia without having the trainer follow.

Unlike dogs, trained rats are able to work with any trainer, anywhere in the world, as a result of training procedures that prioritize mechanical objectivity. Trainers also argue that rodents do not form close bonds with humans. This perhaps explains why when I proposed that it takes a certain kind of intimate knowledge to be able to interpret rodent signs, many of the trainers quickly disagreed. “That’s true if these rodents were dogs. A dog knows if you’re sad or angry but a rat doesn’t. You can’t be close to a rat as you can be close to a dog,” Koba, who has trained both dogs and rats insisted. Many of the trainers also explained that they would be able to train any rodent on any day and it would not make a difference. “Unlike mine-detecting dogs, these rats are not dependent on the same trainer. Which is why if you train a rat today that someone else trained yesterday, the rat will still find the landmines successfully,” Omary explained.

These comments sit uneasily with the sticky quality of human-rodent relations in landmine detection work. Trainers frequently displayed knowledge about rodents that could only have been produced from the social experiences of repetitive and continuous training. The knowledge of interpreting rodent behaviors, movement, and bodies are quickly obscured by the rules of training and detachment in the service of producing a detection technology that is not stuck to particular

trainers or to a particular place. These intimate day-to-day experiences of human-rodent communication and cognition for detecting landmines are subsumed into a project that insists on the interchangeability of trainers and rodents so that these trained rodents can work anywhere regardless of languages, ecologies, and histories that might have bogged them down.

Conclusion: Sticky Matters

Stickiness can also describe a sense of being trapped, burdened, or held back. Several trainers confided in me that they felt stuck in their rodent training jobs. Despite their nuanced abilities to interpret rodent behavior and their experience at training rodents to become landmine detecting technology, many felt that their skills would not transfer easily to other work. Although at first their salaries enabled them to construct houses and pay for their children's school fees, that amount has remained stagnant. In short, these trainers felt stuck and unable to progress.

“I have worked seventeen years training rodents but I do not even have enough money to buy my own car,” one trainer lamented. These trainers understand that they have reached the height of rodent training work and that there is no higher position or salary than where they currently are. I asked this trainer whether he had considered leaving the project and finding a higher paying job, for which he would have good references given the international scope of the project. He rubbished this idea, “Look, you go back to wherever your university is, you write about us and the work we do, and you get a paper that says, so and so did this work, like a PhD, yes. I have done this job for seventeen years and I don't have any paper to show. Who else would hire me?” Such sentiments were echoed by other older trainers. Majaz, now reaching fifty, who started working on the first day of the project, told me separately:

Where do we end up [*Tunaishia wapi*] with rat training skills? There is nothing beyond this work. Only darkness [*Ni giza tu*]. We are stuck [*tumekwama*]. But I am old so it is OK. No one else would hire an old guy like me anyway, so I am thankful to have this job so my children, who are your age now, can go to university and get better jobs.

Majaz's poignant reflection illustrate how the purported success of rodent detection technology that becomes *unstuck* from Tanzania and circulate globally crucially depends on particular forms of stickiness and rootedness.

This chapter has reviewed several types of stickiness that structure the sensory labor of humans and rats training together to detect TNT. As I have described, the human-rodent relationship is necessarily sticky to facilitate a sensory co-laboring that would transform these rodents into landmine detection technology. For trainers and rodents detecting landmines, sensing is a collaborative, cognitive process that depend on the shared abilities to interpret bodies as signs of TNT odor and to communicate them as meaningful information. Sensing, as trainers practice it through language and action, includes far more than just the rodents' olfactory capabilities. Rodents are not mere tools for capturing TNT odor but are themselves part of an interstitial intelligence. To know where landmines are buried, trainers and rodents practice a cultivated, cross-species cognition that brings together human and rodent sensory capacities to produce new sensing abilities. As a form of sensory co-laboring, training enacts an interstitial intelligence that produces information useful for humanitarian mine clearance projects.

Secondly, there is the stickiness of the work of rodent training itself. Due to a lack of jobs that require skills in animal care and training, and because many trainers have only completed

primary education, they are not able to find jobs elsewhere that pay more in spite of the skills they have gained through rodent training work. Many of the older trainers expressed weariness with the work and a sense of being stuck to the project. “I advise the young trainers who have just joined us to save up and open your own business using the money you get,” a trainer shared. The work of rodent training for landmine detection is specific to the extent that many of these trainers find themselves trapped by the skills and experiences that they do possess.

Finally, it is worth bearing in mind that landmine detection and clearance is a slow, painstaking process. After more than twenty-five years of mine detection and clearance work, Cambodia—where many of the trained rats are eventually sent to work—is still considered massively contaminated, a technical term used by the Landmine and Cluster Munition Monitor to report contamination of more than 100 square kilometers. As of 2020, the Monitor estimates that known or suspected contamination in Cambodia is 817 square kilometers.³⁰⁵ According to Omary, manual de-miners working with currently available technologies such as hand-held metal detectors can clear around 120 square meters of land in about four hours. Well-trained mine detection rodents, on the other hand, are said to be able to cover the same area in twenty minutes.

³⁰⁵ International Campaign to Ban Landmines - Cluster Munition Coalition (ICBL-CMC), “Landmine Monitor 2020,” 29, 31.



Figure 12. Poster for a meeting of the International Campaign to Ban Landmines held in Nairobi 2004. The poster reads: "WANTED: A World without Bomb Traps." Kutega is related to the word mtego in Kiswahili, or trap. Photo by author.

Cambodia’s different wars over a thirty-year period combined saw nearly ten million mines laid in the country, with the U.S. dropping 2.75 million tons of bombs. Between the years 1992 and 2020, the Cambodia Mine Action Centre (CMAC), the national agency responsible for humanitarian demining, reported having found and destroyed more than 2.7 million mines and other unexploded ordnances (UXO), a category that includes unexploded bombs, munitions, and other explosive remnants found buried or stuck in the ground.³⁰⁶ Ann Stoler has described these scarred landscapes as littered with “imperial debris,” a way of naming and making obvious the “toxic corrosions and violent accruals” of imperial incursions that “bear on the material environment and on people’s minds.”³⁰⁷ By their design, the “imperial debris” of landmines are tricky. They are traps meant to

³⁰⁶ Cambodian Mine Action Centre, “Progress Report 1992-2020 | CMAC.”

³⁰⁷ Stoler, *Imperial Debris*, 2.

deceive and subvert, lying in wait long after they have been laid, with the aim to maim and seriously injure—but not kill—those who step unwittingly on them. They are easy and cheap to set but take a great deal of cost and effort to remove. One could say that landmines, too, are sticky. They cling to the ground, escaping easy removal and threatening a “slow violence” of injury and trauma on those who continue to live amidst landmines.³⁰⁸

I opened this chapter with the matter of TNT and examined how its sticky materiality becomes known and perceivable through particular kinds of multispecies, sensory labors, that entail and enabled its removal. The success of this sensory co-laboring requires sticky relations between human trainers and rodents, whereby trainers cultivate the skills to know when to detach from or engage with rodents. Such skills are only possible as a result of painstaking, continuous interactions between trainers and rodents in order to develop a shared field of meaningful signs and sensory practices. These trainers and rodents go through tremendous effort in the hopes for humans of preventing further deaths and disability that result from landmine explosions. It is such sticky multispecies sensing that offer some hope to those communities still stuck in landmines’ tenacious grip.

³⁰⁸ Nixon, *Slow Violence and the Environmentalism of the Poor*; Zani, *Bomb Children*.



Figure 13. The main tree under which supplies, such as stakes and measuring tapes, are stored. The msufi tree provides shade for meetings and rest, especially during the hot season. Photo by author.

CHAPTER FIVE

A Working Theory of Rodent Minds

In arguing that the future can be ethnographically examined as a “cultural fact,” Arjun Appadurai suggests that having aspirations requires the cultural capacity to find one’s way through social spaces in order to secure better futures.³⁰⁹ Those with privilege and wealth have more opportunities to refine what he calls the “navigational capacity” required to access knowledge, to obtain goods and services, and to plan for the future. For the poor, he writes, such “nodes and pathways” are “likely to be more rigid, less supple, and less strategically valuable, not because of any cognitive deficit on the part of the poor but because the capacity to aspire...remains less developed.”³¹⁰ Appadurai’s 2013 claim offers one of the more recent instantiations in cultural anthropology of a navigational metaphor used to describe how people make sense of the world. He follows a tradition that, intriguingly, has links back to work with experimental rats in mid-century United States. This chapter tells some of that history and compares it with the practices of the rodent trainers in Tanzania with whom I worked, who also think about how people and rats are similar and different in the ways that they navigate the world around them.

If anthropology has long been concerned about how culture informs the way geography is produced and remembered, then the obverse, that spatial navigation is a good analogy for how *thinking* works, has also gained a lot of traction among anthropologists, especially within the subfield of cognitive anthropology.³¹¹ The anthropologist Anthony Wallace in 1956 coined the

³⁰⁹ Appadurai, *The Future as Cultural Fact*, 195.

³¹⁰ *Ibid.*, 188-90.

³¹¹ Casson, “Schemata in Cognitive Anthropology”; For an ethnography of space, language, and culture, see Bennardo, *Language, Space, and Social Relationships*.

term “mazeway,” a concept foundational to his thought on religions and revitalization movements, especially among the Iroquois of North America. The mazeway, for Wallace, was a mental map representing relationships between the self and the objects, plans, and techniques she encounters. Culture became, in his analysis, a gigantic maze to navigate.³¹²

If the world was akin to a gigantic maze, might people navigating through culture then be akin to rats? For some American anthropologists, psychologists, and other social scientists in the mid-century, the comparison was compelling, as Rebecca Lemov recounts in her historical account of psychology, in which she shows how various experiments with mice and mazes became essential to a scientific understanding of human cognition.³¹³ George Kelly was a psychologist whose work inspired many anthropological discussions within the culture and personality school. His personal construct theory explained how people anticipated future events based on present and past experiences in a particular society. He was not coy when he drew a direct connection between humans and rodents in a maze. “It was their network of constructions that made up the daily mazes that they ran, not the pure realities that appeared to us to surround them,” Kelly wrote in 1969, framing his account of human aspirations and decision making.³¹⁴ Kelly concluded: “Man develops his ways of anticipating events by construing – by stretching out his channels of thought. Thus he builds his own maze.”³¹⁵ In other words, people constructed their own mazes as a navigational aid to contend with visions of the future.

The scientific positions taken by psychologists like Kelly and others directly challenged Karl Marx’s assertion that only humans (not, to take some of his favorite examples, bees or

³¹² See, particularly, Wallace, “Mazeway Resynthesis; a Biocultural Theory of Religious Inspiration”; Wallace, “Mazeway Disintegration: The Individual’s Perception of Socio-Cultural Disorganization”; Wallace, *Revitalizations and Mazeways: Essays on Culture Change*.

³¹³ Lemov, *World as Laboratory*, see Chapter 2.

³¹⁴ Kelly, *Clinical Psychology and Personality*, 84.

³¹⁵ *Ibid.*, 86.

spiders), could possess abstract foresight to guide their actions – that is, with their *minds*, and not just their brains.³¹⁶ Indeed, the view that the mind distinguishes humans from other animals was a subject of much European debate, in which Marx, along with Georg W. F. Hegel and others would have participated. As Zakiyyah Iman Jackson underscores in *Becoming Human*, the eighteenth- and nineteenth-century constitution of humans as uniquely different from other animals by virtue of mind was intimately entangled with the need to philosophically define white Europeans as essentially different from black Africans, during a period when the demand for and trade in slaves from Africa reached a violent fever-pitch.³¹⁷ The tremendous growth in the capture and bondage of Africans required ever more rationalist and rationalizing defenses of enslavement against the rise of abolitionist movements. The world at present remains anti-Black, which leads Jackson to be skeptical of any attempt to recuperate the liberal category of the human to include Africans and the diaspora. Instead, she urges her readers to question the very ontological foundations of being human.³¹⁸

This chapter discusses how for rodent trainers in Tanzania, deliberations about what it means to be human are critically refracted through their conceptions of rodent minds. To understand how the category of human is more a heuristic than a settled historical conclusion, I look to how rodent trainers themselves think about rodent minds, and in turn, reflect on their own experiences of thinking and being human. These rodent trainers draw on concepts from psychology, that they inherit through their training, along with experiences developed from their own lives, to reflect on how rodents think. They offer interpretations of rodent cognitive behavior

³¹⁶ “A spider conducts operations that resemble those of a weaver, and a bee puts to shame many an architect in the construction of her cells. But what distinguishes the worst architect from the best of bees is this, that the architect raises his structure in imagination before he erects it in reality.” Marx, *The Marx-Engels Reader*, 344.

³¹⁷ Jackson, *Becoming Human*, Chapter 2.

³¹⁸ See also Wynter, “Unsettling the Coloniality of Being/Power/Truth/Freedom.”

that are similar to psychologists working on behavior and cognition in the middle of the 20th century, but also different in that there is a type of intelligence, “hekima,” reserved only for humans. By the end of this chapter, I will have described how rodent trainers in Morogoro see similarities between human and rodent thinking, as well as propose an understanding of hekima, or social intelligence, that is unique to humans.

Developments in the fields of psychology, neuroscience, and anthropology deposed the philosophical notion that mind was the sole property of humans. Thinking had lost its seat located in the cranium of *Homo sapiens*. The “mind” quickly became an emergent quality that could be tested and observed (by psychologists and anthropologists) as well as engineered (by computer scientists).³¹⁹ Indeed, the anthropological texts that opened this chapter applied conclusions from rodent cognition research to a cultural analysis of human thought. Few of the preceding works I have just mentioned ever cite one of Edward Chace Tolman’s most important papers published in 1948, which suggested that humans and other animals can create mental representations of their environments. Tolman was a psychologist working most actively between 1920 and 1950 on the idea that purpose and cognition played significant roles in shaping an organism’s behavior. Although rarely recognized as such, Tolman’s research marked one of the earliest turning points in the history of psychology, in which research gradually shifted from a pure behavioristic approach to one that considered an organism’s mind. According to the dominant behaviorist view at the time, which included proponents such as B. F. Skinner, there was no point in trying to understand the mind since it involved conjuring internal, mental states that could never be empirically verified. Tolman critiqued this mechanistic view without dismissing behaviorism entirely through a series of experiments that he and his colleagues conducted to show that behavior

³¹⁹ See, for example, Bateson, *Steps to an Ecology of Mind*; McCorduck, *Machines Who Think*; Mitchell, *Artificial Intelligence*.

was always a result of emergent properties, including memory, experience, goals, and insight, and could thus be contingent on more than muscle-twitches.³²⁰

Tolman's views culminated in a paper entitled, "Cognitive Maps in Rats and Men," published in 1948.³²¹ Although spatial metaphors are ubiquitously used in English, such as when people talk about "finding one's way" through life, the specific action of conjuring a mental map as part of complex processes of thinking found in fields as varied as urban planning, anthropology, and education comes from studies conducted by Tolman and his students with lab rats. Tolman concluded that rats were able to form cognitive maps of their environment to reach food rather than merely taking the rote path that had been ingrained into them through stimulus-response training. He used the results from his experiments to refine the behaviorist view, proposing what he called a "central office," similar to a "map control room." In the "control room," the relationship between stimulus and response is not one-to-one but a "tentative, cognitive-like map of the environment...indicating routes and paths and environmental relationships, which finally determines what responses, if any, the animal will finally release."³²² In Tolman's broader work, the cognitive map became a model for understanding how people and other animals think, which he argued could have profound implications for addressing such matters as racial strife and human aggression.³²³

The centrality of the mind as a site for cognition would come to dominate heated discussions in the fields of psychology, computer science, and anthropology. It was Tolman's intervention into behaviorism that laid the groundwork for later developments in artificial

³²⁰ Carroll, *Purpose and Cognition*, Chapter 5.

³²¹ Tolman, "Cognitive Maps in Rats and Men."

³²² *Ibid.*, 192.

³²³ "Over and over again men are blinded by too violent motivations and too intense frustration into blind and unintelligent and in the end desperately dangerous hates of outsiders. And the expression of these their displaced hates ranges all the way from discrimination against minorities to world conflagrations." *Ibid.*, 208.

intelligence beginning in the 1950s. His oeuvre marked, in many ways, the beginning of an interest in cognition, which many computer scientists hoped could be modeled through artificially intelligent machines. Tolman, however, was always more interested in the mind of the animal than the machine. His scientific insights were always grounded in experiments with rats. So crucial were these animals to Tolman's understanding of how humans think that he dedicated his most important monograph on purposive behaviorism to "M. N. A. (*Mus norvegicus albinus*)," the white rat.³²⁴

Like the cognitive psychologists of the mid-century United States, Tanzanian rodent trainers frequently looked to rodent behavior as a way to speculate about how humans think. Drawing from long-term observation of rodent behaviors and on their experiences working with and caring for *Cricetomys ansorgei* rats, trainers construct what Graham Jones calls a "working theory of mind." Although anthropological theories of mind usually focus on practices of intersubjective awareness among people, I suggest here that rodent trainers in Tanzania develop an interspecies working theory of mind. Based on their work and experiences with panya buku, or *Cricetomys* rats, trainers speculate about and make sense of rat minds, frequently drawing analogies between rats and themselves. Like Tolman, these trainers are constantly evaluating relationships between behavior and thinking in rodents to offer "*ratiocinations*" of human cognition; in other words, a theory of mind.³²⁵

In what follows, I first describe Tolman's study of cognitive maps in rats and humans in the first half of the twentieth century as one of the earliest experimental forays into understanding cognition. Having described some of the insights gained by Tolman and his colleagues from behavioral experiments with rats, I then examine similar insights gained by rodent trainers in

³²⁴ Tolman, *Purposive Behavior in Animals and Men*.

³²⁵ The pun "*ratiocinations*" comes from Tolman himself. See Tolman, "Cognitive Maps in Rats and Men," 207.

Tanzania from their work with rodents. Trainers in Tanzania consistently remark on how rats hypothesize, strategize, make decisions, and possess cunning. These attributes of cognitive activity in rats are then used as evidence and points of reflection in theories proposed by trainers in Tanzania about human thinking. In the final section, I propose that understandings of intelligence in Tanzania go beyond psychology's materialist, that is, brain-centered understanding of the mind to include social concepts require intricate thinking to process. For many Tanzanians, it is this capacity to practice what is known as *hekima*, a kind of intelligence attentive to social wellbeing, that secures a person's success in the world.

Tolman's Study

The anthropologist Graham Jones observed that magicians develop an awareness for how spectators perceive a magician's actions and words during a performance. This awareness, what Jones calls a "working theory of mind," enables magicians to construe spectators' thoughts, which in turn help magicians refine their illusions and misdirection.³²⁶ The term "theory of mind" is itself borrowed from developmental psychology to describe a stage in childhood development where a child comes to the basic realization that the mind is an entity separate from the world. This is most popularly illustrated with a behavioral experiment in which a child and her mother watch an experimenter hide a toy behind a pillow. The mother leaves the room and the experimenter moves the toy to a new hiding location. When the mother returns, the child is asked by the experimenter where her mother thinks the toy will be. Very young children would point to the second hiding place, where the toy actually is. But older children, who understand that the mother did not see the toy being moved, would point at the pillow. These older children understand that what other people

³²⁶ Jones, *Trade of the Tricks: Inside the Magician's Craft*, 55-67.

think may be different from what has happened in the world; in short, they have developed a theory of mind.³²⁷

Anthropologists would further argue that theories of mind are always culturally situated, often in close relation to ideas about the extent to which language and behavior are representative of mental processes. Individuals in some societies may find it difficult to surmise what other people are thinking, subscribing to a theory of mental opacity where intention has to be asserted through word or action.³²⁸ In other societies, individuals may deem language as reflective of the world so that the truth of a lie is assessed in terms of how a lie may or may not align with a state of affairs in the world rather than with a speaker's intentions.³²⁹ In some religions, the mind is something to be controlled through meditation and other bodily practices; a less-controlled mind invites ill-will, anomie, and an absence of attention.³³⁰ How the mind is understood in relation to language, body, action, and intention then depends on how a society understands thinking and its normative functions in maintaining social relations. Theories of mind, for anthropologists, are therefore less about universal human development and much more about how thinking is understood or evaluated by people in different societies.

It is helpful to approach Tolman's cognitive maps as a theory of mind based within a history of Darwinist thought that positions humans as a continuous part of a large and diverse biological world. Within this framework, humans are different from other animals not because humans have the capacity to think. Rather, humans are different because of the degree to which humans think *differently* from other animals. This view continues to dominate contemporary research into comparative cognition. To be sure, Tolman's generalization of rodent cognition to humans has

³²⁷ Luhrmann, "Toward an Anthropological Theory of Mind."

³²⁸ See, for example, the review by Robbins and Rumsey, "Introduction."

³²⁹ See, for example, Danziger's discussions of language and lying in "On Trying and Lying."

³³⁰ See, for example, Cassaniti, *Living Buddhism: Mind, Self, and Emotion in a Thai Community*.

invited criticism. “The leap from the behavior of *Mus norvegicus albinus* in a block maze to the behavior of *Homo sapiens* in a planetary maze is not inconsiderable,” wrote one reviewer of Tolman’s work.³³¹ Although Tolman took extreme care to qualify the extrapolation of his psychological research to social issues, he nevertheless thought it was far more important to be a socially engaged psychologist, especially as war raged in Europe and racial tensions flared in the United States.³³² And he thought this was the way to do it.

The “leap” from rat to human is evident in Tolman’s study of cognitive maps. He concluded the study by suggesting that “narrow” cognitive maps could result in regression, fixation, and aggression. He encouraged “child-trainers” and “world-planners” to instill broad cognitive maps in people, where “there are often round-about and safer paths” to achieve a more mutually interdependent world. From his paper alone, it is not clear what a broad cognitive map would look like. It is very possible, based on Tolman’s other works, that broad cognitive maps are the result of environments that would allow the rat or human to learn and apply their learning strategically. A rat that has to figure out different pathways to reach food would perform better than a rat that has been trained repeatedly to reach food only through a single, narrow path.

Let me now revisit the particulars of Tolman’s paper on cognitive maps in rats and humans. The paper summarizes several experiments conducted by Tolman and his colleagues (many of whom were his former students). Hugh C. Blodgett, a graduate student of Tolman, designed the first set of experiments, in which three groups of rats ran through a maze with several blinds every day for seven days. During each run of the maze, the percentage of errors (running into a blind)

³³¹ Allport, “Review of ‘Drives Toward War.’” Quoted in Carroll, *Purpose and Cognition*, 163.

³³² Tolman was the Chair of the Society for the Psychological Study of Social Issues (SPSSI) near the beginning of the Second World War and advocated for the application of psychology research to address issues of violence and war. He would be a co-signatory of the 1938 Statement on Racial Psychology by the SPSSI, which states that “there is no evidence for the existence of an inborn Jewish or German or Italian mentality.” Quoted in Guthrie, *Even the Rat Was White*, 199.

was recorded. Group I was given food at the end of the maze for all seven days; Group II received the food reward only on the seventh day; and Group III received food beginning on day three. Comparing the results for all three groups, Blodgett found that there was a sharp drop in errors on Day 7 for Group II and on Day 3 for Group III, whereas the decrease in errors was gradual for Group I. These results proved to Blodgett that during the days when the rats were not getting food and running into blinds, they were also building up a “cognitive map” of the maze that they could put to use when there was a reward available, resulting in the sharp drop in errors on the day when food was provided. Blodgett called the phenomenon “latent learning.”³³³

A second group of experiments involved observing and measuring “Vicarious Trial and Error,” or VTE, which is the behavior of hesitating, looking-back-and-forth that animals perform when trying to decide on their next course of action. These VTE experiments, Tolman explained, showed that the rats that performed more VTE were also better learners, that is, they made fewer errors in making the correct choice between visually distinct pathways, only one of which led to food. The higher VTE among good rodent learners was significant in that it showed that the rats were not just passively responding to stimuli but were actively “selecting and comparing” them, making sure that they made the correct visual choice to reach food.³³⁴ In the third group of experiments, rats that approached food that had been placed near a visual pattern received an electric shock. This resulted in the rats later avoiding the location of the food or the particular pattern associated with the shock. The experimenter, Bradford Hudson, another student of Tolman, noticed that the rats would look around right after being electrified to try and understand the source of the shock. When Hudson removed the visual pattern immediately after the shock, these electrified rats did not avoid the pattern and would continue to feed next to it. These experiments,

³³³ Blodgett, “The Effect of the Introduction of Reward upon the Maze Performance of Rats.”

³³⁴ Tolman, “Cognitive Maps in Rats and Men,” 200.

for Tolman, further proved the “active selective character” of the rat’s construction of cognitive maps.³³⁵

In the fourth set of experiments, David Krech (formerly Isadore Krechevsky), yet another one of Tolman’s students, proposed that rats generated “hypotheses” which they then tested through trial-and-error behaviors. Krech set up a four-choice box, with the correct-choice doors leading to the food being designated by a combination of various stimuli, such as light, dark, left or right. Observing the rats run through the box to reach the food at the other end, Krech noticed that rats would try out “hypotheses” at a relatively persistent and well-above chance rates, first going through all the doors on the left, and then choosing all the dark doors.³³⁶ Rats would run through several possible “rules” (“dark doors lead to food”; or “light doors on the left lead to food”) until they were able successfully to run the entire maze to reach food.

In the final set of experiments, rats learned to run through a maze by first reaching a circular table with only one path leading from the table to the food box. Rats repeated this course for three trials a night over four nights. This singular path led the rat through a few turns before reaching the food located in the 2 o’clock position on the table’s circumference (mapping the table, from the point of view of the observer, as a clockface). On the next day, the experimenter blocked the singular path. He then added eighteen paths radiating from the table, with path No. 5 leading directly to the food source. The results showed that 36 per cent of the rats chose to follow path No. 6 (just slightly further from the food than path No. 5), whereas less than 10 per cent of rats chose either path No. 9 or No. 10, which were both adjacent to the original path.³³⁷ For Tolman, this was clear evidence that when the original path was blocked, more rats selected a path that would point

³³⁵ Ibid., 201.

³³⁶ Krechevsky, “The Genesis of ‘Hypothesis’ in Rats.”

³³⁷ Tolman, “Cognitive Maps in Rats and Men,” 203-204.

them in the general direction of the food, rather than a path close to where they had been trained to follow. It was further proof that rats were able to build up cognitive maps of their surroundings which they used to reach food.

Together, these experiments convinced Tolman that rats were not just responding to stimuli. They were thinking, actively evaluating stimuli, deliberating on their options, and making decisions. Tolman's claims marked the beginnings of cognitive and neuroscience research whose focus would be on the processes of thinking that occur in an animal's brain. This new focus moved beyond an understanding of psychology as a set of relationships between stimulus and behavioral responses, further generating interest in research about subjective experience and consciousness. One of Tolman's students, who recognized the sophistication of rats' cognitive abilities, wrote that rats were more like "little furry people" rather than "little furry machines."³³⁸ Although the experiments designed and conducted by Tolman and his students were met with skepticism at the time of their publication, this way of talking about animals as creatures of thought gradually found a footing in cognitive neuroscience research. As one neuroscientist wrote in a 2016 review of neurophysiological experiments, the data indeed shows that the "rats really are deliberating."³³⁹ Such pronouncements would certainly not be out of place in Morogoro, Tanzania. Rodent trainers often call attention to rodent behaviors that they describe as "thinking." The following section examines how rodent trainers in Tanzania talk about rat thinking and "intelligence" in ways similar to cognitive psychologists and neuroscientists, even as they rely on concepts and experiences drawn from their daily lives.

³³⁸ Garcia, "I. Krechevsky and I: Once upon a Time at Berkeley." Quoted in Carroll, 228.

³³⁹ Redish, "Vicarious Trial and Error," 157. Quoted in Carroll, 220.

A Mischief of Rats

There are many ways to describe the way that panya buku, or *Cricetomys* rats, think. The most frequently used word to describe rat thinking in Kiswahili is “-janja.” When used for a person, “mjanja” describes someone who thinks quickly, playfully, and sometimes, deviously. A shrewd entrepreneur trying to turn a profit out of little can be said to be “mjanja.” A young motorbike taxi driver [bodaboda] trying to charge a passenger more than the standard price can also be accused of being “mjanja.” An adept person skilled at mobilizing their social networks to quickly climb the social ladder may also be called, perhaps with a tinge of awe, envy, and suspicion, “mjanja.” Rats who surreptitiously eat ripening crops at night, “go on strike” when they refuse to train, or evade baited traps are deemed “wajanja.”

Ujanja, then, can mean cunning and cleverness. Its meaning is always double, indicating both possession of quick-wit and street-smarts but also suggesting darker, more sinister motives. In fact, many commonly used Kiswahili words for clever have this double-edged quality, “mwerevu” and “janjaruka” being other examples. These words usually stand in contrast with those that describe highly educated or skilled people, such as “mwanazuoni,” “weledi,” “bingwa,” and “mahiri.” Rather than denoting cleverness or intelligence, these latter words designate scholars, experts, and craftspeople. Elders can be said to have “busara” or sagacity. A more neutral word for intelligence, that is one without connotations about its social character, is “akili,” which quite literally means “mind.”³⁴⁰ To describe someone as intelligent [“ana akili”] is to say “he or she has mind.” Alongside -janja, akili is most frequently used to describe how rodents think. For rodent trainers in Morogoro, the rats can certainly think and that they do have minds [wana akili]!

³⁴⁰ From the Arabic word, ‘aql.

I first noticed trainer talk about rodent minds during my first week working as a trainer teaching several rats to detect deactivated landmines. Because *Cricetomys* rats detest the hot sun and are thought to be nocturnal, rodent training starts at daybreak when it is still mostly dark and cool. Every morning, the rats are stirred from their kennels and placed in transport cages that are then slotted into a lorry. I changed into the standard issue uniform for training: a lab coat with huge pockets where I would keep rat food and a notepad, polyurethane Wellington boots for walking in the dewy and sometimes muddy grass, and a clicker for communicating with and training the rats. The lorry departs the headquarters every day at 6 a.m. and stops at the end of the tarred road to pick up bananas from a Mluguru lady who harvests her fruit in the mountains. As the lorry drives away from the city, the road becomes unpaved. That day the road was full of potholes and craters as it was the rainy season, giving everyone – rats and trainers alike – a good shake. By the time we arrived at the training field, we were all alert and ready to train.

