THE EARLY MODERN AMERICAS

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Translating Nature

Cross-Cultural Histories of Early Modern Science

EDITED BY

Jaime Marroquín Arredondo and Ralph Bauer

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Introduction: An Age of Translation

Ralph Bauer and Jaime Marroquín Arredondo

The history of modern science has often been told as the history of discovery—"discovery" in the sense of the finding of new facts and things by empirical means that overturns traditional or received conceptions of nature and the universe. The so-called discovery of America by Europeans in the fifteenth century has hereby become the *paradigm* of modern scientific discovery per se. The classic formulation of this was perhaps the declaration by English statesman and natural philosopher Francis Bacon in the early seventeenth century that Christopher Columbus's discovery of America had announced the coming of a new world of science beyond the book-bound circle of knowledge of the Scholastics. In this new world of science, knowledge would be gained not through the study of books (what Bacon called "received philosophy"), syllogistic reason, or dialectic disputation but instead by the discovery of the secrets of nature through direct observation and empirical experimentation.[1] Since the second part of the twentieth century, however, the modern logic of discovery has been subjected to intense critical scrutiny. On the one hand, the new social history of science has privileged cultural context and social networks over the logic of scientific discovery as an engine of change;[2] on the other hand, postcolonial criticism has insisted that the idea of a New World that lies at the heart of the modern paradigm of discovery is a Eurocentric fiction. It is a fiction predicated on an ontological separation of European subjects doing the discovering from American objects to be discovered, a separation in the process of which non-Western (particularly Amerindian) subjects and knowledge traditions were utterly erased.[3] Scholars today recognize that America was never a tabula rasa—a "New World"—but instead was a world with multiple histories as well as philosophical, historical, and scientific traditions that interacted with those of the European invaders in multiple

global entity and at the same time a polycentric monarchy, it is possible to situate the local significance of herbal manuscripts within the "polycentric and fluid networks of objects or processes in motion."[74] Cienfuegos also helps us understand Fragoso's playful natural history. Fragoso's *Discursos* is a kind of ludic exercise that illuminates the ways in which participation in a community of naturalists and in its work could be playfully simulated.

Cienfuegos saw enemies everywhere, but his suspicions are significant. We have not taken seriously enough the extent to which Spanish naturalists resisted the translation of their knowledge of American flora, fauna, and climate into a Northern or broadly European context. We also underestimate the extent to which early modern communities of scholarship created insiders and outsiders. The use of the vernacular natural history manuscript was one tool for the creation of communities. The cumulative effect of choices such as Cienfuegos's decision not to publish was to make Spanish natural history invisible to modern historians, as Mar Rey Bueno explains.[75] It is difficult for us now to assess the aggregate effect of Spanish natural history in manuscript—because so many of these manuscripts have been lost—or to map the contours of its implied communities.

Clearly, however, the natural history manuscript in the age of the printed herbal was a material argument about the proper locus of enunciation and consumption, a way to contest the implicit claims of universality and ubiquity that print culture made. A great deal of early modern Spanish natural history was a statement about the local utility of knowledge, the special power conferred by the possession of that knowledge, and a counternarrative of imperial universality based on "comercio" not as trade but instead as a process of cultural, ideological, and spiritual conversion. This is without a doubt a unidirectional process that locates Madrid and Seville at its center. It is also a refusal to subscribe to a supranational Republic of Letters. This knowledge allows us to see the rise of the vernacular herbal manuscript in early modern Spain as the result of conscious choices, informed by a particular understanding of how communities of scholarship should be configured.

Chapter 9

New Worlds, Ancient Theories: Reshaping Climate Theory in the Early Colonial Atlantic

Sara Miglietti

Several chapters in this volume have shed light on the crucial role that colonial geoethnography played in transforming early modern science. This chapter will move in a similar direction, delving deeper into the question of how the numerous *historiae* of American lands and peoples that were compiled by early modern travelers, settlers, and missionaries went on to stimulate further intellectual change in the Old World.[1] This chapter will focus on a particular type of geoethnographic inquiry, very popular in the early modern period and known today as "climate theory,"[2] that studied how geography and climate can influence the mode of existence of human societies. Inspired by a long tradition that dated back to the Hippocratic school of medicine (fifth century BCE), early modern climate theorists such as Levinus Lemnius (1505–1568), Juan Huarte (1529–1588), Jean Bodin (1529–1596), and Giovanni Botero (1544–1617), among many others, set out to identify the causal connections that allegedly tied the physical properties of a place to the "natural character" of its inhabitants, thus explaining, for instance, their moral and intellectual dispositions as well as their preference for particular political regimes (e.g., free republic versus despotic monarchy).[3]

For centuries after its birth in classical Greece, climate theory circulated extensively across the Western world, informing not only abstract speculation but also collective behavior in a number of ways (for instance, by orienting settlement patterns in the colonies)[4] and being constantly modified

and "updated" in the process. In this sense, climate theory can be seen as a paradigmatic case of "traveling theory"—that is, in Edward Said's terms, a conceptual system that moves across time, space, and languages, changing shape each time it is received in a new cultural context.[5] The early modern period in particular was one of enhanced engagement with climate theory and thus also unsurprisingly one of accelerated change in this long-standing intellectual tradition. Precisely one of these spectacular changes will be the main focus of this chapter: namely, the shift from a "cosmological" to a "chorological" approach to the study of climate and its influence on mankind,[6] which took place between the sixteenth and seventeenth centuries for reasons not yet entirely clarified. As the chapter suggests, such a shift was not so much a direct consequence of European expansion in the New World (which according to many scholars spurred Europeans to rectify long-held geographical and climatological assumptions inherited from antiquity) but instead resulted from the implementation of new epistemic protocols for gathering, selecting, and organizing geoethnographic information. In Section 3 in particular we shall see how these new protocols informed the numerous instructions, questionnaires, and lists of queries produced at different times by four distinct institutions: the Spanish House of Trade (Casa de la Contratación, est. 1503) and the Council of the Indies (Consejo de Indias, est. 1524), both located in Seville with informants all over Spanish America; the Society of Jesus (est. 1540), based in Rome with important adjunct hubs in Lisbon and Seville and a number of colleges and missions scattered around the New World; and the Royal Society in London (est. 1662), whose wide-ranging network of correspondents included travelers to Canada, North America, and the West Indies as well as settlers residing in the American colonies. It is well known that these four institutions were all similarly invested in gathering useful knowledge from and about the colonies and that they each developed comparable strategies for collecting and managing information.[7] However, the exact extent to which these institutions communicated with and learned from one another remains open to further investigation, particularly for what concerns their geoethnographic pursuits.[8] This chapter will hopefully shed some new light in this sense. It will examine the instructions and questionnaires developed by these institutions alongside some of the accounts that they elicited in response, with the ultimate goal of explaining how these developments may have contributed to the chorological turn in early modern climate theory.

The Chorological Turn in Early Modern Climate Theory

Generally speaking, climate theories fall under two major models that could be called "cosmological" and "chorological" by way of analogy with the two main types of geographical description (cosmology and chorology) theorized in late antiquity by authors such as Ptolemy and still widely practiced in the Renaissance.[9] These two models of climate theory differ from each other in many important respects, including the way in which they each frame the very concept of climate. Cosmological climate theory primarily understands the climate of a place in terms of what we would now call its average temperature, whether hot, cold, or temperate; temperature itself, in this view, is considered to depend primarily on the place's location on the grid map of Earth, particularly with respect to its latitude (which determines the amount of solar heat that any given place receives throughout the year). A good example of this outlook can be found in the so-called Macrobian world map, reproduced here in an early sixteenth-century printed version closely modeled after medieval manuscripts (Figure 9.1). This map divides the world into five major zones: two cold zones, two temperate zones, and a Torrid Zone that stretches across the equator.[10] Cosmological climate theorists built on this rough subdivision to formulate assumptions about the human types inhabiting each of these zones: for instance, they argued that people living close to the Torrid Zone (the Torrid Zone itself was for a long time considered uninhabitable) had weak bodies and keen minds, while they assumed the reverse—that is, strong bodies and weak minds—of people living in cold regions. As for the inhabitants of temperate regions, they were thought to have a similarly temperate constitution, which made them much more likely to grow into well-rounded, civilized human beings.

