

# Global Knowledge on the Move

## Itineraries, Amerindian Narratives, and Deep Histories of Science

*By Neil Safier\**

### ABSTRACT

Since Bruno Latour's discussion of a Sakhalin island map used by La Pérouse as part of a global network of "immutable mobiles," the commensurability of European and non-European knowledge has become an important issue for historians of science. But recent studies have challenged these dichotomous categories as reductive and inadequate for understanding the fluid nature of identities, their relational origins, and their historically constituted character. Itineraries of knowledge transfer, traced in the wake of objects and individuals, offer a powerful heuristic alternative, bypassing artificial epistemological divides and avoiding the limited scale of national or monolingual frames. Approaches that place undue emphasis either on the omnipotence of the imperial center or the centrality of the colonial periphery see only half the picture. Instead, practices of knowledge collection, codification, elaboration, and dissemination—in European, indigenous, and mixed or hybrid contexts—can be better understood by following their moveable parts, with a keen sensitivity toward non-normative epistemologies and more profound temporal frameworks.

**D**URING A CONTEMPLATIVE MOMENT in the late eighteenth century, along the shores of a sizable tributary of the Amazon River, a Brazilian-born naturalist named Alexandre Rodrigues Ferreira (1756–1815) paused to consider how native peoples of that region conceptualized geographical matters. Along with a gardener and two sketch artists, Ferreira had amassed an encyclopedic collection of botanical, faunal, and ethnological specimens during his decade-long journey (1783–1792) through the South American

\* Department of History, University of British Columbia, 1873 East Mall, Room 1297, Vancouver, British Columbia V6T 1Z1, Canada.

I would like to thank Michael Dettelbach, Florence Hsia, and Neil Whitehead for early conversations on this topic; the Department of History's Science and Technology Studies Cluster at the University of British Columbia for comments on an early draft of this essay; Simon Schaffer, Jim Secord, and the participants at the May 2009 CRASSH seminar in Cambridge for their queries and suggestions; Bernie Lightman for his editorial observations; and Sujit Sivasundaram for organizing both the Cambridge meeting and this Focus section and for having graciously invited me to participate.

*Isis*, 2010, 101:133–145

©2010 by The History of Science Society. All rights reserved.

0021-1753/2010/10001-0008\$10.00

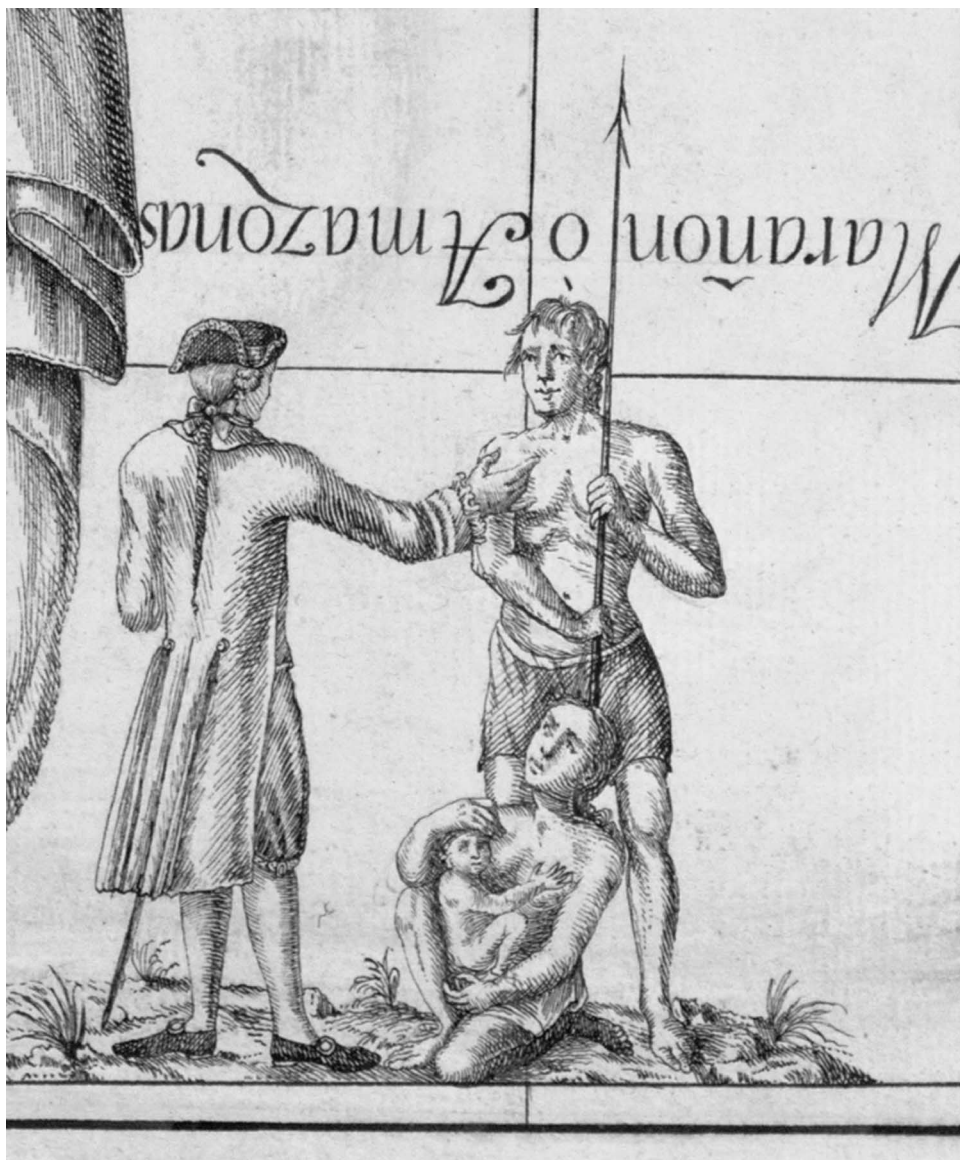
tropics. Like most travelers in the tropical forest, he depended largely on indigenous local guides and native informant-intermediaries to help him navigate the ever-changing conditions of Amazonia's fluvial labyrinth. So it is especially striking that in order to understand native geographic practices he couched his reflections in decidedly European terms: "What," he asked, "might a European raised like one of these *tapuia* do if asked [to describe] a river, its direction, its tributaries, [and] the number of villages that sit upon it, being ignorant of the existence of geometry, geography, hydrography, etc.?" The question he posed that day about native skills seems to have been more about epistemological commensurability than about indigenous prowess. It appeared to compare abilities acquired through the social and cultural conditions that reigned in the tropical lowlands of South America with those skills for comprehending science that would have been innately available to a European. For Ferreira, the geographical sciences he cited were European domains of understanding, intellectual guideposts that those who lived in these parts—such as the *tapuia* (a generic European term for certain indigenous populations of Brazil)—would necessarily have lived without. Ferreira never answered his own rhetorical question. Instead, he described an object created by an Amerindian who marked out a river—along with its tributaries and population centers—using a series of cords and knots. This set of twists and turns made with pieces of rope or string did not constitute what Ferreira considered to be a map. Whatever practical or experiential knowledge it reflected, and however useful or accurate it may have been, the material representation of the river did not rise to the level of science in Ferreira's eyes, at least not a science that he could easily recognize or describe.<sup>1</sup> (See Figure 1.)