Before graduating to the mine fields, where trainers and rodents practice detecting deactivated landmines, I had spent several weeks reading the training protocols and familiarizing myself with the basic techniques of rodent training. As a novice on the field, I was paired with an experienced trainer, Majaz. We were both assigned to train “problem rats,” rats who have not made any progress in their training schedule because they have failed to learn certain behaviors. They are usually several weeks behind their “age set” and usually have trouble performing the correct signals for the presence of a landmine. A well-trained rat, while walking in a field, would stop, sniff, and then scratch for three or more seconds at the location of a buried landmine. During training, trainers know where landmines are buried, so that they can reinforce this scratching behavior with a “click” using a clicker. The click signals to the rat that they will receive a food reward. After hearing the click, the rat rushes toward the trainer with the clicker and receives a

cheekful of banana. Rewarding the correct behavior during training strengthens the association that rats develop between TNT and food, and thus motivates them continuously to seek out TNT odors. Problem rats are those who have one or several issues performing this sequence of behaviors.

In that first week in the field, Majaz and I worked with two “problem rats,” Celine and Xhaka, names that give away the trainers’ favorite singer and footballer. Celine had been struggling with scratching. She had been pausing over places where landmines were buried but would not scratch. This meant that Celine could detect the odor of TNT but she still needed to learn how to communicate this to her human partners. Our task therefore was to train Celine to translate her knowledge of a landmine’s location into a signal that humans would understand. Xhaka, on the other hand, had the opposite problem. He scratched too quickly at a landmine’s location and bounded straight for the trainer, expecting food without waiting for the confirmatory click. Remedial training for these “problem rats” then was to bring their behaviors within the range defined by the protocol, which provided the standardized frameworks for interpreting the meaning of rodent behaviors. Majaz and I were going to “shape” their behavior. “Shaping” was the term coined by the behavioral psychologist, B. F. Skinner, to describe how an experimenter might produce in an animal a desired behavioral response (scratching) to a specific stimulus (TNT) through incremental steps.

We prepared the training box by unrolling a measuring tape at the two long-sides of a 20 by 5-meter box. These measuring tapes would provide the coordinates where the rats scratched. Majaz strapped Celine into her harness, which was then clipped onto a rope that extended across the width of the box between Majaz and me. The rope ensured that Celine would walk along a straight line across the box. Once Celine had walked and inspected the width of the first meter of

the box, Majaz and I stepped sideways by a meter so that Celine could then inspect the width of the second meter of the box. We would repeat this until the twentieth meter, by which Celine would have walked twenty times across the box, sniffing for buried landmines. Majaz and I also held on to a string that was connected to Celine's harness, and we could use this to tug at Celine to encourage her to walk or to move in a certain direction.



Fig. 14. Training set-up. The harness of a rat is strapped to a taut rope extended between the legs of the two trainers (in blue). Another rope is connected to the rat and held by the trainers. This hand-held rope is used to for tugging the rat in a particular direction. A training supervisor observes and takes notes.
Photo by author.

My nerves on the first morning of training probably did not put Celine at ease. Celine ambled slowly, pausing frequently in the dewy grass and looking up at me or at Majaz. Each step was painfully slow so that we were only at the third meter ten minutes later in a box that should not take longer than twenty minutes to complete with a well-trained rat. Soon, we approached a

buried landmine, whose location was indicated on a metal plaque staked into the side of the box: 5-3, that is, the landmine was located at the fifth meter on the length and third meter on the width of the box. In the more advanced stages of training, mine locations would be blinded to simulate real-life conditions where trainers have no knowledge whatsoever about where mines may be buried. We watched as Celine slowly approached the 5-3 position. At 5-2, she paused and her nose twitched vigorously as she took in the scent of TNT seeping out from underground. We waited for her to scratch; Majaz whispered an encouragement, “Fukua!” Finally, Celine’s front paws moved in a circular motion for two brief rotations. “CLICK!” Majaz punctuated the action with the clicker, and gently tugged at Celine’s rope, who then ambled gingerly to Majaz to get her food reward. Majaz stroked her head, praising “Safi sana, poa poa,” as she chewed and swallowed her fragrant share of banana. Her scratch had barely lasted one second, but this was how shaping worked. At the next landmine, we would wait until Celine made several more rotations of her paws before we clicked, repeating this over several days until she would scratch for a full three seconds.

We were clocking in at 20 minutes when we approached the next mine at 9-1 near the halfway point of the box. Majaz said that after this mine, we should call it a day for Celine. We waited again for Celine to approach the location. As before, she paused over the mine, her whiskers scanning the air, creating little eddies of TNT odor that wafted around her snout. Her paws did not move. We waited a minute, then two. “She knows but she is on strike [Anajua lakini anagoma]!” Majaz said with frustration, shaking his head and sighing. Another minute passed, and Majaz stepped into the box, unfastened Celine, and placed her back into the cage. “We will try again tomorrow. She is intelligent but lacks motivation [Ana akili ila hana motisha],” Majaz said, as he gave Celine a pat. We moved on to another box now, and prepared Xhaka to walk.

Xhaka needed to learn how to scratch until the moment of the confirmatory click before running off for his due reward. Unlike Celine, who needed to learn to produce a new behavior, Xhaka already produced all the right behaviors. He was scratching for slightly more than a second, and correctly identifying the locations of landmines. But he also scratched furiously. Without hearing the click, he would rush over to demand his banana. Majaz tutted as he strapped the harness onto Xhaka. “This one is very clever [huyu ni mjanja sana],” he remarked, and added, “He wants to eat without working [Ataka kula bila kazi].” During the training, we refused to give Xhaka his food reward when he scratched for a second and rushed toward us. We allowed him to double-back to the same landmine and waited until he would scratch for 2 seconds. After several minutes of him moving back and forth, Xhaka seemed to be losing interest. We moved on to the next landmine, where several minutes later, Xhaka detected and scratched. Click! It was not that much longer than a second of scratching. “It’s better than nothing. I was afraid he was getting frustrated,” Majaz explained, and ended the training session. “At least he heard the click, so that he can start to understand its meaning,” he said. For Majaz, taking a shortcut around work to “eat” was a sign of cleverness, even in spite of Xhaka’s inability to follow protocol. Celine’s ability to know where a landmine was, although she was not able to properly indicate it, was also deemed intelligent.

Majaz was not the only trainer who explicitly referred to rodent thinking when describing their behaviors. Every year in August, Morogoro hosts Tanzania’s national annual agricultural fair, which celebrates and honors the noble work of farming. One of the most popular booths at the fair every year features these trained rats. Rodent trainers demonstrate their training techniques to a captivated audience, who watch the rats dig up TNT-filled tea-eggs that the trainers have buried in sand on a table. Groups of school children and their teachers, curious passers-by, and visitors from cities and villages come by the booth to listen to the trainers explain what is happening before

their eyes. One of the trainers, Njovu, a former secondary school teacher in history and civics, described the clicker as a tool of communication [chombo cha mawasiliano] between human and rat: “A click allows the rat to understand that he has done a good job and that he will receive a reward [zawadi],” he said. “By doing this over and over again,” he elaborated, “the rat remembers [anakumbuka] the smell of the landmines.”

As the demonstration began, the audience leaned in with rapt and quiet attention. Another trainer, Ibrahim, carried two tea-eggs of TNT and buried them in the sand in front of the spectators while Njovu strapped a rat into his harness. When the rat was placed on the table, his nose and whiskers began twitching. He looked to each side of the table, at the many gawking faces on one end and his expectant trainers on the other. With sudden agility, he dashed across the table, abruptly stopping right above a buried tea-egg to sniff the air. Ibrahim called the spectators’ attention to this moment, saying, “When he pauses like this, you can see his thoughts [mafikirio]. Now wait and see him scratch.” The rat took a few more moments before he plunged his paws into the red soil and began scratching furiously. CLICK! The rat then ran toward Njovu and savored his mash of avocado and peanut butter reward. “When you click [piga kengele], you are exchanging thoughts with the rat,” Njovu explained. “The rat knows what you’re thinking when you click,” he added as the crowd clapped their hands.



Fig. 15. Training demonstration at the Nanenane Annual Agricultural Fair in Morogoro. Students visiting the booth wait eagerly to watch a rat detect TNT-positive tea-eggs that would be buried in the soil on the table. Photo by author.

In March, when the heavy rains begin to fall during the Masika season, it is no longer possible to train rats out in the field. Even if it is not raining the morning of a training, the ground and grass will be soaking wet. The rats detest moisture. When we did try to train them, hoping that the ground was dry enough, the rats would stall, stand up on their hind legs, and begin to groom. This would happen so frequently that the rats spent more time licking themselves than sniffing for landmines. For this reason, during the rainy season, the training shifted its focus to younger rats who were learning the odor of TNT before being able to detect a landmine. I was paired with Grace, one of the few female trainers. We were assigned to train a young rat named Kudra. It was

his first time being harnessed and clipped to the walking rope. As Grace strapped the harness onto him, he tried to wriggle free, but as soon as he wore it, I gave him some food to establish a connection between the harness and a reward. Next, Grace clipped the harness to the rope that ensures that Kudra walks in a straight line. While she did this, I buried a few tea eggs, some of which had TNT.

Initially, Kudra tried to scramble away from the rope but could not. He paused and stood on his hind legs and then walked in a circle. It struck me that what I was seeing was what Tolman identified as “vicarious trial and error” and “hypothesizing.” Kudra tried again to walk sideways away from the rope. He paused again and then turned to walk along the rope. Once he understood the constraints on his mobility, Kudra started sniffing the soil for TNT. At the first egg, he again tried to walk sideways but could not. He paused and then suddenly scratched the TNT-positive tea egg. CLICK! I confirmed his find and he walked back along the rope toward me to receive his reward. After he had eaten, Kudra ran back again, past the first tea egg, and went on to the second, which does not have TNT. He walked past it straight to the third, without trying to move away from the rope, and scratched up the third tea egg. CLICK! Another helping of food, this time from Grace, who said, “He’s learning [anajifunza].” I observed a similar pattern of behavior in other young rats. When they are first learning to detect the odor of TNT, they do so by trying different behaviors until they make the connection between food and certain behaviors. It is almost as if I could see them think and test theories out to establish what actions are expected of them in order to get the food reward. It became clear in that moment what Ibrahim meant when he told the audience at the fair that he could “see the rat’s thoughts.”

Rodent trainers discuss rodent cognitive abilities frequently, even outside the context of work. While at a café for lunch with several trainers, I remember being part of a heated discussion

about what types of ugali was better for eating. Ugali is a starch staple in a Tanzanian meal. Similar in texture to polenta and made from maize meal, ugali is eaten with meat, beans, and vegetable dishes. There are several types of ugali. The most popular one is the type made from refined maize flour. When cooked, it is snow white in color and smooth in texture. To achieve this color and consistency, the flour [unga wa sembe] has to be ground from the sweet, fleshy part of the corn kernel [punje], leaving out the harder, more fibrous germ [kiini] at the kernel's center. Flour ground from the entire corn kernel may also be used to make ugali wa dona, resulting in a more textured, brown colored ugali. "People usually prefer the white ugali because it tastes better," Majaz chipped in, "but really humans are confused!" Ibrahim, who was now ordering his food, agreed, "The outer part of the kernel has less nutrition. We should really be eating the germ because it gives you more strength [nguvu]." Both Majaz and Ibrahim asked for dona, made from the whole kernel. Majaz then reflected on his tribulations with clever rodent [panya] pests. "The panya are smart [wajanja]. If you leave out your maize and the panya eats them, you see that they only eat the germ [kiini] and leave the outer parts [sembe] of the kernel. We should be more like rats and eat the germ, not just the sembe," he offered. Ibrahim and the other trainers voiced their agreements.

During and outside of training, rodent trainers often speculate about rodent thinking, referring to their behaviors as clever or intelligent. These designations of cognition to rodents occur when rodents are said to figure out a task that is expected of them in exchange for a food reward. They are said to be thinking when they are accused of taking shortcuts around the training protocol to get food more quickly. Finally, rodent behaviors, such as eating the germ of a corn kernel, are also deemed to be intelligent. In each of these situations, rodent thinking, described as intelligent [akili] or clever [-janja], is established through evaluative talk of rodent cognition based on how these rats behave. In the next section, I discuss some of the possible theories and experiences that

trainers draw on to construct interpretive frameworks that allow them to establish working theories of mind in rodents.

Behavioral Theories

It would be a mistake to consider the cognitive talk about rodent behaviors as “folk theories” or merely local conceptions of rodent behavior. This section discusses the various sources of knowledge and experiences that rodent trainers draw on to construct their working theories of rodent minds. As rodent trainers working for an international NGO, these trainers often meet foreign visitors and researchers, many of whom are trained in psychology and neuroscience. The intellectual work that goes into considering different theories of cognition among rodent trainers therefore often entangle concepts borrowed from psychology as well as ideas about human and nonhuman animal behaviors from their own experiences living in Morogoro. Put differently, rodent trainer reflections about rodent minds are ongoing, self-critical evaluations of what it means to be human, tied to notions of morality and intelligence in Tanzania.

My earlier discussion of Tolman not only provides a conceptual point of comparison to consider how rodent trainers observe and discuss rodent cognition. Tolman’s work, as well as the research and learning theories of other behavioral and cognitive psychologists, form the foundation of training protocols at the rodent-training project. All new and incoming trainers, including myself, have to read through the training standard operating procedure, which I refer to as the training protocol. The protocol provides instructions for each stage of training, including success thresholds that rats must meet to proceed to the next stage. In addition to specific instructions, the protocol also defines key terms in the psychology of learning, such as *shaping*, *reward*, *reinforcement*, *blind test*, *cuing*, and *indication*. As a document, the protocol is a collective

product. It was written, edited, and revised by several learning psychologists, behavioral experts, and comparative psychologists, including Alan Poling, Amanda Mahoney, Haylee Ellis, Amy Durgin, Timothy Edwards, and Cynthia Fast, all of whom have published scientific papers based on their work with the organization. The reproduction, animal welfare, and diet sections of the protocols were informed by research carried out by zoologists and animal trainers including Ron Verhagen, Miriam Schneider, Caterina Caneva, and Danielle Lee. All of these authors were based at universities in the U.S., New Zealand, Italy, Germany, and Belgium. Although Tanzanian rodent scientists work at the university where the organization is based, their work is focused on the taxonomic and ecological aspects of rodents (see Chapter Two).

My focus here is on the rodent trainers themselves. Most trainers have completed their primary school education [darasa la saba]. A few have a secondary school certificate [kidato channe]. Two trainers have completed some amount of higher education [Form 6] or are earning a certificate from a vocational training college. None of the rodent trainers have gone to university, although the younger trainers often express a strong desire to gain more education. The inequality in educational attainment between and among expatriate staff and Tanzanian rodent trainers is a point of contention around how skills and intelligence are formally recognized and rewarded. The task of explaining many of the psychological and behavioral concepts in the protocols thus falls to Tanzanian supervisors, who usually have trained rodents for over ten years. Occasionally, the expatriate staff of the organization would conduct training sessions or dedicate time during meetings to explain concepts like shaping, extinction, or discrimination.

Many of these concepts are also defined in the protocols. For example, shaping, a concept that we have encountered earlier, is defined in the protocol as:

a procedure for training a new behavior by rewarding behaviors that are closer and closer to the desired target behavior. Shaping is used throughout the training process and is sometimes also called ‘shaping by successive approximation.’

These definitions are elaborate and clumsy by design because they avoid attributing any internal, mental processes to behavior. Although training can, for example, be described as the cognitive processes of learning and remembering, many of the definitions in the protocol only refer to relationships between stimulus and behavior.

Rodent trainers, however, have no allegiance to such structures of thought. When I have heard this term explained among trainers in the field, they would use the word “shaping” borrowed from English and define it as an incremental process that teaches a rat to perform a task well. Often, these explanations are phrased in cognitive terms. For example, Majaz explained shaping in this way:

Akifukua kidogo tunampa chakula. Akifukua tena, tunasubiri. Afukue zaidi, ndipo tumpe chakula. Tunarudia mara nyingi mpaka panya aelewe kazi yake.

If he scratches a little, we give him food. When he scratches again, we wait until he scratches for a little while more, then we give him food. We do this many times until he *understands* his job.

The use of the word “understand” refers to the cognitive processes of the rat in training. Given the behavioral foundations and the discomfort that experimental psychologists still harbor when

attributing internal, mental states to behavior, the protocol never describes “shaping” as a process of incremental understanding. In contrast, the trainers, frequently use words like “think” [-fikiri], “understand” [-elewa], and “recognize” [-tambua], all of which ascribe cognition to the rat.

A few of the expatriate researchers with whom I spoke accept that rats do think, understand, and strategize while they are being trained. However, in terms of the training protocols themselves, and within experiments that they conduct to test different training strategies, the expatriate psychologists hew closely to the disciplinary convention. Indeed, the type of language that we have encountered in Tolman’s paper is absent. If Tolman’s idea of cognitive maps in rats allows for rats to generate hypothesis, select stimuli, and form mental images, Tolman is still sure to underline in his papers that he is using “anthropomorphic” language. Later studies by neuroscientists that build on Tolman’s idea of cognitive maps would attribute the navigation of space to the firing of neurons in an animal’s hippocampus.³⁴¹ In many ways, such language is a more sophisticated return to the “muscle twitches” of behaviorism, but in the newer, more technologically advanced language of neurons and brain scans.

Nonetheless, the language and concepts borrowed from behaviorist psychology and cognitive science offer trainers a vocabulary from which to build a working theory of rodent minds. In general, speculations about rodent minds by trainers describe rodent cognition in two broad ways. The first is related to learning. The learning aspect of rodent minds enables trainers to teach rodents to seek out the odor of TNT in return for food. This is best captured by Ibrahim earlier, who described the “clicker” as a way to “exchange thoughts” between humans and rats. Even if trainers could not directly communicate with rodents, training allowed for a communicative framework through which humans and rodents could still “think” together when trying to figure

³⁴¹ The literature here is vast. For a selection, see O’Keefe and Nadel, “The Cognitive Map as a Hippocampus”; Epstein et al., “The Cognitive Map in Humans”; Spiers, “The Hippocampal Cognitive Map.”

out the location of a landmine. Information is being constantly exchanged between a trainer and a rat established through the co-laborious, sensory processes of training (see Chapter Four). In short, a rodent's behavior and thinking may be taught and shaped through deliberate and sustained interaction with humans.

The other component of a rodent mind is related to its nature, or what trainers refer to as "asili." Asili is what endows the rodent with its ecological habits, such as foraging, burrowing, being nocturnal, and reproductive cycles, which trainers recognize are difficult to alter through interspecies, social interactions. When trainers do describe rats as having individual personalities, they are referring to particular admixture of learning and nature in a rat's cognitive ability. For example, when one of the young rats, named Jia, refused to train from the very moment he was weaned from his mother, the trainers explained that Jia's asili, or nature, was probably very strong. "We can try to train him," Alex, the trainer who takes care of young rats told me, "but most likely he will want to return to his asili [origins]." Rats with a strong asili were less likely to be socialized, and thus, usually ill-suited for training to detect landmines.

Although the ability of a rat to be trained is usually understood as *intelligence* by rodent trainers, there are rodent behaviors attributed to the creatures' nature that many trainers also admire and find intelligent. It is these sets of "natural" behaviors, those that cannot be altered by training, that serve as counterpoints to human social behavior. We have already encountered an example of this earlier. The rats' preference for the germ of a corn kernel was evidence of the animal's intelligence because they sought after the most nutritious part of a seed. Another key example for our discussion is the description of how these rats build their burrows. Trainers who have experience trapping rodents recalled stumbling onto the burrows of these panya buku rats, which they have dug up in order to trap them. They were astounded to see that the rats were very particular

and orderly in the construction of their burrows. “It’s like a house,” one trainer, Rajabu, explained. “In it, there are three rooms. One room is for defecating, one room for the storage of food, and another room for sleeping. There is no mixing between the rooms. The feces are always only in the one room, and the food in the other,” he said.

Alex who spends most of his time in the kennels because he is in charge of training the young rats confirmed Rajabu’s observation. “You see the same behavior in the cages,” he agreed. He took me to a cage, a concrete cubicle with a wire mesh door that went from one side and over the top of the cubicle, so that natural light and air could easily enter the cage from above. Each cage has a clay pot turned onto its side that served as a burrow-like environment. Most of the time, rats curl up inside this pot to sleep, their bicolored tails poking out of the opening. We peered through the wire mesh from above, getting a bird’s eye view of the cage floor. The rat of this cage has very clearly organized her cage, which I have never noticed until Alex pointed it out. She was sleeping in her pot. Beside the pot, and half hidden by the wood chippings that formed her bedding, there was a dried mango peel and a half-eaten corncob. In the furthest corner of the cage from her sleeping pot, there was a pile of feces. Every rat had a slightly different arrangement in their cages but food, fecal, and sleeping spaces were always separate.



Fig. 16. A clay pot on its side to serve as a burrow-like environment for the rat. Photo by author.

Rajabu remarked that the rodents showed “civilization” or *ustaarabu* in Kiswahili in the way that they “plan their house.” They have specific ways about organizing their home, not unlike humans, who “should” keep their food, sleeping spaces, and toilet apart. “Even the rats know that a good home has to be well-organized,” Rajabu noted, and concluded, “Without a doubt, these rats are intelligent.” In another conversation, Majaz casually referred to rodent reproductive behavior as exemplary. “People these days are losing their culture,” he quipped and shook his head while we observed young university students flirting with one another on the roadside. Majaz is almost fifty now and he is a proud father of three children, all of whom would be high school graduates. His eldest son was the first in the family to go to university. “For the rats, it takes two or three days to get to know each other before they have sex,” he explained, “but the youth these days, they say hello and then have sex right after!” Majaz did not specifically say that people should be more like the rats he trains, but rodent courtship behaviors, just like rodent burrowing, become counterpoints for discussing human cultures. Speculative talk about rodent minds almost always imply how humans should behave, usually in ways that secure a person’s future in society.

A working theory of rodent minds structures and explains many of the concepts and rodent behaviors that trainers have to contend with in their daily lives. They draw on both concepts they have learned from psychology and comparative cognition as well as from their own experiences in Tanzanian society. Together, these speculations about rodent thinking become fodder for discussing and evaluating human behaviors, linking thought to social practice. Through these discussions, intelligence becomes a skill that is valued in Tanzanian society, a quality that can aid a person in cultivating a good life. Whether it is knowing how to eat healthily, or the knowledge to organize one’s home, or the self-control required to find romantic companionship, intelligence

in humans enables one to get ahead in life. Trainers value this kind of intelligence and some have referred to it as “hekima,” which I discuss in the final section of this chapter.

Hekima

Bajajis, the three-wheeled autorickshaw popular in India, began to show up in Tanzania sometime around 2010 and has since become a regular mode of public transportation. Owners decorate the back of their bajajis, daladalas [buses], and lorries, with proverbs, sayings, and motivational quotes. Sometimes they display Biblical sayings; other times, they declare their support for Yanga or Simba or Manchester United, popular soccer clubs in Tanzania; and sometimes they are decorated with methali, or provocative and meaningful proverbs in Kiswahili. Most sayings are in Kiswahili, but a good number of them are in English and a few in Arabic. There is one bajaji that I have seen several times, speeding past on the main street, that brandished a brightly painted methali, “Hekima ni busara.” This methali confounded me. Translating this saying into English was also difficult since both words, “hekima” and “busara”, are defined in dictionary by the Institute of Kiswahili Research at the University of Dar es Salaam (TUKI) as closely resembling “wisdom.”³⁴²

If rats and other animals were understood to possess cleverness and intelligence [-janja; akili], hekima and busara are only reserved for human beings. Busara is usually used for elders to describe a highly-respected sagacity that can only come with hindsight, experience, and cultivated intuition.³⁴³ As H. Odera Oruka emphasizes, sage philosophy is not only about traditional cosmologies but a commingling of traditional beliefs and a critical objection to and, at times, a

³⁴² TUKI (Taasisi ya Uchunguzi wa Kiswahili), *Kamusi Ya Kiswahili Sanifu*.

³⁴³ It is worth noting that discussions of wisdom and sagacity in African philosophy comes mainly from examples based in East Africa. See Oruka, *Sage Philosophy: Indigenous Thinkers and Modern Debate on African Philosophy*; Kalumba, “Sage Philosophy.”

“rationative improvement” on those very beliefs.³⁴⁴ Busara, or wisdom, emerges from a sustained and critical deliberation of ideology, usually in ways that maintain or conserve the cultural worldviews of a community. When I asked rodent trainers, who are also Waluguru, about busara, they attributed it to elders or to the wahunga (pl.) of their villages, elders of either gender who oversee questions of civil matters and resolve disputes among married couples, families, and neighbors. A mhunga (sg.) is someone with busara, I was told, because they need to know all the customs (mila) of the clan (ukoo) and to apply it in order to settle conflicts in a fair way. Do these rats have busara? “Not at all!” was the response, accompanied by laughter. “Rats have habits, not customs [Panya wana tabia sio mila],” Rajabu explained.

In contrast, hekima seemed to describe a kind of social intelligence. When that same bajaji zipped by one day, I happened to be walking with Manyasa, one of the newer rodent trainers who was several years younger than I. I quickly pointed to the message on the bajaji’s back and asked him what it meant. He thought about it for a while and replied that even he was confounded. He said that both words meant someone who is old and wise, but that hekima was sometimes more useful when you have to deal with many people [unadili na watu wengi]. I later checked with an elderly friend from Ugogo who used to teach English and whose favorite book is *The Grapes of Wrath* by John Steinbeck. He was a constant source of wisdom for me when it came to the particularities of Kiswahili. When I asked him about the proverb, “hekima ni busara,” he agreed with Manyasa’s evaluation. Hekima was an ability to “read the room” as it were, and modulating one’s speech and actions in a way that fostered respect, fortune, and solidarity [utu] in a community. To be able to act with hekima, then, is to have busara.

³⁴⁴ Oruka, *Sage Philosophy: Indigenous Thinkers and Modern Debate on African Philosophy*, 29.

When I asked if rats or other animals could have *hekima*, the answer was No. Rats were intelligent [-a na akili] and so are humans, he explained, but *hekima* requires understanding social interaction and relationships [mahusiano]. This is what makes a person successful in life. “Having knowledge [elimu] and being intelligent [akili] is not enough to succeed in life. To live well is to be able to use the knowledge you have in a way that people can respect you for it,” my elderly companion continued, and concluded, “This is something only humans can do.” “Here is an example,” he added, offering great advice for any budding field worker, “If you want to do your research well here in our community, you have to speak Kiswahili well, understand our customs, and behave in a way that makes people trust you. That is *hekima*.” This understanding aligns with what other scholars have written about *hekima* that draw on literary sources. It is an admired quality that can best be understood as a kind of ability or intelligence to maintain social relations and solve social problems, closely related to the concept of communal solidarity [*utu*].³⁴⁵

Following this discussion of *hekima*, intelligence as it is understood, discussed, and evaluated in Tanzania often include a person’s ability to foster and maintain social relationships. Such forms of intelligence go beyond the psychological and cognitive frameworks for understanding mind. They are forms of intelligence that can only be practiced by human beings. To put this in another way, given this socially inclusive understanding of intelligence in Tanzania, the psychological and cognitive concepts used to explain rodent behavior and thinking are generalizable to humans only in as much as they pertain to individual human cognitive practice, such as making decisions, testing hypothesis, and learning. Unlike Tolman, Skinner, and many other psychologists, who believe that behavioral and cognitive understandings of the human mind can help solve political and social issues such as racism, war, and violence, rodent trainers would

³⁴⁵ See Leslie, “*Hekima* and *Busara*: Are They Different Concepts and How Do They Related to *Utu*?”

wager that the solution to these problems lay in the cultivation of good social relations, a practice that requires hekima, an intelligence that goes beyond the mind, understood cognitively.

Nonetheless, rodent trainers often desire and dream about having a particular kind of mind, for either themselves or their children, sanctioned by a university degree and represented through the possession of a certificate. The certificate, with its ability to index knowledge, skill, and social status, becomes a hotly contested material among rodent trainers who require proof of their knowledge if they want to find other employment. Due to the fact that many rodent trainers have only completed their primary education, discussion about formal education often generates anxiety and grievance. One rodent trainer, for example, in refusing to participate in an interview with me, said:

So many foreigners come to [this organization] to do their research and then leave with a degree. I have worked here and trained rats for ten years but what do I have to show for it? Nothing!

His frustration was shared in less explicit ways among other older trainers, who often feel stuck in their jobs. Without the certificates necessary for higher paying jobs and with their gaining age, it would be challenging for them to find new employment. The risk of finding new employment would be very high since at their age (forties and fifties) their salaries support entire families. On the other hand, many younger trainers with less to lose risk unemployment by looking for other work, usually discreetly so as to avoid invalidating their contract.

I highlight this final anecdote to illustrate one other understanding of mind [akili] by rodent trainers. This notion of mind is very much tied to expertise and skills for which many rodent

trainers think they are not adequately recognized. Majaz, for example, explained why training rodents is really grueling work and much more difficult than training dogs. “When you train a dog, he does not resist you, he responds. But when you train rats, they resist training so you need to use your mind [tumia akili] to find ways around it,” he said. Another trainer, Ali, in another interview, added that training rats was exhausting. Trainers wake up early in the morning every day and perform the same motions: take rat out of cage, put rat in harness, walk rat, click, reward the rat with food, put the rat back in cage, clean the cage of feces, and repeat. Yet, despite this routine work, trainers have to pay extremely close attention to the rats and their behaviors in order to ensure that they are properly trained. “We don’t even get any trips, no parties, no entertainment so that we can refresh our minds. Training rats requires a fresh mind,” he said, using the phrase “fresh mind” in English. The mind, for Ali, needs to always stay alert in order to perform the training well. He mentioned that if the employer does not provide loans, which the organization stopped doing in 2017, then the trainer’s mind is always busy thinking about budgeting and household expenses instead of on training rats.