The chorological model portrayed climate in quite different terms, namely as the result of complex interactions between a number of site-specific factors that were (rightly) thought to influence heat and rainfall distribution as well as other local meteorological phenomena. While cosmological climate theory revolved around broadly sketched climatic zones, chorological climate theory focused on much smaller regions and analyzed these regions in considerable detail. Moving from the empirical observation that places located in the same latitude often present striking differences in climate, chorological climate theorists explained such differences in light of specific landscape features such as the nature of the terrain (e.g., flat or hilly), the qualities of local bodies of

Figure 9.1. Zonal world map. Macrobius, *In somnium Scipionis libri duo* (Cologne: [Eucharius Hirtzhorn], 1521), sig. c4v.

water (e.g., running or standing), and the type of soil (e.g., sandy or rocky, fertile or barren). These and other features were held responsible for shaping local microclimates within the broader climatic regions defined by latitude. A good example of this perspective can be seen in a map of Rome drawn for Marsilio Cagnati's neo-Hippocratic treatise on the salubrity of Roman air, which was printed in Rome in 1599 (Figure 9.2). This medical-environmental map zooms in on specific geographical features—such as Rome's seven hills and the Tiber River—in order to explain why different parts of the city proved more or less conducive to physical and temperamental diseases among local inhabitants.[11] Like Cagnati, many other early modern climate theorists relied

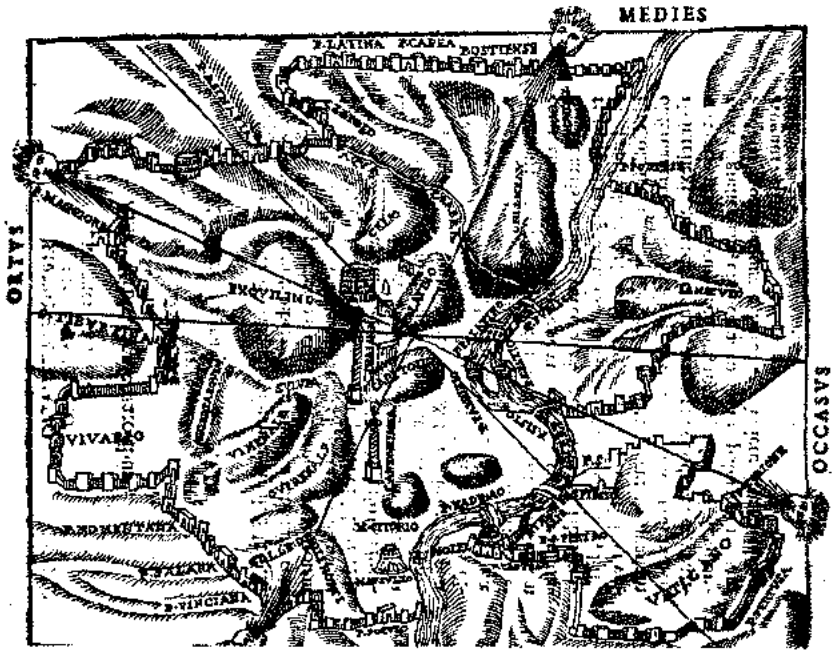

Figure 9.2. Map of Rome emphasizing landscape features. Marsilio Cagnati, *De Romani aëris salubritate* (Rome: Luigi Zanetti, 1599), 55.

on the site-specific nature of climate to explain the presence of different human types within the same band of latitude—an experiential truth that cosmological climate theory could not apparently account for.

Cosmological and chorological climate theories thus seem to differ from each other in crucial respects. While both models posit a direct causal correlation between climate and human nature, they disagree on matters of great importance, such as what climate is, what determines it, and the proper scale at which it should be analyzed, and also whether it is possible to ascertain the climate of a place—and therefore the natural character of its inhabitants—based simply on the place's geographical coordinates (primarily latitude, although some climate theorists, including Jean Bodin, ascribed a role to longitude as well). While cosmological climate theorists argued that latitude was a reasonably accurate predictor of climate and climatic influence, chorological climate theorists objected that specific landscape features ought to be taken into account as well. Consequently, cosmological climate theorists

tended to operate primarily with the classic tools of mathematical cosmography, whereas chorological climate theorists often incorporated some degree of observational fieldwork into their procedures.[12] From the point of view of method, then, cosmological climate theory appears to be predominantly deductive and predictive, while chorological climate theory is fundamentally inductive and, at least to some extent, empirical.

These undeniable differences should not, however, be overstated. Surprising as it may seem in light of what has just been said, cosmological and chorological climate theories coexisted side by side with relative ease well into the Renaissance. The reason for this is that the two models were not perceived as mutually exclusive but instead as complementary. To be sure, theorists often had preferences for one or the other model: to take two famous examples from classical antiquity, Aristotle's approach in Book 7 of *Politics*[13] is predominantly cosmological, while the Hippocratic treatise *Airs, Waters, Places* leans decidedly toward the chorological model. Still, it was not rare for authors to experiment with both models, whether in different places in their corpus (Ptolemy, for example, alternated a chorological approach in his *Geography* with a cosmological approach in his *Tetrabiblos*) or within the very same work, apparently without any sense of self-contradiction. Good examples of this are the Spanish Dominican Bartolomé de Las Casas (1484–1566), who combined the two models to describe the climate of Hispaniola in his *Apologética historia sumaria* (largely composed around 1551–1552),[14] and the aforementioned Jean Bodin, whose systematic overview of climate theory in his *Methodus ad facilem historiarum cognitionem* (1566) begins at the general level of cosmology but subsequently moves down to the detailed level of chorology, in the top-down fashion typical of many early modern cosmographies.[15]

This dynamic coexistence of cosmological and chorological climate theories was still the norm in the second half of the sixteenth century, but things were bound to change dramatically in later periods. Over the course of the seventeenth century, a hiatus opened between cosmological and chorological climate theories. Attention now shifted to the latter, while the former fell out of favor and became increasingly marginal to the climatological debate, only to resurface again in the eighteenth century.[16] What triggered this shift is still unclear. A common explanation connects it to the geographical explorations, suggesting that empirical observation of unfamiliar climates led Europeans to reconsider their long-held assumption that latitude was the primary determinant of climate and thus to abandon cosmological climate theory in favor of its chorological counterpart.[17] European travelers to the New World specifically observed that places located in the same latitude were comparatively much colder in America than in Europe (largely as a result of the mitigating effect of the Gulf Stream in Europe, a phenomenon that early modern observers were not completely unaware of but failed to relate to the different climatic conditions in the two continents). American climates were perceived as overall more extreme than their European counterparts, with colder, longer winters and exceedingly hot summers. Yet European settlers also frequently remarked that the American climate was becoming more and more temperate as forests were cleared, agriculture was developed, and urban centers multiplied in the wake of European colonization.[18] Experience thus seemed to prove that landscape, not latitude, was the single most important factor in determining the climate of a place, so much so that the conscious or unconscious manipulation of particular landscape features—for instance, through changing patterns of land use—could go so far as to alter the climate of a whole country.[19]

If we trust this dominant narrative, the chorological turn in seventeenth-century climate theory should stand as a bright example of the revolutionary power of empirical observation, further confirming the crucial role that the great discoveries played in redefining early modern science. It seems, however, that such an account does not pay sufficient attention to the flexibility and resilience of ancient epistemic paradigms. Following Anthony Grafton, one could point out that for a good century after Christopher Columbus, the new empirical knowledge flowing in from the Americas was incorporated with surprising ease into the conceptual frameworks inherited from antiquity.[20] Even the most disruptive piece of evidence could be used to reinforce traditional doctrines rather than to challenge them. Thus, Bodin invoked the new geographical discoveries to buttress the established worldview based on Holy Writ and classical authorities,[21] while the Jesuit José de Acosta—a famously outspoken critic of Aristotle's meteorology, at least on the surface—structured his understanding of South American climates around the principles of Peripatetic natural philosophy.[22]

These and other examples seem to suggest that empirical evidence alone is not enough to cause the collapse of long-standing epistemic paradigms. What, then, is needed to generate deep conceptual change? The next section will sketch out an alternative answer, suggesting that the chorological turn in seventeenth-century climate theory owed less to the inflow of fresh geoethnographic information than to the new strategies that were being developed

for soliciting, organizing, and validating such information; less to the *content* of knowledge than to its *forms* and *structures*—that is, to the ways in which knowledge was framed and communicated.