Despite its extensive duration and the extraordinary harvest of plants, insects, birds, reptiles, native masks, and human skeletons it acquired, the Ferreira expedition to the Brazilian Amazon was but one in a number of officially sponsored Portuguese exploratory missions undertaken in the second half of the eighteenth century. As such, it should be considered in the global context of an aggressive Portuguese scientific expansion to other fluvial sites—including the Cunene River in Angola and the Sena and Sofala Rivers in Mozambique—as well as Atlantic island environments like Cape Verde and coastal settings in Asia, namely Goa. Ferreira's expedition to Amazonia was also inextricably linked to South American boundary disputes, a direct legacy of the 1494 Treaty of Tordesillas divvying up the world between the two Iberian powers. For these reasons, Ferreira felt that acquiring geographical information was just as important as collecting the leaves, barks, and fruits that made up the native pharmacopeia. But local populations were never far from view.<sup>2</sup>

Since the sixteenth century, imperial powers that were engaged in the conquest and

<sup>1</sup> Alexandre Rodrigues Ferreira, "Observações gerais e particulares sobre a classe dos mamíferos observados nos territórios dos três rios, das Amazonas, Negro, e da Madeira," in *Viagem filosófica pelas capitânias do Grão Pará, Rio Negro, Mato Grosso e Cuiabá: Memórias: Zoologia e botânica* (Rio de Janeiro: Conselho Federal de Cultura, 1972), pp. 67–204, on pp. 93–94 (here and throughout this essay, all translations are my own unless otherwise indicated). On Alexandre Rodrigues Ferreira, Portuguese colonial science, and Amazonian colonization see Ronald Raminelli, *Viagens ultramarinas: Monarcas, vassallos, e governo a distância* (São Paulo: Alameda, 2008); and Ângela Domingues, *Quando os índios eram vassallos* (Lisbon: CNCDP, 2000). On the subject of Ferreira's interaction with indigenous geographical concepts see Neil Safier, "The Confines of the Colony," in *The Imperial Map: Cartography and the Mastery of Empire*, ed. James Akerman (Chicago: Univ. Chicago Press, 2009), pp. 133–183.

<sup>2</sup> On these Portuguese expeditions see Raminelli, *Viagens ultramarinas*; and William J. Simon, *Scientific Expeditions in the Portuguese Overseas Territories (1783–1808) and the Role of Lisbon in the Intellectual-Scientific Community of the Late Eighteenth Century* (Lisbon: IICT, 1983).