These meanings of mind, or *akili*, seem to capture notions of a specialized kind of attention. Whether it is the attention given to rodent training, as opposed to other life challenges, or the attention required to understand rodent behavior as part of training, these senses of mind describe an expertise that continues to go unrecognized, either in terms of a certificate or satisfactory work conditions. As Alex remarked in his interview, “All we want is a way to show that we have this skill [uwezo] to train animals, that we have the mind for it.” At the end of my fieldwork, I collected a list of suggestions that rodent trainers wanted to see improved. These included issues of pay, education opportunities, and working conditions such as access to loans and salary advances, which were crucial for trainers to make small investments, such as buying building materials,

vehicles, or seeds in bulk to support other types of income-generating work. I brought this up with the point person at the university, a Tanzanian professor of entomology in the Pest Management Centre, as well as with a Belgian member of the board of directors for the organization, and with the CEO of the organization. They welcomed and supported better working conditions, but they all provided several reasons for why they could not realize them: decline in funding, high salaries demanded by European staff, and Tanzanian government restrictions that tie pay to the level of education. These were all true. Funding for mine clearance projects in the world has declined drastically since the 2000s. European staff did demand more pay, and were usually paid somewhere between 2 (summer interns) and 1000 times (directors) more than Tanzanian staff. As a public institution, the university could not pay trainers more than the amount fixed by the Tanzanian government according to education levels. In the end, working conditions remained the same.

Conclusion: Lose Your Mind

This chapter positions rodent trainers in Tanzania as philosophers of the mind who explore, propose, and critique the experiences of being human through their speculation of rodent minds. By drawing on their own experiences with rats, these trainers participate in a long, cross-disciplinary history of thinking about cognition that depend on careful observations of rodent behaviors. Rodent trainers in Tanzania speculate about rodent minds as a way to understand how best to train them to detect landmines. Through speculations of rodent learning and cunning, rodent trainers subsequently reflect on the importance of being intelligent in Tanzanian society.

Although rats and humans share many cognitive abilities, the one type of thinking that is still the sole provenance of human beings is *hekima*. To rodent trainers in Morogoro and to many

Tanzanians, hekima is the intelligent ability to understand and participate in social relations that foster social solidarity and wellbeing. To have hekima is to be wise, a quality of the mind that insists on thinking through and with people, rather than only about concepts and ideas. In fact, the kind of thinking that is preoccupied only with ideas and not people can become a drain on one's own hekima.

This became clear while I was preparing an application for a grant. Several trainers noticed that I was mentally stressed, that my mind was occupied with too many things [mambo mengi]. "Don't think about too many things!" they cautioned, "Or you will lose your mind."

CHAPTER SIX

Traps

It is a common scene in Tanzania: On bicycles, at the market, and all around the bus station, men sell rat poison, glue boards, live traps, and snap traps. Some of these are imported from China, and others from Oman. Whether in the business capital of Dar es Salaam or in smaller cities like Morogoro, people talk and complain about *panya*, a Kiswahili term meaning “rodent” and encompassing all gnawing small mammals. *Panya* figure in stories about children getting bitten, missing articles of clothing, denuded corncobs, and occasionally witchcraft, all told by Tanzanians who purchase rodent control technologies in the hopes to keep rodents out of their homes and fields.

Iddy Juma Kilongola is a man in his mid-forties who designs and makes rodent traps, which he then sells at the weekly Saturday market in Morogoro not far from the Sokoine University Pest Management Center. His stall features several small kill traps, which resemble a box fitted with a spring mechanism. There are also larger traps made of thin steel, woven in the shape of a lantern. These contraptions are used for live trapping. Pointing to a coffin-sized trap filled with scurrying, squeaking mice, Iddy boasted with a salesman’s shrewdness, “This can catch 400 in one day.” My curiosity was piqued by the array of traps he had fashioned – and particularly by those designed to catch rodents alive. “Why would you want to catch them alive?” I asked. “Because,” Iddy chuckled, “in the countryside, *panya* are a snack [*mboga*].”³⁴⁶

³⁴⁶ *Mboga* literally means vegetables, but the word is also used to denote small, edible creatures including mice and termites. In Tanzania and throughout southern Africa, rodents are occasionally trapped or hunted as food. A rodent trainer from Iringa told me that rodents are considered a meat relish, or a “bonus addition” to the main meal, or *kitoweo*.

In our interviews, Iddy often spoke about his traps as technological inventions that offered more just modes of rodent control over other commercially produced traps and rodenticides. In this chapter, I explore how Iddy and other inhabitants of Morogoro struggle to earn a living that often requires meditating on practices of killing rodents. Central to these practices of attaining “the good life” is the imagination of the *just possible* that manifests materially in the design and use of rodent traps. In an agricultural region of Tanzania where rodent abundance constantly threatens human sustenance, the “just possible” comes to life through Iddy’s situated trap-making, capturing the many ways in which Tanzanian selves and communities successfully produce sustenance in a world where it is seemingly scarce. Visions of the just possible like Iddy’s trap-making endeavor, as we shall see, generate new social relations and forms of value that in turn hold unexpected promises of multispecies justice.

Commensal rodents – that is, rats and mice that share food with humans and are thus usually co-present with people – are widely regarded as pests. The figure of the pest occupies an ambiguous position within discussions of animal welfare and ecological conservation.³⁴⁷ Most ecologists and proponents of animal welfare agree that the prioritization of certain ecosystems and economies often justifies control of animal populations that threaten conservation goals or business.³⁴⁸ Debates concerning “humaneness” as it pertains to various pest management methods are in fact conversations about killing. “Humane,” as an adjective used by practitioners of animal population management, signals how swiftly, efficiently, and painlessly animal pests are killed or removed through culling, trapping, or poisoning.³⁴⁹ The designation of the term “pest” itself

³⁴⁷ See Brooks, “Animal Rights and Vertebrate Pest Control.”

³⁴⁸ Littin et al., “Animal Welfare and Ethical Issues Relevant to the Humane Control of Vertebrate Pests.”

³⁴⁹ John Hadidian notes that many of the terms used by advocates and critics of animal welfare such as “pest” and “humane” are not clearly defined. Hadidian particularly points out that the use of so-called “humane” traps that restrain or capture animals alive may often result in lacerations, trauma, and even death when an animal is left out in extreme heat or cold. What animals are seen as “pest” can often change depending on particular ecologies,

implicates political valuations that strike at the heart of what Achille Mbembe calls “necropolitics,” or “the power and the capacity to dictate who may live and who must die.”³⁵⁰ When considered within the lexicon of “pest management,” necropolitics makes visible who has power to influence policy decisions, whose livelihoods are worth protecting from the threat of pests, and – in the context of colonialism and racism in Africa – which human and nonhuman lives are deemed extinguishable. When considered within historical and social contexts of human-animal relations in Africa, the term “humane” as it is understood in terms of “pest management” does not just center on questions of how humans should treat other animals but also who is afforded the dignity of being human. This double meaning of “human/e” threads through Iddy’s traps, as well.

In the following, I show how we may interpret Iddy’s traps as instruments both of killing and of justice. The very practices of making technologies for rodent killing are, through Iddy’s creative designs, meditations on the limits of “animal welfare” as a framework for discussing pest control. Discussions about animal welfare can sometimes overlook those precarious livelihoods that depend on minimizing the effects of “animals that cause damage [*waharibifu*],” the Tanzanian expression for “pests.” Rather than focus on the term “human/e” and its accompanying ethical considerations of what killing should look like, I hope to underscore how Iddy and other Tanzanians articulate a version of multispecies justice through their efforts to preserve their livelihoods amid challenges posed by rodents, a lack of resources, and limited formal education. Through creative design, Iddy’s artisanal traps are deeply informed by a desire to improve the lives of his community while struggling with the ethics of killing rodents. I present Iddy’s traps as

communities, and histories of migration and colonialism. See Hadidian, “Taking the ‘Pest’ Out of Pest Control: Humaneness and Wildlife Damage Management”; Hadidian, Unti, and Griffin, “Measuring Humaneness.”

³⁵⁰ Mbembe, “Necropolitics,” 11.

crucial material-semiotic interventions into discussions about multispecies relations in contexts where human lives exist at the very edge of survival.

Beyond multispecies considerations, I also hope to interrogate notions of justice in relation to decolonizing scholarship on African technology. The Kiswahili term “*fundi*,” or fabricator, succinctly captures Iddy’s ability to assemble and mobilize skills, experimentation, and social relations to bring his traps to life. In attending to the intellectual and physical labor entailed by *fundi* like Iddy, I seek to recuperate African technological endeavors that are often written out of global histories of technology. In doing so, I follow Kenda Mutongi’s call for scholars to “take seriously what ordinary Africans are making in Africa and how they are making it.”³⁵¹ To this end, I approach Iddy’s artisanal repurposing of construction materials and techniques as a form of inventive and intellectual labor. Through his technical mastery of trap-making, Iddy imagines and generates *just possible* futures, whose subjects include not just Iddy and his community but also the intended target of Iddy’s traps – rodents.

³⁵¹ I am indebted to Clapperton Chakanetsa Mavhunga and Laura Ann Twagira’s work for broadening the space to think about technological innovation from the continent. Mueni wa Muiu uses “*fundi*” (“fabricator” in English) as an analytical concept in political science. Kenda Mutongi encouraged me to think deeply about Iddy’s ingenuity and his relationship to working on the streets of Morogoro. See Mavhunga, *The Mobile Workshop*; Twagira, “Introduction”; Muiu and Martin, *A New Paradigm of the African State*; Mutongi, *Matatu*, 271.



Figure 17. Iddy at his rodent trap stall and workshop in Morogoro town center. Photo by author.

The “First Robot”: Traps as Intellection

At the workshop located opposite the *daladala* (minibus) stand, Iddy displays his traps under an umbrella on a reused “Vodacom” advertisement banner amid piles of wood and metal spokes. He is usually seated on a machine he calls “a goat” [*mbuzi*], which he invented to drill holes through wood and conjoin them into traps. Iddy painted the “goat” and decorated it with the slogan *Tanzania ya Viwanda*, meaning “Industrial Tanzania,” which invokes the government’s development plan to build up Tanzania’s manufacturing economy. Under this he added *Ubunifu Kwanza*, “Imagination/Invention Comes First.” In Kiswahili, “*ubunifu*” simultaneously refers to imagination, creativity, and invention, all qualities that Iddy’s enterprise embodies. In our conversations, Iddy expressed hopes for someday operating a “trap factory” that would provide economic opportunities to farmers and youth, many of whom struggle to find gainful employment

in Tanzania. Placing himself squarely within the nation's industrializing aspirations through colorful designs on his machine, Iddy dreamed that his trap factory will "bring fortune [*baraka*] to the whole country."

Putting together bicycle gears and leftover construction materials to design and build traps, one could argue that Iddy shares certain qualities with engineers and computer scientists who create and support software that is free and open-source. These efforts allow anyone to distribute, modify, and make use of software without profits accumulating exclusively to owners of intellectual property. Iddy's ability to tailor his trap designs to better suit community needs than commercial ones evokes practices of designing free and open-source technologies that Ron Eglash, a scholar of cybernetics, argues engenders "generative justice." Inspired by the makers of Arduino and other open-source platforms, Eglash contrasts "generative justice" with "distributive" and "restorative justice." These latter ways, he suggests, often place demands for social justice on authorities and governments, conceding a top-down view of justice.³⁵²

On the contrary, generative justice emerges from the very people whose work creates value for themselves and for others in their communities through constantly shifting social arrangements. Instead of conceptions of justice that issue from questions about distribution or individualist capabilities, generative justice prioritizes social practices of living well that transform oppressive systems.³⁵³ I consider Iddy's engineering a kind of generative justice within a multispecies community of farmers, trappers, and rodents. It should become obvious that his traps are deeply embedded in a production process substantially shaped by interspecies relations and communal

³⁵² Eglash, "An Introduction to Generative Justice."

³⁵³ Iris Young critiques the focus on distribution in social justice movements that pits different social groups against one another. She advocates for an "enablement" approach to justice, which emphasizes eradicating "structural injustices" that affect some groups more than others. In this respect, her work is similar to the capabilities approach of justice later developed by Martha Nussbaum and Amartya Sen. See Young, *Justice and the Politics of Difference*; Nussbaum and Sen, *The Quality of Life*.

concerns and are thus better suited to the needs of the more-than-human communities that Iddy inhabits.

To recognize rodent traps as instruments of justice-making is not to ignore the fact that traps capture—and often kill—their prey with “unthinking, poised violence”³⁵⁴ and “deliberate wickedness,”³⁵⁵ as the anthropologists Alfred Gell and Henry Lewis Morgan respectively observe more than a century apart.³⁵⁶ Donna Haraway notes that “there is no way to eat and not to kill.”³⁵⁷ In Tanzania, where agriculture subtends and supports people’s ability to thrive, rodent trapping exists within a matrix of quotidian calculations for survival. To be able “to eat,” which is also an idiomatic way of saying “to earn a living” in Kiswahili, depends on how much food one must share with uninvited others such as rodents. In this regard, Iddy’s traps are material manifestations of how Tanzanians think ethically about killing those with whom they must share food.

Growing one’s own food became an important survival strategy in the context of food rationing measures in the 1980s, when Tanzania was subject to austere structural adjustment programs. Yet even before that decade of struggle, having enough to eat had always been a key priority for many Tanzanians and the foundation for all personal development [*maendeleo*]. *Chakula ni uhai*, so the saying goes, or Food is Life. For this reason, the figure of the farmer, or *mkulima*, holds a high moral position in Tanzanian society. The hard, grueling labor of farming is considered noble and associated with feeding the family and developing the nation. Agriculture has always been Tanzania’s largest economic sector. Tanzania’s founding father and first president, Julius Kambarage Nyerere, described agriculture as “the foundation of all our

³⁵⁴ Gell, “Vogel’s Net,” 26.

³⁵⁵ Morgan, *The American Beaver and His Works*, 236.

³⁵⁶ Alfred Gell wrote his essay in 1996 whereas Henry Lewis Morgan’s book on *The American Beaver and His Works* was published in 1868.

³⁵⁷ Haraway, *When Species Meet*, 295.

progress.”³⁵⁸ Thirty years later, in 2009, President Jakaya Mrisho Kikwete launched a national economic initiative, “*Kilimo Kwanza*” (“Farming First”), to “modernize” the agricultural sector as the nation’s main driver of development. Agriculture accounted for roughly one-third of the country’s gross domestic product in 2017, a figure that does not include the many food products that come from people’s gardens that sometimes supplement a household’s income.³⁵⁹

Almost all the men and women I know in Morogoro participate in some form of agricultural work. Being able to garden or farm is considered a crucial life skill. In small pockets of gardens, even close to the town center, people plant stalks of corn and cassava or tend banana and papaya groves. Often, salaries from paid work are insufficient to meet household need, so people rely on their gardens for nourishment. As Rashidi, a rodent trapper, explained when describing his 250-square foot garden, “What we grow we don’t buy. The money we save, we use to pay for our children’s schooling.” The room I lived in during fieldwork was part of a larger compound owned by a landlady who often shared her bounty of fruit, lemongrass, and vegetables with me. “If you don’t eat them, the *ngedere* (vervet monkeys) will,” she would say.

If food is indeed life and part of an intricate calculus for survival and success in Tanzania, then the harvesting of garden produce by *non-human* entities must be weighed up against household budgets, school fees, delayed wages, and rapidly rising costs of living. Experiences with animals that cause damage to harvests, or *waharibifu*, are common. These critters include grain borers and weevils, vervet monkeys, bamboo rats, field mice, and mongoose, among others. Rodents figure frequently and perniciously in local residents’ accounts. They “attack” during the planting and growing seasons. They infest homes, biting children or stealing items of clothing, especially underwear [*chupi*]. They appear without warning and in swarms. Rats and mice devour

³⁵⁸ Quoted in Mura, “The Discontented Farmer: State-Society Relations and Food Insecurity in Rural Tanzania.”

³⁵⁹ “Gross Domestic Product 2017.,” National Bureau of Statistics, United Republic of Tanzania.

newly planted seeds and seedlings or climb up corn stalks to gobble up maturing cobs. During the months of January and February, it is common to meet a despondent acquaintance who has had an entire weekend's worth of sowing devastated overnight by a ravenous pack of rats.

Due to its mountain ranges, fertile soil, and diverse climates, Morogoro district supplies Tanzania with myriad fruits, grains, and vegetables, including strawberries, maize, rice, papaya, bananas, onions, and millet. Consequently, Morogoro town is also home to the Ministry of Agriculture's Rodent Control Centre, as well as Tanzania's only agricultural university, the Sokoine University of Agriculture (SUA). Iddy's trap-making enterprise thus stands within a society that confronts in many ways the problem of learning, in Haraway's words, how "to live responsibly within the multiplicitous necessity and labor of killing" as part of daily life.³⁶⁰

Embedded within a context where killing rodents is unavoidable, Iddy and other trappers are deeply "engaged in intellection, firmly anchored in their own philosophies, and alert to the world around and beyond them as a source of things that they render technological."³⁶¹ Striving to flourish with just enough resources in ways that foster socially just and possible futures, they practice what I call the condition of the *just possible*. Trap makers and farmers leave open the possibility of cultivating multispecies wellbeing through their experimentation with and deployment of traps. Contending with the labor of killing, they wrestle with the entangled, "emergent ecologies" that bind crops, rodents, and humans together.³⁶² The act of trapping rodents does not always fit within schemes for eradication and control. Sometimes, traps serve to catch food, which may include rodents. In their effort to craft just possible futures for themselves, others,

³⁶⁰ Haraway, *When Species Meet*, 80.

³⁶¹ Mavhunga, *What Do Science, Technology, and Innovation Mean from Africa?*, 8.

³⁶² Kirksey, *Emergent Ecologies*.

and “other others,” trap-makers thus complicate the simplistic and deadly designations of rodents as “pests.”³⁶³

In positioning traps as practical and theoretical tools that navigate the daily realities of living with rodents, I both invoke and challenge extant anthropological literature on traps and trapping.³⁶⁴ Anthropologists have long admired the technical sophistication involved in the design of traps, often comparing their workings to electrical circuits or motherboards. Like open-source software, traps and their designs circulate freely. They are adopted, appropriated, and repurposed through dynamic processes of migration, exchange, and circulation. E. B. Tylor, writing at the end of the nineteenth century, considered traps alongside other implements such as weapons and wheels as evidence of mental development among people whom he called “primitive.”³⁶⁵

Other anthropologists like Julius E. Lips, who did extensive work among the Innu of the Labrador Peninsula, considered the trap to be the “First Robot,” an invention that was “certainly of greater consequence to the history of mankind than the invention of the wheel.”³⁶⁶ Lips surveyed traps from North America, West Africa, and Europe, concluding that they are possibly “the oldest application of relay structures” and that they formed an integral part of any “modern technique” of automation and information processing.³⁶⁷ In a comparable vein, Alfred Gell in his essay entitled “Vogel’s Net: Traps as Artworks and Artworks as Traps” describes traps as a kind of “automaton,” with a cybernetic ability to produce action in the absence of a person. Gell praises traps as devices that “embody ideas [and] convey meanings” because the trap “by its very nature, is a transformed representation of its maker, the hunter, and the prey animal, its victim, and of their

³⁶³ Jacques Derrida coined the term “other others” to refer to nonhuman animals who often fall out of human-centered ethical considerations: Derrida, *The Gift of Death*, 69. I thank Sophie Chao for bringing this to my attention.

³⁶⁴ See also Corsín Jiménez and Nahum-Claudel, “The Anthropology of Traps.”

³⁶⁵ Tylor, *Anthropology*.

³⁶⁶ Lips, *The Origin of Things*, 83.

³⁶⁷ *Ibid.*, 80.

mutual relationship.”³⁶⁸ Posing traps as a “nexus of intentionalities between hunters and prey animals,” Gell evokes their ability to bring together different worlds.³⁶⁹ In other words, Gell suggests that traps are portals through which sensory worlds collide and converge. Trap designers imagine and inhabit the sensory worlds of their prey, building them into traps to capture prey without catching the specific prey’s attention.

The imaginative adoption of the prey’s sensory world featured centrally in the rodent traps I surveyed in Tanzania. Some, for instance, incorporated enclosed, dark spaces into their designs, mimicking a rodent burrow. Suleimani, a trapper and research technician at the university’s pest management center, explained that this is because rodents find wide-open spaces threatening. “They walk next to a wall, or around rocks and bushes, but never across a field,” he said. “*Panya* like small, dark spaces. It is like their home.” Individuals like Suleimani draw on a deep well of experiential knowledge about rodent ecology and behavior in fashioning and using traps. Often, Suleimani would share with me behavioral details about *panya* that are absent from or, occasionally, contradictory to established scientific literature. On one trapping expedition, Suleimani placed a live trap close to a burrow entrance of a *panya buku* (*Cricetomys* sp.) and then skipped the next burrow we found. “This is the exit,” he said. “Usually, *panya buku* have territories of around fifty meters, so we have to walk further to set the next trap.” Other trappers volunteered behavioral notes when we passed by suitable trapping locations. Once while we were in the mountains, a trapper named Rashidi directed my attention to some long grass. “You will find *panya mchanga* there,” he said, referring to the striped *Rhabdomys pumilio* rodent. He followed this revelation with a description of the scraggy vegetation and lightly disturbed soil that led him to know what species of rodents lived there. Trap technologies are thus imbued with human

³⁶⁸ Gell, “Vogel’s Net,” 29.

³⁶⁹ *Ibid.*, 29.

knowledge *about* animal behavior gained primarily through experience with, and proximity to, a given species. Setting up traps in suitable locations relies on “intimate knowledges” that trappers possess about rodent ecology and ethology.³⁷⁰

Taken together, traps materialize processes of knowledge-making and imagination that go beyond “the given, the already there, [and] the taken for granted of social life and the world in which social life unfolds.”³⁷¹ The embodied practices of designing, building, and laying traps are ways that people grapple with the possibilities of living with rodents amid constant struggles to eat and live well.

How to Make a Rodent Trap

Loud squeals of grinding metal competed with traffic noises from the transport stand opposite Iddy’s stall. His hoarse voice overcoming the din, Iddy walked me through the steps of making a box trap. He was seated on his “goat” [*mbuzi*], the machine that resembled the animal, its neck jutting out to the level of Iddy’s face. Attached to the cyborg ungulate’s head are bicycle gears, one large and one smaller, conjoined by greasy chains. Iddy had fashioned a kind of handle in place of the pedal, which he turned with one hand to drill through wood held in the other.

Iddy and his siblings grew up in Kilosa village, some 70 miles from Morogoro. “After my mother got pregnant, my father left and I have never received any support from him,” he said. In the mornings, Iddy and his elder brother would go and tend to the 400-square-foot field where his mom had planted crops. “My mother would be in town, selling firewood or sugarcane in exchange

³⁷⁰ Both Hugh Raffles and Radhika Govindrajan write about intimacy and knowledge production in multispecies relations. Even Henry Lewis Morgan, in his work on a different, larger rodent, acknowledged the “knowledge of the habits of beavers [that] is necessary to the trapper to pursue his vocation.” These trappers were “Indian and white trappers on the south shore of Lake Superior.” See Morgan, *The American Beaver and His Works*, 227, 133. See also Raffles, “Intimate Knowledge”; Govindrajan, *Animal Intimacies*.

³⁷¹ Joel Robbins makes a case for anthropologically studying people’s imaginations of alternatives and possibilities. Robbins, “Beyond the Suffering Subject,” 457.

for maize flour to feed us,” he explained. Iddy attributed his difficult life to the fact that he never went to school. “Everything I learn, I learn from the street,” he said. He initially worked for food and then later for pocket change [*posho*] unloading produce from trucks. He roamed the streets and met people who would sometimes offer him construction jobs, such as hauling bricks, cement, and metal.

“It’s not always fair [*haki*],” he admitted, “Sometimes I get paid much less than what was offered, but I never demanded more. I worked hard from morning to night and learned a lot.”³⁷² Iddy’s ability to invent new tools like the “goat” came from having to perform construction tasks without proper equipment. The conditions were often challenging, but he credited those days for gifting him with creativity [*ubunifu*]. “I had to use my brain a lot. My boss was impressed and started paying,” he recounted. Eventually, he started saving up wages obtained from his labors. Soon, Iddy was buying Chinese-made traps and selling them on the street.

Moving from town to town, Iddy regularly heard people complain about rodents and other pests destroying their crops. “In one of the villages, I tell you, there must have been something occult [*mambo ya ajabu*] going on. You could not walk without stepping on a rodent!” he recalled. This gave Iddy the idea of starting a trap business. “But these Chinese traps,” he went on, “the customers complain about them.” Snap traps imported from China were made of light metal with sensitive triggers. Several customers had returned with complaints that the traps he had sold them maimed rodents but did not kill them. Customers woke up to find blood stains on their sheets and

³⁷² *Haki*, the Kiswahili word for “fairness” or “justice,” is also the word used for “rights.” *Haki za binadamu*, for example, means “human rights.” *Haki* is one of those Indian Oceanic words that shaped and marked Tanzanian cultural practice. I have encountered *haki* in the context of justice and fairness in Bahasa Melayu, Hindi, Urdu, and Arabic. See Geertz, *Local Knowledge*, for ethnographic examples of *haqq* from Indonesia and Morocco, specifically Chapter 8.

floor, traces of what appeared to be a painful escape. Worse, if a rodent had crawled into a crevice and died, they were often unable to find the decomposing body except by its festering stench.

Iddy realized that he had to make his own traps to accommodate his customers' requests. He experimented with four or five designs, which were all constructed from wood and metal spokes with different trigger mechanisms. Using only hand tools, Iddy created a box trap with a trigger mechanism that he fashioned out of metal spokes twisted into springs. "I discovered that the springs are important. You need enough strength to kill but you don't want it to be too strong," he said, showing me a model that he had just built. "Why not?" I asked. "So that if a child puts her fingers into the trap, she won't get hurt," he answered.

This ethnographic moment reveals how traps are sites for figuring out multispecies wellbeing. Traps are more than just what Gell called "texts on animal behavior."³⁷³ Rather, as Iddy explained, traps may be designed to constrain and influence the behaviors of rodents and humans who both share a penchant for satisfying their curiosity. For instance, rodents are wary of new objects (neophobic), but they also tend to explore and forage for new sources of food. Similarly, a child's curiosity might be aroused by a trap – a contraption that invites fiddling and play with its dangling bait and mechanical workings. The problem with Chinese traps, Iddy said, is that they are too sensitive. At the slightest touch, they snap and maim, causing the rodent to die slowly and in pain, or in the case of a child, injuring their unwitting fingers.

Iddy's very movements of twisting metal, drilling wood, and fastening a trigger in a trap embody an artisanal calculation that balances the demands of child safety, the need for immediate rodent death, and the efficacy of a trap. "I design traps so the springs work *only* when *panya* is fully inside and he is killed instantly. The springs are not strong enough to injure a child's finger,"

³⁷³ Gell, "Vogel's Net," 27.

he assured me. Iddy does not claim that his traps are “humane.” However, he respects rodents as living beings capable of experiencing pain, and in some cases, of outsmarting his traps. Some rats, he noted, can avoid getting ensnared. “I haven’t found a good design for house rats [*panya wa nyumba*]. They are too smart [*wajanja sana*]. They recognize a trap and very few are tricked,” Iddy conceded.

At the market, Iddy’s traps are popular because they are cheaper than imported ones and are less likely to fail. Chinese metal traps rust and degrade quickly whereas Iddy’s traps, which are made of wood, are more durable in Morogoro’s tropical weather. The modular design of Iddy’s traps also means that he can easily customize them to specific requests. Fusing business and community interests, Iddy’s trap designs draw on his own experiences as a casual laborer to offer better ways to protect people’s livelihoods from rodents. As Eglash and Foster write of Maker communities in Africa, Iddy is “simultaneously pulling the warp of innovation geared toward the future while also weaving in the weft of repair practices already deeply entrenched” in their lives.³⁷⁴ The very practices of drilling holes, bending metal, and hoisting wood into a trap embody the imagination of a future where children are not injured and where rodents are swiftly killed – in other words, where multispecies interests are enfolded into the design of traps.

Rodenticides are a Poisoned Chalice

Within their political economies of use, traps are material practices that confront us with critical questions about survival, the good life, and multispecies wellbeing. Traps, trap alternatives such as rodenticides, and deliberations over their respective uses represent the very material ways in

³⁷⁴ Eglash and Foster, “On the Politics of Generative Justice: African Traditions and Maker Communities,” 129.

which Tanzanians grapple with their own positions within multispecies relations of killing, living, and eating together.

When considering rodenticides, many Morogoro inhabitants are attuned to the risks of toxic exposure. This is reflected in daily conversations about natural products [*asili*] and locally [*kienyeji*] grown produce, which they tend to prefer over factory-farmed and store-bought food. “Only foreigners buy frozen store chicken,” several Morogoro residents told me, adding “You don’t know what chemicals and antibiotics they pump into them.” People also tend to buy produce on the street or in the wet markets, sold by women “from the mountains” that are “free from pesticide.” Stacey Langwick noted that Tanzanian gardeners harbor similar suspicions towards industrially produced food. Practices of cultivating medicinal foods [*dawa lishe*], Langwick writes, are sites of meditation and mediation for cultivating a politics of habitability amidst an industrializing Tanzania.³⁷⁵ For the same reasons, small-scale Tanzanian farmers with whom I spoke rarely use rat poison [*sumu*]. “We don’t know if these chemicals go into our food or our water,” they mused.

Shawa is a retired agricultural officer at the Rodent Control Centre located along the main road to the Sokoine University of Agriculture. He commands the respect of all current staff and still regularly comes by the office. During the early days of the Centre in the late 1980s, Shawa conducted several studies monitoring long-term population fluctuations of *panya shamba*, or field mice (*Mastomys natalensis*). He performed several “palatability studies” in which he tested several mixtures of bait with poison to see which ones attracted (and killed) the most rodents. In our interview, Shawa explained that the Rodent Control Centre was initially established to improve Tanzania’s agricultural sector by providing advice and technical assistance to farmers dealing with

³⁷⁵ Langwick, “A Politics of Habitability.”

rodent pests. More recently, however, the under-resourced Centre functions as a clearing house for government-distributed rodenticides during outbreaks. These included several varieties of warfarin and zinc phosphide, well-known poisons used throughout the world to combat rodent infestations. Shawa worried about the long-term health effects of these poisons. “I see that people who used poisons in the 1990s, they now have some kind of illness,” he explained. When I asked him to elaborate, he recalled that farmers developed growths on their hands and had difficulty clenching their fists.