From Seville to Rome: The "Birth" of the Questionnaire

Around the middle of the sixteenth century, geoethnography was one of the fastest-developing fields of knowledge in the Latin West. The flood of incoming information about the so-called New World and its native inhabitants found a place in the growing body of natural-historical and ethnographic literature avant la lettre, including travel accounts, cosmographies, and natural-philosophical treatises that comprised anthropological sections.[23] While the Iberian Peninsula was one of the earliest and most important epicenters for the collection and systematization of geoethnographic knowledge in this period, the phenomenon quickly spread to other European regions, gaining particular momentum in countries such as France, England, the Low Countries, and some German-speaking territories that engaged more or less extensively in colonization efforts in the Americas and elsewhere.[24]

In a context of increased geopolitical competition, the acquisition and dissemination of information about the New World was caught in tensions between secrecy and transparency, rivalry and collaboration, as María Portuondo has stressed in her landmark study of cosmography and empire in the early Iberian Atlantic.[25] In Spain, two institutions were entrusted with the delicate task of storing geoethnographic information safely while also making it easily accessible and exploitable for actual governmental practice: these were the House of Trade and the Council of the Indies. Both institutions were based in Seville, both had been established in the early stages of Spanish colonial expansion in Central and South America, and both became instrumental for collecting and managing information of all kinds about the New World. To do so, these institutions developed new data-gathering strategies, which included the distribution of standardized questionnaires among travelers to or residents in the American colonies.[26] While this practice was first introduced by House of Trade pilots and cosmographers in the early decades of the sixteenth century, it was later brought to perfection by the Council of the Indies, particularly under the directorship of Juan de Ovando (1515–1575), who thoroughly reformed the council's administrative structure and made considerable efforts to establish more systematic mechanisms for collecting and managing various types of information of colonial interest.[27] Upon Ovando's initiative, a first

questionnaire in thirty-seven chapters was circulated in 1569 among colonial officials and informants in the Indies. Other questionnaires followed in 1571 and 1573, and a final list of fifty queries, drafted shortly after Ovando's death, was sent to the presses in 1584. The focus in many of these questionnaires was first and foremost on the environmental properties of the site described and on the character of local native populations. Such an emphasis on geoethnographic material was not new: already in 1533, in a royal proclamation to the Audiencia of Mexico, Charles V had recommended the collection of data about "the qualities of the land and its wonders" and the "types of native people [who] are there."[28] But compared to these earlier and rather vague instructions, the later questionnaires were much more elaborate "tools of inquiry" that often included "precise specifications for how questions were to be answered."[29]

This is especially true of geoethnographic queries, which became increasingly detailed over the years. For instance, the *Memorial* of Alonso de Santa Cruz, composed in the mid-1550s, prompted travelers and explorers to provide thorough information about the environmental characteristics of each site ("whether it is mountainous or flat, whether it is full of wetlands and marshes") as well as about specific landscape features (rivers, mountains, lakes, springs), natural resources, and the character and customs of indigenous populations.[30] The questionnaires that were drafted in the 1570s and 1580s following Ovando's guidelines continued and strengthened this trend. For instance, the *Memorial* that the Council of the Indies issued in 1584 for Nueva Galicia included questions about the region's climate ("whether it is very cold or hot, humid or dry; whether it rains often or not and at what times rain is more or less frequent; and what are the strongest winds that blow there and from what direction they blow and in what periods of the year"), landscape features ("whether the land is even or rugged, flat or mountainous, abounding in rivers and springs or not, rich or poor of water, full or not of fertile meadows, fecund or barren of fruits and other sustenance"), and latitude ("the height or latitude of the pole . . . or, in which days of the year the sun does not project any shadow whatsoever at noon"), placed alongside queries about the number, character, and customs of local inhabitants ("whether there are many or few Indians, and if there were more or fewer before than now and if so why; if there are any, whether they are settled in fixed, nucleated settlements; and the size and nature of their mental skills, inclinations, and way of life").[31]

This combination of environmental analysis and ethnographic inquiry similarly characterizes the reports compiled in response to the council's questionnaires, generally by colonial officials. Later known as *Relaciones de Indias*,

these reports usually took the form of itemized lists of answers, arranged in the same order as the queries in the questionnaire: they typically started with detailed descriptions of the environmental properties of the site at hand, followed by remarks about the physical and moral constitution of local indigenous populations. For instance, a 1586 *relación* about the Andine region of Vilcas Huamán, in modern-day Peru, started out by saying that most villages in the area were located in "healthy sites and climates" (*asiento y temple sano*) and went on to observe that native inhabitants tended to enjoy good health, aside from occasional bouts of scrofula (*lamparones*), fevers (*calenturas*), and abscesses (*apostemas*).[32] In the same year, the author of a *relación* on the *repartimiento* of San Francisco de Atunrucana y Laramati, in what is now the Huamanga region of Peru, reported that the inhabitants of La Concepción and Guanca, two low-lying sites, were often ill on account of the excessive heat, whereas those who lived in the "well-tempered" (*de buenos temples*) villages up in the sierra were free from disease.[33] In both cases, the juxtaposition of remarks about local environmental properties and about the complexion of indigenous populations invited the implicit conclusion that temperament and climate were intrinsically connected.

While Spanish colonial administrators played a fundamental role in promoting the questionnaire form in the sixteenth century, the use of questionnaires as information-gathering tools was not unparalleled at the time. Soon after its official establishment in 1540, the Society of Jesus began to use similar strategies to collect and manage information of various kinds, including geoethnographic data on foreign territories where the society had recently established colleges and missions for the propagation of the Christian faith.[34] Toward the end of the sixteenth century, these territories included Brazil (the first Jesuit mission in the Americas, founded in 1549), Peru, Paraguay, Florida, and New France (i.e., modern-day Quebec).[35]

Missionary concerns explain not only the centrality of geoethnographic knowledge to the Jesuit *ratio studiorum*[36] but also the special place that climate theory occupies in the works of Jesuit or Jesuit-educated writers such as the aforementioned José de Acosta, whose *Historia natural y moral de las Indias* is an important document of Jesuit climatological ideas,[37] and Giovanni Botero, whose *Relationi universali* (1591–1596)—an ambitious geopolitical description of the known world—is structured around the notion of environmental influence.[38] Further demonstration of Jesuit interest in climate theory comes from the *litterae annuae*, reports compiled once a year from the overseas provinces that contained various kinds of information about life in the missions.