**Figure 1.** With his back to the viewer, a fully clothed European man engages in conversation with an Amerindian family. The exchange of geographical knowledge about the Amazon River and its tributaries often took place in ephemeral moments like the one depicted here even though Europeans frequently denied that Amerindian knowledge was commensurable with European scientific norms. Francisco Requena, “*Mapa de una parte del Rio Yapura: Comprehendida desde su entrada en el Rio Marañon por su boca mas occidental hasta el pueblo de San Antonio de Maripi,*” detail. Courtesy of the Geography and Map Division, Library of Congress, Washington, D.C.

colonization of the Americas recognized that coming to terms with the customs, beliefs, and techniques of local populations—including their own self-referential systems of knowledge—was an important component of the overall project. As one Spanish cosmographer explained in instructions he gave to New World travelers, “You should seek

out information regarding [indigenous] practices with regards to science, or what they understand [*sienten*] about the creation of the world and the movement and composition of the heavens.” And yet, the broader question of the epistemological commensurability between European and indigenous systems of knowledge has become a fundamental issue for historians of science only in the last few decades. It was Bruno Latour’s classic discussion of a local Sakhalin island map used by the French naval officer La Pérouse as part of a global network of “immutable mobiles” that encouraged scholars to correlate knowledge produced in the metropole with similar processes that were taking place within or beyond the colonial fold. Increasingly, historians of science have come to recognize that knowledge acquired by European expeditions overseas included at least some portion of knowledge derived from indigenous sources and that in many cases imperial reconnaissance depended entirely on these contacts with local cultures. Historians and anthropologists have redefined scientific knowledge collected at the so-called “periphery” and processed at the imperial “center” in myriad ways, ranging from knowledge that is hybrid or “mestizo” in character to a kind of “middle ground” knowledge.<sup>3</sup> The manner by which indigenous peoples of the Americas and elsewhere actually contributed to processes of collection, codification, and dissemination of inquiries into the natural world has in turn become a core issue for those attempting to write more integrated and global histories of science.

Such integrated histories—which view both European and non-European forms of knowledge as legitimate systems of understanding—must by necessity take into account the paucity of sources that shed reliable light on indigenous methods for interrogating and responding to the natural world.<sup>4</sup> But how? Expanding the archive and sites through which traditional narratives of encounter and exchange can be recounted is one option.<sup>5</sup> Another is expanding the scale within which these historical processes are examined, moving away from an overly constrained emphasis on laboratories and academies—the *sine qua non* of the constructivist approach—to consider knowledge that is by definition mobile or itinerant.<sup>6</sup> The call for historians of science to “concentrate on the multidimensional . . . local

<sup>3</sup> Alonso de Santa Cruz, *Obra cosmográfica*, Vol. 1, pp. 70–71, cited in María P. Portuondo, *Secret Science: Spanish Cosmography and the New World* (Chicago: Univ. Chicago Press, 2009), p. 112; and Bruno Latour, *Science in Action* (1987; Cambridge, Mass.: Harvard Univ. Press, 2003), pp. 215–219. For redefinitions of the scientific knowledge collected at the “periphery” and processed at the “center” see Serge Gruzinski, *La pensée métisse* (Paris: Fayard, 1999); and Richard White, *The Middle Ground: Indians, Empires, and Republics in the Great Lakes Region, 1650–1815* (Cambridge: Cambridge Univ. Press, 1991).

<sup>4</sup> See Sujit Sivasundaram’s contribution on this topic to this Focus section: “Sciences and the Global: On Methods, Questions, and Theory.”

<sup>5</sup> In her study on glaciers, Julie Cruikshank fluidly merged textual narratives of exploration with oral accounts and songs from the Tlingit and Athapaskan tradition; see Cruikshank, *Do Glaciers Listen? Local Knowledge, Colonial Encounters, and Social Imagination* (Vancouver: UBC Press, 2005), p. 258. Other scholars have rejected such practices as “upstreaming,” using contemporary oral accounts to read present practice into past behaviors. See White, *Middle Ground* (cit. n. 3), p. xiv. See also Daniel Richter, *Facing East from Indian Country* (Cambridge, Mass.: Harvard Univ. Press, 2001).

<sup>6</sup> On the portability and circulation of knowledge in the Atlantic context see James Delbourgo and Nicholas Dew, eds., *Science and Empire in the Atlantic World* (New York: Routledge, 2008); Antonio Barrera-Osorio, *Experiencing Nature: The Spanish American Empire and the Early Scientific Revolution* (Austin: Univ. Texas Press, 2006); Delbourgo, *A Most Amazing Scene of Wonders: Electricity and Enlightenment in Early America* (Cambridge, Mass.: Harvard Univ. Press, 2006); Neil Safier, *Measuring the New World: Enlightenment Science and South America* (Chicago: Univ. Chicago Press, 2008); and Londa Schiebinger, *Plants and Empire: Colonial Bioprospecting in the Atlantic World* (Cambridge, Mass.: Harvard Univ. Press, 2004). For Asia and the Indian Ocean region see Fa-Ti Fan, *British Naturalists in Qing China: Science, Empire, and Cultural Encounter* (Cambridge, Mass.: Harvard Univ. Press, 2004); Carla Nappi, *The Monkey and the Inkpot: Natural History and Its Transformations in Early Modern China* (Cambridge, Mass.: Harvard Univ. Press, 2009); and Kapil Raj,

contexts of scientific endeavor” has to some degree been answered, removing the so-called peripheries from the strict purview of colonial historians and displacing the imperial centers from their privileged position at the forefront of the history of science’s grand narrative.<sup>7</sup>