Shawa was skeptical when I told him that I could not find any published research on the long-term effects of warfarin on the health of humans, other animals, or plants.³⁷⁶ Most of the studies dealt only with measures to prevent the accidental, immediate poisoning of livestock and people. “The problem with using poisons,” Shawa noted with concern, “is that you use a lot and so you have huge sacks of it lying around that farmers didn’t use, even today. Who knows what happens to the poisons? Are they seeping into the ground? Are they going into the well water?” Shawa continued, “Children may die because they eat rodenticide. Disposing of poisons is a challenge.” He recounted how rodents could build resistance to these rodenticides so that farmers must use second generation versions to keep up. Shawa opined that the Centre’s main job should be to educate farmers about farming responsibly, including in the responsible use of poisons. Yet, with the Centre’s reduced budget, deteriorating equipment, and dwindling staff, this was difficult to do. Common to many scientific institutions throughout Africa, these challenges cause Shawa to

³⁷⁶ The World Health Organization (WHO), United Nations Environment Program (UNEP), and International Labor Organization (ILO) of the United Nations concluded, based on available studies, that “Exposure of the general population to warfarin as a rodenticide through air, drinking-water, or food is unlikely and does not constitute a significant health hazard.” See International Programme on Chemical Safety, “Warfarin.” Gwen Ottinger and others term this lack of research on a chemical’s long-term health hazard as a “structured knowledge gap,” meant to disempower communities and exclude them from procedural justice. See Ottinger, “Changing Knowledge, Local Knowledge, and Knowledge Gaps.”

worry over the fact that he was never able to study the unintended, toxicological consequences of rodenticide use.³⁷⁷

Iddy echoed Shawa's sentiments about poisons: "I tell you, some of these poisons take time to work, up to seven days. By then, the rodent would have gone far. What if someone eats him? What if a cat eats him? Where does the poison go?" Like Shawa, Iddy questioned what happens to poisons once they have been ingested by the rodent. "Do they end up in the water, in our food? When you poison a rodent, you poison other animals together," he said. For this reason, Iddy discourages his customers from using rodenticides. His advice is always to use a trap, or raise a cat, but never to resort to rodenticides. "Our body might transform when we eat something that has rat poison," Iddy conjectured, "And the rodents suffer. They don't die right away. They crawl around, they go mad, they go to a corner, and then they slowly die."

Iddy's distrust of rodenticides articulates a particular stance in relation to multispecies justice. Iddy arrives at his position through his work of inventing and building traps as he generates alternatives to rodenticides that nonetheless remain imbricated with important questions about human-rodent relations in an agricultural context. In this regard, trap-making is both a practical and a theoretical endeavor. Through the very handiwork of building traps, Iddy thinks about and imagines a future that is just possible for the intertwined lives of people and rodents in Morogoro.

Toward a Generative, Multispecies Just Possible

Iddy had been invited to set up his stall at the Annual *Nanenane* Agricultural Fair, where I sought to meet him. In a long queue to enter the fairgrounds, we shuffled slowly under the midday heat. I could smell the charred fat of *mishikaki* (skewered meat) and roasting popcorn. Buses brimmed

³⁷⁷ See Tousignant, *Edges of Exposure: Toxicology and the Problem of Capacity in Postcolonial Senegal*.

with school children in bright white uniforms, jostling for space and prompting piercing shrieks from the policewomen and their whistles.

Once I finally bought a ticket and entered the fairgrounds, I waded through the crowd to Iddy's stall. On the way, I passed by shiny tractors, a patch of gigantic eggplants, a snake gallery, and a mock Bwana Sukari factory demonstrating how sugar is made. At last, I found Iddy at his stall, seated on his goat. I was surprised to see that he was drilling through a piece of metal rather than the usual wood. This was a new design. He had also repainted the goat in bright colors and added a new motto: "*Tanzania ya Viwanda. Morogoro Kwanza. Ubunifu jadi yetu.*" In English, this translates as: "Industrial Tanzania. Morogoro Comes First. Imagination is our heritage." Iddy's stall was shot through with the country's flag colors and symbols, thus positioning his work as part of a national aspiration that boasts creativity as traditionally Tanzanian.

As I watched Iddy work, I soon recognized his new trap design. It was a Sherman. Made of aluminum and light to carry, these live traps are the tool of choice for ecologists conducting trap-and-release studies of small mammal populations. And just a few days earlier, over a hundred Sherman traps laid out overnight by Sokoine University's Pest Management Centre had been stolen. Data collected from this study was intended to contribute to a long-term project to predict rodent outbreaks and implement pest management strategies that did not rely on poisons. The trappers Suleimani and Rashidi had been able to track down and retrieve several stolen traps at Chamwino market. Yet they only recovered several dozen, and the research had to be halted.

This was where Iddy came in. He had bought sheets of aluminum, cut them into smaller pieces, and constructed several Sherman-like traps. "I'm still testing the trigger springs," he remarked. He inserted a pencil into the trap, which meekly snapped shut. Through Iddy's ability to reverse-engineer a Sherman and construct the trap with an entirely different spring mechanism,

the university research project was able to continue. The university could buy the traps more cheaply, without incurring the exorbitant import duties that Tanzanian customs frequently levy. With Iddy's technical ability, Suleimani and Rashidi continued to trap mice, and their data collection was only briefly interrupted.

Both Iddy's kill traps and live traps are interventions into an ongoing multispecies predicament that binds humans and rodents into close-knit relations that require constant negotiations of who eats, who dies and who lives. Val Plumwood orthographically recognizes this intimate relation as "Food/Death," writing that the most "basic feature of animal existence on planet earth" is that "we are food and that through death we nourish others."³⁷⁸ In Morogoro, where people rely on food they cultivate to make ends meet, human-rodent entanglements become sites where nourishment and death have to be constantly negotiated. Rodents who consume too much food threaten human sustenance and endanger lives that depend on making just enough.

Trap-making is first and foremost Iddy's means of earning a living. He is proud of his accomplishments, particularly given his journey from the days of moving hundred-pound loads in exchange for food. By serving his community's needs for rodent control, generating income, and eschewing the accumulation of profits exclusive to an owner of intellectual property, one could argue that Iddy's audacious creativity also proposes new ecological entanglements that try to resolve the Food/Death conundrum. Whether they are designed to kill quickly and thoroughly, or for live trapping so as to offer safer, poison-free methods, Iddy's traps knit together – materially and intellectually – human and rodent worlds. His traps make visible the potentially disastrous, cascading ecological consequences that ensue when rodenticides are used, in hopes of avoiding

³⁷⁸ Plumwood, "Tasteless," 324.

what Deborah Rose Bird calls “double death.”³⁷⁹ The fact that people may consume rodents and other plants and animals that have been exposed to toxic rodenticides means that the use of any rodenticide runs the risk of jeopardizing many lives. From the perspectives of Iddy, Shawa, and others who grow their own food, the use of rodenticides conjures anxiety about wide-ranging, long-term effects of poison on human and environmental health. Additionally, “double death” conjoins shared, multispecies vulnerabilities: rodents and children getting maimed by badly designed, faulty traps imported from abroad.

Tanzanians who use traps do not deny that traps mark the end of an animal’s life. Yet, despite the many methods for trapping and killing rodents practiced in Morogoro, Iddy and others readily concede that their machinations may be foiled by “smart” [*wanaoakili*] rodents. Even when faced with alluring (albeit poison-laced) baits, rodents adapt over the course of a few generations and build resistance to rodenticides. Rodents’ ability to survive and subvert the most enticing of traps garners Iddy’s admiration. “In the end, you can only do so much. Rodents are cunning,” he concluded. “You can lay a trap but they know, and they will go around it and eat your maize.”

What is valuable, then, for people in Morogoro living with rodents is not the total eradication of rodent pests through indiscriminate methods such as rodenticides. Rather, value is generated in the everyday endeavor, through the design and deployment of technology, to live well with those who eat together. These endeavors take on a concrete form in the traps that Iddy has built. When deployed, these traps become significant sites for reconfiguring relationships between rodents and people, informed by a constantly negotiated calculus of multispecies nourishment.

³⁷⁹ For Deborah Bird Rose, the death of an organism, ecosystem, or metabolic pathway, usually results in a “relentless cascade” of more deaths, “fracturing a compact [between life and death] that has been integral to life on earth.” Rose, “Double Death.”

Conclusion: Imagining the Just Possible

“Such a history begs the question, How does one delight in precarious life?”

Joshua Bennett³⁸⁰

Not so long ago, the white-minority governments of Rhodesia (present day Zimbabwe) and South Africa used warfarin and other rodenticides as a chemical weapon against Black activists fighting for decolonization.³⁸¹ White supremacists in southern Africa saw little difference between Africans and rodents, and they sought to eradicate both. Black Americans, too, have been dehumanized by racist laws and other experiences of inequality that often placed them in close disposition and proximity to nonhuman animals, including rats.³⁸²

Against the backdrop of these histories, Joshua Bennett counters that such dehumanizing experiences prepare the ground for Black writers to articulate a “more robust vision of human, and nonhuman,” and its “cognitive and otherwise potential.”³⁸³ For Bennett, it is important that his work acknowledges Black experiences of suffering and subjection without foreclosing possibilities for poetry, imagination, and resilience.³⁸⁴ The stories I tell here of trap-making in Morogoro attempt to answer Bennett’s question, “How does one delight in precarious life?” Although Iddy and others who work with rodents in Morogoro live on the edges of making ends meet, they find delight and formulate visions of the future through their design and deployment of traps. It is for this reason that Iddy’s trap-making is a form of generative justice. By “hacking” traps that subvert

³⁸⁰ Bennett, *Being Property Once Myself*, 8.

³⁸¹ See Gould and Folb, “Project Coast”; Wittenberg, “Poison in the Rhodesian Bush War.”

³⁸² See Mavhunga, “Vermin Beings.”

³⁸³ Bennett, *Being Property Once Myself*, 8.

³⁸⁴ *Ibid.*, 8-10.

their commodified counterparts, Iddy generates new spaces within which he and others in Morogoro can reconceive their social relations with one another and with other nonhuman animals.

In contemporary Tanzania, human-rodent relations manifest the practical realities of learning to live well with others – a theme of central importance to multispecies justice. People who opt to use Iddy’s traps seldom appropriate the language of war against rodents that is characteristic of pest extermination efforts in Euro-America. Instead, they embrace them as part and parcel of everyday life. “They live with us, they eat with us,” a fruit seller at the market once told me nonchalantly. While many of my interlocutors have relied on terms like “enemy” [*adui*] to denote *panya*, rarely did they want to see them eradicated or killed by the thousands. If anything, rodents were acknowledged for their intelligence and resilience, even if begrudgingly. “If only humans [*binadamu*] were more like *panya*!” said Rashidi, in the context of deploring the “antics” of today’s youth. For Rashidi, many young Tanzanians dress sloppily and have abandoned all effort to look presentable, behavior that paled in comparison with the conscientious, self-grooming habits of rodents. Human-rodent relations in Morogoro thus exemplify a cosmopolitics wherein possible notions of justice are not foreclosed by a particular view of rodents but rather worked out in the design and use of traps.³⁸⁵ This cosmopolitical approach draws attention to the material ways through which people conceive of and enact justice, and how these practices relate in turn to the access and distribution of resources and technology.

The (unequal) material conditions that undergird Iddy’s trap-making came through in our final conversation. When asked about his hopes for the future, Iddy laughed. He gestured to his traps and said:

³⁸⁵ Isabelle Stengers outlines a deliberative framework for envisioning a world we want to live in that considers the experiences and existence of different actors – human and nonhuman – without foreclosing the political possibilities that emerge. Stengers’ work nicely shows how trap-making could be considered a cosmopolitical practice. See Stengers, “The Cosmopolitical Proposal.”

First, I would like a power drill. A drill will let me make four times more traps. Second, I would like a factory. I want to provide jobs for youth who cannot find any work; if you don't have work, you don't have nothing (*bila kazi, hamna kitu*)! Third, I would like some stickers to put on each trap, with my name and phone number, so people know that this young man from Tanzania made this trap. It is the only one like it in the world and when people in China, Malaysia, America see the trap, they know that this man from Tanzania, who never went to school, made this trap.

His technoscientific dreams notwithstanding, Iddy's desire to own an electric drill should caution us against celebrating this story merely as an example of African improvisation or a smart "workaround." Iddy would not have chosen to make traps using the "goat" if he could have done otherwise. It is for this reason that I have avoided using the terms "improvisation" or "bricolage" to describe Iddy's traps because these terms have so often and subtly marked African practices of technology as inferior copies of those found elsewhere.³⁸⁶

Instead, I appropriate the language used by scholars of computing, who credit hackers and makers for their ingenuity in designing open-source software that reconfigures existing notions of equality, freedom, and justice. By smuggling notions of activist creativity into Iddy's trap-making

³⁸⁶ Lily Irani critiques the term "*jugaad*" or "workaround," as used by Indian entrepreneurs to describe rural technologies. Calling a technology *jugaad* ascribes it a lack of design, inferior to proper innovation. See Irani, *Chasing Innovation*, 175-192. Chakanetsa Mavhunga writes that "tinkering" is "such a horrible word because it refers to a mender... a trial and error person, a meddler, or, worse yet, a clumsy, unskilled worker." Mavhunga, *What Do Science, Technology, and Innovation Mean from Africa?*, 7-9. I am also grateful to Jean Comaroff for helping me think through these points in a conversation about Bedford lorries in Sudan.

enterprise, I avoid framing African hacks into extant technologies as *improvisation*, which as the term's etymology suggests, describes an "unforeseen" progress. On the contrary, Iddy's traps are purposefully designed through an intricate, intellectual process that brings together questions of livelihoods, wellbeing, and multispecies justice. They are "*ubunifu*" or "inventions," which at their roots in both English and Kiswahili foreground the new and deliberate, both as idea and object. And they arouse feelings of delight and pride in Iddy, who continues to show them off to passersby and potential customers.

Seriously engaging with both human-rodent relations and with the hardships and possibilities posed by such relations forms the ground upon which people like Iddy envision just possible futures. It is within such knotty multispecies relations that Iddy finds delight and pride – so colorfully conveyed on his machine – in showcasing a vision for his trap enterprise and for the world. To be sure, Iddy's vision of life can be stark. "*Maisha ni mapambano*," he often says, "Life is a struggle." Although Iddy works under challenging circumstances and within limited resources, earning just enough money to get by, his traps are nonetheless modes of self-expression, pride, and aspiration. By "imagining other possibles and other realities" through his trap designs, Iddy, to borrow Arturo Escobar's words, "forces us to rethink many of our everyday practices and politics."³⁸⁷ Seated on his goat, turning the drill, and constructing traps, Iddy crafts *just* possible futures, in which he would own a trap factory that provided jobs to his community while his traps circulated across the world.

The just possible, as Iddy's story suggests, is the condition of doing enough to thrive while incorporating considerations of more-than-human wellbeing with ingenuity. It is a condition that acknowledges the radical potential in particular and local practices of *kufanyafanya tu*, or "making

³⁸⁷ See Escobar, *Pluriversal Politics*, 4.

do with what one has.”³⁸⁸ Even as they evoke elegant objects of contemporary art and contemplation, as Alfred Gell would have appreciated, Iddy’s traps embody his *ubunifu* (or, imagination) for crafting just possibles. They are informed by a striving to live well and delight in multispecies worlds. Meeting the needs of Tanzanian farmers, whose livelihoods depend on safeguarding sufficient harvests from rodents without indiscriminate methods, Iddy generates designs for killing *and* living with rodents without endangering the people, plants, and other animals who share the agricultural communities of Morogoro.

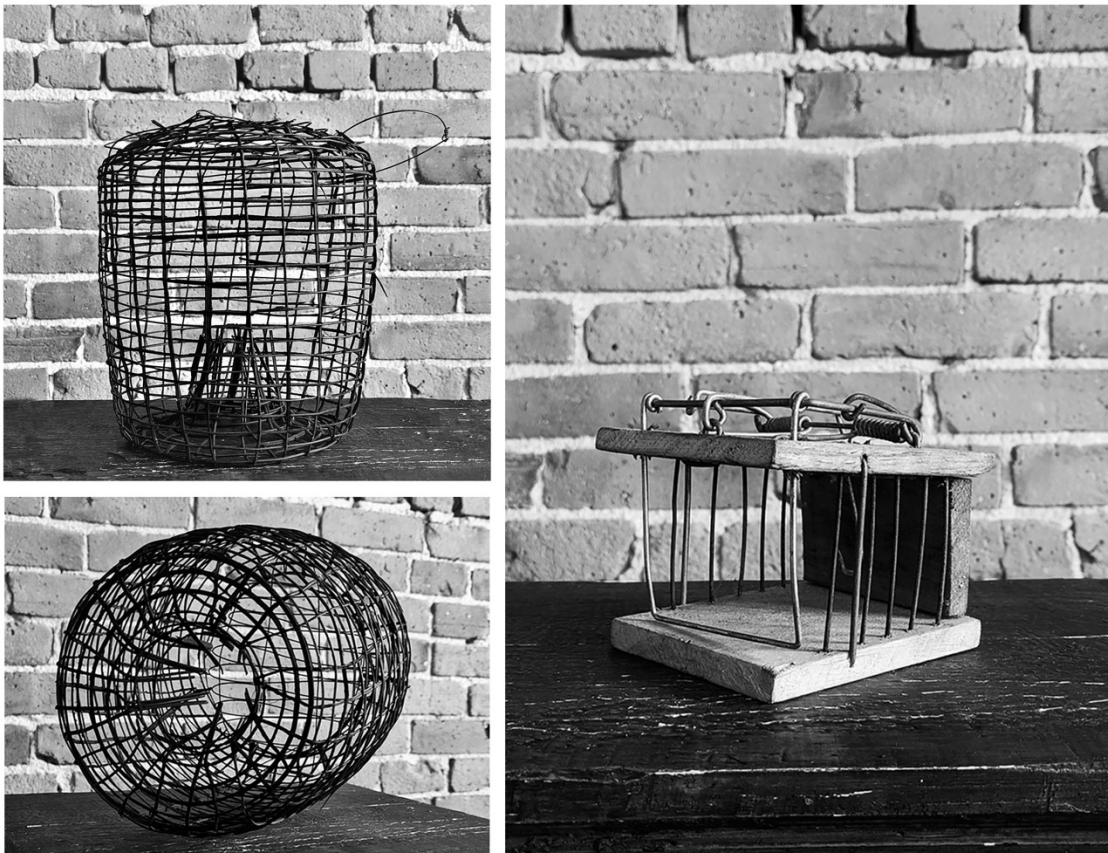


Figure 18. Iddy’s traps. Photos by author.

³⁸⁸ Mutongi, *Matatu*, 35.

CHAPTER SEVEN

The Timewreck of Treasure Hunting

When Alex pulled me aside into the break room where we both worked, it was to tell me that gem-encrusted goblets, gold coins, and bejeweled daggers were buried in the mountains that surrounded the town. Such reports of buried treasure were common throughout Tanzania, and were especially common in mountainous regions, such as the Usambara or the Uluguru, near where Alex and I spoke. Stories about finding treasures and the wealth that they bring are shared widely and discreetly, occasionally breaking into the public or onto messaging platforms when, from time to time, misfortune befalls their seekers.

Alex works for a non-profit organization based in Morogoro, Tanzania, which trains giant pouched rats (*Cricetomys ansorgei*) to detect landmines. These trained rats are later deployed in countries like Angola and Cambodia, where the rodents participate in humanitarian mine clearance efforts. Having worked as a rodent trainer for almost twenty years, Alex is well-respected for his experience and ability to interpret rodent behaviors. Rats trained to look for particular odors of explosive material must accurately signal their presence so their trainers, like Alex, can mark the mine's location for subsequent clearance. When a trained rat comes upon the odor of trinitrotoluene, or TNT, seeping from a buried mine, it signals TNT's presence by scratching in the dirt. An experienced trainer like Alex would be able to accurately interpret these rodent signals, and it was these very skills that Alex would apply to his attempts of looking for buried treasure.

That afternoon when Alex had told me about treasures was also the day before I was to travel to Germany to spend the New Year with close friends. He wanted to see if I would be able to help him get in touch with Germans who had occupied mainland Tanzania during the period of

German colonialism in East Africa (1885-1918). I told Alex that it would be extremely unlikely that any former German colonial officers would still be alive today but that I would check with friends to see if their parents or grandparents might have been stationed in Tanganyika. “What is it that you want to know?” I asked. “Any information about buried treasures,” he answered, “any maps, stories, rituals that can help me find treasure.” In Germany, I asked around as I had promised, seeing if my friends’ parents, aunts, and grandparents could recall any details. Everyone I spoke to was befuddled. Many were not aware that Tanzania had once been a colony of Germany. When I brought this news back to Alex, he was disappointed but he moved on quickly to another plan which he had been hatching while I was away. He announced it with an invitation: “Would you join our next expedition?”

Treasure hunting is a practice that many might relegate to the realm of the quixotic and adventurous. Yet, across the world, treasure hunting has long been a popular practice. In the United Kingdom alone, there were over one thousand incidences of found treasure, including gold coins, reported between 2014 and 2015.³⁸⁹ In Thailand, Mexico, Tanzania, and the United States, it is not uncommon to find the occasional news story about treasure hunts and finds.³⁹⁰ Given treasure hunting’s frequent and geographically diverse occurrence, it is surprising that very little anthropological attention has been paid to this practice. Among archeologists, treasures figure centrally as part of discussions about past societies, framed by complex ethical and political considerations that shape the presentation and preservation of artifacts.³⁹¹ Among anthropologists, accounts of treasure hunting are rare. A comprehensive account by Johannes Dillinger of “magical treasure hunting” found in Europe and North America from the Middle Ages to the twentieth

³⁸⁹ The Economist, “Hitting the Jackpot; Buried Treasure.”

³⁹⁰ The Economist, “Asia”; Mead, “The Curse of the Buried Treasure”; Neimark, “Treasure Fever.”

³⁹¹ Gould, *Shipwreck Anthropology*; Nadia Abu El-Haj, *Facts on the Ground*.

century might count as a stunning work of political anthropology, significantly discussing magical treasure hunting in relation to society's changing understandings of the economy.³⁹² Working in Mexico's Sierra Tarahumara, Frances Slaney argues that inter-ethnic tensions between blancos and Tarahumaras shape how each community relates to the promise of subterranean fortunes.³⁹³ Other notable mentions of buried treasure in cultural anthropology, however, are subsumed under the topic of mineral mining. Anthropologists like Andrew Walsh and Elizabeth Ferry, writing about Madagascar and Mexico respectively, examine and question the social and technical processes that transform buried matter such as sapphires and silver into elements for (e)valuation, exploitation, and exchange in the global market.³⁹⁴ Such studies turn up disputes about ownership, profiteering, labor, and the global circulation of value while also showing how the extractive industries depend on and consolidate existing racial, economic, and environmental inequalities.³⁹⁵ The treasure-seekers in Morogoro would also draw associations between precious minerals and treasures, and between their own pursuit of treasure with the conditions of economic unpredictability.

In the following, I first describe how rodent trainers who work at the non-profit in Morogoro apply their animal training skills to the search for buried treasure. Drawing on sign-searching practices from their human-rodent encounters, rodent trainers resort to the interpretation of sensuous signs, such as rock formations and dreams to locate possible treasure sites. I then suggest that we may understand treasure hunting in Morogoro as counter-hegemonic imaginations that disrupt the temporality of postcolonial development time. Finally, I situate these temporal disruptions within ongoing national discussions about resource nationalism, a signature policy of

³⁹² Dillinger, *Magical Treasure Hunting in Europe and North America*.

³⁹³ Slaney, "Otherness and the Underground: Buried Treasure in the Sierra Tarahumara."

³⁹⁴ See Walsh, "In the Wake of Things"; Ferry, "Memory as Wealth, History as Commerce."

³⁹⁵ See, for example, Yusoff, *A Billion Black Anthropocenes or None*; Arboleda, *Planetary Mine*.

the Tanzanian government under the Magufuli administration. As with mineral exploitation, treasure hunting practices among rodent trainers in Morogoro bring into focus how working-class Tanzanians experience and enact contestations around Africa's wealth and its economic and technological future. Ethnographic data in this article come from my own experiences working as a rat trainer for six months while conducting field research on more-than-human sensory labor.

In Tanzania, people use the word “treasure,” or *hazina* in Kiswahili, to refer to valuable objects hidden or buried underground, or in caves and old buildings, such as houses and churches built by European colonizers. Like its classical Latin root *thēsauros* (later transformed into the popular Latin of Gaul *trēsaurus*, from which later words are derived), the word “treasure” has a capacious range of meanings in both English and Kiswahili. It may refer to a collection of poetry or proverbs, divinity, wisdom, state finances, or even magic.³⁹⁶ In Morogoro, *hazina* straddles several conceptual grounds. It links together legendary buried treasure, the exploitation of precious minerals, and questions of sovereignty within a global economic system over which Tanzania has little influence. This chapter explores how treasure-seeking rodent trainers entwine several meanings of *hazina* by imagining “timewrecks,” a term I use to describe competing temporalities that lay claim to occluded wealth that treasure hunters hope to retrieve from buried pasts. Understood in this way, treasure hunting as timewreck emerges as a form of “skillful making”³⁹⁷ enacted through reconfigurations of timescapes that enable people like Alex to reclaim a certain degree of ownership over valuable artifacts that are always already at future risk of being pilfered by visitors and strangers [*wageni*]. As “timewrecks,” treasure hunting gestures, on one hand, to the residual effects of colonialism, socialism, and neoliberalization in Tanzania, and on the other, suggests its potentiality as a site of salvaging new forms of agency.

³⁹⁶ Mauss and Humbert calls magic a “treasury of ideas.” See Mauss and Humbert, *A General Theory of Magic*, 143.

³⁹⁷ Bear, “Time as Technique.”

Indeed, landmines and treasures are examples of what Ann Stoler calls “imperial debris,” those residues and remnants of empire that represent the “protracted imperial processes that saturate the subsoil of people’s lives and persist, sometimes subjacently, over a long durée.”³⁹⁸ “Ruin,” she notes, is “both the claim about the state of a thing and a process affecting it.”³⁹⁹ Following Stoler, I argue that landmines and treasures are therefore not only material vestiges of a distant past. They also perdure in uncertain and invisible existence, prolonging the psychological and social wreckage still wrought by colonial violence and exploitation. Indeed, the question in Tanzania of what to *do* with landmines or buried treasures once detected or unearthed is often answered not only by material practices of digging up, but also by the activation of people’s anticipatory notions of development in the forms of cultivable land or personal wealth derived from the retrieval of these buried artifacts. To put it succinctly, pieces of imperial debris possess long afterlives that fold into the imaginative timewrecks of future being.

In this article, the concept of timewrecking is inspired by Kodwo Eshun’s notion of “chronopolitical acts.” Writing about Afro-futurism, Eshun describes “chronopolitical acts” as practices that subvert time and undermine the temporal logics that have long condemned Africans in the eyes of the “modern” to specific geohistorical epochs, such as the primitive, Third World, underdeveloped, or dystopian. As “a series of powerful competing futures,”⁴⁰⁰ treasure hunting collapses colonial histories into postcolonial ones, the secular realm into the spiritual, and the visible into the invisible. They infiltrate the slow, progressive march of development in which Africa is said to have to endure, or at best, “leapfrog its way into the future.”⁴⁰¹ Many African

³⁹⁸ Stoler, “Imperial Debris,” 192.

³⁹⁹ *Ibid.*, 195.

⁴⁰⁰ Eshun, “Further Considerations of Afrofuturism,” 297.

⁴⁰¹ See, for example, a recent report by the World Bank on “leapfrogging” in Africa.

<https://www.worldbank.org/en/news/opinion/2017/10/11/africa-can-enjoy-leapfrog-development>

nations, Western governments, and international organizations such as the World Bank continue to invest in these evolutionary temporalities, evident in Tanzania's own national development plan to transition from an agricultural to an industrial economy.⁴⁰² Eshun's concept of chronopolitics are consonant with critically viewing modernity and tradition as "shifting ideological authorizations" frequently monopolized by postcolonial states to regulate sexuality, race, and class difference.⁴⁰³ In this light, practices of treasure hunting capture the reconstitution of time among people who feel excluded and expelled from national and global modernity. Alex, who liked to remind me of Tanzania's wealth in natural resources [*maliasili*], described how he and his friends rarely see the benefits of this wealth, despite being constantly reminded by political leaders that Tanzania's economy was one of the fastest growing on the continent. As a result of such glaring inequalities, it is no wonder that "Modernity," Eshun writes, is "rendered forever suspect."⁴⁰⁴

Treasure hunting thus represents an attempt to live in the "aftermath of modernity."⁴⁰⁵ It is at once an unwillingness to give in to a sheer lack of economic opportunities and a desire to explore and experiment with alternative kinds of futures.⁴⁰⁶ The following explores how treasure hunters in Morogoro reorder time through their search for treasure, and in so doing, recuperate a degree of agency in a global economy that has dispossessed them of opportunities to improve their living standards and accumulate wealth. In welding together the interpretation of dreams and other sensuous signs of treasures, Alex and other treasure-seekers refuse to cede ground to the unpredictable timescapes currently forged by those with access to gadgets and knowledge, such as maps, GPS units, and night vision goggles, to command land. I suggest that timewrecking is a way

⁴⁰² Ministry of Finance and Planning, "National Five Year Development Plan, 2016/17 - 2020/21."

⁴⁰³ Alexander, *Pedagogies of Crossing*, 213. For other notions of how temporalities are mobilized in the constitution of identity, see also Hobsbawm and Ranger, *The Invention of Tradition*; Fabian, *Time and the Other*.