Though initially meant for manuscript circulation within the Society of Jesus, these letters soon became so popular that they began to appear in print, either individually or as part of larger collections such as the best-selling *Lettres édifiantes et curieuses écrites des missions étrangères* (1703–1776). The engrossing descriptions of exotic lands and peoples contained in these letters certainly did much to captivate a much larger readership than originally intended.[39] But these descriptions were also meant to fulfill another, perhaps more fundamental, function: namely, to convey information of immediate operative value.[40] As early as 1554, the founder of the Society of Jesus, Ignatius of Loyola, had instructed missionaries to the overseas provinces to send detailed reports of the "cosmography of the regions to which they travel," the climate and wildlife found in those regions, and any "extraordinary" properties of the land.[41] Ignatius explained that such information was of crucial importance because "the state of the air" and "the nature of places" were known to have direct repercussions on "human mores."[42] From a missionary perspective, the value of climate theory rested primarily in the fact that it enabled one to understand the character of indigenous populations and thus devise effective strategies for evangelizing them.

Ignatius's instructions for missionary letter writing mainly revolved around content, but other Jesuits also took a keen interest in form and structure; indeed, precise guidelines in this sense were issued since the early days of the Society of Jesus.[43] The template of the *litterae annuae* in particular was formalized in 1547 by the society's secretary, Juan Alfonso de Polanco (1517–1576), in a short text that was subsequently included in the *Constitutions* of 1558.[44] While Polanco's instructions for letter writing (*Reglas que deven observar acerca del escribir*) contain no specific mention of geoethnographic information and no indication of how such information should be gained and organized, the recurring pattern visible in the geoethnographic sections of many Jesuit letters suggests the existence of separate guidelines, possibly in the form of questionnaires dictating patterns for the collection and communication of this type of data. More research in the Society of Jesus archives would be necessary to confirm this point, but recent studies on Jesuit information-management practices show that by the latter half of the sixteenth century, the society had developed a highly standardized questionnaire-based method of gathering knowledge on various matters. Particularly strong evidence in this sense comes from Marcus Friedrich's work on Jesuit *informationes*. These documents were used to collect information about the moral and intellectual qualities of individual Jesuits at crucial steps in their career so as to decide, for

instance, "which type of religious vows should be taken by candidates, who was to govern, who was to be dismissed, who was to become a missionary," and so forth.[45] Friedrich has demonstrated that from the 1560s onward, questionnaires became the most commonly used means for gaining such information because of the "high degree of standardization" that they allowed. Since the *informationes* solicited personal assessments that could be tainted by subjective bias, "prefabricated questionnaires" based on a "standard evaluation template" were soon introduced to ensure objectivity and fairness. Each type of *informatio* (there were several: *ad gradum, ad gubernationem, ad dimittendum,* etc.) proposed the same set of twelve or so questions "about biographical detail, virtues, physical appearance, character, and behavior"; answers should follow in the same order as the questions and should never exceed the space allotted in the form.[46] These general principles remained fairly constant, but the actual way in which the questionnaires were filled out seems to have evolved over time. While the earliest known examples of compiled *informationes* (ca. 1595) feature short paragraphs of narrative prose, toward the end of the seventeenth century this discursive form was progressively abandoned in favor of greater concision, and answers were gradually reduced to "single qualifying words" inserted into "a pre-fabricated cloze."[47]

From Rome to London: The Royal Society's "Heads" and "Queries"

The trends documented for the Society of Jesus find some interesting parallels in other institutional contexts over the course of the seventeenth century. A case in point is that of the early Royal Society, yet another institution deeply invested in collecting "useful knowledge" about non-European countries and their inhabitants.[48] One of the first initiatives taken by the society shortly after its foundation in 1662 was to establish a worldwide network of correspondents to contribute toward the compilation of a "natural history of all countries." At the time, it must be noted, "natural history" encompassed not only the world of nature but also that of humans: in the case of the Royal Society this inclusion of "the human world within the remit of the natural historian" was a direct consequence of the firm belief of many of its early fellows in the influence of environmental factors over human beings.[49] Henry Oldenburg (1619–1677), the society's long-term secretary, spelled out such a belief most explicitly in his preface to the March 1676 issue of the society's journal, the *Philosophical Transactions*. Here, Oldenburg called for an exhaustive and "methodical" natural history of "the great variety of soyls, fountains, rivers, lakes etc. in the several places of this globe; and of the manifold effects, productions and operations of the sun, and perhaps of other celestial influences, upon them all; or of subterranean steams, or peculiar winds, arising at state or uncertain times."[50] Oldenburg argued that such a history would clarify, among other things, why "the shapes, features, statures, and all outward appearances, and also the intrinsick mentals or intellectuals of mankind" varied so greatly in different parts of the world.[51] The New World occupied an especially important place in this grand scheme, for Oldenburg noted that the relatively pristine environments of "many parts of America, and of some countreys remote, and thinly inhabited in the North" could offer more accurate information about "the nature of the places" and its influence on living beings than the "richly cultivated and polite neighbourhood of France, Italy, Spain, Germany, etc.," where "culture, improvement and artificial ornaments" had deeply changed the land as well as its inhabitants.[52]

Just like Spanish colonial administrators and Jesuit superiors, Royal Society fellows turned to the questionnaire as an effective tool for collecting information.[53] This continuity in data-gathering strategies may be more than just coincidental, especially if seen in light of recent scholarship that has stressed the impact of Iberian and Jesuit science on the early Royal Society.[54] The numerous lists of "heads" or "queries" now preserved in the society's archives in London were for the most part drafted in the 1660s and early 1670s by a group of fellows that included Robert Boyle (1627–1691), Thomas Henshaw (1618–1700), John Hoskyns (1634–1705), Robert Moray (1609–1673), and Oldenburg himself. Some of these questionnaires were disseminated in manuscript form among selected correspondents: for instance, a list titled "Enquiries for Barbary" was sent to Sir Henry Howard, the English ambassador in Morocco, and to other contacts in the region in 1669;[55] another list of questions about Brazil, in Latin ("Inquirenda per Brasiliam"), was addressed in 1671 to Thomas Hill (possibly a younger brother of Abraham Hill, the society's treasurer), who promised to forward them to a Dutch Jesuit in Salvador de Bahia—"a very curious, ingenious and inquisitive man, and especially desirous to serve the Royal Society," who had lived in Brazil for several years and was said to know the country well.[56] Other questionnaires were printed in the *Philosophical Transactions*, thus reaching a wider public: in a single year (1667), the society's journal published lists of queries on Turkey, Persia, Surat and other East Indian regions; Virginia and the Bermudas; Guyana and Brazil; Hungary and Transylvania; Egypt, Guiney, and Greenland.

These questionnaires all shared a similar template: a series of numbered questions, following one another with no apparent order or connection (an order actually *did* exist,[57] but responders were not expected to grasp it; they were, in fact, actively discouraged from doing so, for reasons that will become clear later). The queries solicited information about aspects such as the "temperature of ye air," the "diseases ye inhabitants are most subject to," the "variations of ye weather" and the types of "meteors it is most wont to breed," "the nature of ye soyle" and other "observables" of the land (such as mountains, rivers, lakes, ponds, and springs), and finally "ye inhabitants, men and women, what are their inclinations, dyet, aeconomy, conveniences of living, their strength, agility, stature, shape, color."[58] This template had been set by Robert Boyle with his *General Heads for a Natural History of a Countrey, Great or Small*, written on Oldenburg's request in the spring of 1666 and published shortly afterward in the *Philosophical Transactions*.[59] The great majority of questionnaires on individual countries that were drafted after 1666 followed Boyle's model closely and departed from it only in requesting additional information about matters specific to a particular country. There is, however, one major difference between Boyle's *General Heads* and the later lists of queries compiled in its wake. While Boyle's list opens with questions about the "longitude and latitude of the place" (specifically insofar as these are "of moment in reference to the observations about the air") and the "fixt starrs" and "constellations" to which the place is "said to be subject to,"[60] later questionnaires usually leave out cosmographical and astrological considerations altogether and move straight into the second of Boyle's heads, concerning air and meteorological phenomena. In 1669 Oldenburg adopted this simplified format in his suggested restructuring of Boyle's *General Heads*, which is preserved in an autograph manuscript in the Royal Society archives (Figure 9.3).[61] Although Oldenburg's revised list of *General Heads of Inquiries for All Countries* was never printed and therefore enjoyed a more limited circulation than Boyle's original version,[62] it is an important document of wider trends within the early Royal Society. In particular, as the next section will show in further detail, Oldenburg's manuscript testifies to shifting notions of climate and climatic influence in this period and more specifically to the marginalization of cosmological factors in favor of chorological ones.