But many challenges remain. Narratives of exploration and encounter—like those that Ferreira and La Pérouse provided their contemporaries—often yielded mixed results when used as legitimate records of indigenous behaviors. Narrative conventions, special interests, and cultural prejudices regularly clouded the eyes of proto-ethnographers. What is more, the populations early modern Europeans described and the terms they used were often fabrications based on preexisting European categories, the very term “Indian” being the most obvious example. These terms then became fixed and were appropriated by the very people to whom they were initially applied. As two Brazilian anthropologists have noted, “artificial and generic as they were at the time of their creation, these labels have progressively come to be ‘inhabited’ by flesh-and-blood people.”<sup>8</sup>

Native populations were flesh-and-blood people in the past as well, and they had their own notions of history that, like their cultures, developed and changed over time. Therefore, they should in no way be relegated to a timeless past, their histories springing to life only when European actors happened to provide descriptions of them in images and texts.<sup>9</sup> In this essay, I suggest three possible frames that may help to create more seamless histories of science that include indigenous actors and categories: an emphasis on itineraries and connected histories; attempts to redefine traditional indigenous knowledge on its own terms; and, with specific reference to Amazonia, the use of deep history to rethink more remote strands of science and its histories in a global frame. These approaches and their respective disciplinary perspectives are offered here as a preliminary route map toward reconstructing the histories of non-European knowledge systems: a scientific history of South American subalterns whose stories have for too long been hidden from our view.

### BROKERS, ITINERARIES, AND CONNECTED HISTORIES

Among attempts to integrate non-Western perspectives into the broader Western narrative of the history of science, a comparative approach has been the most common. Seeking to examine the similarities and parallels between scientific developments along national lines, specialists have often reached across the aisle to vastly different cultural traditions.

---

*Relocating Modern Science: Circulation and the Construction of Knowledge in South Asia and Europe, 1650–1900* (New York: Palgrave Macmillan, 2007). In the African context see Mary S. Morgan, “‘On a Mission’ with Mutable Mobiles” (Working Papers on the Nature of Evidence: How Well Do ‘Facts’ Travel? No. 34/08), London School of Economics, Aug. 2008.

<sup>7</sup> David Wade Chambers and Richard Gillespie, “Locality in the History of Science: Colonial Science, Technoscience, and Indigenous Knowledge,” in *Nature and Empire: Science and the Colonial Enterprise*, ed. Roy MacLeod, *Osiris*, 2nd Ser., 2000, 15:221–240, on p. 240.

<sup>8</sup> Manuela Carneiro da Cunha and Mauro W. B. de Almeida, “Indigenous People, Traditional People, and Conservation in the Amazon,” *Daedalus*, 2000, 129:315–338, on p. 316.

<sup>9</sup> Marshall Sahlins, *Islands of History* (Chicago: Univ. Chicago Press, 1987); Stuart Schwartz and Frank Salomon, “New Peoples and New Kinds of People: Adaptations, Adjustments, and Ethnogenesis in South American Indigenous Societies (Colonial Era),” in *Cambridge History of the Native Peoples of the Americas*, 2 vols., ed. Schwartz and Salomon (Cambridge: Cambridge Univ. Press, 2000), Vol. 2, pp. 443–501; Peter Nabokov, *A Forest of Time: American Indian Ways of Knowing* (Cambridge: Cambridge Univ. Press, 2002); and Carlos Fausto and Michael Heckenberger, “Indigenous History and the History of the ‘Indians,’” in *Time and Memory in Indigenous Amazonia: Anthropological Perspectives*, ed. Fausto and Heckenberger (Gainesville: Univ. Press Florida, 2007), pp. 1–43.

The world's preeminent scientific civilizations—including India, China, and the Islamic world—are frequently included in broad, global surveys of science and its history. But rather than placing these civilizations at the center of their own respective local (or indeed global) histories, such surveys often deal with them strictly in relation to contemporaneous developments in Western cultures. One scholar discussed the “fructifying effect” that Arabic-Islamic civilization had on the course of Western intellectual development, arguing that the “success of modern science in the West” was due to “neutral spaces” that were “free from the incursions of political and religious censors.”<sup>10</sup> This emphasis on “successful” civilizations (read: the West) tends to displace those groups or individuals that have made heterogeneous contributions to science or that conceptualize the natural world in less traditional ways.

New approaches emphasizing the mobile and interconnected nature of knowledge have questioned the definition of science as an institutionally driven and socially bound activity. Against the “intercivilizational” approach, this new orientation emphasizes the connections between individuals and groups with varying degrees of political autonomy, rather than between large and vague “civilizations.” Looking through the prism of shape changers, beguilers, and shifty personalities has highlighted the contingent processes inherent in scientific practices on both the European and the non-European ends of the table, providing a stimulating window through which to understand histories of science in a globalized and interconnected world.<sup>11</sup>

Other recent volumes offer encouraging points of departure for theorizing the relationship of go-betweens to the broader history of scientific practices.<sup>12</sup> So does Sanjay Subrahmanyam's paradigm of “connected histories”—in contradistinction to comparative histories—which argues for connecting stories *between* empires and geographical regions and for “reconfiguring” early modern history by transforming the way we think about temporal categories.<sup>13</sup> A perspective emphasizing extraimperial connections expands the range of actors who participated in the production of scientific knowledge, not only as “pathfinders” and porters in the literal sense but also as individuals who shaped and organized data according to their own developed standards of expertise.