⁴⁰⁴ Eshun, "Further Considerations of Afrofuturism," 233.

⁴⁰⁵ Ferguson, *Expectations of Modernity*, 234.

⁴⁰⁶ Appadurai, *The Future as Cultural Fact: Essays on the Global Condition*.

through which treasure-seekers in Morogoro contend with the confounding material conditions that delimit their economic precarity and promise. Timewrecking thus augurs a kind of counter-hegemonic imagination, positioning anticipation against determination, undermining an evolutionary time flowing from colonial extraction to postcolonial development, from which those like Alex are excluded.

Given that imagination has been used in a variety of different and sometimes contradictory ways,⁴⁰⁷ it is worth emphasizing how I use this word. Imagination will refer to speculative practices that require treasure-seekers to invent creative ways to search for signs of unfortold and invisible valuables. Imagination also denotes how buried treasures are seen as a prospect—that is, how they are artifacts that bear the potential to radically alter or break away from one’s life because of the wealth that they promise. As mental and embodied acts shaped by stories and images that craft “other existence besides those actually experienced,”⁴⁰⁸ imagination is *underdetermined* by their conditions of production.⁴⁰⁹ In this sense, I depart from more Durkheimian notions of imaginaries that describe sets of common values and ideas by which people try to bring forth certain notions of belonging and identity, such as imagined communities,⁴¹⁰ social imaginary,⁴¹¹ or technoscientific imaginary.⁴¹² My purpose here is to focus more on the desires for living otherwise and the imaginative practices to realize them, which is key to the speculative character of treasure hunting.

Even as imagination envisions possibilities that subvert and disrupt reality, it is still very much rooted in histories of capitalism and colonialism. Scholars of Africa have examined

⁴⁰⁷ Stankiewicz, “Against Imagination.”

⁴⁰⁸ Beidelman, *Moral Imagination in Kaguru Modes of Thought*, 204.

⁴⁰⁹ Sneath, Holbraad, and Pedersen, “Technologies of the Imagination.”

⁴¹⁰ Anderson, *Imagined Communities*.

⁴¹¹ Taylor, *Modern Social Imaginaries*.

⁴¹² Marcus, *Technoscientific Imaginaries*.

imagination and fantasy as social acts⁴¹³ that contend with the sweeping forces of large-scale global processes, such as neoliberal capitalism,⁴¹⁴ mineral extraction,⁴¹⁵ migration, and ongoing forms of (neo)colonialism.⁴¹⁶ The apocalyptic, aspirational, and occultic imaginations found in these works are closely linked to the disruptive and unequal effects of globalization and development on the continent.⁴¹⁷ They highlight an essential indeterminacy that characterizes the condition of living in the postcolonial places of late modern capitalism. That landmine detection, treasure hunting, and mineral mining deal with what lies beneath the ground is no accident. Indeed, within and without the continent, it is such discussions about Africa's hidden value and untapped resources that have long and vigorously animated colonial, nationalist, capitalist, industrial, and—now—technological promises of development and prosperity. Empire, as it were, leaves behind both bounty and brutality.

Landmines and Treasure Hunting

Throughout Tanzania, treasure seekers rely on sign-searching practices to look for buried treasure. Combining different semiotic regimes offered by local legends, occult practices, and ecological knowledge, they explore areas near colonial German buildings, caves, and mountain forests to uncover sites they suspect might host buried fortunes. The group in Morogoro with whom I eventually joined were unique in that they derived many of their sign-searching practices from their work training rats to detect landmines. In the following, I show how animal training techniques are applied by rodent trainers to their search for buried treasures.

⁴¹³ Weiss, "Thug Realism."

⁴¹⁴ Comaroff and Comaroff, "Millennial Capitalism."

⁴¹⁵ Hecht, "Interscalar Vehicles for an African Anthropocene."

⁴¹⁶ Ndjio, "'Magic Body' and 'Cursed Sex.'"

⁴¹⁷ Smith, "Witchcraft in Africa."

Rodent trainers undergo several months of training to familiarize themselves with the protocols of animal training through operant conditioning. The operant conditioning of animal behavior originated with B. F. Skinner, a psychologist who believed that animal behavior could be deliberately shaped by pairing behavioral causes and reward effects in specific ways and environments. In the case of rodent training, rodents are taught to detect the odor of trinitrotoluene, or TNT, an explosive material, through a string of associations. They then indicate their sensing of this odor by scratching the ground, which signals the potential presence of a landmine. Upon observing this signal, the trainer (who, for the purpose of training, knows where landmines are buried) uses a clicker to make a 'click' sound, signaling to the rat that it would be rewarded for having correctly located a landmine. Operant conditioning is repeated until the rat habitually associates the odor of TNT with food to the extent that a trained rodent would voluntarily seek out TNT in search of food.

While scratching offers a clear sign of a buried landmine, it is also common foraging behavior. This raises a problem for less experienced rodent trainers. How does a trainer know whether a rat has found a landmine or is merely foraging for insects, roots, or seeds to eat? Such an epistemological quandary is resolved by strictly following a protocol, a move also borrowed from Skinner. Writing in 1957, Skinner and his colleague Charles B. Ferster, also a behavioral psychologist, argued that the best way to increase control and reduce error during the shaping of animal behavior is in the design of operant conditioning experiments. They encouraged automation in experiments through the use of a programmed apparatus to measure, incite, and reward a behavior. This way, the timing and intervals between stimulus, action, and reward are always exact, leading to expected behavioral outcomes.⁴¹⁸

⁴¹⁸ Ferster and Skinner, *Schedules of Reinforcement*.

In the absence of such automation, trainers ensured that they strictly followed instrumental protocols, such as training the rats to scratch the ground for three full seconds. In Morogoro, the rodents learn to detect deactivated landmines buried by the Tanzanian military for training purposes. The locations of these deactivated landmines are stored in a database to which only supervisors have access. There are no records of landmines in Tanzania, although unexploded ordnances are sometimes found in the Kagera region, northwest of Tanzania, where a war was fought between Uganda and Tanzania in 1978-9.⁴¹⁹ The trained rats are sent to countries like Angola and Cambodia, where decades-long armed conflicts have left behind many landmines and other unexploded ordnances. During training, trainers follow a strict protocol to confirm rodent scratches that are more than three seconds. On one of the mornings when I was working with Alex, we quietly counted our seconds while we watched the rat scratch the ground. This was crucial to ensure that trainers working with any trained rodent could expect to confirm the location of a landmine when indicated by scratching. This was especially important when these trained rats, which are endemic to Tanzania, are sent to work in mine clearance projects in other countries. Knowing with certainty that a landmine has been located by a trained rat is a matter of life and death.

During my time working as a rodent trainer, however, I seldom ever made it to “three” before my training partner, Alex, clicked and gave the rat its reward. Nonetheless, when the results were later checked against the database, it confirmed that Alex and the rat had correctly identified all the landmines in the plot of land we were randomly assigned. Perplexed, I asked Alex how he knew to click just before the three-second mark. His answer was simple. He said that he paid attention to the way the rat moved, the way it perked up its ears or twitched its whiskers. All of

⁴¹⁹ “Six Tanzanian Schoolchildren Killed in ‘grenade’ Explosion.”

this together, as a “bundle” of signs,⁴²⁰ lets Alex know with certainty that a landmine has been detected. “Counting to three is the written protocol,” he explained, and added, “In practice, if there are seeds on the ground, the rat will scratch for more than three, even five seconds, so on its own, scratching is not enough.” For Alex and a majority of experienced trainers, there are two types of signs; those designated by the protocols and those that emerge from experience. These latter signs the trainers refer to as “alama” in Kiswahili. It was this class of signs that was more meaningful. It also requires refined skills to interpret. In the terms of Charles Peirce’s theory of signs,⁴²¹ alama are symbols rather than indexes. They do not necessarily point to the presence of landmines but denote their object by virtue of convention. This became clear when the combination of perked ears and other rodent postures were described by Alex as “behaviors that we understand based on our experience [uzoefu] training the rats.” The Kiswahili word for experience, “uzoefu,” derived from the verb “kuzoea,” means to become habituated or used to something, sometimes also connotating a kind of intuitive or innate knowledge. Alama therefore are signs that emerge over time, requiring experience and tacit knowledge to notice and interpret, what Christina Grasseni calls the “processes of visual ‘enskilment’.”⁴²² Rather than rely on written protocols, experienced trainers draw on cultivated practices of attention to find meaning in a rodent’s scratch (or for that matter, a wink).

It is this same class of signs that Alex and his colleagues rely on to search for treasures. To find treasure, one must have the ability to distinguish between those more obvious, scrutable signs and “alama,” those symbols that depend upon a seeker’s experience and intuition to interpret. In the shadows of the Uluguru mountain range, a spine that unfurls from north to south, delineating

⁴²⁰ Keane, “Semiotics and the Social Analysis of Material Things.”

⁴²¹ Peirce, *Peirce on signs*.

⁴²² Grasseni, “Introduction,” 3.

the region of Morogoro, one finds old houses and crumbling missionary churches built by the Germans in the early 1900s. These ruins signal the nearby presence of buried silverware, coins, and other heirlooms. German colonialism in Tanganyika itself was a short affair, marked by disorganization and several local uprisings. When the Germans lost World War I in 1918, they fled Tanganyika overnight, Alex explained, adding, “They left in such a hurry that they couldn’t take all their possessions with them. So they buried plates, coins, jewelry, hoping to retrieve them one day.” Many of the buildings have previously been searched, their secret compartments emptied and tiled floors ripped apart. Recalling my solicitation of German elders on behalf of Alex about any knowledge of buried treasures in Tanzania, I noted a marked contrast between German and Tanzanian memory of the colonial era. Treasure hunters in Morogoro search for treasures around these very visible and material edifices of colonialism, while in Frankfurt, few Germans remember their colonial histories, discursively buried beyond recollection. Long after their roofs have fallen in, old colonial buildings like Morningside in Morogoro continue to haunt those who would hunt for treasure. On their own, these buildings are not sufficient signs of buried treasure. To find the exact locations of where treasure might be buried, Alex and his colleagues would have to search for “alama.”

The Search for Treasure

My initial participation in their treasure hunting expeditions was not immediately welcomed. Alex could not explain the sudden reluctance to have me join their expeditions and I was asked instead to attend a meeting for a kind of vetting. Huddled into a windowless room of a house, I sat across from a panel of older men one morning. They wanted to first ascertain my intentions and it soon dawned on me that they were worried that I might somehow steal any treasure they found. The

oldest man in the room, whom everyone respectfully addresses as Mzee Juma (“Mzee” is an honorific for male elders), was dressed in a kanzu and kofia, the ivory-colored robe and hat of pious Muslim men. It was he who proceeded to ask me questions about my origins, faith, upbringing, and the focus of my research.

The retired rodent trainer then explained this need for scrutiny. Mzee Juma recalled a German tourist whom he had brought hiking in the mountains. He said that the German visitor brought many devices with him: maps, a GPS receiver, binoculars, and books with detailed drawings. The next day, Mzee Juma received a call from a friend who lived in a village near the summit ridge. The friend complained to Mzee Juma that his German companion had stolen treasure. Villagers had noticed a white man walking through the forest at night, swinging his flashlight and looking through night vision goggles. They charged that he had returned at night so that he could secretly steal treasures that he had known about. Joni, who would later accompany Alex on our treasure finding expedition, chimed in with another story of his own. He told the story of an Omani man who worked for a Chinese construction company. He had bought some land in the foothills of the mountains where he planned to settle down. The Omani merchant began building a house but many years passed and the construction was never finished. For a long time, only an abandoned shell of a building, four moldy walls, with holes for windows and a door and no roof stood at the site. Joni and his friends decided to inspect the construction and found a large hole in its middle. The Omani, Joni said, had built walls to conceal the fact that he was digging up treasure. Once he had retrieved them, he left and never returned.

Turning his attention to me, Mzee Juma then said, “We don’t want you to do the same.” He admitted that they would not be able to compete with me if I had brought along ground scanners and night vision goggles. The only tools available were shovels, a hoe, and some rope. Mzee Juma

and the group were hopeless that these inferior tools would compete with the types of gadgets that the German visitor had brought with him. “We are just people who farm. Without machines [mitambo], we cannot find the treasures as quickly as the whites [wazungu],” Mzee Juma noted. By lamenting their lack of geoprospecting technologies, however, Mzee Juma, Alex, and other treasure seekers in some ways undersold the expertise that came with applying their alternative sensory practice and knowledge. The ability to intuit and interpret those symbols in the land that point to treasure relies on what historians of science Loraine Daston and Peter Galison have called “trained judgement.”⁴²³ Signs, whether of buried landmines or treasures, require the mastery of particular techniques for interpretation – a deployment of certain skills of discernment shaped by experience. Or in Mzee Juma’s own telling, “because we don’t have the machines, we find other ways to help us find the treasure.”

⁴²³ Daston and Galison, *Objectivity*.



Fig. 19. Morningside. Photo by author.

We met early in the morning at Morningside, a dilapidated German mansion built in 1911 near one of the summits of the Uluguru mountains. From there, we hiked for a short distance to a site where Alex and Joni had been exploring for several months. On the way, we stopped by a hole that was about five feet deep, overgrown with creepers and grass. Joni said that some undefined years ago, a babu [grandfather] who used to work for the Germans recalled that healers were hired by German officers to hide a chest of precious objects under a grove of misigizi trees. Animal bones were scattered where treasures had been buried, a consequence of the rituals [tambiko]

conducted to safeguard these treasures. It was the memory and attention to these signs of half-buried bones that led the babu, according to Joni, to the site of the treasure. “Treasure hunting is hard work,” Joni explained. “Sometimes you need dawa to retrieve the treasure,” he went on, using a word for “medicine” that is also frequently used to talk about potions or concoctions that one might procure from a healer. “And,” Alex added, “it has to be the right person to do it.” As a former employee of colonial German officers, the babu had a connection to these treasures and so he was able to find them. After some scratching and digging, the story went, valuable items began to appear. I asked them if they knew what these items were. They replied that they included an old kettle [birika], pots [vyungu], and other vessels [vyombo] that contained precious metals. They even had a photo of one of these vessels stored on Alex’s flip phone, which he then showed to me. On Alex’s flip phone screen was a grainy photo of a rusty cylindrical object that resembled an unexploded bomb. I pondered what might have happened to the babu. Neither Alex nor Joni knew, but they speculated that the babu must have become very rich from the gemstones that were purportedly contained in this vessel.

As we climbed higher up into the mountains, the farms and homesteads slowly disappeared and were replaced by large trees, vines, and bushes of what looked like pandanus plants. Alex and Joni wanted to bring me to an area that Joni had dreamt about. In the dream, Joni was visited by an old woman wrapped from head to toe in a kanga, a colorful fabric worn by women in East Africa. She came to his front door, announced her presence, and showed him a black and white photograph and pointed at it. She then left without saying a word. Joni did not know what to make of this dream but a few months later, while he and Alex were walking, Joni suddenly recognized the landscape before him. It was the photograph, and the old woman had pointed at the treasure.

To assuage my skepticism, Joni and Alex then pointed out all the other signs that they said confirmed that there was treasure to be found.

They are certain, based on the symbols present in our surroundings, that there was treasure hidden in an invisible cave under a large boulder. Alex enumerated all the scrutable signs. A boulder rose out from the forest undergrowth, creating a sort of portico over a rock face that Alex said was a cave entrance. Several feet away, two leaning rocks flanked the boulder and pointed like arrows at the purported cave. But these signs alone were not sufficient to indicate treasure. Alex said that they would not have noticed these signs if it were not for a dream Joni had. In it, Joni was visited by an old woman, wrapped from head to toe in a kanga, a colorful fabric worn by women in East Africa. She came to his front door, announced her presence [kubisha hodi mlangoni], and showed him a black and white photograph and pointed at it. She then left without saying a word. Joni did not know what to make of this dream but a few months later, while he and Alex were walking in the mountains, Joni suddenly recognized the landscape before him. It was the photograph, and the old woman had pointed at the boulder!

We moved quickly to the crevice under the boulder, shovels clanking in our bags. There was no cave entrance, only a rock wall. I could make out the raised outline of a shape. Joni traced his fingers around it and remarked that it was the shape of a human skull [fuvu], another symbol that this was where treasures must be buried. Alex had retrieved several sticks of incense [udi] from his backpack and lit them. “This is to make sure we won’t be cursed [logwa],” he explained as he placed the incense sticks around us. I noticed dried wax on the ground and understood that we were not the only treasure seekers who have been here. Such rituals [tambiko] were crucial to ensuring that the operation proceeded safely, with the permission of any spirits who may roam or guard the entrance.

Joni said that they had consulted healers and elders, and slept overnight at the entrance, trying to figure out a way to get the cave to “show itself.” “I can feel it, there is treasure inside this rock. We just need to find a way in,” Alex added. As fragrant smoke swirled around us, Alex then nodded to me, “We brought you here because we think you could try and help us open this door.”

Millennial Capitalist Speculations

One of the prevailing social paradoxes of the last decade has been the tremendous intensity with which conspiracy theories, aliens, and other enchantments have taken hold, even as governments, universities, and corporations turn increasingly – and with little success – to science and technology to justify and rationalize capitalist modes of production. Scholars including Jean and John Comaroff, Achille Mbembe, Harry West, and Peter Geschiere have argued that enchantment has long been the condition of postcolonial Africa, suggesting that panics about mystical and magical occurrences usually accompanied—and explained—ruptures in the fabric of economic and social life caused by uneven capitalist development on the continent.⁴²⁴ These scholars argue that claims about witches, zombies, and global conspiracies on the African continent are contemporary social phenomena that call attention to global capitalism’s very own occult properties.

As Tanzania moved slowly toward integration into the global economy, so did inequality, occult sightings, and speculation. Older Tanzanians remember the food rationing caused by unpredictable booms and busts in the global commodity markets. They saw kinship structures dissolve into relationships of patronage and bribery. Millions of dollars in development aid seem to disappear or benefit a small elite, while Tanzanian youth with degrees, puzzle over their inability to procure employment. These stories are no longer unique to Tanzania, of course. Many people

⁴²⁴ Comaroff and Comaroff, “Occult Economies and the Violence of Abstraction”; Mbembe, *On the Postcolony*; West, *Kupilikula*; Geschiere, “Witchcraft and Modernity: Perspectives from Africa and Beyond.”

around the world currently live in a speculative moment where the flows of capital and money are unpredictable, contested, and difficult to understand. As Comaroff and Comaroff make clear, the occult is not some return to or vestige of tradition.⁴²⁵ Rather, they are expressions of discontent with the capricious forces of global capitalism. In their search for treasure, Alex and his colleagues retool culturally familiar techniques to contend with precarity, or as E. E. Evans-Pritchard noted, “New situations demand new magic.”⁴²⁶ It would however be a mistake to assume that treasure hunting merely expresses discontent against the rapacity of global capitalism. Treasure hunting also offers possibilities for attaining other unanticipated futures.⁴²⁷ By corralling the occult with the hopeful, treasure hunting becomes a mode for constructing agency, a strategy for managing the harsh, overwhelming uncertainties of present economic life.

As Alex put it himself, “If you live your life doing the same thing every day, your life will never change. I want to do something different and see what happens, even if I fail.” In this enunciation, Alex is cognizant that his chances of striking gold are woefully slim. It is an “argument from the future,” what Stefan Helmreich, writing of biologists searching for life on other planets, explains is the condition where present action is always contingent on the imagination of possible emergent futures.⁴²⁸ The economic sociologist Jens Beckert argued that such future facing is foundational to the system of capitalism, “in which actors—be they firms, entrepreneurs, investors, employees, or consumers—orient their activities toward a future they perceive as open and uncertain, containing unforeseeable opportunities as well as incalculable risks.”⁴²⁹ Treasure seekers, like astrobiologists and venture capitalists, speculate futures that justify

⁴²⁵ Comaroff and Comaroff, “Millennial Capitalism.”

⁴²⁶ Evans-Pritchard, *Witchcraft, Oracles and Magic among the Azande*, 513.

⁴²⁷ Rebecca Bryant?

⁴²⁸ Helmreich, *Sounding the Limits of Life*, 80.

⁴²⁹ Beckert, *Imagined Futures*, 1-2.

certain present action, accompanied by the full awareness that they are embarking on a risky gamble. Often, there are no treasures to be found. And sometimes, they risk being cursed. [pesa za haraka]

When the rodent-training project refused a loan to Alex for buying construction materials to upgrade his home, Alex grumbled aloud about his inability to find “development” despite being gainfully employed. Working for international organizations can be a prestigious stepping stone for many Tanzanians but such work is often beholden to sudden, unpredictable policy and financial changes. Funding can run out, and geopolitics can thwart the renewal of a project. The salary is meagre and there are often insurmountable challenges for employees to gain new skills. “How is it that I have worked for this international project, training rats for twenty years, but I still don’t have enough money to buy a car? How come I still don’t know how to use a computer? What development [maendeleo] can I show?” Alex complained. Alex’s use of the word “development” here resembles the many meanings that Christine Walley found in her ethnography among the island residents of Mafia, on the southeastern coast of Tanzania.⁴³⁰ Maendeleo for Alex was about his ability to get ahead in life; it is as much about social mobility as it is about economic advancement. These conceptions of development refract through Mzee Juma’s suspicion of the German hiker with gadgets. The recognition that they lack access to metal detectors are marked by an anxiety and cynicism that they have been abandoned by the forward march of progress and development.

Animated by counter imaginaries, treasure hunting activities are therefore reflections on the highly technologized future of global capital. The lack of access to ground scanners and detectors compels treasure seekers to create their own techniques and technologies to help them

⁴³⁰ Walley, “Our Ancestors Used to Bury Their ‘Development’ in the Ground.”

compete with foreign prospectors, and construct a place for themselves in that future. On the surface of things, counter imaginaries of treasure hunting may not mitigate the harsh inequalities through which Alex and others navigate. But they reveal several complex and critical aspects of a political economy that conditions their existence, albeit not in overdetermined ways. It is to this larger context of political economy that I now turn to situate practices of treasure hunting within discussions about resource nationalism in Tanzania.

“Tanzania is not grandma’s field!”

In the way that they model treasure hunting on their experiences with rodent training, Alex, Joni, and Mzee Juma are unique even if the practice is common to many parts of the country. In fact, the twenty-first century has seen an efflorescence of treasure hunts, becoming spectacular touchstones for comedy, drama, investigative journalism, and even revisionist histories of the early American republic.⁴³¹ Whether in New England, East Anglia, or Morogoro, accounts of treasure hunting reverberate with similar themes: buried in the ground are valuable artifacts left behind by people of an older and foreign civilization who are no longer around.

That these treasured artifacts are linked to the foreign is crucial to their value, indexing access to a certain kind of coveted power, represented in the German hiker’s technological mastery over land and time. We have already encountered other foreigners earlier: the Omani merchant, a Chinese construction companies, and an American-educated Malaysian anthropologist (me). Their identities alert us to the complex and multilayered experiences of (neo)colonialism in the region. For over a millennium, East Africa has been a center of Indian Ocean trade and exchange. In the eighteenth century, the Omani empire seized control of the East African coast from the Portuguese,

⁴³¹ See, for example, *The Detectorists* (2014-2017), a TV show about treasure hunting. See also Peterson, *The City-State of Boston*; Mead, “The Curse of the Buried Treasure.”

consolidating it as a cultural, economic, and political powerhouse that threatened European colonial interests on the continent. In the twentieth century, Chinese and Indian immigrants to East Africa constructed railways. They first worked as cheap or indentured laborers in colonial extraction projects. When struggles for decolonization on the continent gained pace, Chinese workers assisted Tanzania's construction of one the longest railways in the world, connecting the East African coast to the Zambian Copperbelt as part of a global anti-capitalist and anti-imperialist movement. It is not by sheer coincidence then that an Omani merchant, who works for a Chinese construction company, and an Asian anthropologist from the United States find themselves enmeshed in the speculative nonfictions of treasure hunting. Their appearance can be better appreciated when we situate them within ongoing changes in the political economy of mining in Tanzania.

When describing treasures, people frequently speak interchangeably in Kiswahili of “treasure” and “mineral” to refer to the artifacts that they are after. Initially fearing that my sense of these words' synonymy was a result of my own linguistic ineptitude, I asked Alex and others to clarify whether they were talking about treasures [hazina] or mineral [madini]. “It does not matter which,” Alex replied, “whether it is gold or mercury or coins, they are all the same.” I understood “the same” to mean that both treasures and minerals elicit similar desires and hopes. Both treasures and minerals offer the prospect of becoming suddenly rich, evident in the excited way that people – at coffee stands and on messaging platforms – talked about Saniniu Laizer, a small-scale miner who twice came upon millions of dollars' worth of tanzanite, a rare gemstone found only in Tanzania.⁴³²

⁴³² Vitalis, “Gemstone Billionaire Saniniu Laizer Fulfills Promise of Building School.”

But there is another reason that explains why both treasures and minerals may be spoken of in the same breath. They spur anxieties about technological inequality and exploitation. Small-scale miners in Tanzania often endure a complex thicket of procedures to obtain mining licenses, occasionally resorting to illicit connections to gain access to work that often puts them at risk of toxic exposure. These small-scale miners rarely have the appropriate equipment for carrying out the dangerous work of mining except for their hands and a shovel, owing to the extremely expensive price of the tools required. As a result, foreign mining corporations—well-stocked with equipment, lawyers, investors, and government connections—are the largest beneficiaries of mineral wealth in Tanzania.

Such disparity in access to Tanzania’s mineral wealth did not go unnoticed by John Pombe Magufuli, who was elected as the country’s president in 2015 on a platform to industrialize the economy and protect local industries. His government oversaw a dizzying array of infrastructure projects funded by Chinese, Turkish, and other Asian economies, building new airport terminals, an electric railway, and highways, with further plans to construct a hydroelectric dam to supply more energy to the country’s budding manufacturing sector. During his tenure, President Magufuli railed against the “imperialist” agenda of multinational corporations, Western donor countries, and international organizations. It was time, he promised in his many public speeches, that Tanzania stood up for itself and no longer offered up its natural resources at the expense of national benefit. As part of this effort, the government introduced dramatic changes to the mining sector. The government ordered reviews and sometimes reneged on contracts signed with mining companies, such as Barrick Gold and Petra Diamonds, causing shocks to the companies’ share values. Several new laws were passed, mandating an increase in the percentages of government shareholding, a ban on exports of raw gold and copper, and a requirement that mining products must be processed

locally prior to export. Laws like these, the government argued, ensured that processing and refining facilities would be built within the country, keeping wealth in Tanzania, creating jobs, and encouraging development in the manufacturing industry. The president made sure to highlight these achievements when he campaigned for reelection in 2020, which he won in a landslide despite, or perhaps because of, the intimidation of violence and imprisonment that opposition leaders and civil society activists had faced.⁴³³

Many ordinary Tanzanians offered their resounding support for Magufuli's aggressive policies. After news broke of the government's intention to build walls around tanzanite mines to prevent the gems from being smuggled out, Alex voiced his approval to me, saying that it was time the world stopped treating Tanzania like their own backyard. In Kiswahili, this expression takes the form of an evocative declaration: "Tanzania is not grandma's field [shamba la bibi]!" The slippage that occurred between treasure and mineral, and between Alex and President Magufuli's speech, helpfully frames the anxiety and suspicion that treasure seekers felt about foreign prospectors who were, in their eyes and perhaps rightly so, out to benefit at the expense of Tanzanians. These attitudes were not fueled by any feeling of xenophobia or nativism. Rather, they were motivated by questions of technological capability and Tanzania's lack of access to those technologies required to compete with the larger world and to benefit from its own resources. To speak of treasures and minerals interchangeably therefore brings together affective modes of suspicion, anxiety, and contestation over technologies of extraction that provide not only access to wealth, but the promise of participation within the global capitalist economy. Mineral extraction, after all, along with its sprawling, intricate processes of speculation and prospecting, is a kind of treasure hunting. It is yet a search for Africa's buried treasure, for its untapped value, which

⁴³³ President Magufuli died in March 2021 and is succeeded by his Vice President, Samia Suluhu Hassan, who is the current President of Tanzania.

beckons with promises of huge profits to those who would risk capital and invest technology to unearthen. Under the logics of twenty-first century capital, “Africa remains the last territory on Earth that has not yet been entirely subjected to the rule of capital,” Achille Mbembe writes, “It is the last repository of a vast body of untapped wealth.”⁴³⁴

The imaginations that make treasure hunting possible are always already woven into national experiences of living in an unequal world. It is this ongoing experience of extraction and exploitation, stretching from colonial to neoliberal times, that Walter Rodney and Claude Ake have so forcefully charged as the reason for the continent’s lagging technology and underdevelopment.⁴³⁵ Geology, including mineral mining and prospecting, have always relied on the fractionating practices of racialization to accumulate wealth and value, Kathryn Yusoff reminds us.⁴³⁶ More recently, the continent’s exploitation has been driven less by Euro-American corporations and governments, and increasingly by Chinese and Middle Eastern companies. The conditions of global capitalist production has remained largely unchanged since Rodney described how the West benefited from cheap raw materials and coerced labor in Africa. What has happened, with the introduction of these rising economic powers, is that the world has now undergone a further refinement in that division of labor, where the U.S. and Europe are now mostly consumers, China and other Asian economies the manufacturers, and Africa, still the source of raw materials.

What has been remarkable in the linear temporality of development as it is invoked by those with an economic interest in exploiting Africa is, on one hand, a relegation of African nations to an indefinitely deferred progress that other richer societies have realized, and on the other, a belief that economic progress might come if only they wait their turn on the road to

⁴³⁴ Mbembe, *Out of the Dark Night*, 222.

⁴³⁵ Ake, *A Political Economy of Africa*; Rodney, *How Europe Underdeveloped Africa*.