As we have already seen in the case of the Jesuit *informationes* studied by Friedrich, responders to Royal Society questionnaires were expected to answer each question concisely in the order provided and without adding

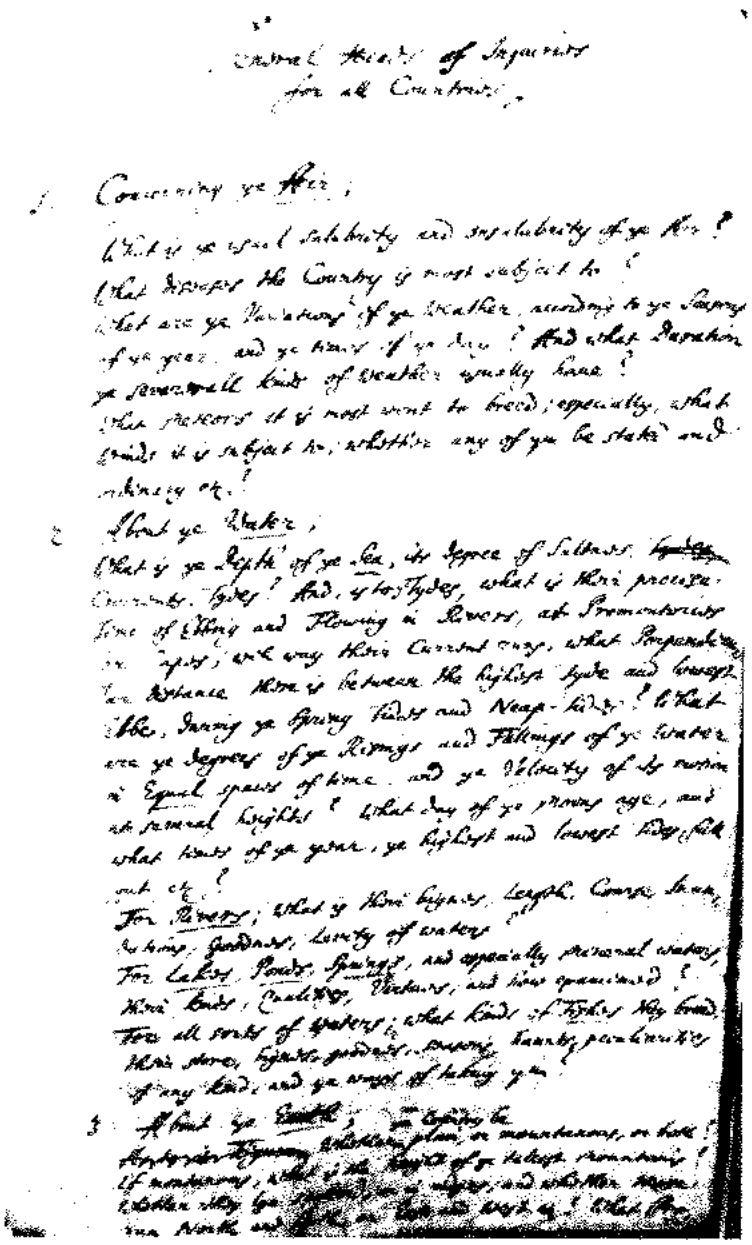

Figure 9.3. Henry Oldenburg, "General Heads of Inquiries for All Countries" (October 6, 1669), London, Royal Society, Classified Papers, 19/43. Photo: Sara Miglietti. Courtesy of the Royal Society Library and Archives.

any extraneous material. Evidence from surviving sets of answers suggests that these instructions were taken very seriously.[63] Responders should also restrain from articulating transitions between the answers, as one would normally do in account or narrative; they were instead required to respect and replicate the fragmented nature of the questionnaire in their own responses by offering discrete facts in a disconnected fashion. As a result of this scattered appearance, when some of these texts were prepared for publication in the *Philosophical Transactions*, Oldenburg (in his capacity as editor in chief) occasionally intervened to modify them by, for instance, introducing connecting words or phrases that would improve readability.[64]

Textual dispersion, it would seem, was not an unintended by-product but rather a carefully crafted effect of the questionnaire form. Indeed, such textual dispersion was integral to the epistemic strategies that leading Royal Society fellows such as Boyle were eager to promote at the time. Harriet Knight has shown how Boyle deliberately cultivated textual incoherence as a way to collect vast amounts of "factual data" without running the risk of falling into "premature and fanciful systematization."[65] A similar (and equally Baconian) concern with pretheoretical "matters of fact" also inspired the society's geoethnographic questionnaires, which solicited raw data devoid of any narrative or argumentative arrangement in order to reduce the danger of theoretical or ideological bias.[66] The form of the questionnaire was, in other words, a rhetorical strategy in the service of a particular epistemology.

In this respect, the Royal Society's lists of "heads" and "queries" for the collection of geoethnographic knowledge continue a long trajectory that, as this chapter has shown, can be traced back to the introduction of questionnaires as an information-gathering technology in early sixteenth-century Spain and to their subsequent adoption by Jesuit missionaries around the globe. Along the way, the questionnaire form evolved in the sense of an increasing systematization and standardization, and important changes also occurred in the form and structure of the responses prompted by these questionnaires. While the *Relaciones de Indias* of the 1570s and 1580s were still predominantly narrative in character, the narrative component was gradually reduced in early seventeenth-century Jesuit *informationes* and virtually disappeared (at least in principle) in the responses that Royal Society correspondents returned to London throughout the last third of the seventeenth century. By encouraging the traveler-reporter to uncouple description from explanation and privilege the former over the latter, Royal Society questionnaires performed the crucial epistemic function of "teaching the eye to see" in a different way, beyond—and if necessary against—long-standing conceptual frameworks.[67]

Conclusion: The Questionnaire Form and the Chorological Turn

Among the long-standing conceptual frameworks that the questionnaire form contributed to unmaking and remaking was the age-old theory of climatic influence. As we have seen at the beginning of this chapter, climate theory underwent a deep transformation over the course of the seventeenth century, as the long-dominant cosmological model was gradually replaced by its chorological counterpart. The chorological turn in seventeenth-century climate theory has often been explained in light of the new empirical evidence that had become available in the aftermath of the great explorations. In this view, the discovery of the habitability of the Torrid Zone and the realization that vastly different climates coexisted within the same band of latitude contributed to discrediting cosmological conceptions of climate. This chapter has taken a different approach to the question, examining how changes in the form and structure of geoethnographic discourse may have contributed to reshaping climate as a scientific object by promoting a new way of gathering and communicating knowledge about it.[68] Particular attention has been given to the geoethnographic questionnaires that were issued by institutions such as the Council of the Indies, the Society of Jesus, and the Royal Society and then widely disseminated through extensive networks of correspondents around the globe. The adoption of questionnaires as a means of collecting geoethnographic information thoroughly modified the form of climatological discourse by replacing explanation with description and by reducing the narrative component traditionally prevalent in travel accounts. In so doing, questionnaires contributed to redirecting the traveler's gaze toward specific "matters of fact" and away from unwarranted generalizations, causal inferences, and premature systematizations. By forcing the traveler-reporter into an artificial, rhetorically induced condition of pretheoretical experience, questionnaires helped call into question (or at least suspend judgment on) long-standing epistemic paradigms, thus also paving the way for the gradual emergence of new ones.