In my own work, itineraries reveal pathways linking individuals, objects, and impulses between sites that are often taken for granted in the Atlantic system of knowledge production and that frequently lie outside the purview of metropolitan institutions and imperial capitals. Removing the strict limitations of a single national or imperial frame reveals other processes beyond the traditional loci of scientific production. I refer to these processes as “scientific commemoration”—the myriad activities by which empirical observations are transformed into tangible, memorable products. In order to garner authority, early modern scientific experiments needed to be replicable and persuasive, and those who recorded data and shaped experimental material into a communicable form needed to know how such activities would become memorable for a distant audience. The

<sup>10</sup> Chambers and Gillespie, “Locality in the History of Science” (cit. n. 7), p. 233; and Toby E. Huff, *The Rise of Early Modern Science: Islam, China, and the West* (Cambridge: Cambridge Univ. Press, 1993), pp. 13, 11.

<sup>11</sup> See Simon Schaffer *et al.*, eds., *The Brokered World: Go-Betweens and Global Intelligence, 1770–1820* (Uppsala: Science History Publications, 2009).

<sup>12</sup> In addition to *The Brokered World*, see Delbourgo and Dew, eds., *Science and Empire in the Atlantic World* (cit. n. 6); and *Itinerario*, 2009, 33(1), which includes an excellent essay on this theme by Lissa Roberts entitled “Situating Science in Global History: Local Exchanges and Networks of Circulation” (pp. 9–30).

<sup>13</sup> Sanjay Subrahmanyam, “Connected Histories: Notes towards a Reconfiguration of Early Modern Eurasia,” *Modern Asian Studies*, 1997, 31:735–762.

inscriptive, narrative, and material techniques used to “commemorate” experiments can be used to tease out different stages in the elaboration of scientific texts and treatises. Mobile, interconnected, and brokered forms of knowledge can thus allow nontraditional actors to emerge from within unexpected, often ephemeral sources: from sloppy notes taken in a muddy field to the proof-sheets of an edited compendium fabricated within European printing houses and learned societies.<sup>14</sup>

#### DEFINING INDIGENOUS KNOWLEDGE

But connected histories between individuals or regions can have limitations. While specific stories reveal the mobile nature of scientific knowledge in the early modern period and the myriad actors involved in its production, they usually emerge as the result of European accounts. In order to bring other sources to bear on received narratives in the history of science, strategies from the anthropologist’s ken are fruitful as well. One obvious point of interest is the anthropologist’s attention to the material object, something historians of science have been keen on recognizing as a locus of both literal and phenomenological meaning. One anthropologist has written that “material things index the human productive activity that went into them, [and] they materialize social and cosmological structures that would otherwise elude direct experience.” This focus on the material object has recast many encounters that took place between non-European populations and European travelers. For instance, whale bones served as a pretext for the sustained contact between William Parry and the Inuit in northern Canada from 1821 to 1823, a crucial period in Parry’s expedition in search of a northwest passage. Fueled by the social and economic needs of the Inuit to trade with passersby, this interaction produced extensive geographical and ethnological knowledge for the British, while at the same time fostering oral accounts of the British passage in the social memory of the Inuit. As such, whale bones served as a point of intersection for both groups, enabling us in retrospect to perceive the encounter as one that was propelled as much by indigenous agency as by supposedly intrepid European curiosity.<sup>15</sup>

In the South American context, indigenous medicinal practices offer a similarly striking example of the contrast between “traditional” and “Western” scientific narratives. The Brazilian anthropologist Manuela Carneiro da Cunha has described a school for shamans established by a group of Kraho Indians in the central Brazilian state of Tocantins. These ritual leaders and expert dealers in traditional medicine came together to oppose an accord that had been reached between a prestigious medical school in São Paulo—which was interested in the neurological effects of some of the native plants of the region—and another group of shamans that considered themselves authorized to speak on behalf of all shamans who had such knowledge. This conflict

<sup>14</sup> On the notion of “scientific commemoration” more broadly see Safier, *Measuring the New World* (cit. n. 6).

<sup>15</sup> Webb Keane, “Subjects and Objects,” in *Handbook of Material Culture*, ed. Chris Tilley et al. (Thousand Oaks, Calif.: Sage, 2006), pp. 197–202, on pp. 201–202; and Michael T. Bravo, “Ethnological Encounters,” in *Cultures of Natural History*, ed. N. Jardine, J. A. Secord, and E. C. Spary (Cambridge: Cambridge Univ. Press, 1996), pp. 338–357 (on the interactions of Parry and the Inuit). On anthropologists’ attention to the material object see the Focus section on “Thick Things,” edited by Ken Alder: *Isis*, 2007, 98:80–142. See also Lorraine Daston, ed., *Biographies of Scientific Objects* (Chicago: Univ. Chicago Press, 2000); Daston, ed., *Things That Talk: Object Lessons from Art and Science* (New York: Zone, 2004); Amiria Henare, Martin Holbraad, and Sari Wastell, eds., *Thinking through Things: Theorising Artefacts Ethnographically* (London/New York: Routledge, 2007); and Nicholas Thomas, *Entangled Objects: Exchange, Material Culture, and Colonialism in the Pacific* (Cambridge, Mass.: Harvard Univ. Press, 1991).