⁴³⁶ Yusoff, *A Billion Black Anthropocenes or None*.

development.⁴³⁷ Today, however, fewer and fewer Africans actually buy into the promises of development. In their hunt for treasure, scouring the land for those symbols that require deep, intuitive experience to interpret, Alex and his colleagues refuse to acknowledge the temporalities that so forcefully restrict them to a lifetime of low-wage work and limited consumption. In digging for treasures left behind among ruins in the Morogoro mountains, they make visible the ongoing processes of ruination provoked by colonial and capitalist forces in Tanzania, and in so doing, disrupt the chronological ruse that the passage of development, if they were to wait, would grant them access to the middle-class. To hunt for buried treasure, then, is to reorder and resist histories of colonialism and development. It is to practice a form of chronopolitics.

Conclusion

“The storm irresistibly propels him into the future to which his back is turned, while the pile of debris before him grows skyward. This storm is what we call progress.”

– Walter Benjamin (1968).⁴³⁸

When news arrived from Malaysia that my grandfather was near his death, I made arrangements to go see him for the last time. Six months had by now passed since Alex first pulled me aside to tell me about treasures. A day before my departure, Alex came by to wish me a safe journey and offered to take me to the bus station. He also floated a possibility. The group of treasure hunters had pooled together some money, he said, and they wanted to see if I could buy a ground penetrating scanner in Malaysia, where such tools were much cheaper and more easily available.

⁴³⁷ Trouillot, *Global Transformations*.

⁴³⁸ Benjamin, “Theses on the Philosophy of History,” 257-8.

“We can pay some of it right now, and then the rest, we will pay you back in installments,” he explained. “It would really help our work,” he added.

It might be tempting to conclude this chapter with the knowledge that Alex and his fellow treasure hunters thought that their sign-searching practices, which drew on experiences both in rodent training and with magic and dreams, was an alternative modernity that was superior to the gadgets and equipment for which they yearn. To do so is to dismiss the how these practices actually call attention to the vast social and economic disparities that they experience in their encounters with such figures as the German hiker and the Omani merchant. Indeed, the strict vetting process to which I was subject and their suspicion toward foreign prospectors are strategies for limiting access to the treasure for the very reason that they would not be able to compete with metal detectors and other sensing technologies. A ground penetrating scanner would surely make their work easier, and they readily recognized that its possession would allow them to focus on the very practice of detecting treasures rather than on the sign-searching practices that only get them to the site but not necessarily the means of accessing the treasures. The scanner, Alex said, would really help them, especially given that they are “behind” [tuko nyuma] when it comes to technology. Such sentiments are similar to the attitudes among Zambian mineworkers, who, Ferguson writes, desire and aspire to the trappings of modernity, where they would have unfettered access to technology, enjoy a middle-class standard of living, and rely on public institutions and infrastructures.⁴³⁹

I decided to turn down Alex’s request. Even if I was able to purchase such a technology for Alex, I would have to pay an exorbitant import fee at the airport upon entering Tanzania. “I understand,” he said, “we will have to rely on ourselves.” There was a sense of disappointment in

⁴³⁹ Ferguson, *Expectations of Modernity*, 185-6.

Alex's reply but he was also determined to continue using the same sign-searching methods he and his colleagues have been practicing. If, as Ferguson claims, that ordinary Africans have begun – during a time of indefinite decline, decay, and disintegration – to feel that they are locked out of modernity, then Alex's reply offers a pragmatic mode of encountering that uncertainty. As chronopolitical acts, treasure hunting contests those very temporalities from which many Tanzanians are excluded. Despite their many failed attempts, practices of surfacing treasures continue to glimmer with the possibility of imagining and crafting a different way of life. Their persistence to look for treasure refuses to accept the kind of emerging temporality that Mbembe claims distinguishes contemporary African experience today, “in which the future horizon is apparently closed, while the horizon of the past has already receded.”⁴⁴⁰

In *Theses on the Philosophy of History*, Walter Benjamin describes progress as “one single catastrophe which keeps piling wreckage,” a force that propels history into the future as the “pile of debris...grows skyward.”⁴⁴¹ In light of Benjamin's aphoristic pronouncement, treasure hunting appears more and more to be about the hope to glean something from the wreckage of progress. In the ruins of relentless development, those who find themselves barred from participation in the global economy may resort to looking through what have been left behind in modernity's aftermath. Whether as valuable artifacts for which Alex spends his time searching, or landmines that remain buried in the ground in Cambodia, where Alex's trained rats go to work, they are linked by the storm of progress that has justified the horrors of war and exploitation, leaving a trail of material and psychological wreckage. In its multifarious meanings, “treasure” draws together a bundle of signs, affects, and practices that define the discontent and ambiguity that accompanies living in the wreckage of global capitalism. As imagination and critique, treasure hunting in

⁴⁴⁰ Mbembe, *On the Postcolony*, 16-7.

⁴⁴¹ Benjamin, “Theses on the Philosophy of History,” 257-8.

Tanzania calls attention to these historical and economic injustices, while offering the possibilities to disrupt and break through the constrictions of the present. On a global scale, the pervasive interest in Africa's untapped potential and rich resources continues to drive multinational corporations and foreign investors to search for new markets, new minerals, and new treasures on the continent. And so continues the hunt.

EPILOGUE

Toward an Interstitial Intelligence

The December 1958 issue of *if*, an American science fiction magazine, featured a short story by Rog Phillips called “Rat in the Skull,” in which a rat inhabits a humanoid robot and has full control over the robot’s movements and speech. Later in the story, the lab rat who has been raised to think that he was human discovers that he has indeed been a rat all along, trapped in the skull of a humanoid robot. Upon this realization, he goes on a murderous rampage, killing the only child of his inventors, Dr. Joseph MacNare and his wife, Alice.

Named Adam, the rat-in-the-robot was part of a secret research project to prove that nonhuman animals were capable of abstract symbol systems and therefore could think with words to form meaningful concepts.⁴⁴² Immediately after his birth, Dr. MacNare fastened the rat’s limbs and head to levers and pedals so that over time, the robot’s mechanical movements—and speech—became a natural extension of the rat’s body. As Adam grew up, he learned to speak and move in similar ways to a human child, even though, from the back of Adam’s skull, one could still peer through the glass and see a rat in place of a brain. For the MacNares, the distinction between rat and brain gradually disappeared to the extent that Joseph would write that Adam “has an integrated mind, entirely human in every respect.”⁴⁴³

The climax of “Rat in the Skull” arrives one evening while the MacNares are out. Their other, human son, Paul, and his friends venture into the study where Adam is asleep. Curious about the rat in the glass skull, Paul removes Adam from the control room to have a better look at the animal. This wakes Adam from his sleep. In the terror of that rude awakening, Adam suddenly

⁴⁴² Phillips, “Rat in the Skull.”

⁴⁴³ *Ibid.*, 14.

realizes that he is a rat and can only scuttle maddeningly about until the frightened Paul places him back into the skull. Adam goes berserk and in a fit of rage, kills Paul and his friend. The MacNares come home and are horrified at the sight of their dead son lying beside a whimpering, sobbing Adam. When the police arrive to investigate, the coroner picks the rabid rat out of the robot by his tail, and with a sharp swing, slams the animal onto the desk.

“Rat in the Skull” became a sensation in the science fiction world for the way that the story so tragically portrayed the lab rat’s near-achievement of becoming human. Published in 1958, the story coincided with the culmination of what Rebecca Lemov calls the “American Experiment” of human, social engineering during the first half of the twentieth century.⁴⁴⁴ The story captured the imagination of an American public steeped in frequent reports and news about psychology research that claimed to explain the mechanisms of human behavior based on experiments conducted on laboratory rats and other animals. The ways rats responded to certain patterns, intensities, and configurations of stimuli as they ran mazes, avoided electric shocks, and solved puzzles became an important source of data for research about human behavior. Such rodent experiments allowed psychologists including John B. Watson, B. F. Skinner, and Edward C. Tolman to advocate for certain pedagogies, environmental designs, and systems of rewards and punishments to perfect human society.⁴⁴⁵ The cover art for “Rat in the Skull” was therefore an invitation to flirt with the possibility that much of what psychology claims to understand about human thinking is really about rat thinking.

⁴⁴⁴ Lemov, *World as Laboratory*.

⁴⁴⁵ See also Carroll, *Purpose and Cognition*; Costall, “From Darwin to Watson (and Cognitivism) and Back Again”; Schneider and Morris, “A History of the Term Radical Behaviorism”; Rutherford, *Beyond the Box: B.F. Skinner's technology of behavior from laboratory to life, 1950s-1970s*.

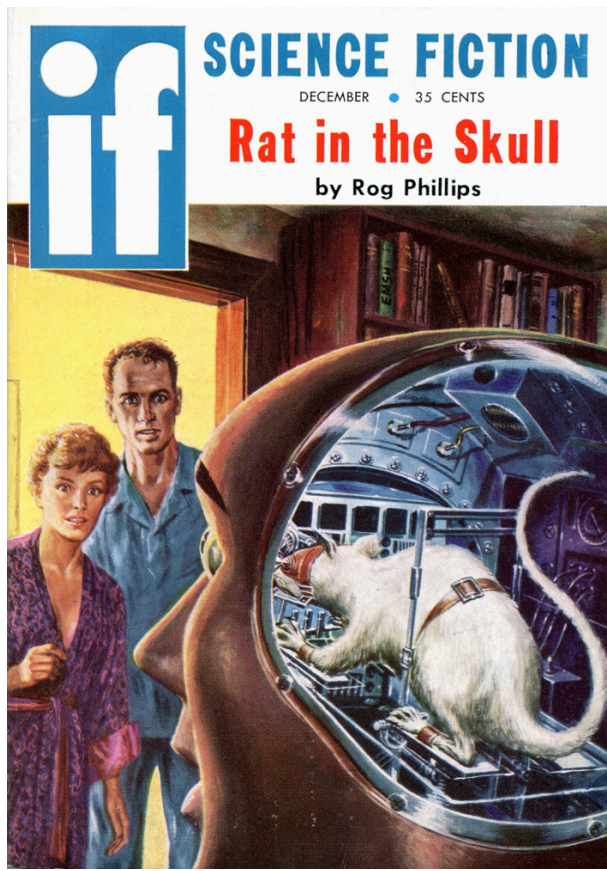


Image 20. Cover art of *if* magazine by Ed Emshwiller, December 1958 issue. Open Source.

For a science fiction story about a rat-controlled humanoid robot, the setting is predictably white, middle-class, heteronormative, and American. Dr. Joseph MacNare, the academic who conceptualized the project, is a swashbuckling white man in his forties who persuades his wife, Alice, to support him in the risky endeavor. Alice supports her husband's project by taking on the maternal care of the rat, bathing the rodent every few days while the rat is drugged on opiates. As the Black American psychologist Robert Guthrie would later put it in 1976, "Even the rat was white."⁴⁴⁶ The cover art not only represented the sciences of human cognition that had become so deeply entwined with rodent cognition. It also bared its whiteness. The publication of "Rat in the Skull" intersected, in the United States and Europe, with psychological explanations of racial difference, particularly in terms of Black inferiority and dysfunction. At this time, psychologists

⁴⁴⁶ Guthrie, *Even the Rat Was White*.

and sociologists in the United States published reports that analyzed Black family structures and “pathology” as well as the root causes of scholastic failure and underachievement among Black schoolchildren in the United States. In Africa, colonial psychiatrists attempted to understand the relationship between malnutrition, disease, and mental development in Britain’s African colonies.⁴⁴⁷ These researches coincided with the era of decolonization, during which questions about mental capacity and knowledge production were key sites of contestation. In both Euro-America and Africa, the racialization of thinking would transform, through protest, community organizing, and resistance, into critical thinking about race, sparking experiments of decolonization in Africa and movements for civil rights in the United States.

Yet, more than half a century after the publication of “Rat in the Skull,” the laboratory rodent, so to speak, remains thoroughly white. Racist and colonial understandings of the various sciences of the mind persist, including in psychology, psychiatry, and neuroscience, where racial differences are reinscribed through the categorizations of mental illness, brain scans, and neural responses to stimuli.⁴⁴⁸ *Transcendent Kingdom* (2020), a novel by Ghanaian-American author Yaa Gyasi draws on optogenetic experiments with lab mice to tell the story of Gifty, a neuroscience graduate student at Stanford who narrates her experiences of growing up in a family that struggles with opioid addiction and depression. Gifty’s experiences as one of the few Black female neuroscientists in the field as well as her immigrant Ghanaian family’s confrontations with racism in Alabama are key themes throughout the novel.

⁴⁴⁷ See Carothers, *The African Mind in Health and Disease*; Moynihan, *The Negro Family: The Case for National Action*.; Coleman, *Equality of Educational Opportunity*.

⁴⁴⁸ See, for example, recent discussions from within these fields. Bulhan, “Stages of Colonialism in Africa”; Heinz et al., “The Uncanny Return of the Race Concept”; Warner, “Psychiatry Confronts Its Racist Past, and Tries to Make Amends.”

As part of her experiments, Gifty injects lab mice with viruses that alter their genetic expression so that she can study and control, using light, how mice might respond to and overcome addiction and depression. As she explains in her own words, “Could optogenetics be used to identify the neural mechanisms involved in psychiatric illnesses...?”⁴⁴⁹ She wonders if the insights yielded from her mice could really have saved her brother and mother’s lives:

In other words, many, many years down the line, once we’ve figured out a way to identify and isolate the parts of the brain that are involved in these illnesses, once we’ve jumped all the necessary hurdles to making this research useful to animals other than mice, could this science work on the people who need it the most? Could it get a brother to set down a needle? Could it get a mother out of bed?⁴⁵⁰

Unlike the psychologists and behavioral scientists who preceded her, Gifty was not too sure if the answers to these questions lay in the brain alterations to which she subjects her lab mice. Her uncertainty is further compounded by her memories and experiences of growing up Black, immigrant, and female. She wonders if such richly complex experiences could ever be captured in a series of experiments with lab rodents. Nonetheless, her efforts harbor a hope that rodents in behavioral testing chambers or mazes would still shed light on the human brain, and ultimately bring some closure to the suffering she has witnessed.

⁴⁴⁹ Gyasi, *Transcendent Kingdom*, 44.

⁴⁵⁰ *Ibid.*

These two stories, written over half century apart, migrate across boundaries that delineate the global South from the North, and confound those that differentiate the rodent from the human. They help me frame questions about emergent notions of thinking that are today increasingly dominated by talk about artificial intelligence, or A.I. For here, there is another story of how pervasive notions of thinking, manipulated and manufactured with laboratory rodents, have come to define our experiences of the world. Like rats navigating Tolman's mazes or those sniffing out explosives in Morogoro, machine learning uses the language of training to articulate a theory of thinking. "Training" has come to describe a variety of teaching and learning practices. An athlete trains, and so does a pastry chef. Schoolchildren are trained to recite multiplication tables and dogs are house trained. Training is ubiquitous in the field of computing.

Programmers who write algorithms that categorize and classify data or predict outcomes from specific datasets have to first train their algorithms. This training takes on several forms, including supervised learning, where a programmer "trains" a system to produce specific, desired outcomes based on a fixed range of inputs by continuously providing feedback on each outcome. Like the rat who hears a click on a TNT+ sample, these systems "learn" to classify datasets correctly. When programmers label these desired outcomes as good—often on a numerical scale—these systems learn through reinforcement, and will, in the future, sort and perform actions in ways that have received good feedback.

Despite the shared language of conditioning and training between animal and algorithm, drawing comparisons between rodent training and machine learning without further explanation is misleading: these are extremely different systems at work, and as this dissertation has shown, rodent training requires an inordinate amount of *sensory* skill, intuition, and experience that can only be forged within interspecies relations. However, it is important to call attention to this

analogy because, as scholars of computing such as Ruha Benjamin, Nick Seaver, Beth Semel and many others have shown, language used to talk about A.I. often smuggles along oppressive notions about gender, race, and class that significantly impact how machine learning produces knowledge.⁴⁵¹ This dissertation has also shown that the language of training smuggles into A.I. notions of rodent thinking.

Indeed, because so much of our knowledge systems are increasingly being designed and structured through machine learning, I suggest that A.I. has slowly reduced thinking to an effect of training as it has been understood through psychology experiments with laboratory rodents. Training, its Oxford English Dictionary definition proposes, means to “subject to discipline and instruction for development of character, behaviour, or skill.”⁴⁵² A glance at the entire entry, however, shows that “train” captures a wide range of meanings, including those of learning that take the form of prolonged conditioning through reinforcement. Indeed, one of the earliest uses of the word “train” comes from Palladius’ *De re Rustica*, a fifteenth-century treatise on farming, in which training meant the direction, manipulation, or treatment of a vine, such as grape, to bring about a necessary or desired form.⁴⁵³ This earlier definition aligns with how rodent trainers in Morogoro understand the process of training. In Kiswahili, they use the word “kufundisha” for training, which is also the word for “teach.” I want further to suggest here that this residual definition of training, as that of a process for shaping that occurs between two subjects, whether a teacher and a student, or a horticulturalist and her vine, or a trainer and his rat, exemplifies an

⁴⁵¹ See, for example, Buolamwini, “Gender Shades: Intersectional Phenotypic and Demographic Evaluation of Face Datasets and Gender Classifiers”; Semel, “Speech, Signal, Symptom: Machine Listening and the Remaking of Psychiatric Assessment”; essays in Vertesi and Ribes, *DigitalSTS*; essays in “Indigenous Protocol and Artificial Intelligence Position Paper”; Open Letter by Coalition for Critical Technology, “Abolish the #TechToPrisonPipeline,” June 23, 2020.

⁴⁵² Oxford English Dictionary, “Train, v.1.”

⁴⁵³ Ibid.

interstitial intelligence that is more generative for understanding thinking than artificial intelligence.

In computing, training is an unreflexive form of thinking that often reproduces social injustice and exclusion, encoded into the algorithmic infrastructure of knowledge systems. The word training has also, in this contemporary moment, come to describe the purported solutions for those injustices encoded into artificial intelligence. For example, one solution for diversifying the workforce of the tech industry is to *train* more computer scientists, particularly those who are women and from Black, brown, and poorer backgrounds. Another solution is to offer an endless stream of diversity *training* at academies and companies that create computing systems, including at the Massachusetts Institute of Technology or at Google. To go over the reasons for why these solutions do not actually resolve ingrained inequalities in tech is beyond the scope of this dissertation, but they have been exceptionally studied by other scholars.⁴⁵⁴ The point I wish to make here is that training has been proposed as a sort of reparation or reformation of the industry's continued exclusion of women, people of color, and much of the developing world. "Training" is offered as a tool to create better artificial intelligence, both in terms of algorithmic power and socially just algorithms.

Drawing on my ethnographic work with rodent trainers in Morogoro, I propose *interstitial intelligence* as an alternative to artificial intelligence. As interstitial intelligence, training goes beyond the recuperation of unjust technoscientific systems through more inclusion and more diversity. Rather, it foregrounds the many liminal ways in which people approach knowledge systems, and centers these as crucial sites for generating theories, critique, and

⁴⁵⁴ For an overview of scholarship, see Rankin, "For 50 Years, Tech Companies Have Tried to Increase Diversity by Fixing People Instead of the System"; Robson, "What Unconscious Bias Training Gets Wrong... and How to Fix It."

imagination for counterhegemonic futures. To practice interstitial thinking is to recognize one's own marginality not in a peripheral sense, as if one's thinking is somehow outside of or bordering on the corpus of what is considered knowledge. Rather, interstitial thinking invokes a marginality defined in terms of its intersubjectivities—between global North and South, human and posthuman, machine and animal—those sometimes unacknowledged spaces of articulating an epistemology about difference, exchange, and ambiguity from a position of lesser privilege.

Interstitial intelligence, or I², therefore, resists the colonizing effects of A.I. It is a pluriversal attempt to insist upon the many styles of thinking that make up the world.⁴⁵⁵ A.I. is gradually defining the terms of the production and systematization of knowledge, and establishing newer hierarchies of their access. Within debates and discussions about development, which continues to be the mainstay of anthropological research in Africa, A.I. is embraced both by multinational development organizations and national governments as a moonshot to achieve prosperity and security. Against such digitally and algorithmically colonizing forces, I locate thinking not within the neuroscientific brain, or the psychological mind, or even, in an anthropological culture. Rather thinking, as proposed by those who encounter and enculture rodents in Morogoro, comes from interspecies, intellectual practices that contend with a world that grapples, unceasingly, with the many futures that are yet to come.

⁴⁵⁵ See, for example, works in anthropology and psychology by scholars such as Price-Williams, *Explorations in Cross-Cultural Psychology*. See also Escobar, *Pluriversal Politics*.

REFERENCES

Archival Sources

- Tanzania National Archives (TNA), Dar es Salaam, Tanzania – All TNA sources are listed in the following order, when available: Accession Number, followed by File Number, Index Number Volume Number, and Page Number. For example, the source TNA J10/12704/1037/113-118 indicates Accession No. J10 (“Medical and Sanitary”), File No. 12704, Index No. 1037, pages 113-8. The source TNA 11901/v2/225 indicates File No. 11901, Volume 2, page 225.
- Rodent Research Project Papers, Private Collection, Antwerp, Belgium.
- Mammal Collections, Africa Museum, Tervuren, Belgium.

Bibliography

- Achola, Milcah Amolo. “Colonial Policy and Urban Health: The Case of Colonial Nairobi.” *Azania: Archaeological Research in Africa* 36–37, no. 1 (2001): 119–37. <https://doi.org/10.1080/00672700109511703>.
- Afro-Asian Networks Research Collective. “Manifesto: Networks of Decolonization in Asia and Africa.” *Radical History Review* 2018, no. 131 (2018): 176–82. <https://doi.org/10.1215/01636545-4355317>.
- Ahmed, Sara. *The Cultural Politics of Emotion*. Edinburgh, UK: Edinburgh University Press, 2004.
- Aiyar, Sana. *Indians in Kenya: The Politics of Diaspora. Indians in Kenya*. Cambridge, MA: Harvard University Press, 2015.
- Ake, Claude. *A Political Economy of Africa*. Harlow, Essex: Longman, 1981.
- Alexander, M. Jacqui. *Pedagogies of Crossing: Meditations on Feminism, Sexual Politics, Memory, and the Sacred*. Durham, NC: Duke University Press, 2005.
- Allen, Garland E. *Life Science in the Twentieth Century*. London; New York: Cambridge University Press, 1979.
- Allport, G. W. “Review of ‘Drives Toward War.’” *Psychological Bulletin* 40 (1943): 293–96.
- Amin, Samir. *Eurocentrism: Modernity, Religion, and Democracy: A Critique of Eurocentrism and Culturalism*. 2nd ed. Nairobi, Kenya: Pambazuka, 2010.
- Anderson, Benedict. *Imagined Communities: Reflections on the Origin and Spread of Nationalism*. London, UK: Verso, 1991.

- Anderson, Warwick. "Postcolonial Technoscience." *Social Studies of Science* (Sage Publications, Ltd.) 32, no. 5/6 (2002): 643. <https://doi.org/10.1177/030631202128967361>.
- Anzaldúa, Gloria. *Borderlands/La Frontera: The New Mestiza*. San Francisco, CA: Aunt Lute Books, 1987.
- Appadurai, Arjun. *The Future as Cultural Fact: Essays on the Global Condition*. London, UK: Verso, 2013.
- Arboleda, Martín. *Planetary Mine: Territories of Extraction under Late Capitalism*. London: Verso, 2020.
- Arowosegbe, Jeremiah O. "African Scholars, African Studies and Knowledge Production in Africa." *Africa* 86, no. 2 (2016): 324–38. <https://doi.org/10.1017/S0001972016000073>.
- Ashe, Robert Pickering. *Two Kings of Uganda: Or, Life by the Shores of Victoria Nyanza*. S. Low, Marston, Searle, & Rivington, 1889.
- "Asia: All That Glisters...; Treasure Hunting in Asia." *The Economist*. London, United Kingdom: The Economist Intelligence Unit N.A., Incorporated, January 18, 2003.
- Baker, Lee D. *From Savage to Negro: Anthropology and the Construction of Race, 1896-1954*. Berkeley: University of California Press, 1998.
- Bateson, Gregory. *Steps to an Ecology of Mind*. New York: Ballantine Books, 1972.
- Bear, Laura. "Time as Technique." *Annual Review of Anthropology* 45, no. 1 (2016): 487–502. <https://doi.org/10.1146/annurev-anthro-102313-030159>.
- Beckert, Jens. *Imagined Futures: Fictional Expectations and Capitalist Dynamics*. Cambridge, MA: Harvard University Press, 2016.
- Beidelman, Thomas O. "Further Adventures of Hyena and Rabbit: The Folktale as a Sociological Model." *Africa: Journal of the International African Institute* 33, no. 1 (1963): 54–69. <https://doi.org/10.2307/1157797>.
- . *Moral Imagination in Kaguru Modes of Thought*. Washington, DC: Smithsonian Institution Press, 1993.
- Beller, Jonathan. *The Cinematic Mode of Production: Attention Economy and the Society of the Spectacle*. Lebanon, NH: University Press of New England, 2012.
- Benjamin, Walter. "Theses on the Philosophy of History." In *Illuminations: Essays and Reflections*, edited by Hannah Arendt, 253–64. New York: Schocken, 1968.
- Bennardo, Giovanni. *Language, Space, and Social Relationships: A Foundational Cultural Model in Polynesia*. Cambridge, UK: Cambridge University Press, 2009.
- Bennett, Joshua. *Being Property Once Myself: Blackness and the End of Man*. Cambridge, Massachusetts: The Belknap Press of Harvard University Press, 2020.
- Benson, Etienne. "Animal Writes: Historiography, Disciplinarity, and the Animal Trace." In *Making Animal Meaning*, edited by Linda Kalof and Georgina M. Montgomery, 3–16. East Lansing: Michigan State University Press, 2011.
- . *Wired Wilderness: Technologies of Tracking and the Making of Modern Wildlife*. Baltimore: Johns Hopkins University Press, 2010.
- Bequaert, J. "The C. Andresen Hubbard Collection of Fleas of the Pacific Northwest." *Psyche: A Journal of Entomology* 57 (January 1, 1950). <https://doi.org/10.1155/1950/41407>.
- Blodgett, H. C. "The Effect of the Introduction of Reward upon the Maze Performance of Rats." *University of California Publications in Psychology* 4 (1929): 113–34.
- Bock, Philip K. *Rethinking Psychological Anthropology: Continuity and Change in the Study of Human Action*. New York, NY: W.H. Freeman, 1988.

- Bourdieu, Pierre. *Distinction: A Social Critique of the Judgement of Taste*. Cambridge, Mass: Harvard University Press, 1984.
- Bowker, Geoffrey C., and Susan Leigh Star. "The Case of Race Classification and Reclassification under Apartheid." In *Sorting Things out: Classification and Its Consequences*, 195–225. Cambridge, MA: MIT Press, 2000.
- Brooks, Dale L. "Animal Rights and Vertebrate Pest Control." *Proceedings of the Thirteenth Vertebrate Pest Conference* 6 (1988): 14–17.
- Bulhan, Hussein A. "Stages of Colonialism in Africa: From Occupation of Land to Occupation of Being." *Journal of Social and Political Psychology* 3, no. 1 (2015): 239–256. <https://doi.org/10.5964/jspp.v3i1.143>.
- Buolamwini, Joy Adowaa. "Gender Shades: Intersectional Phenotypic and Demographic Evaluation of Face Datasets and Gender Classifiers." PhD Thesis, Massachusetts Institute of Technology, 2017.
- Burnett, D. Graham. *Trying Leviathan: The Nineteenth-Century New York Court Case That Put the Whale on Trial and Challenged the Order of Nature*. Princeton, NJ: Princeton University Press, 2007.
- Burt, Jonathan. *Rat. Animal*. London: Reaktion Books, 2006.
- Callon, Michel. "Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St Brieuc Bay." *The Sociological Review* 32, no. 1 (1984): 196–233. <https://doi.org/10.1111/j.1467-954X.1984.tb00113.x>.
- Cambodian Mine Action Centre. "Progress Report 1992-2020 | CMAC," January 2020. <https://web.archive.org/web/20210603185104/https://cmac.gov.kh/en/article/progress-summary-report/cmac-s-operational-progress-report-from-1992-to-january-2020.html>.
- Candea, Matei. "I Fell in Love with Carlos the Meerkat': Engagement and Detachment in Human–Animal Relations." *American Ethnologist* 37, no. 2 (2010): 241–58. <https://doi.org/10.1111/j.1548-1425.2010.01253.x>.
- Capshew, James H. "Engineering Behavior: Project Pigeon, World War II, and the Conditioning of B. F. Skinner." *Technology and Culture* 34, no. 4 (1993): 835–57. <https://doi.org/10.2307/3106417>.
- Carothers, John C. *The African Mind in Health and Disease*. World Health Organization, 1953.
- Carroll, David W. *Purpose and Cognition: Edward Tolman and the Transformation of American Psychology*. Cambridge; New York: Cambridge University Press, 2017.
- Cassaniti, Julia. *Living Buddhism: Mind, Self, and Emotion in a Thai Community*. Ithaca, NY: Cornell University Press, 2015.
- Casson, Ronald W. "Schemata in Cognitive Anthropology." *Annual Review of Anthropology* 12 (1983): 429–62.
- Centellas, Katherine McGurn. "The Localism of Bolivian Science Tradition, Policy, and Projects." *Latin American Perspectives* 37, no. 3 (May 2010): 160–75. <https://doi.org/10.1177/0094582X10366536>.
- Césaire, Aimé. *Discourse on Colonialism*. Edited by Robin D. G. Kelley. New York: Monthly Review Press, 2000.
- Chadarevian, Soraya de, and Harmke Kamminga, eds. *Molecularizing Biology and Medicine: New Practices and Alliances, 1910s-1970s*. Amsterdam, Netherlands: Harwood Academic Publishers, 1998.
- Chen, Kuan-Hsing. *Asia as Method: Toward Deimperialization*. Durham, NC: Duke University Press, 2010.