In many ways, the story reconstructed in this chapter has been that of a fourfold process of translation: across languages, disciplines and genres, geographical spaces, and institutional sites of knowledge production. But it is also a story of epistemic change and a study in its dynamics. How do highly

resilient conceptual paradigms change and evolve? In the case of climate theory, it seems likely that the change took place, or at least became possible, when the imposition of a new layout for the collection and communication of geoethnographic information modified the ways in which early modern travelers encountered, experienced, and represented New World environments and the people in them. When seen in this light, the chorological turn in seventeenth-century conceptions of climate appears as a subparadigm shift (from cosmological to chorological climate theory) that took place *within* the overarching paradigm of climate theory—leaving the central notion of climate's influence of man unscathed but thoroughly transforming the terms in which this notion was construed, with far-reaching implications for its theoretical and practical uses.

Clear indications of such a shift can be seen, for instance, in editions and translations of sixteenth- and early seventeenth-century cosmographies that were later reprinted without the introductory cosmological sections.[9] Another telling sign comes from Oldenburg's revision of Boyle's *General Heads* in 1669 (examined in the previous section), which similarly reflects a departure from the cosmological and astrological components of traditional climate theories in favor of a wholly meteorological and chorological outlook. Overall, this chapter has argued that such changes were facilitated by the widespread adoption of questionnaires as a means of soliciting information from travelers. The revolutionary force of these questionnaires rests less in the *content* of the information conveyed by those who responded to them than in the particular *forms* in which both questions and answers were framed and expressed. Initially introduced as a practical strategy for managing information flows, these questionnaires generated a chain of epistemic consequences that reached the very core of European natural-philosophical thought, ultimately extending to the time-honored doctrine of climatic influence.

Part IV

Translation in the Transoceanic Enlightenment

71. Cienfuegos, *Historia de las plantas*, 2:396–397; Carolus Clusius, *Rariorum aloquot stirpium per Hispanias observatarum Historia, libris duobus expressa* (Antwerp: ex officina Christophori Plantini, 1576), 151.

72. "Siempre que los estrangeros (como tan amigos nuestros) pueden quitar honra, gloria, reputacion, o fama a España lo hazen, digolo por Carlo Clusio." Cienfuegos, *Historia de las plantas*, 2:396–397.

73. Cienfuegos, *Historia de las plantas*, 1:1; Clusius, *Rariorum aloquot stirpium*, 11.

74. Marcelo Aranda et al., "The History of Atlantic Science: Collective Reflections," *Atlantic Studies* 7, no. 4 (2010): 495.

75. Mar Rey Bueno, "Herbolaria de Indias: Apuntes para una materia médica del Nuevo Mundo (1516–1526)," *Azogue* 7 (2010–2013): 255.

Chapter 9

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1. See, Ralph Bauer and Jaime Marroquín Arredondo, "Introduction: An Age of Translation," this volume.

2. Of common use among scholars since the late nineteenth century, the term "climate theory" has recently come under criticism on account of the semantic shift of the term "climate" from premodern times to the present. See Franz Mauelshagen, "Ein neues Klima im 18. Jahrhundert," *Zeitschrift für Kulturwissenschaften* 1 (2016): 39–57. In the absence of a better alternative, the term will be retained here for the sake of convenience though in full awareness of the methodological issues involved in its use.

3. Mary Floyd-Wilson, *English Ethnicity and Race in Early Modern Drama* (Cambridge: Cambridge University Press, 2003).

4. Richard Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600–1860* (Cambridge: Cambridge University Press, 1995); Mark Harrison, *Climates and Constitutions: Health, Race, Environment and British Imperialism in India, 1600–1850* (Oxford: Oxford University Press, 1999); Rebecca Earle, *The Body of the Conquistador: Food, Race and the Colonial Experience in Spanish America, 1492–1700* (Cambridge: Cambridge University Press, 2012); Anya Zilberstein, *A Temperate Empire: Making Climate Change in Early America* (Oxford: Oxford University Press, 2016); Sara Miglietti and John Morgan, eds., *Governing the Environment in the Early Modern World: Theory and Practice* (Abingdon, UK: Routledge, 2017).

5. Edward W. Said, "Traveling Theory," in *The World, the Text, and the Critic* (Cambridge, MA: Harvard University Press, 1983), 226. For a "longue durée" history of climate theories, see Clarence Glacken, *Traces on the Rhodian Shore: Nature and Culture in Western Thought from Ancient Times to the End of the Eighteenth Century* (Berkeley: University of California Press, 1967).

6. The meaning of the terms "cosmological" and "chorological" is explained in section 2 below.

7. See, for instance, Daniel Carey, "Compiling Nature's History: Travellers and Travel Narratives in the Early Royal Society," *Annals of Science* 54, no. 3 (1997): 269–292; Antonio Barrera-Osorio, *Experiencing Nature: The Spanish American Empire and the Early Scientific Revolution* (Austin: University of Texas Press, 2006); María M. Portuondo, *Secret Science: Spanish Cosmography and the New World* (Chicago: University of Chicago Press, 2009); Andrés Prieto, *Missionary Scientists: Jesuit Science in Spanish South America, 1570–1810* (Nashville: Vanderbilt University Press, 2011); Paul Nelles, "Cosas y cartas: Scribal Production and Material Pathways in Jesuit Global Communication (1547–1573)," *Journal of Jesuit Studies* 2 (2015): 421–450. Other studies will be cited below.

8. Some important first steps in this direction include Conor Reilly, "A Catalogue of Jesuitica in the 'Philosophical Transactions of the Royal Society of London' (1665–1715)," *Archivum Historicum Societatis Iesu* 27 (1958): 339–362; Victor Navarro, "Tradition and Scientific Change in Early Modern Spain: The Role of the Jesuits," in *Jesuit Science and the Republic of Letters*, ed. Mordechai Feingold (Cambridge, MA: MIT Press, 2006), 331–388; Jorge Cañizares-Esguerra, "The Colonial Iberian Roots of the Scientific Revolution," in *Nature, Empire, and Nation: Explorations of the History of Science in the Iberian World* (Stanford, CA: Stanford University Press, 2006), 14–45.

9. See Frank Lestringant, *Mapping the Renaissance World: The Geographical Imagination in the Age of Discovery*, trans. David Fausett (Cambridge, UK: Polity, 1994), 3–4; Matthew McLean, *The* Cosmographia *of Sebastian Münster: Describing the World in the Reformation* (Aldershot, UK: Ashgate, 2007), 94–99.

10. On the Macrobian world map and its origins and influence, see Nicolás Wey Gómez, *The Tropics of Empire: Why Columbus Sailed South to the Indies* (Cambridge, MA: MIT Press, 2008), 71–92.

11. Marsilio Cagnati, *De Romani aëris salubritate* (Rome: Luigi Zanetti, 1599), 55. This map has been studied by Saul Jarcho, "Two Maps in an Early Treatise on Epidemiology (Cagnati, 1599)," *Journal of Urban Health: Bulletin of the New York Academy of Medicine* 61, no. 8 (1985): 763–766. For other similar examples, see Saul Jarcho, "Some Early Italian Epidemiological Maps," *Imago Mundi* 35 (1983): 9–19.

12. Portuondo, *Secret Science*.

13. Aristotle, *Politics* 7.7 (1327b, 23–33).

14. Francisco Carriscondo Esquivel, "El valor de la *Apologética historia sumaria* para el análisis de la neología astronómica y cosmográfica renacentista," *Revista de filología española* 89, no. 1 (2009): 163–174.

15. See Jean Bodin, *Method for the Easy Comprehension of History* [*Methodus ad facilem historiarum cognitionem*], trans. Beatrice Reynolds (New York: Columbia University Press, 1945), 84–86.

16. For instance, Montesquieu's discussion of climate theory in Books 14–19 of the *Spirit of the Laws* (1748) features an interesting mix of cosmological and chorological views, thus testifying to a revival of cosmological climate theory during the Enlightenment.