reflected differing notions about how traditional indigenous knowledge should be shared with modern institutions, as well as about who had the right to speak on behalf of those who are party to such knowledge. Carneiro da Cunha has also argued that because many traditional societies have a private understanding of their own cultural heritage, they find themselves necessarily at odds with Western society, where knowledge is both protected and exchanged in the public domain. For her, Western scientific knowledge and traditional knowledge are not necessarily commensurable, but “this incommensurability does not reside in their respective results.” Rather, it resides in the aspiration to universality that characterizes Western knowledge: the need to discover laws that are applicable at all times and in all places. Traditional knowledge systems work according to different criteria, and, once again, physical objects are revelatory of these differences. Carneiro da Cunha uses the example of a community in Acre (Brazil), some of whose residents believe that stones are living organisms: “It may be that where you live, stones are not alive,” said one resident to another, “but here they grow and for that reason are living.”<sup>16</sup> The underlying idea is that entirely valid systems of knowledge—be they Western or traditional—do not necessarily function according to the same criteria for internal truth or consistency; nor is it always clear who controls access to the information these systems protect.

Although certain features of indigenous practice may indeed diverge from the universalizing tendency of Western science, empirical and experimental behaviors abound within native traditions, whether as millenarian or modern practices. How these native knowledge practices are treated and valued by travelers or encroaching cultures can be seen as a chapter in the politics of indigenous rights, especially through the form most closely associated with the history of science and techniques—namely, intellectual property. There has been a vigorous debate among those seeking to protect indigenous rights as to whether intellectual property protection—a set of laws enshrined in a Euro-American framework and normally related to new rather than old knowledge—is the appropriate way to secure profits accruing from indigenous cultural or intellectual patrimony. This debate has often been couched in global terms using territorial metaphors. According to one scholar, the search for such protection has been “stimulated by the desire to secure possession, in terms that will have *international* legal purchase, of natural resources and ways of life in the face of *encroachment*.”<sup>17</sup> The patrimony of indigenous populations, despite being locally acquired and organized, is perceived as being “encroached” upon by other groups and other legal systems with transnational interests. Therefore, the protection against such threats needs to be conceived outside of a local or national framework as well.

An eighteenth-century anecdote suggests that such questions have historical roots. In discussing a curious proposal to erect a set of pyramids at the ends of a geodetic baseline outside Quito (present-day Ecuador), Antoine-François Prévost argued that Latin should not be the sole language in which the pyramids’ inscriptions were written: “It seems that our traveling savants will have commerce with men who are capable of reasoning and feeling, and that . . . they should at the very least translate

<sup>16</sup> Manuela Carneiro da Cunha, “De Charybde en Scylla: Savoirs traditionnels, droits intellectuels et dialectique de la culture,” XXVIème Conférence Marc Bloch, Paris, 10 June 2004, accessed at <http://cmb.ehess.fr/document110.html> (27 Apr. 2009); and Carneiro da Cunha, “Relações e dissensões entre saberes tradicionais e saber científico,” *Revista USP* (São Paulo, Brazil), 2007, 75:76–84, on p. 78.

<sup>17</sup> Marilyn Strathern, “Potential Property: Intellectual Rights and Property in Persons,” *Social Anthropology*, 1996, 4:17–32, on p. 21 (emphasis added).



their inscription into the language of Peru.”<sup>18</sup> This nod to the enfranchisement of the native populations as part of a project in which, directly or not, they had a stake is only one example we can look toward in determining how native rights were articulated in an era before modern commercial and legal protection for scientific knowledge was established. Using indigenous narratives to determine the ways in which their knowledge should be protected conforms both to the conditions in which such knowledge was produced and to the contexts and geographic range in which that knowledge would eventually be deployed.

#### AMAZONIA AT THE CROSSROADS OF TIME

During its long history of contact with the wider world, Amazonia has often served as a laboratory for the production of European knowledge about indigenous cultures and societies. In the eighteenth and nineteenth centuries, myriad travelers made observations regarding the “character” of the Amazon’s native populations. In the twentieth century, the southern portion of the Amazon River basin served as a field site for Claude Lévi-Strauss during his first ethnographic forays in the 1930s and 1940s. Along the Andean cordillera, recent disciples of Lévi-Strauss (notably the anthropologists Philippe Descola and Anne-Christine Taylor) have carried out fieldwork on the Achuar peoples of the Ecuadorian Amazon, concluding that transspecies interaction and a fluid boundary between the human and the “natural” speak to an epistemology—purportedly universal but appearing with particular force in certain South American indigenous groups—that operates beyond a paradigm opposing Nature to Culture.<sup>19</sup> In and around the island of Marajó, near the headwaters of the Amazon, archaeologists have also discovered ceramic artifacts (so-called Marajoara pottery) that radically reformulated previous assumptions about the carrying capacity of the Amazonian ecosystem and the cultural development of the region’s inhabitants, with important implications for lowland urbanization patterns and the history of indigenous technologies.<sup>20</sup>