- Classen, Constance. "Foundations for an Anthropology of the Senses." *International Social Science Journal* 49, no. 153 (September 1, 1997): 401–12. <https://doi.org/10.1111/j.1468-2451.1997.tb00032.x>.
- Coalition for Critical Technology. "Abolish the #TechToPrisonPipeline," June 23, 2020. <https://medium.com/@CoalitionForCriticalTechnology/abolish-the-techtoprisonpipeline-9b5b14366b16>.
- Coleman, James S. *Equality of Educational Opportunity*. Washington: U.S. Department of Health, Education, and Welfare, Office of Education, 1966.
- Coleman, William. *Biology in the Nineteenth Century: Problems of Form, Function, and Transformation*. Cambridge; New York: Cambridge University Press, 1977.
- Comaroff, Jean, and John L. Comaroff. "Millennial Capitalism: First Thoughts on a Second Coming." *Public Culture* 12, no. 2 (2000): 291–343.
- . "Occult Economies and the Violence of Abstraction: Notes from the South African Postcolony." *American Ethnologist* 26, no. 2 (1999): 279–303.
- Comaroff, Jean, and John L. Comaroff. *Theory from the South: Or, How Euro-America Is Evolving toward Africa*. Boulder, CO: Paradigm Publishers, 2012.
- Comaroff, Jean, and L. Comaroff. "Naturing the Nation: Aliens, Apocalypse and the Postcolonial State." *Journal of Southern African Studies* 27, no. 3 (2001): 627–51. <https://doi.org/10.1080/13632430120074626>.
- Comaroff, John L., and Jean Comaroff. "Goodly Beasts, Bestly Goods: Cattle and Commodities in a South African Context." *American Ethnologist* 17, no. 2 (1990): 195–216.
- Corsín Jiménez, Alberto, and Chloe Nahum-Claudel. "The Anthropology of Traps: Concrete Technologies and Theoretical Interfaces." *Journal of Material Culture* 24, no. 4 (December 1, 2019): 383–400. <https://doi.org/10.1177/1359183518820368>.
- Costall, Alan. "From Darwin to Watson (and Cognitivism) and Back Again: The Principle of Animal-Environment Mutuality." *Behavior and Philosophy* 32, no. 1 (2004): 179–95.
- Crane, Johanna Tayloe. *Scrambling for Africa: AIDS, Expertise, and the Rise of American Global Health Science*. Expertise: Cultures and Technologies of Knowledge. Ithaca, NY: Cornell University Press, 2013.
- Crowcroft, Peter. *Elton's Ecologists: A History of the Bureau of Animal Population*. University of Chicago Press, 1991.
- Dale, Joshua Paul, ed. *The Aesthetics and Affects of Cuteness*. New York: Routledge, Taylor & Francis Group, 2016.
- Danziger, Eve. "On Trying and Lying: Cultural Configurations of Grice's Maxim of Quality" 7, no. 2 (May 1, 2010): 199–219. <https://doi.org/10.1515/iprg.2010.010>.
- Daston, Lorraine. "Ground-Zero Empiricism." *Critical Inquiry* 47, no. S2 (2020): S55–57. <https://doi.org/10.1086/711436>.
- Daston, Lorraine, and Peter Galison. *Objectivity*. Cambridge, MA: Zone Books, 2007.
- Dattatreyan, Ethiraj Gabriel. "Diasporic Sincerity: Tales from a 'Returnee' Researcher." *Identities* 21, no. 2 (2014): 152–67. <https://doi.org/10.1080/1070289X.2013.854722>.
- Derrida, Jacques. *The Gift of Death, Second Edition & Literature in Secret*. Chicago, IL: University of Chicago Press, 2017.
- Despret, Vinciane. "The Body We Care for: Figures of Anthro-Zoo-Genesis." *Body & Society* 10, no. 2–3 (June 1, 2004): 111–34. <https://doi.org/10.1177/1357034X04042938>.

- Dillinger, J. *Magical Treasure Hunting in Europe and North America: A History*. Palgrave Historical Studies in Witchcraft and Magic. London, UK: Palgrave Macmillan, 2012. <https://doi.org/10.1057/9780230353312>.
- Douglas, Mary. "Animals in Lele Religious Symbolism." *Africa* 27, no. 1 (1957): 46–58. <https://doi.org/10.2307/1156365>.
- . *Purity and Danger; an Analysis of Concepts of Pollution and Taboo*. New York: Praeger, 1966.
- Droney, Damien. "Ironies of Laboratory Work during Ghana's Second Age of Optimism." *Cultural Anthropology* 29, no. 2 (2014): 363–84. <https://doi.org/10.14506/ca29.2.10>.
- Drummond, David C. "Letter to Mogens Lund," February 1, 1978. Private Archive, Antwerp, Belgium.
- Dupré, John. *Humans and Other Animals*. Oxford, UK: Clarendon Press, 2002.
- Durkheim, Émile. *The Elementary Forms of the Religious Life*. New York, NY: The Free Press, 1995.
- Eco, Umberto. *Mouse Or Rat?: Translation as Negotiation*. London, UK: Weidenfeld & Nicolson, 2003.
- Edelman, Birgitta. "'Rats Are People, Too!': Rat-human Relations Re-rated." *Anthropology Today* 18, no. 3 (June 1, 2002): 3–8. <https://doi.org/10.1111/1467-8322.00118>.
- Eglash, Ron. "An Introduction to Generative Justice." *Teknokultura* 13, no. 2 (2016): 369–404.
- Eglash, Ron, and Ellen K. Foster. "On the Politics of Generative Justice: African Traditions and Maker Communities." In *What Do Science, Technology, and Innovation Mean from Africa?*, edited by Clapperton Chakanetsa Mavhunga, 117–35. Cambridge, MA: The MIT Press, 2017.
- Eliot, T. S. *Old Possum's Book of Practical Cats*. New York, NY: Harcourt Brace Jovanovich, 1982.
- Elliott, Denielle, and Davy Kiprotich Koech. *Reimagining Science and Statecraft in Postcolonial Kenya Stories from an African Scientist*. New York, NY: Routledge, 2020.
- Epstein, Russell A., Eva Zita Patai, Joshua B. Julian, and Hugo J. Spiers. "The Cognitive Map in Humans: Spatial Navigation and Beyond." *Nature Neuroscience* 20, no. 11 (October 26, 2017): 1504–13. <https://doi.org/10.1038/nn.4656>.
- Ereshefsky, Marc. *The Poverty of the Linnaean Hierarchy: A Philosophical Study of Biological Taxonomy*. Cambridge, UK: Cambridge University Press, 2000.
- Escobar, Arturo. *Pluriversal Politics: The Real and the Possible*. Durham : Duke University Press, 2020.
- Eshun, Kodwo. "Further Considerations of Afrofuturism." *CR: The New Centennial Review* 3, no. 2 (2003): 287–302. <https://doi.org/10.1353/ncr.2003.0021>.
- Evans-Pritchard, E. E. *Witchcraft, Oracles and Magic among the Azande*. Oxford, UK: Clarendon Press, 1937.
- Evans-Pritchard, Edward Evan. *The Nuer: A Description of the Modes of Livelihood and Political Institutions of a Nilotic People*. Oxford, UK: Oxford University Press, 1969.
- Fabian, Johannes. *Time and the Other: How Anthropology Makes Its Object*. New York: Columbia University Press, 2002.
- Fanon, Frantz. *The Wretched of the Earth*. New York, NY: Grove Press, 2004.
- Farquhar, Judith. *Appetites: Food and Sex in Post-Socialist China*. Durham, NC: Duke University Press, 2002. <https://doi.org/10.1515/9780822383451>.

- Feierman, Steven. *The Shambaa Kingdom: A History*. Madison, WI: University of Wisconsin Press, 1974.
- Ferguson, James. *Expectations of Modernity: Myths and Meanings of Urban Life on the Zambian Copperbelt*. Berkeley, CA: University of California Press, 1999.
- . *The Anti-Politics Machine: "Development," Depoliticization, and Bureaucratic Power in Lesotho*. Minneapolis, MN: University of Minnesota Press, 1994.
- . "The Bovine Mystique: Power, Property and Livestock in Rural Lesotho." *Man* 20, no. 4 (1985): 647–74. <https://doi.org/10.2307/2802755>.
- Ferry, Elizabeth Emma. "Memory as Wealth, History as Commerce: A Changing Economic Landscape in Mexico." *Ethos* 34, no. 2 (2006): 297–324.
- Ferster, Charles B., and B. F. (Burrhus Frederic) Skinner. *Schedules of Reinforcement*. New York, NY: Appleton-Century-Crofts, 1957.
- Forth, Gregory. "Of Mice and Rats: The Place of Murids in Nage Animal Classification and Symbolism." *Journal of Ethnobiology* 32, no. 1 (2012): 51–73. <https://doi.org/10.2993/0278-0771-32.1.51>.
- Fortun, Kim. "From Latour to Late Industrialism." *HAU: Journal of Ethnographic Theory* 4, no. 1 (2014): 309–29. <https://doi.org/10.14318/hau4.1.017>.
- Foucault, Michel. *The Order of Things: An Archaeology of the Human Sciences*. Repr. Routledge Classics. London, UK: Routledge, 2007.
- Gabrys, Jennifer. "Sensors and Sensing Practices: Reworking Experience across Entities, Environments, and Technologies." *Science, Technology, & Human Values* 44, no. 5 (2019): 723–36. <https://doi.org/10.1177/0162243919860211>.
- Garcia, John. "I. Krechevsky and I: Once upon a Time at Berkeley." In *Knowing, Thinking, and Believing: Festschrift for Professor David Krech*, edited by Lewis Petrinovich and James L. McGaugh, 71–84. New York, NY: Plenum, 1976.
- Geertz, Clifford. "Deep Play: Notes on the Balinese Cockfight." *Daedalus* 134, no. 4 (2005): 56. ———. *Local Knowledge: Further Essays In Interpretive Anthropology*. Basic Books, 2008.
- Geissler, Paul W., Guillaume Lachenal, John Manton, Noémi Tousignant, Evgenia Arbugaeva, and Mariele Neudecker, eds. *Traces of the Future: An Archaeology of Medical Science in Africa*. Bristol, UK: Intellect Ltd, 2016.
- Gell, A. "Vogel's Net: Traps as Artworks and Artworks as Traps." *Journal of Material Culture* 1, no. 1 (1996): 15–38. <https://doi.org/10.1177/135918359600100102>.
- Genest-Villard, H. "Revision Du Genre Cricetomys (Rongeurs, Cricetidae)." *Mammalia* 31 (1967): 390–455. <https://doi.org/10.1515/mamm.1967.31.3.390>.
- Geschiere, Peter. "Witchcraft and Modernity: Perspectives from Africa and Beyond." In *Sorcery in the Black Atlantic*, edited by Luis Nicolau Parés and Roger Sansi-Roca, 233–58. Chicago, IL: The University of Chicago Press, 2011.
- Ghyselen, Astrid, Paul Wenzel Geissler, Johan Lagae, and Peter E. Mangesho. "Scenes of Amani, Tanzania: Biography of a Postcolonial Landscape." *Journal of Landscape Architecture* 12, no. 1 (2017): 6–17. <https://doi.org/10.1080/18626033.2017.1301285>.
- Ginzburg, Carlo. "Clues: Roots of an Evidential Paradigm." In *Clues, Myths, and the Historical Method*, 96–125. Baltimore, MD: Johns Hopkins University Press, 1989.
- Glissant, Edouard. "Creolization in the Making of the Americas." *Caribbean Quarterly* 54, no. 1/2 (1995 2008): 81–89.
- Glissant, Édouard. *Poetics of Relation*. Ann Arbor, MI: University of Michigan Press, 1997.

- Gould, Chandr'e, and Peter I. Folb. "Project Coast: Apartheid's Chemical and Biological Warfare Programme." Geneva, Switzerland: United Nations Institute for Disarmament Research (UNIDIR), Centre for Conflict Resolution (CCR), 2002.
- Gould, Richard A, ed. *Shipwreck Anthropology*. Albuquerque, NM: University of New Mexico, 1983.
- Govindrajan, Radhika. *Animal Intimacies: Interspecies Relatedness in India's Central Himalayas*. Chicago, IL: University of Chicago Press, 2018., 2018.
- Grasseni, Cristina. "Introduction: Skilled Visions: Between Apprenticeship and Standards." In *Skilled Visions*, edited by Cristina Grasseni, 1–20. New York: Berghahn Books, 2007. <http://www.jstor.org/stable/j.ctt9qcj0q.4>.
- Green, Monica H. "Putting Africa on the Black Death Map: Narratives from Genetics and History." *Afriques. Débats, Méthodes et Terrains d'histoire*, no. 09 (2018). <https://doi.org/10.4000/afriques.2125>.
- "Gross Domestic Product 2017." National Bureau of Statistics, United Republic of Tanzania, March 2018.
- Guthrie, Robert V. *Even the Rat Was White: A Historical View of Psychology*. New York, NY: Harper & Row, 1976.
- Gyasi, Yaa. *Transcendent Kingdom*. New York, NY: Alfred A. Knopf, 2020.
- Haddon, Alfred, ed. *Reports of the Cambridge Anthropological Expedition to the Torres Strait*. Cambridge, UK: Cambridge University Press, 1903.
- Hadidian, John. "Taking the 'Pest' Out of Pest Control: Humaneness and Wildlife Damage Management." *Attitudes Towards Animals Collection* 14 (2012): 7–11.
- Hadidian, John, Bernard Unti, and John Griffin. "Measuring Humaneness: Can It Be Done, and What Does It Mean If It Can?" *Proceedings of the Vertebrate Pest Conference* 26 (2014): 443–448. <https://doi.org/10.5070/V426110335>.
- Hagen, Joel Bartholemew. *An Entangled Bank: The Origins of Ecosystem Ecology*. New Brunswick, NJ: Rutgers University Press, 1992.
- Hallen, Barry. "Contemporary Anglophone African Philosophy: A Survey." In *A Companion to African Philosophy*, edited by Kwasi Wiredu, W. E. Abraham, Abiola Irele, and Ifeanyi Menkiti. Blackwell Companions to Philosophy 28. Malden, MA: Blackwell Pub, 2004.
- . "Robin Horton on Critical Philosophy and Traditional Thought." *Second Order* 6, no. 1 (1977): 81–92.
- Halverson, John. "Animal Categories and Terms of Abuse." *Man* 11, no. 4 (1976): 505–16. <https://doi.org/10.2307/2800435>.
- Haraway, Donna Jeanne. *The Companion Species Manifesto: Dogs, People, and Significant Otherness*. Chicago, IL: Prickly Paradigm Press, 2003.
- . *When Species Meet*. Minneapolis, MI: University of Minnesota Press, 2008.
- Harden, Jacalyn. "Native like Me: Confessions of an Asiatic Black Anthropologist." *Critique of Anthropology* 31, no. 2 (June 1, 2011): 139–55. <https://doi.org/10.1177/0308275X11399978>.
- Harris, W. V. "A Short Note on the Races of Honey Bees in Tanganyika Territory." *Bee World* 12, no. 8 (August 1, 1931): 90–91. <https://doi.org/10.1080/0005772X.1931.11093042>.
- Hecht, Gabrielle. *Being Nuclear: Africans and the Global Uranium Trade*. Cambridge, Mass: MIT Press, 2012.

- . “Interscalar Vehicles for an African Anthropocene: On Waste, Temporality, and Violence.” *Cultural Anthropology* 33, no. 1 (February 22, 2018): 109–41. <https://doi.org/10.14506/ca33.1.05>.
- Hegel, Georg Wilhelm Friedrich 1770-1831. *Lectures on the Philosophy of World History*. The Hegel Lecture Series. Cambridge, UK: Cambridge University Press, 1975.
- Heidegger, Martin. *The Fundamental Concepts of Metaphysics: World, Finitude, Solitude*. Studies in Continental Thought. Bloomington, IN: Indiana University Press, 1995.
- Heinz, Andreas, Daniel J. Müller, Sören Krach, Maurice Cabanis, and Ulrike P. Kluge. “The Uncanny Return of the Race Concept.” *Frontiers in Human Neuroscience* 8 (2014). <https://doi.org/10.3389/fnhum.2014.00836>.
- Helmreich, Stefan. *Alien Ocean: Anthropological Voyages in Microbial Seas*. Berkeley, CA: University of California Press, 2009.
- . “Homo Microbis: Species, Race, Sex, and the Human Microbiome.” In *Sounding the Limits of Life: Essays in the Anthropology of Biology and Beyond*, 62–72. Princeton, NJ: Princeton University Press, 2016.
- . “How Scientists Think; About ‘Natives’, for Example. a Problem of Taxonomy Among Biologists of Alien Species in Hawaii.” *Journal of the Royal Anthropological Institute* 11, no. 1 (March 1, 2005): 107–28. <https://doi.org/10.1111/j.1467-9655.2005.00228.x>.
- . “Nature/Culture/Seawater.” *American Anthropologist* 113, no. 1 (2011): 132–44. <https://doi.org/10.1111/j.1548-1433.2010.01311.x>.
- . *Sounding the Limits of Life: Essays in the Anthropology of Biology and Beyond*. Princeton, New Jersey: Princeton University Press, 2016.
- . “Torquing Things Out: Race and Classification in Geoffrey C. Bowker and Susan Leigh Star’s ‘Sorting Things Out: Classification and Its Consequences.’” *Science, Technology & Human Values* 28, no. 3 (2003): 435–40.
- Helmreich, Stefan, and Sophia Roosth. “Life Forms: A Keyword Entry.” *Representations* 112, no. 1 (2010): 27–53. <https://doi.org/10.1525/rep.2010.112.1.27>.
- Herle, Anita, and Sandra Rouse. *Cambridge and the Torres Strait: Centenary Essays on the 1898 Anthropological Expedition*. Cambridge; New York: Cambridge University Press, 1998.
- “Hitting the Jackpot; Buried Treasure.” *The Economist*, 2016.
- Hobsbawm, E. J., and T. O. Ranger. *The Invention of Tradition*. Cambridge, UK: Cambridge University Press, 1983.
- Hochschild, Adam. *King Leopold’s Ghost: A Story of Greed, Terror, and Heroism in Colonial Africa*. Boston, MA: Houghton Mifflin, 1998.
- Horton, Robin. “African Traditional Thought and Western Science. Part I. From Tradition to Science.” *Africa: Journal of the International African Institute* 37, no. 1 (1967): 50–71. <https://doi.org/10.2307/1157195>.
- . “African Traditional Thought and Western Science. Part II. The ‘Closed’ and ‘Open’ Predicaments.” *Africa: Journal of the International African Institute* 37, no. 2 (1967): 155–87. <https://doi.org/10.2307/1158253>.
- Howes, David. *Sensual Relations: Engaging the Senses in Culture and Social Theory*. Ann Arbor, MI: University of Michigan Press, 2003.
- Hubbard, C. Andresen. “Observations on the Life Histories and Behavior of Some Small Rodents from Tanzania.” *Zoologica Africana* 7, no. 1 (1972): 419–49.
- . “Observations on the Life Histories and Behaviour of Some Small Rodents from Tanzania.” *African Zoology* 7, no. 2 (1972): 419–49.

- Hulselmans, Jan. “Samenwerken Met Walter: Paus of Grote Roerganger?” In *Liber Amicorum: Prof. Dr. Walter Verheyen*. Antwerp, Belgium, 1998.
- Hume, David. “Of National Characters.” In *Essays: Moral, Political, and Literary*, edited by Eugene F. Miller, Rev. ed., 197–215. Indianapolis, IN: Liberty Fund, 1987.
- Hutchins, Edwin. *Cognition in the Wild*. Cambridge, MA.: MIT Press, 1995.
- Huxley, Julian. “Editor’s Introduction.” In *Animal Ecology*, by Charles S. Elton, ix–xvii. New York: Macmillan Co., 1927.
- Iiffe, John. *A Modern History of Tanganyika*. Cambridge, UK: Cambridge University Press, 1979.
- “Indigenous Protocol and Artificial Intelligence Position Paper.” Aboriginal Territories in Cyberspace, 2020. <https://spectrum.library.concordia.ca/id/eprint/986506>.
- Ingold, Tim. “The Animal in the Study of Humanity.” In *What Is an Animal?*, edited by Tim Ingold, 84–99. London, UK: Routledge, 1988.
- . *The Perception of the Environment: Essays on Livelihood, Dwelling & Skill*. London; New York: Routledge, 2000.
- International Campaign to Ban Landmines - Cluster Munition Coalition (ICBL-CMC). “Landmine Monitor 2020,” 2020.
- International Programme on Chemical Safety. “Warfarin: Health and Safety Guide.” Health and Safety Guide. Geneva: World Health Organization, 1995.
- Irani, Lilly. *Chasing Innovation: Making Entrepreneurial Citizens in Modern India*. Princeton, NJ: Princeton University Press, 2019.
- Jackson, Michael, ed. *Things as They Are: New Directions in Phenomenological Anthropology*. Bloomington, ID: Indiana University Press, 1996.
- Jackson, Zakiyyah Iman. “Animal: New Directions in the Theorization of Race and Posthumanism.” *Feminist Studies* 39, no. 3 (2013): 669–85.
- . *Becoming Human: Matter and Meaning in an Antiracist World*. Sexual Cultures. New York, NY: New York University Press, 2020.
- “Jinsi Panya Wanavyofundishwa Kugundua Mabomu SUA Morogoro | JamiiForums,” September 29, 2009. <https://web.archive.org/web/20210605142827/https://www.jamiiforums.com/threads/jinsi-panya-wanavyofundishwa-kugundua-mabomu-sua-morogoro-kitengo-cha-apopo.1262303/>.
- Johnson, Jennifer Lee. “Fishwork in Uganda: A Multispecies Ethnohistory about Fish, People, and Ideas about Fish and People.” PhD Thesis, University of Michigan, 2014.
- Jones, Graham M. *Trade of the Tricks: Inside the Magician’s Craft*. Berkeley, CA: University of California Press, 2011.
- Kahama, C. George, T. L. Maliyamkono, and Stuart J. Wells. *The Challenge for Tanzania’s Economy*. Melton, UK: James Currey, 1986.
- Kalumba, Kibujjo M. “Sage Philosophy: Its Methodology, Results, Significance, and Future.” In *A Companion to African Philosophy*, edited by Kwasi Wiredu, 274–81. Malden, MA: Blackwell Publishing Ltd., 2004.
- Karenga, Maulana. “In Honor of Aimé Césaire: Thinking Clearly and Dangerously.” *Black Camera* 22/23, no. 2/1 (2008): 133–35.
- Kay, Lily E. *The Molecular Vision of Life: Caltech, the Rockefeller Foundation, and the Rise of the New Biology*. New York: Oxford University Press, 1993.

- Keane, Webb. "Semiotics and the Social Analysis of Material Things." *Language & Communication*, Words and Beyond: Linguistic and Semiotic Studies of Sociocultural Order, 23, no. 3–4 (2003): 409–25. [https://doi.org/10.1016/S0271-5309\(03\)00010-7](https://doi.org/10.1016/S0271-5309(03)00010-7).
- Kelly, Ann H., and Javier Lezaun. "Urban Mosquitoes, Situational Publics, and the Pursuit of Interspecies Separation in Dar Es Salaam: Interspecies Separation in Dar Es Salaam." *American Ethnologist* 41, no. 2 (2014): 368–83. <https://doi.org/10.1111/amet.12081>.
- Kelly, George. *Clinical Psychology and Personality: The Selected Papers of George Kelly*. Edited by Brendan A. Maher. New York, NY: Wiley, 1969.
- Kilonzo, Bukheti S. "Plague Epidemiology and Control in Eastern and Southern Africa during the Period 1978 to 1997." *The Central African Journal of Medicine* 45, no. 3 (March 1, 1999): 70–76.
- Kilonzo, Bukheti S., and J. I. K. Mhina. "The First Outbreak of Human Plague in Lushoto District, North-East Tanzania." *Transactions of the Royal Society of Tropical Medicine and Hygiene* 76, no. 2 (1982).
- Kilonzo, Bukheti S., Julius Mhina, Christopher Sabuni, and Georgies Mgode. "The Role of Rodents and Small Carnivores in Plague Endemicity in Tanzania." *Belgian Journal of Zoology* 135, no. (supplement) (2005): 119–25.
- Kilonzo, Bukheti S., and R. S. Mtoi. "Entomological, Bacteriological and Serological Observations After the 1977 Plague Outbreak in Mbulu District, Tanzania." *East Africa Medical Journal* 60, no. 2 (1983): 91–7.
- Kimambo, Isaria N., Gregory H. Maddox, and Salvatory S. Nyanto. *A New History of Tanzania*. Dar es Salaam, Tanzania: Mkuki na Nyota Publishers, 2017.
- Kingdon, Jonathan. *Field Guide to African Mammals*. Second edition. London, UK: Bloomsbury, 2015.
- Kipnis, Andrew B. "Agency between Humanism and Posthumanism: Latour and His Opponents." *HAU: Journal of Ethnographic Theory* 5, no. 2 (2015): 43–58. <https://doi.org/10.14318/hau5.2.004>.
- Kirksey, Eben. *Emergent Ecologies*. Durham, NC: Duke University Press, 2015.
- . "Species: A Praxiographic Study." *Journal of the Royal Anthropological Institute* 21, no. 4 (2015): 758–80. <https://doi.org/10.1111/1467-9655.12286>.
- Kirksey, S. Eben, and Stefan Helmreich. "The Emergence of Multispecies Ethnography." *Cultural Anthropology* 25, no. 4 (2010): 545–76. <https://doi.org/10.1111/j.1548-1360.2010.01069.x>.
- Kohn, Eduardo. *How Forests Think: Toward an Anthropology Beyond the Human*. Berkeley, CA: University of California Press, 2013.
- Krechevsky, Isadore. "The Genesis of 'Hypothesis' in Rats." *University of California Publications in Psychology* 6 (1932): 45–64.
- Kuklick, Henrika. *The Savage within: The Social History of British Anthropology, 1885-1945*. Cambridge, UK: Cambridge University Press, 1991.
- Langwick, Stacey Ann. "A Politics of Habitability: Plants, Healing, and Sovereignty in a Toxic World." *Cultural Anthropology* 33, no. 3 (2018): 415–43. <https://doi.org/10.14506/ca33.3.06>.
- Latour, Bruno. *On the Modern Cult of the Factish Gods*. Science and Cultural Theory. Durham, NC: Duke University Press, 2010.
- . *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford, UK: Oxford University Press, 2005.

- Lee, Jia Hui. "Contact Zones." In *Gender: Animals*, edited by Juno Salazar Parreñas, 213–26. Macmillan Interdisciplinary Handbooks. Farmington Hills, MI: Macmillan Reference, 2017.
- Leirs, Herwig, Nils Chr. Stenseth, James D. Nichols, James E. Hines, Ron Verhagen, and Walter Verheyen. "Stochastic Seasonality and Nonlinear Density-Dependent Factors Regulate Population Size in an Africa." *Nature* 389, no. 6647 (1997): 176. <https://doi.org/10.1038/38271>.
- Lemov, Rebecca M. *World as Laboratory: Experiments with Mice, Mazes, and Me*. New York, NY: Hill and Wang, 2005.
- Leslie, David. "Hekima and Busara: Are They Different Concepts and How Do They Related to Utu?" *Swahili Forum* 17 (2010): 24–33.
- Levi-Strauss, Claude. *Totemism*. Boston: Beacon Press, 1963.
- Lévi-Strauss, Claude. *Wild Thought: A New Translation of "La Pensée Sauvage."* Translated by Jeffrey Mehlman and John Harold Leavitt. Chicago, IL: The University of Chicago Press, 2021.
- Lips, Julius. *The Origin of Things*. New York, NY: A. A. Wyn, Incorporated, 1947.
- Littin, K. E., D. J. Mellor, B. Warburton, and C. T. Eason. "Animal Welfare and Ethical Issues Relevant to the Humane Control of Vertebrate Pests." *New Zealand Veterinary Journal* 52, no. 1 (2004): 1–10. <https://doi.org/10.1080/00480169.2004.36384>.
- Livingston, Julie. *Improvising Medicine: An African Oncology Ward in an Emerging Cancer Epidemic*. Durham, NC: Duke University Press, 2012.
- Luciano, Dana, and Mel Y. Chen. "Has the Queer Ever Been Human?" *GLQ: A Journal of Lesbian and Gay Studies* 21, no. 2–3 (2015): 183–207. <https://doi.org/10.1215/10642684-2843215>.
- Luhrmann, Tanya M. "Toward an Anthropological Theory of Mind." Edited by Tanya M. Luhrmann. *Suomen Antropologi: Journal of the Finnish Anthropological Society* 36, no. 4 (2011): 5–69.
- Machang'u, Robert. "Walter Norbert Verheyen: Appreciations and Regards." In *Liber Amicorum: Prof. Dr. Walter Verheyen*. Antwerp, Belgium, 1998.
- Majnep, Ian Saem, and R. N. H. Bulmer. *Birds of My Kalam Country*. Auckland, New Zealand: Auckland University Press, 1977.
- Makundi, Rhodes, T.J. Mbise, and Bukheti Kilonzo. "Observations on the Role of Rodents in Crop Losses in Tanzania and Control Strategies." *Beitrage Zur Tropischen Landwirtschaft Und Veterinarmedizin (Journal of Tropical Agriculture and Veterinary Science)* 29 (1991): 465–74.
- Mamdani, Mahmood. *Citizen and Subject: Contemporary Africa and the Legacy of Late Colonialism*. Princeton Studies in Culture/Power/History. Princeton, NJ: Princeton University Press, 1996.
- . "The African University." *London Review of Books*, July 19, 2018. <https://www.lrb.co.uk/the-paper/v40/n14/mahmood-mamdani/the-african-university>.
- Marcus, George E. *Technoscientific Imaginaries : Conversations, Profiles, and Memoirs*. *Technoscientific Imaginaries : Conversations, Profiles, and Memoirs / George E. Marcus, Editor*. Chicago, IL: University of Chicago Press, 1995.
- Marx, Karl, and Friedrich Engels. *The Marx-Engels Reader*. Edited by Robert C. Tucker. 2d ed. New York: W. W. Norton & Company, 1978.