17. See, for instance, Karen Kupperman, "The Puzzle of the American Climate in the Early Colonial Period," *American Historical Review* 87, no. 5 (1982): 1262–1289; Karen Kupperman, "Fear of Hot Climates in the Anglo-American Colonial Experience," *William and Mary Quarterly* 41, no. 2 (1984): 213–240.

18. Zilberstein, *A Temperate Climate*; Kupperman, "The Puzzle of the American Climate," 1287–1288. Kupperman focuses on seventeenth-century British travelers, but similar

observations with regard to the climatic impact of animal farming were made by Gonzalo Fernández de Oviedo (1478–1557) in his *Historia general y natural de las Indias*. See Antonello Gerbi, *Nature in the New World: From Christopher Columbus to Gonzalo Fernández de Oviedo* (Pittsburgh: University of Pittsburgh Press, 1985), 289.

19. James R. Fleming, *Historical Perspectives on Climate Change* (Oxford: Oxford University Press, 1998), 21–32.

20. Anthony Grafton, April Shelford, and Nancy Siraisi, *New Worlds, Ancient Texts: The Power of Tradition and the Shock of Discovery* (Cambridge, MA: Harvard University Press, 1995). See also Bauer and Marroquín Arredondo, "Introduction," this volume. For some interesting remarks regarding the value and potential limits of Grafton's work, see Andrea Frisch, *The Invention of the Eyewitness: Witnessing and Testimony in Early Modern France* (Chapel Hill: University of North Carolina Press, 2004), 77n1.

21. See, for instance, Bodin, *Method for the Easy Comprehension of History*, 102, where we find one of very few references to the New World and its peoples in Bodin's works (compare with Grafton, Shelford, and Siraisi, *New Worlds, Ancient Texts*, 126).

22. Prieto, *Missionary Scientists*, 149–152.

23. See Bauer and Marroquín Arredondo, "Introduction," this volume. For a classic overview, see Margaret T. Hodgen, *Early Anthropology in the Sixteenth and Seventeenth Centuries* (Philadelphia: University of Pennsylvania Press, 1964).

24. Stephanie Leitch, *Mapping Ethnography in Early Modern Germany: New Worlds in Print Culture* (New York: Palgrave Macmillan, 2010); Daniel Carey and Claire Jowitt, eds., *Richard Hakluyt and Travel Writing in Early Modern Europe* (Farnham, UK: Ashgate, 2012).

25. Portuondo, *Secret Science*. On secrecy and competition, see also Bauer and Marroquín Arredondo, "Introduction," this volume.

26. Barrera-Osorio, *Experiencing Nature*, 82–99.

27. On Ovando, see Stafford Poole, *Juan de Ovando: Governing the Spanish Empire in the Reign of Philip II* (Norman: University of Oklahoma Press, 2004).

28. Quoted and translated in Barrera-Osorio, *Experiencing Nature*, 81.

29. Ibid.

30. The text of Santa Cruz's *Memorial* is published in *Relaciones Geográficas de Indias—Perú*, 2 vols., ed. Marcos Jiménez de la Espada (Madrid: Atlas, 1965), 2:xvi–xxi. The passage quoted here ("tengan cuidado de saber el sitio della, si es montuosa ó llana, ó si es llena de anegadizos ó lagunas") is taken from question 3 of the *Memorial* (xix).

31. "Memoria de las cosas a que se ha de responder y de que se han de hacer las relaciones," in *Relaciones Geográficas del siglo XVI: Nueva Galicia*, ed. René Acuña (Mexico City: UNAM, 1988), 18 ("3. Y, generalmente, el temperamento y calidad de la dicha provincia o comarca, si es muy fría o caliente, o húmeda o seca, de muchas aguas o pocas y cuándo son, más o menos, y los vientos que corren en ella qué tan violentos y de qué parte son, y en qué tiempos del año"; "4. Si es tierra llana o áspera, rasa o montuosa, de muchos o pocos ríos o fuentes, y abundosa o falta de aguas, fértil o falta de pastos, abundosa o estéril de frutos y de mantenimientos"; "6. El altura o elevación del polo . . . o en qué días del año el sol no echa sombra ninguna al punto del medio día"; "5. De muchos o pocos indios, y si ha tenido más o menos en otro tiempo que ahora, y las causas que dello se superien; y, si los hay, [si] están poblados en pueblos formados y permanentes; y el talle y suerte de sus entendimientos, inclinaciones y manera de vivir").

32. "Descripcion fecha de la provincia de Vilcas Guaman por el illustre señor Don Pedro de Carabajal . . . en el año de 1586," in *Relaciones Geográficas de Indias—Perú*, 1:209; see throughout in response to question 17 of Ovando's thirty-seven-chapter questionnaire of 1569.

33. "Descripcion de la tierra de la tierra del repartimiento de San Francisco de Atunrucana y Laramati . . . año de 1586," in *Relaciones Geográficas*, Vol. 1, ed. Jiménez de la Espada, 233.

34. Markus Friedrich, "Government and Information-Management in Early Modern Europe: The Case of the Society of Jesus (1540–1773)," *Journal of Early Modern History* 12 (2008): 539–563. As J. Gabriel Martínez-Serna has recently observed, it would be highly desirable to see more "comparative studies of secular imperial networks and the Jesuit organization." J. Gabriel Martínez-Serna, "Procurators and the Making of the Jesuits' Atlantic Network," in *Soundings in Atlantic History: Latent Structures and Intellectual Currents, 1500–1830*, ed. Bernard Bailyn and Patricia L. Denault (Cambridge, MA: Harvard University Press, 2009), 181. In particular, more information will be necessary to establish whether interactions between secular and Jesuit networks played any role in promoting the rise of questionnaires as a privileged form of data collecting in the latter half of the sixteenth century.

35. Martínez-Serna, "Procurators and the Making of the Jesuits' Atlantic Network," 190–191.

36. François de Dainville, *La Géographie des humanistes* (Geneva: Slatkine Reprints, 1969); Stephen Harris, "Mapping Jesuit Science: The Role of Travel in the Geography of Knowledge," in *The Jesuits: Cultures, Sciences, and the Arts, 1540–1773*, ed. John W. O'Malley et al. (Toronto: University of Toronto Press, 1999), 212–240. For the role of geography in the Jesuit *ratio studiorum*, see *The Ratio Studiorum: The Official Plan for Jesuit Education* [Ratio atque Institutio Studiorum Societatis Iesu], trans. Claude Pavur (St. Louis: Institute of Jesuit Sources, 2005), 109.

37. Prieto, *Missionary Scientists*; Glacken, *Traces on the Rhodian Shore*, 450.

38. On Botero's *Relationi universali*, see Romain Descendre, *L'Etat du monde: Giovanni Botero entre raison d'état et géopolitique* (Geneva: Droz, 2009). On the architecture of the *Relationi* and its ties to climate theory, see Federico Chabod, "Giovanni Botero," in *Scritti sul Rinascimento* (Turin: Einaudi, 1967), 342–343. On Botero and his sources for the American sections of the *Relationi*, see Aldo Albonico, *Il mondo americano di Giovanni Botero* (Rome: Bulzoni, 1990). Botero also discusses climate theory in his treatise on the reason of state, *Della ragion di Stato* (Venice: Giolito de' Ferrari, 1589), 5.2.

39. On the genres and readership of early modern travel writing, including the Jesuit missionaries' reports to Rome, see Andreas Motsch, "Relations of Travel: Itinerary of a Practice," *Renaissance and Reformation/Renaissance et Réforme* 34, nos. 1–2 (2011): 207–236; Matthew Day, "Western Travel Writing, 1450–1750," in *The Routledge Companion to Travel Writing*, ed. Carl Thompson (Abingdon, UK: Routledge, 2015), 161–172; Adrien Paschoud, *Le Monde amérindien au miroir des* Lettres édifiantes et curieuses (Oxford, UK: Voltaire Foundation, 2008), 145–168.