Other archaeological and anthropological work has challenged established regimes of historical temporality by using indigenous frames and deeper historical cross-sections to understand aspects of native culture that earlier ethnohistorians had been unable to access. Indigenous notions of temporality have thus come to challenge certain linear Western paradigms of history. Because Western historiography has been so dependent on a sacred historical time frame, and its own seemingly inexorable progression of socioeconomic and cultural advances, it has not been able to integrate long-term historical models from anthropology or alternative non-Western ideas for conceptualizing temporal processes.<sup>21</sup>

<sup>18</sup> Prévost’s argument appeared in *Le Pour et Contre*, 1735, 77:35. For a detailed discussion of the pyramid controversy, and its implications for the enfranchisement of native laborers who participated in the project, see Safier, *Measuring the New World* (cit. n. 6), Ch. 1.

<sup>19</sup> Philippe Descola, *Par-delà nature et culture* (Paris: Gallimard, 2006); and Anne-Christine Taylor, “The Soul’s Body and Its States: An Amazonian Perspective on the Nature of Being Human,” *Journal of the Royal Anthropological Institute*, 1996, 2:201–215. See also Eduardo Kohn, “How Dogs Dream: Amazonian Natures and the Politics of Transspecies Engagement,” *American Ethnologist*, 2007, 34:3–24.

<sup>20</sup> See, e.g., Anna Roosevelt, *Moundbuilders of the Amazon: Geophysical Archaeology on Marajo Island, Brazil* (San Diego, Calif.: Academic, 1991); and, more recently, Michael J. Heckenberger *et al.*, “Amazonia 1492: Pristine Forest or Cultural Parkland,” *Science*, 2003, 301:1710–1714.

<sup>21</sup> On the challenges and barriers to writing outside of a sacred historical frame see Daniel Smail, “In the Grip of Sacred History,” *American Historical Review*, 2005, 110:1337–1361.

This assertion raises the question: What time line should be adopted for a global history of science? And according to whose criteria—indigenous or European—should such a paradigm be established?

In the case of the Amazon, archaeologists in Brazil, the United States, and elsewhere have advocated for a history of the region that reveals long-term changes in the natural ecosystem and in the deeper structures of human cultures and societies. Rejecting the myth that Amazonia prior to 1492 was a balanced, harmonious, and untouched ecological paradise, scholars now recognize that it was a place of cultural and ethnic flux, a crossroads for groups that, migrating between the Andean highlands and the Colombian plateaus, brought with them their arts, culture, and technical skills. The study of landscapes bearing deep records of human passages has been crucial for this history. As Carole Crumley has written, landscapes maintain the mark of the activities that affected them: “[Human] practices are maintained or modified, decisions are made, and ideas are given shape; a landscape retains the physical evidence of these mental activities.”<sup>22</sup> These kinds of traces in the material landscape complement other evidence recorded by archaeologists, including large road systems, attractive spears, and elaborate funerary urns. These discoveries have served to dispel the previous idea of small, technically primitive groups of itinerant peoples in Amazonia who were incapable of producing sophisticated material cultures.

Anthropologists have also been effective in recovering indigenous conceptions of space and time, shedding light on long-term changes wrought by human and nonhuman denizens of Amazonia.<sup>23</sup> Amazonian societies changed dramatically in the last two millennia—well before the arrival of Europeans—and those changes can be understood by looking more deeply at native populations’ own concepts of time and historical change. Jean-Pierre Chaumeil has proposed a “cumulative conception of time” that escapes from the more traditional cyclical model through the use of sacred flutes, mortuary remains, and “layers” of history between living and dead generations. Chaumeil discusses “mythic journeys” that inscribe notions of time onto spatial landscapes, a form of “topographic writing” and historical memory that traditional sources have ignored. The Yanéscha of eastern Peru also used topographic writing to inscribe their memories and rituals. For the Yanéscha, the historical present is a period between a timeless past and a timeless future, and they use sacred music in addition to topography to counteract the “suffering, pain, death, and oblivion” associated with this epoch.<sup>24</sup>

Nothing should prevent historians from using similar analyses to understand natural knowledge through the prism of a deeper historical past. By focusing on the ritual aspects of food preparation, healing practices, astronomical observations, botanical remedies, or tools to alter the landscape, historians of science can reconstruct past

<sup>22</sup> Carole Crumley, “Historical Ecology: A Multidimensional Ecological Orientation,” in *Historical Ecology: Cultural Knowledge and Changing Landscapes*, ed. Crumley (Santa Fe, N.M.: School of American Research Press, 1994), pp. 1–13, cited in William Balée and Clark L. Erickson, “Time, Complexity, and Historical Ecology,” in *Time and Complexity in Historical Ecology: Studies in the Neotropical Lowlands*, ed. Balée and Erickson (New York: Columbia Univ. Press, 2006), pp. 1–17, on p. 2.

<sup>23</sup> Fausto and Heckenberger, eds., *Time and Memory in Indigenous Amazonia* (cit. n. 9); Balée and Erickson, eds., *Time and Complexity in Historical Ecology*; and Neil L. Whitehead, ed., *Histories and Historicities in Amazonia* (Lincoln: Univ. Nebraska Press, 2003).