- Mauss, Marcel, and Henri Humbert. *A General Theory of Magic*. London, UK: Routledge and K. Paul, 1972.
- Mavhunga, Clapperton Chakanetsa. *The Mobile Workshop: The Tsetse Fly and African Knowledge Production*. Cambridge, MA : MIT Press, 2018.
- . “Vermin Beings On Pestiferous Animals and Human Game.” *Social Text* 29, no. 1 (2011): 151–76. <https://doi.org/10.1215/01642472-1210302>.
- , ed. *What Do Science, Technology, and Innovation Mean from Africa?* Cambridge, MA: The MIT Press, 2017.
- Mbembe, Achille. “Decolonizing the University: New Directions.” *Arts and Humanities in Higher Education* 15, no. 1 (2016): 29–45. <https://doi.org/10.1177/1474022215618513>.
- . “Necropolitics.” *Public Culture* 15, no. 1 (2003): 11–40. <https://doi.org/10.1215/08992363-15-1-11>.
- . *On the Postcolony*. Studies on the History of Society and Culture: 41. Berkeley : University of California Press, 2001.
- . *Out of the Dark Night: Essays on Decolonization*. New York, NY: Columbia University Press, 2021.
- McCorduck, Pamela. *Machines Who Think*. 2nd edition. Natick, MA: Routledge, 2004.
- McCulloch, Jock. *Colonial Psychiatry and “the African Mind.”* Cambridge, UK: Cambridge University Press, 1995.
- Mead, Rebecca. “The Curse of the Buried Treasure.” *The New Yorker*, November 9, 2020. <https://www.newyorker.com/magazine/2020/11/16/the-curse-of-the-buried-treasure>.
- Messeri, Lisa. *Placing Outer Space: An Earthly Ethnography of Other Worlds*, 2016.
- Ministry of Finance and Planning. “National Five Year Development Plan, 2016/17 - 2020/21.” Dodoma, Tanzania: Ministry of Finance and Planning, June 2016.
- Mitchell, Melanie. *Artificial Intelligence: A Guide for Thinking Humans*. Illustrated edition. Farrar, Straus and Giroux, 2019.
- Mitchell, Timothy. *Rule of Experts: Egypt, Techno-Politics, Modernity*. Berkeley, CA: University of California Press, 2002.
- Morgan, Lewis Henry. *The American Beaver and His Works*. Philadelphia, PA: J.B. Lippincott & Company, 1868.
- Moynihan, Daniel P. *The Negro Family: The Case for National Action*. Washington, DC: Office of Policy Planning and Research, U.S. Department of Labor, 1965.
- Msangi, A. S. “The Surveillance of Rodent Populations in East Africa in Relation Plague Endemicity.” *Dar Es Salaam University Science Journal* 1 (1975): 6–20.
- Mudimbe, V. Y. *The Invention of Africa : Gnosis, Philosophy, and the Order of Knowledge*. African Systems of Thought. Bloomington: Indiana University Press, 1988.
- Muiu, Mueni Ma, and Guy Martin. *A New Paradigm of the African State: Fundi Wa Afrika*. New York, NY: Palgrave Macmillan, 2009. <https://doi.org/10.1057/9780230618312>.
- Mullin, Molly H. “Mirrors and Windows: Sociocultural Studies of Human-Animal Relationships.” *Annual Review of Anthropology* 28, no. 1 (1999): 201–24. <https://doi.org/10.1146/annurev.anthro.28.1.201>.
- Mulungu, Loth, G. Lupenza, S.O.W.M. Reuben, and R.N. Misangu. “Evaluation of Botanical Products as Stored Grain Protectant Against Maize Weevil, *Sitophilus Zeamays* (L.) on Maize.” *Journal of Entomology* 4 (2007): 258–62. <https://doi.org/10.3923/je.2007.258.262>.

- Mura, Marika Noemi. “The Discontented Farmer: State-Society Relations and Food Insecurity in Rural Tanzania.” DPhil Thesis. Coventry, UK, 2015.
- Mutongi, Kenda. *Matatu: A History of Popular Transportation in Nairobi*. Chicago, IL: University of Chicago Press, 2017., 2017.
- Mwangi, Danson, Kareri. “Multi-Species Entanglement: Human-Baboon Interactions in Nthongoni, Eastern Kenya.” PhD Thesis, Durham University, 2019. <http://etheses.dur.ac.uk/13458/>.
- Mwangi, Evan. *The Postcolonial Animal: African Literature and Posthuman Ethics*. Ann Arbor, MI: University of Michigan Press, 2019.
- Myers, Natasha. *Rendering Life Molecular: Models, Modelers, and Excitable Matter*. Durham, NC: Duke University Press, 2015.
- Nadia Abu El-Haj. *Facts on the Ground: Archaeological Practice and Territorial Self-Fashioning in Israeli Society*. University of Chicago Press, 2002.
- Ndjio, Basile. “‘Magic Body’ and ‘Cursed Sex’: Chinese Sex Workers as ‘Bitch-Witches’ in Cameroon.” *African Affairs* 113, no. 452 (2014): 370–86. <https://doi.org/10.1093/afraf/adu042>.
- Ndlovu-Gatsheni, Sabelo J. “The Cognitive Empire, Politics of Knowledge and African Intellectual Productions: Reflections on Struggles for Epistemic Freedom and Resurgence of Decolonisation in the Twenty-First Century.” *Third World Quarterly*, July 8, 2020, 1–20. <https://doi.org/10.1080/01436597.2020.1775487>.
- Ndung’u, Njuguna, and Landry Signé. “The Fourth Industrial Revolution and Digitization Will Transform Africa into a Global Powerhouse.” *Brookings* (blog), 2020. <https://www.brookings.edu/research/the-fourth-industrial-revolution-and-digitization-will-transform-africa-into-a-global-powerhouse/>.
- Neimark, Jill. “Treasure Fever.” *Hakai Magazine*, January 14, 2020. <https://www.hakaimagazine.com/features/treasure-fever/>.
- Nelson, Alondra. *The Social Life of DNA: Race, Reparations, and Reconciliation After the Genome*. Boston, MA: Beacon Press, 2016.
- Neumann, Roderick P. *Imposing Wilderness: Struggles over Livelihood and Nature Preservation in Africa*. Berkeley, CA: University of California Press, 1998.
- Ngũgĩ wa Thiong’o. *A Grain of Wheat*. Oxford, UK: Heinemann Educational, 1986.
- . *Decolonising the Mind: The Politics of Language in African Literature*. London, UK: J. Currey, 1986.
- Nixon, Rob. *Slow Violence and the Environmentalism of the Poor*. Cambridge, MA: Harvard University Press, 2011.
- Nordling, Linda. “How Decolonization Could Reshape South African Science.” *News. Nature*, February 7, 2018. <https://doi.org/10.1038/d41586-018-01696-w>.
- Nussbaum, Martha, and Amartya Sen, eds. *The Quality of Life*. Oxford, UK: Oxford University Press, 1993.
- Nyamnjoh, Francis B. *#RhodesMustFall: Nibbling at Resilient Colonialism in South Africa*. Bamenda, Cameroon: Langaa Research & Publishing CIG, 2016.
- O’Keefe, John, and Lynn Nadel. “The Cognitive Map as a Hippocampus.” *Behavioral and Brain Sciences* 2, no. 4 (1979): 520–33. <https://doi.org/10.1017/S0140525X00064256>.
- Olayemi, Ayodeji, Violaine Nicolas, Jan Hulselmans, Alain D. Missoup, Elisabeth Fichet-Calvet, Drazo Amundala, Akaibe Dudu, et al. “Taxonomy of the African Giant Pouched Rats (Nesomyidae: Cricetomys): Molecular and Craniometric Evidence Support an

- Unexpected High Species Diversity.” *Zoological Journal of the Linnean Society* 165, no. 3 (2012): 700–719. <https://doi.org/10.1111/j.1096-3642.2012.00823.x>.
- Oruka, H. Odera, ed. *Sage Philosophy: Indigenous Thinkers and Modern Debate on African Philosophy*. Leiden, Netherlands: E. J. Brill, 1990.
- Ottinger, Gwen. “Changing Knowledge, Local Knowledge, and Knowledge Gaps: STS Insights into Procedural Justice.” *Science, Technology, & Human Values* 38, no. 2 (March 1, 2013): 250–70. <https://doi.org/10.1177/0162243912469669>.
- Owen, Taylor, and Ben Kiernan. “Bombs over Cambodia.” *The Walrus*, 2006.
- Paavola, Jouni. “Livelihoods, Vulnerability and Adaptation to Climate Change in Morogoro, Tanzania.” *Environmental Science & Policy* 11, no. 7 (2008): 642–54. <https://doi.org/10.1016/j.envsci.2008.06.002>.
- Padayachee, Vishnu, and Imraan Valodia. “Malaysian Investment in South Africa: Some Initial Observations.” *Economic and Political Weekly* 33, no. 38 (1998): 2435–37.
- Parreñas, Juno Salazar. *Decolonizing Extinction: The Work of Care in Orangutan Rehabilitation*. Durham, NC: Duke, 2018.
- Paxson, Heather. *The Life of Cheese: Crafting Food and Value in America*. Berkeley, CA: University of California Press, 2013.
- Peirce, Charles S. *Peirce on Signs: Writings on Semiotic*. Edited by James Hoopes. Chapel Hill, NC: University of North Carolina Press, 1991.
- Pels, Peter. *A Politics of Presence: Contacts between Missionaries and Waluguru in Late Colonial Tanganyika*. Amsterdam, Netherlands: Harwood Academic Publishers, 1999.
- Peterson, A. Townsend, Monica Papeş, Mary G. Reynolds, Neil D. Perry, Britta Hanson, Russell L. Regnery, Christina L. Hutson, Britta Muizniek, Inger K. Damon, and Darin S. Carroll. “Native-Range Ecology and Invasive Potential of *Cricetomys* in North America.” *Journal of Mammalogy* 87, no. 3 (2006): 427–32. <https://doi.org/10.1644/05-MAMM-A-133R3.1>.
- Peterson, Mark. *The City-State of Boston: The Rise and Fall of an Atlantic Power, 1630-1865*. Princeton, NJ: Princeton University Press, 2019.
- Phillips, Rog. “Rat in the Skull.” *If*, December 1958.
- Plumwood, Val. “Tasteless: Towards a Food-Based Approach to Death.” *Environmental Values* 17, no. 3 (2008): 323–30.
- Porter, Theodore M. *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*. Princeton, NJ: Princeton University Press, 1995.
- Posel, Deborah. “Race as Common Sense: Racial Classification in Twentieth-Century South Africa.” *African Studies Review* 44, no. 2 (2001): 87–113. <https://doi.org/10.2307/525576>.
- Pratt, Mary Louise. *Imperial Eyes: Travel Writing and Transculturation*. London, UK: Routledge, 1992.
- Price-Williams, Douglas R. *Explorations in Cross-Cultural Psychology*. Explorations in Cross-Cultural Psychology. Oxford, UK: Chandler & Sharp, 1975.
- Quayson, Ato. “Colonial Space-Making and Hybridizing History, or ‘Are the Indians of East Africa Africans or Indians?’” In *Diasporas: Concepts, Intersections, Identities*, edited by Professor Kim Knott and Doctor Sean McLoughlin, 243–48. London, UK: Zed Books Ltd., 2013.
- Raffles, Hugh. *In Amazonia: A Natural History*. Princeton, NJ: Princeton University Press, 2002.

- . “Intimate Knowledge.” *International Social Science Journal* 54, no. 173 (September 1, 2002): 325–35. <https://doi.org/10.1111/1468-2451.00385>.
- Rankin, Joy Lisi. “For 50 Years, Tech Companies Have Tried to Increase Diversity by Fixing People Instead of the System.” *Slate Magazine*, March 31, 2021. <https://slate.com/technology/2021/03/google-acm-digital-skills-training-diversity-history.html>.
- Redish, A. David. “Vicarious Trial and Error.” *Nature Reviews Neuroscience* 17, no. 3 (2016): 147–59. <https://doi.org/10.1038/nrn.2015.30>.
- Rheinberger, Hans-Jörg. “Recent Science and Its Exploration: The Case of Molecular Biology.” *Studies in History and Philosophy of Biol & Biomed Sci* 40 (2009): 6–12. <https://doi.org/10.1016/j.shpsc.2008.12.002>.
- Richards, Graham. “Getting a Result: The Expedition’s Psychological Research, 1898-1913.” In *Cambridge and the Torres Strait: Centenary Essays on the 1898 Anthropological Expedition*, edited by Anita Herle and Sandra Rouse, 136–57. Cambridge, UK: Cambridge University Press, 1998.
- Ritvo, Harriet. *Noble Cows and Hybrid Zebras: Essays on Animals and History*. Charlottesville, VA: University of Virginia Press, 2010.
- . “On the Animal Turn.” *Daedalus* 136, no. 4 (2007): 118–22.
- . *The Animal Estate: The English and Other Creatures in the Victorian Age*. Cambridge, MA: Harvard University Press, 1987.
- . *The Platypus and the Mermaid, and Other Figments of the Classifying Imagination*. Cambridge, MA: Harvard University Press, 1997.
- Robbins, Joel. “Beyond the Suffering Subject: Toward an Anthropology of the Good: Beyond the Suffering Subject.” *Journal of the Royal Anthropological Institute* 19, no. 3 (2013): 447–62. <https://doi.org/10.1111/1467-9655.12044>.
- Robbins, Joel, and Alan Rumsey. “Introduction: Cultural and Linguistic Anthropology and the Opacity of Other Minds.” *Anthropological Quarterly* 81, no. 2 (2008): 407–20. <https://doi.org/10.1353/anq.0.0005>.
- Roberts, J. I. “The Endemicity of Plague in East Africa.” *East African Medical Journal* 12 (1935): 200–219.
- Roberts, J. Isgaer. “Plague Conditions in an Urban Area of Kenya (Nairobi Township).” *The Journal of Hygiene* 36, no. 4 (October 1936): 467–84.
- S2A3 Biographical Database of Southern African Science. “Roberts, Mr Austin,” 2020. http://www.s2a3.org.za/bio/Biograph_final.php?serial=2357.
- Robson, David. “What Unconscious Bias Training Gets Wrong... and How to Fix It.” *The Guardian*, April 25, 2021. <http://www.theguardian.com/science/2021/apr/25/what-unconscious-bias-training-gets-wrong-and-how-to-fix-it>.
- Rodney, Walter. *How Europe Underdeveloped Africa*. Washington, DC: Howard University Press, 1974.
- Rose, Deborah Bird. “Double Death.” *The Multispecies Salon* (blog), November 17, 2014. <https://www.multispecies-salon.org/double-death/>.
- Rosevear, D. R. “The Rodents of West Africa.” London, UK: British Museum (Natural History), 1969.
- Rutherford, Alexandra. *Beyond the Box: B.F. Skinner’s Technology of Behavior from Laboratory to Life, 1950s-1970s*. Toronto, Canada: University of Toronto Press, 2009.

- Santos, Boaventura de Sousa. *Epistemologies of the South: Justice against Epistemicide*. London, UK: Routledge, 2016.
- Sayer, Karen. “The ‘Modern’ Management of Rats: British Agricultural Science in Farm and Field during the Twentieth Century.” *BJHS Themes*, June 2017, 1–29. <https://doi.org/10.1017/bjt.2017.7>.
- Schneider, Susan M., and Edward K. Morris. “A History of the Term Radical Behaviorism: From Watson to Skinner.” *The Behavior Analyst* 10, no. 1 (1987): 27–39. <https://doi.org/10.1007/BF03392404>.
- “Science, Technology and Innovation Strategy 2024 | African Union.” Accessed October 19, 2019. <https://au.int/en/documents/20191009/science-technology-and-innovation-strategy-2024>.
- Scott, James C. *Seeing like a State: How Certain Schemes to Improve the Human Condition Have Failed*. New Haven, CT: Yale University Press, 2008.
- Semel, Beth. “Speech, Signal, Symptom: Machine Listening and the Remaking of Psychiatric Assessment.” PhD Thesis, Massachusetts Institute of Technology, 2019.
- Seremetakis, C. Nadia. *The Senses Still: Perception and Memory as Material Culture in Modernity*. Chicago, IL: University of Chicago Press, 1996.
- Sheridan, Derek. “‘If You Greet Them, They Ignore You’: Chinese Migrants, (Refused) Greetings, and the Inter-Personal Ethics of Global Inequality in Tanzania.” *Anthropological Quarterly* 91, no. 1 (2018): 237–65. <https://doi.org/10.1353/anq.2018.0007>.
- . “Weak Passports and Bad Behavior: Chinese Migrants and the Moral Politics of Petty Corruption in Tanzania.” *American Ethnologist* 46, no. 2 (2019): 137–49. <https://doi.org/10.1111/amet.12757>.
- Silverstein, Michael. “‘Cultural’ Concepts and the Language-Culture Nexus.” *Current Anthropology* 45, no. 5 (2004): 621–52. <https://doi.org/10.1086/423971>.
- Singleton, Grant Robert, Lyn A. Hinds, Herwig Leirs, Zhibin Zhang, and Australian Centre for International Agricultural Research, eds. *Ecologically-Based Management of Rodent Pests*. Canberra, Australia: Australian Centre for International Agricultural Research, 1999.
- “Six Tanzanian Schoolchildren Killed in ‘grenade’ Explosion.” *BBC News*, November 8, 2017. <https://www.bbc.com/news/world-africa-41914765>.
- Slaney, Frances M. “Otherness and the Underground: Buried Treasure in the Sierra Tarahumara.” In *Anthropology and Alterity: Responding to the Other*, edited by Bernhard Leistle, 207–29. New York, NY: Routledge, 2019.
- Smith, James H. “Witchcraft in Africa.” In *A Companion to the Anthropology of Africa*, edited by Roy Richard Grinker, Stephen C. Lubkemann, Christopher B. Steiner, and Euclides Gonçalves, First published., 63–79. Hoboken, NJ: Wiley, 2019.
- Sneath, David, Martin Holbraad, and Morten Axel Pedersen. “Technologies of the Imagination: An Introduction.” *Ethnos: Journal of Anthropology* 74, no. 1 (2009): 5–30. <https://doi.org/10.1080/00141840902751147>.
- Spackman, Christy, and Jacob Lahne. “Sensory Labor: Considering the Work of Taste in the Food System.” *Food, Culture & Society* 22, no. 2 (March 15, 2019): 142–51. <https://doi.org/10.1080/15528014.2019.1573039>.
- Spiers, Hugo J. “The Hippocampal Cognitive Map: One Space or Many?” *Trends in Cognitive Sciences* 24, no. 3 (2020): 168–70. <https://doi.org/10.1016/j.tics.2019.12.013>.

- Stambach, Amy. "The Rationality Debate Revisited." *Reviews in Anthropology* 28, no. 4 (2000): 341.
- Stankiewicz, Damien. "Against Imagination: On the Ambiguities of a Composite Concept." *American Anthropologist*, 2016. <https://doi.org/10.1111/aman.12696>.
- Steinhart, E. I. "Hunters, Poachers and Gamekeepers: Towards a Social History of Hunting in Colonial Kenya." *The Journal of African History* 30, no. 2 (1989): 247–64.
- Stengers, Isabelle. "The Cosmopolitical Proposal." In *Making Things Public: Atmospheres of Democracy*, edited by Bruno Latour and Peter Weibel, 994–1003. Cambridge, MA: The MIT Press; ZKM, 2005.
- Stocking, George W. *Race, Culture, and Evolution: Essays in the History of Anthropology*. Reprinted. Chicago, IL: University of Chicago Press, 1982.
- Stoler, Ann Laura. *Along the Archival Grain: Epistemic Anxieties and Colonial Common Sense*. Princeton, NJ: Princeton University Press, 2010.
- . *Carnal Knowledge and Imperial Power: Race and the Intimate in Colonial Rule*. Berkeley, CA: University of California Press, 2002.
- , ed. *Imperial Debris: On Ruins and Ruination*. Durham, NC: Duke University Press, 2013.
- . "Imperial Debris: Reflections on Ruins and Ruination." *Cultural Anthropology* 23, no. 2 (2008): 191–219. <https://doi.org/10.1111/j.1548-1360.2008.00007.x>.
- Sullivan, Robert. *Rats: Observations on the History & Habitat of the City's Most Unwanted Inhabitants*. New York, NY: Bloomsbury USA, 2005.
- Suzuki, Yuka. *The Nature of Whiteness: Race, Animals, and Nation in Zimbabwe*. Culture, Place, and Nature. Seattle: University of Washington Press, 2017.
- Tallbear, Kim. "Why Interspecies Thinking Needs Indigenous Standpoints, Theorizing the Contemporary." Cultural Anthropology Website, April 24, 2011. <http://www.culanth.org/fieldsights/260-why-interspecies-thinking-needs-indigenous-standpoints>.
- Tamarkin, Noah. *Genetic Afterlives: Black Jewish Indigeneity in South Africa*. Theory in Forms. Durham, NC: Duke University Press, 2020.
- Tambiah, Stanley J. "Animals Are Good to Think and Good to Prohibit." *Ethnology* 8, no. 4 (1969): 423–59. <https://doi.org/10.2307/3772910>.
- Taylor, Charles. *Modern Social Imaginaries*. Durham, NC: Duke University Press, 2004.
- "Theorizing Queer Inhumanisms." *GLQ: A Journal of Lesbian & Gay Studies* 21, no. 2/3 (2015): 209–48. <https://doi.org/10.1215/10642684-2843323>.
- Thomas, Oldfield. "On Mammals from Northern Angola Collected by Dr. W. J. Ansorge." *The Annals and Magazine of Natural History* 7, no. 78 (1904).
- Thompson, Rebekah Grace. "Pigs, People, Pathogens: Health and Multispecies Relations in Central Uganda." PhD Thesis, University of Edinburgh, 2019. <https://era.ed.ac.uk/handle/1842/36101>.
- Tilley, Helen. *Africa as a Living Laboratory: Empire, Development, and the Problem of Scientific Knowledge, 1870-1950*. Chicago, IL: University of Chicago Press, 2011.
- . "Ecologies of Complexity: Tropical Environments, African Trypanosomiasis, and the Science of Disease Control in British Colonial Africa, 1900-1940." *Osiris* 19 (2004): 21–38.

- Tolman, Edward C. "Cognitive Maps in Rats and Men." *The Psychological Review* 55, no. 4 (1948): 189–208.
- . *Purposive Behavior in Animals and Men*. New York: Century, 1932.
- Tousignant, Noémi. *Edges of Exposure: Toxicology and the Problem of Capacity in Postcolonial Senegal*. Durham, NC: Duke University Press, 2018.
- "Train, v.1." In *Oxford English Dictionary*. Oxford University Press. Accessed June 8, 2021. <http://www.oed.com/view/Entry/204410>.
- Trouillot, Michel-Rolph. *Global Transformations: Anthropology and the Modern World*. New York, NY: Palgrave Macmillan, 2003.
- . *Silencing the Past: Power and the Production of History*. Boston, MA: Beacon Press, 1995.
- Tsing, Anna Lowenhaupt. *Friction: An Ethnography of Global Connection*. Princeton, NJ: Princeton University Press, 2005.
- TUKI (Taasisi ya Uchunguzi wa Kiswahili). *Kamusi Ya Kiswahili Sanifu*. Dar Es Salaam, Tanzania: Oxford University Press, 1981.
- Twagira, Laura Ann. "Introduction: Africanizing the History of Technology." *Technology and Culture* 61, no. 2S (2020): S1–19. <https://doi.org/10.1353/tech.2020.0068>.
- Tylor, Sir Edward Burnett. *Anthropology: An Introduction to the Study of Man and Civilization*. London, UK: Macmillan, 1881.
- Verheyen, Walter, Jan L. J. Hulselmans, Theo Dierckx, Loth Mulungu, Herwig Leirs, Marco Corti, and Erik Verheyen. "The Characterization of the Kilimanjaro *Lophuromys Aquilus* True 1892 Population and The Description of Five New *Lophuromys* Species (Rodentia, Muridae)." *Bulletin van Het Koninklijk Belgisch Instituut Voor Natuurwetenschappen--Biologie* 77 (2007): 23–75.
- Vertesi, Janet, and David Ribes, eds. *DigitalSTS: A Field Guide for Science & Technology Studies*. Princeton, New Jersey: Princeton University Press, 2019.
- Visweswaran, Kamala. "Race and the Culture of Anthropology." *American Anthropologist* 100, no. 1 (1998): 70–83. <https://doi.org/10.1525/aa.1998.100.1.70>.
- Vitalis, Evagrey. "Gemstone Billionaire Saniniu Laizer Fulfills Promise of Building School." *The Citizen*. January 14, 2021. <https://www.thecitizen.co.tz/tanzania/news/gemstone-billionaire-saniniu-laizer-fulfills-promise-of-building-school--3257430>.
- Wallace, A. F. "Mazeway Resynthesis; a Biocultural Theory of Religious Inspiration." *Transactions of the New York Academy of Sciences* 18, no. 7 (1956): 626–38. <https://doi.org/10.1111/j.2164-0947.1956.tb00491.x>.
- Wallace, Anthony F. C. "Mazeway Disintegration: The Individual's Perception of Socio-Cultural Disorganization." *Human Organization* 16, no. 2 (1957): 23–27. <https://doi.org/10.17730/humo.16.2.pt214314t767kr3w>.
- . *Revitalizations and Mazeways: Essays on Culture Change*. Edited by Robert Steven Grumet. Lincoln, NE: University of Nebraska Press, 2003.
- Walley, Christine J. "Our Ancestors Used to Bury Their 'Development' in the Ground: Modernity and the Meanings of Development within a Tanzanian Marine Park." *Anthropological Quarterly* 76, no. 1 (2003): 33–54.
- Walley, Christine J. *Rough Waters: Nature and Development in an East African Marine Park*. Princeton, NJ: Princeton University Press, 2004.
- Walsh, Andrew. "In the Wake of Things: Speculating in and about Sapphires in Northern Madagascar." *American Anthropologist* 106, no. 2 (2004): 225–37.

- Wanderer, Emily Mannix. "Biologies of Betrayal: Judas Goats and Sacrificial Mice on the Margins of Mexico." *BioSocieties* 10, no. 1 (2015): 1–23. <https://doi.org/10.1057/biosoc.2014.13>.
- Warner, Judith. "Psychiatry Confronts Its Racist Past, and Tries to Make Amends." *The New York Times*, April 30, 2021. <https://www.nytimes.com/2021/04/30/health/psychiatry-racism-black-americans.html>.
- Weheliye, Alexander G. *Habeas Viscus: Racializing Assemblages, Biopolitics, and Black Feminist Theories of the Human*. Durham, NC: Duke University Press, 2014.
- Weiss, Brad. "Thug Realism: Inhabiting Fantasy in Urban Tanzania." *Cultural Anthropology* 17, no. 1 (2002): 93–124. <https://doi.org/10.1525/can.2002.17.1.93>.
- Wenzel, Jennifer. "Reading Fanon Reading Nature." In *What Postcolonial Theory Doesn't Say*, edited by Anna Bernard, Ziad Elmarsafy, and Stuart Murray, 185–201. New York, NY: Routledge, 2016.
- West, Harry G. *Kupilikula: Governance and the Invisible Realm in Mozambique*. Chicago, IL: University of Chicago Press, 2005.
- Wheeler, Quentin, and Rudolf Meier. *Species Concepts and Phylogenetic Theory: A Debate*. New York, NY: Columbia University Press, 2000.
- White, Hylton. "Beastly Whiteness: Animal Kinds and the Social Imagination in South Africa." *Anthropology Southern Africa* 34, no. 3–4 (2011): 104–13. <https://doi.org/10.1080/23323256.2011.11500014>.
- White, Luise. "Poisoned Food, Poisoned Uniforms, and Anthrax: Or, How Guerillas Die in War." *Osiris* 19, no. 1 (2004): 220–33. <https://doi.org/10.1086/649403>.
- Wiredu, J. E. "How Not to Compare African Traditional Thought with Western Thought." *Transition*, no. 75/76 (1997): 320–27. <https://doi.org/10.2307/2935425>.
- Wiredu, Kwasi. *Cultural Universals and Particulars: An African Perspective*. Bloomington, IN: Indiana University Press, 1996.
- . "Knowledge, Truth and Fallibility." In *The Concept of Knowledge*, edited by I. Kucuradi and R. S. Cohen. Boston, MA: Kluwer Academic, 1995.
- Wittenberg, Colm. "Poison in the Rhodesian Bush War." Master's Thesis, Leiden University, 2019.
- Wolfe, Cary. *What Is Posthumanism?* Minneapolis, MN: University of Minnesota Press, 2010.
- Wynter, Sylvia. "Unsettling the Coloniality of Being/Power/Truth/Freedom: Towards the Human, After Man, Its Overrepresentation--An Argument." *CR: The New Centennial Review* 3, no. 3 (2003): 257–337. <https://doi.org/10.1353/ncr.2004.0015>.
- Yarrell, William. "January 14, 1840." *Proceedings of the Zoological Society of London* 8 (1840): 1–3.
- Yarrow, Thomas, Matei Candea, Catherine Trundle, and Jo Cook, eds. *Detachment: Essays on the Limits of Relational Thinking*. Manchester, UK: Manchester University Press, 2015.
- Young, Iris Marion. *Justice and the Politics of Difference*. Princeton, NJ: Princeton University Press, 1990.
- Yusoff, Kathryn. *A Billion Black Anthropocenes or None*. Minneapolis, MN: University of Minnesota Press, 2018.
- Zani, Leah. *Bomb Children: Life in the Former Battlefields of Laos*. Durham, NC: Duke University Press, 2019.
- Zinsser, Hans. *Rats, Lice, and History*. New Brunswick, NJ: Transaction Publishers, 2008.

- Ziwa, Michael H., Mecky I. Matee, Bernard M. Hang'ombe, Eligius F. Lyamuya, and Bukheti S. Kilonzo. "Plague in Tanzania: An Overview." *Tanzania Journal of Health Research* 15, no. 4 (2013): 252–58. <https://doi.org/10.4314/thrb.v15i4.7>.
- Ziwa, Michael H., Mecky I. Matee, Bukheti S. Kilonzo, and Bernard M. Hang'ombe. "Evidence of *Yersinia Pestis* DNA in Rodents in Plague Outbreak Foci in Mbulu and Karatu Districts, Northern Tanzania." *Tanzania Journal of Health Research* 15, no. 3 (2013). <https://doi.org/10.4314/thrb.v15i3.1>.