40. Harris, "Mapping Jesuit Science," 231. See also Paul Nelles, "Seeing and Writing: The Art of Observation in the Early Jesuit Missions," *Intellectual History Review* 20, no. 3 (2010): 317–333.

41. Ignatius of Loyola to Father Gaspar Berze (Barceo), Rome, February 24, 1554, in *Obras completas de San Ignacio de Loyola* (Madrid: Editorial Catolica, 1963), 854–855 ("que se escriviese algo de la cosmografía de las regiones donde andan los nuestros, como sería

cuán luengos son los días de verano y de invierno, cuándo comienza el verano, si las ombras van sinistras, o a la mano diestra. Finalmente, si otras cosas hay que parezcan extraordinarias, se dé aviso, como de animales y plantas no conocidas, o no in tal grandeza, etc."). See Harris, "Mapping Jesuit Science."

42. Letter of November 22, 1547, quoted in Dainville, *La Géographie des humanistes*, 113.

43. Nelles, "Seeing and Writing."

44. Nelles, "Cosas y cartas," 425.

45. Friedrich, "Government and Information-Management," 547.

46. Ibid., 549.

47. Paul Nelles ("Seeing and Writing," 329) has identified a similar shift from continued narrative to fragmented description in some seventeenth-century *litterae annuae*, such as those that the French missionary Paul Le Jeune sent from New France in the 1630s.

48. Carey, "Compiling Nature's History."

49. John Gascoigne, "The Royal Society, Natural History and the Peoples of the 'New World[s],' 1660–1800," *British Journal for the History of Science* 42, no. 4 (2009): 541.

50. Henry Oldenburg, "Preface," *Philosophical Transactions* 11, no. 123 (March 1676): 552–553. On Oldenburg, see Marie Boas Hall, *Henry Oldenburg: Shaping the Royal Society* (Oxford: Oxford University Press, 2002).

51. Oldenburg, "Preface," 553.

52. Ibid., 555.

53. Michael Hunter, "Robert Boyle and the Early Royal Society: A Reciprocal Exchange in the Making of Baconian Science," *British Journal for the History of Science* 40, no. 1 (2007): 1–23.

54. See, for instance, Reilly, "A Catalogue of Jesuitica"; Cañizares-Esguerra, "The Colonial Iberian Roots"; John Gascoigne, "Crossing the Pillars of Hercules: Francis Bacon, the Scientific Revolution and the New World," in *Science in the Age of Baroque*, ed. Ofer Gal and Raz Chen-Morris, 217–237 (Dordrecht: Springer, 2013).

55. London, Royal Society, Classified Papers, 19/44 and 19/46. Various sets of answers to this questionnaire are also preserved (Classified Papers, 19/75, 19/76, 19/77).

56. Thomas Hill to Henry Oldenburg, July 13, 1671, in Henry Oldenburg, *Correspondence*, Vol. 8, ed. Alfred Rupert Hall and Marie Boas Hall (Madison: University of Wisconsin Press, 1971), 155–156. The original list of queries is preserved in Classified Papers, 19/73 (transcribed and translated in Oldenburg, *Correspondence*, 8:220–251); Oldenburg sent them to Hill on August 19, 1671.

57. Hunter, "Robert Boyle and the Early Royal Society."

58. I draw this list of questions from Oldenburg's "Queries for His Excellencie the Lord Henry Howard of Norfolk, Embassador for His Majesty to Marocco [*sic*]," London, Royal Society, Classified Papers, 19/33 (ca. 1669).

59. Robert Boyle, "General Heads for a Natural History of a Countrey, Great or Small," *Philosophical Transactions* 1, no. 11 (April 1666): 186–189. For the history of this text, see Hunter, "Robert Boyle and the Early Royal Society." Boyle's "General Heads" were extremely popular and long-lived and were reprinted several times in the seventeenth and eighteenth centuries either as a stand-alone piece or within collections of travel writings.

60. Boyle, "General Heads," 186.

61. London, Royal Society, Classified Papers, 19/43 (dated October 6, 1669). See Hunter, "Robert Boyle and the Early Royal Society," 19–20.

62. According to a note in the manuscript, the list was sent shortly afterward to Martyn Lo, vice consul of Iskenderun, along with a list of particular inquiries for Turkey. Hunter ("Robert Boyle and the Early Royal Society"), who first attracted attention to this document, does not seem to realize that it is Oldenburg's list, not Boyle's, that most closely reflects the template of individual lists of queries drafted after 1666.

63. See Thomas Tenison's letter to Oldenburg of November 7, 1671 (Oldenburg, *Correspondence*, 8:344–348), where the future archbishop of Canterbury apologizes for inadvertently reshuffling the order of his answers to questions in the "Enquiries Concerning Agriculture" section previously printed in *Philosophical Transactions* 1, no. 5 (July 1665): "A[nswer] to Q[uestion] 9, misplac'd by me" (346).

64. For a case in point, see Oldenburg's insertion of the connecting phrase "So much of the Baths" (in italics) to transition from the section on baths to the section on quarries in the printed version of Edward Browne's "Accompt Concerning the Baths of Austria and Hungary; as Also Some Stone-Quarries, Talcum Rocks, &c. in Those Parts," *Philosophical Transactions* 5, no. 59 (May 1670): 1050. Browne's original text can be read in Henry Oldenburg, *Correspondence*, Vol. 5, ed. Alfred Rupert Hall and Marie Boas Hall (Madison: University of Wisconsin Press, 1968), 484.

65. Harriet Knight, *Organising Natural Knowledge in the Seventeenth Century: The Works of Robert Boyle* (Saarbrücken: Lambert Academic Publishing, 2011), 33.

66. For the concept of "matter of fact," its Baconian origins, and its role and implications for the scientific mentality of the early Royal Society, see Lorraine Daston, "Perché i fatti sono brevi?," *Quaderni storici* 36, no. 3 (2001): 745–770; Knight, *Organising Natural Knowledge*, 32–52.

67. Joan-Pau Rubiès, "Instructions for Travellers: Teaching the Eye to See," *History and Anthropology* 9, nos. 2–3 (1996): 139–189.

68. In this sense, my approach is similar to that of other scholars who have investigated the connection between rhetoric and epistemology in early modern natural science. See, for instance, Peter Dear, "Totius in Verba: Rhetoric and Authority in the Early Royal Society," *Isis* 76, no. 2 (1985): 144–161; Hunter, "Robert Boyle and the Early Royal Society"; Neil Safier, "Transformations de la zone torride: Les répertoires de la nature tropicale à l'époque des Lumières," *Annales: Histoire, Sciences Sociales* 66, no. 1 (2011): 143–172.

69. A good case in point is Inca Garcilaso de la Vega's history of the Incas, *Comentarios reales de los Incas*, first published in Lisbon in 1609. As Neil Safier ("Transformations de la zone torride," 17) has noted, the two opening chapters, which situate Peru within the framework of cosmological climate theory, disappear in eighteenth-century French translations of the work.

Chapter 10

1. Pehr Kalm, *Voyage de Pehr Kalm au Canada en 1749*, ed. Jacques Rousseau, Guy Béthune, and Pierre Morisset (Montreal: P. Tisseyre, 1977), 3.

2. James Delbourgo and Nicholas Dew, "Introduction: The Far Side of the Ocean," in *Science and Empire in the Atlantic World*, ed. James Delbourgo and Nicholas Dew (New York: Routledge, 2008), 5.

3. Kalm, *Voyage de Pehr Kalm au Canada en 1749*, 3. See also Lisbet Koerner, *Linnaeus: Nature and Nation* (Cambridge, MA: Harvard University Press, 1999).

4. For a broader Atlantic perspective on these cultural encounters, see the other chapters in this volume. For overviews of the history of botanical and ecological exchange in French