<sup>24</sup> Jean-Pierre Chaumeil, “Bones, Flutes, and the Dead: Memory and Funerary Treatments in Amazonia,” in *Time and Memory in Indigenous Amazonia*, ed. Fausto and Heckenberger, pp. 243–283; and Fernando Santos-Granero, “Time Is Disease, Suffering, and Oblivion: Yanéscha Historicity and the Struggle against Temporality,” *ibid.*, pp. 47–73, on p. 47.

practices as well. As Carlos Fausto and Michael Heckenberger have remarked, the topics studied by anthropologists have changed from “kinship, politics, economy, or religion” to “subjectification, embodiment, empowerment, agency, and identity.”<sup>25</sup> These latter categories are in no way incompatible with recent work in the history of science. An attention to the technical aptitudes of indigenous peoples and the broad range of knowledge they bring to interactions with the natural environment can enhance our understanding of the codependence of ritual, power, and natural knowledge, in Amazonia and beyond.

#### THE SCIENTIFIC IMPERIALISM MODEL REVISITED

So how might these different approaches assist historians of science in teasing new global histories out of an arguably limited documentary corpus? What I hope to have shown are some ways of fusing recent methodologies in history, anthropology, and archaeology with the history of science in order to achieve this goal. These methods allow us to escape from a narrow temporal and territorial view of history and incorporate other peoples and places within the received narrative of scientific “expansion.” The “imperial” model of global scientific production—with European empires at the forefront of natural knowledge acquisition, codification, calculation, and dissemination—should make way for a more expansive definition of scientific enterprise on a global scale. Clearly, we do not need to discard the studies that have usefully examined imperial institutions for their role in connecting colonized worlds with the European metropole. But we may wish to look toward alternative models that do not reinforce the omnipotence of the imperial center at the expense of local or moving platforms of knowledge creation.

Questions of commensurability (or the co-production of knowledge) have their relevance for this expanded frame, just as they did during the colonial period. Europeans often sought to efface indigenous knowledge in order to buttress their own claims, aided by the supposition that native informants were not reliable eyewitnesses. Innate cultural prejudice that developed during Europe’s interactions with other parts of the non-European world, including Asia and Africa, led the bulk of European travelers in the Americas to speak in tremendously pejorative terms of indigenous knowledge systems. From Charles-Marie de La Condamine to Cornelius de Pauw, native residents of the Americas were perceived as retrograde human specimens whose inferiority was marked on their characters from birth. Alexandre Rodrigues Ferreira was no exception. Referring to Amerindians’ knowledge of mathematics, he explained that “for those who do not have moveable goods for their descendants to inherit, nor money to count, nor extended calculations to carry out either about time or space, clearly arithmetic is of no use.”<sup>26</sup> For these Europeans, the idea of indigenous science was akin to the indigenous use of mathematics: something so rudimentary that it was only worth mentioning in order to ridicule.

The explicit comparison between European and Amerindian systems of knowledge was not limited to the realm of science. The traits and cultural mores of Amerindians were prominent features of many European narratives describing their cultural encounter with

<sup>25</sup> Fausto and Heckenberger, “Introduction,” in *Time and Memory*, ed. Fausto and Heckenberger, pp. 1–43, on p. 4.

<sup>26</sup> Ferreira, “Observações gerais e particulares sobre a classe dos mamíferos observados nos territórios dos rios, das Amazonas, Negro, e da Madeira” (cit. n. 1), p. 92.



**Figure 2.** “Yuripuxuna Indian.” Alexandre Rodrigues Ferreira attempted to classify the indigenous populations he encountered in Amazonia according to their technical skills and the tools they used. Courtesy of the Fundação Biblioteca Nacional, Rio de Janeiro, Brazil.

native peoples of the Americas. (See Figure 2.) In the case of the Guaicuru Indians, for example, Ferreira came away particularly impressed with their treatment of slaves, in contradistinction to the contemporaneous European participation in the slave trade: “We call [the Indians] barbarous [*bárbaros*]; and yet, in this region, they do not dishonor humanity as do the most refined nations of Europe, who despite having rationality that is

fed by philosophy and illuminated by revelation, seem nonetheless to have chosen the heaviest means to control the yoke of African slavery in the Americas.”<sup>27</sup> Such texts by Europeans certainly served the role of integrating non-European populations into a more inclusive history of natural knowledge production on a global scale. But ethnographic data drawn from necessarily biased sources needs to be supplemented by other strategies, including following itineraries across linguistic and imperial boundaries, borrowing from conceptual categories in other disciplines, and looking for ways that “prehistorical” categories can inform historical development in the past and in the present. What is required are modes of inquiry that highlight particular local contexts in a system of exchanges that was perpetually in motion. A grand, linear narrative seems harder to maintain when our own scholarly itineraries through these knowledge networks reveal connections that were not immediately apparent to those whose worlds we later imagine and reconstruct.

<sup>27</sup> Alexandre Rodrigues Ferreira, “Guaicurus,” in *Viagem ao Brasil de Alexandre Rodrigues Ferreira: Coleção etnográfica*, 3 vols. (Lisbon: Kapa, 2005), Vol. 3, pp. 22–27, on p. 26.