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Chapter 7

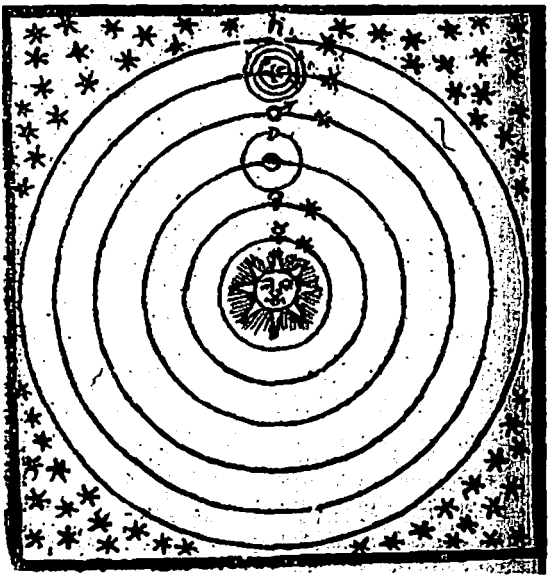
Science in America: The Seventeenth Century

Introduction

The development of modern thought in connection with colonization has been a recurrent theme in these introductions, and this connection is particularly evident in the emergence of modern science. If by science one generally understands not only a kind of knowledge but also a way of knowing, both parts of this definition changed fundamentally over the course of the period surveyed in this volume. This change is evident, for instance, in the transformation, over the course of the sixteenth century, in the character of maps. In the fifteenth century, at the start of the age of colonization, a map was not necessarily an accurate rendition of geographical fact. A *mappa-mundi,* or world map, offered an understanding of geography, rather than its exact representation. Theory took precedence over observation. For example, should observation of an area of the globe yield a proportion of land to water that contradicted a cartographer's idea of the world, he might well sketch in an island he thought must exist although no one had actually seen it. For this medieval map-maker, knowledge was a matter of concepts more than of facts. Of course, he did not invent the outlines of the continents or the directions of rivers; he strove to represent the landscape as accurately as he knew it. But accuracy was not as important to him as what he thought of as truth, which descended from geographical and cosmic laws that prevailed no matter what he observed with his limited powers of sight and measurement.

In the sixteenth century, a different kind of map gradually took precedence as sea travel ventured further and further out of sight of any coast. These maps, called portolans or charts, were sketched by sailors and continuously revised to incorporate new information. Portolans had existed earlier but had been considered merely instruments of navigation, while the *mappae-mundi* projected the true nature of the universe. Now, not only seamen but those to whom the seamen reported the stories of their voyages began to picture the globe as it was sketched in the portolans. Mercator's invention of a way to project curved longitudes and latitudes onto a two-dimensional chart sealed the transfer of authority over representations of the world from theory to empirical reality.

This shift of authority signaled a general shift in the basic definition of knowledge, so that it became a matter first of empirical data: an accumulation of observed and verifiable facts. By the late sixteenth and seventeenth centuries, science was based on measurement and experimentation. Francis Bacon, whose interest in colonization illustrates the connection between imperial enterprise and the development of modern



The Copernican system, 1675

science (see his "Of Plantations" in chapter 2), is often assigned the role of having codified this new scientific philosophy. Broadly, its establishment was the work of the Royal Society, founded in 1660 but in existence as a group of scholars at least twenty years earlier. One of the first actions of the Royal Society as an institution "for Improving Natural Knowledge" was to name two curators of experimentation, one of whom helped Robert Boyle construct his famous air-pump. (The French Académie des Sciences, organized at the end of the seventeenth century, was less exclusively dedicated to experimentation and French science characteristically gave more weight to theory. Until the eighteenth century, the Royal Society was the primary influence on science in the English colonies.)

The new science was a science of practice and also a practical science, whose close relation to actuality was not only a matter of philosophy but of politics. The Royal Society was dedicated to national service, which involved it in building not just the air-pump but the empire. Like the Renaissance mathematician Thomas Hariot who became involved in the fate of the Virginia colony, Boyle was deeply interested in New England, and, out of this engagement, drew up a set of categories for gathering information to be followed by any exploration party anywhere in the world. Nothing better represents the intrinsic character of seventeenth-century science and its relation to the times than his outline of an empirical investigation that will both increase the sum of knowledge about the world and enable its more efficient colonization. Boyle's "heads" project the list of sciences related to the colonial enterprise: astronomy, navigation, cartography, anthropology, natural science (botany, zoology, and minerology).

Two sciences, medicine and linguistics, are left out or invisibly subsumed, perhaps because they require more participation than Boyle envisions for a first survey. But for actually settling foreign territories, medicine and linguistics were essential branches of knowledge and, like the others, through the experience of colonization, became highly experimental. How this worked out in medicine is easy to imagine (the controversy over small-pox innoculation makes it clear), but what it meant for the study of language may be less evident. In fact, the use of language and theories of language changed from the fifteenth to the seventeenth centuries in ways that paralleled contemporary transformations in the conception of knowledge. At the start of the period, language was viewed as a repository of tradition and presumptive reason.

Latin was the language of educated people, connecting their views to transcendent principles. Hobbes, however, denounced metaphorical language as breeding passion and confusion, and Bishop Thomas Sprat, in his 1667 *History of the Royal Society of London,* proposed "a close, naked, natural way of speaking; positive expressions; clear senses, a native easiness; bringing all things as near the mathematical planness" as can be. But plain English took longer to assert itself than objective measurement. When Bacon expanded his *Advancement of Learning* in 1623, he also translated its title into Latin: *De dignitate et augmentis scientiarum.* Newton published the *Principia* in Latin in 1687 and not until 1704—or almost a century after the appearance of the King James Bible—did he publish his *Opticks* in English.

During the seventeenth century, through the new scientific methods applied in conjunction with expanding explorations, Europeans acquired a far more reliable and enabling account of the globe. At the same time, some reports from the field revealed that empirical science, precisely through its reliance on observation, was surprisingly vulnerable to imaginative projections. The careful reports of John Josselyn about the New World's remarkable flora and fauna, and of Increase Mather about some extraordinary events observed in colonial New England, suggest that fact and fantasy can be difficult to distinguish.

M.J.

Suggested readings: The scientific revolution of the seventeenth century has a large literature. Marie Boas, *The Scientific Renaissance, 1450–1630,* offers an overview, as does Alfred Rupert Hall in *From Galileo to Newton.* Treatments of its American manifestation are scattered in these and other works. Perry Miller devotes a chapter of *The New England Mind: From Colony to Province,* "The Experimental Philosophy," to Puritan science, and Daniel J. Boorstin in parts 8 and 9 of *The Americans: The Colonial Experience,* "New World Medicine" and "The Limits of American Science," also looks back to the seventeenth century.