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MICHAEL SAUTER

Between Outer Space and Human Space:  
Knowing Space as the Origin of Anthropology

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Fax: 5727•9800 ext. 6314  
Correo electrónico: [publicaciones@cide.edu](mailto:publicaciones@cide.edu)  
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*"And since you have just been attacking me for commending astronomy for low motives, let me approve of it now on your principles; for it must be obvious to everyone that it, of all subjects, compels the mind to look upwards and leads it from earth to the heavens."*

*—Plato, The Republic*

*"The astronomer and the natural philosopher both conclude that the world is round, but the astronomer does this through a mathematical middle that is abstracted from matter, whereas the natural philosopher considers a middle lodged in matter. Thus there is nothing to prevent another science from treating in the light of divine revelation what the philosophical disciplines treat as knowable in the light of human reason."*

*—Thomas Aquinas, Summa Theologiae*

*"Astronomers investigate with great labour whatever the sagacity of the human mind can comprehend. Nevertheless, this study is not to be reprobated, nor this science to be condemned, because some frantic persons are wont boldly to reject whatever is unknown to them. For as astronomy is not only pleasant, but also very useful to be known: it cannot be denied that this art unfolds the admirable wisdom of God."*

*—John Calvin, Commentary on the Book of Genesis*

*"I wanted to become a theologian, and for a long time I was restless. Now, however, observe how through my effort God is being celebrated in astronomy."*

*—Johannes Kepler, Letter to Michael Maestlin*

*"Two things fill the mind with ever new and increasing admiration and awe, the more often and steadily reflection is occupied with them: the starry heaven above me and the moral law within me. Neither of them need I seek and merely suspect as if shrouded in obscurity or rapture beyond my own horizon; I see them before me and connect them immediately with my existence."*

*—Immanuel Kant, Critique of Practical Reason*



## Abstract

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*This essay expressly connects two major themes in the intellectual history of early-modern Europe between 1400 and 1800: the rise spatial thinking and the emergence of anthropological thought. It argues that the return to western Europe of Greek ideas about space —especially Euclidian ones— in the fifteenth century set in motion a series of intellectual changes that, ultimately, resulted in the Enlightenment's creation of anthropology. The most important change was what the essay calls the "terrestrialization of man", which it identifies as the ability to put into space both places and people that one cannot see. This "terrestrialization" is most apparent in the ability of Europeans to think of the human being as having a specific spatial context. The key element in this intellectual change was, the essay further argues, the rise of astronomy as a scientific discipline, for astronomy provided the tools with which people could envision not only human spaces but also extra-terrestrial ones. In a sense, human beings became defined not only by the spaces they occupied but also with respect to spaces that they manifestly did not. The essay then concludes with the idea that true anthropological thinking came only after astronomers taught Europeans to imagine the possibility of extra-terrestrial life, because at that point space became the ultimate backdrop for evaluating the worth of terrestrial life.*

## Resumen

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*Este ensayo expresamente conecta dos de los grandes temas en la historia intelectual de la Europa moderna temprana entre 1400 y 1800: el ascenso del pensamiento espacial y la emergencia del pensamiento antropológico. Se argumenta que el regreso de las ideas griegas sobre el espacio a Europa occidental, especialmente las ideas de Euclidiano, en el siglo XV, promovieron una serie de cambios intelectuales que, finalmente, resultaron en la creación ilustrada de la antropología. El cambio más importante es lo que el ensayo denomina la "territorialización del hombre", que identifica como la habilidad de colocar en el espacio ambos lugares y a personas que nadie puede ver. Esta "territorialización" es mayormente visible en la habilidad de los europeos para pensar al ser humano dentro de un contexto espacial específico. El elemento clave en este cambio intelectual fue, como el ensayo argumenta, el inicio de la disciplina científica y astronómica, ya que la astronomía proveyó las herramientas con las cuales las personas podían imaginar no sólo espacios humanos, sino también espacios extraterrestres. En cierto sentido, los seres humanos se definieron no únicamente por los espacios que habitaban sino también con respecto a espacios que manifiestamente no ocupaban. Este ensayo concluye, por lo*

*tanto, con la idea de que un verdadero pensamiento antropológico únicamente pudo concebirse después de que los astrónomos le enseñaron a Europa a imaginar la posibilidad de una vida extraterrestre, ya que para ese punto el espacio se convirtió en el último dorso para evaluar el valor de la vida terrestre.*

## *Introduction*

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Let us begin at the end, with a photograph of our planet Earth in Figure 1. Often called “Earth Rising”, this image was taken on 24 December 1968, by the crew of the Apollo 8 mission, and it, along with other photos taken during that mission, is of staggering historical significance, because it documents the first moment in five thousand years of recorded history that any human being physically saw the entire earth. It has often been credited with giving impetus to the then-nascent environmentalist movement, which, if true, would make it an ancestor of much of our contemporary political rhetoric.<sup>1</sup> However, what interests me about this photograph is that every educated person in the modern world is capable of interpreting it. Those of us raised within the Western-inspired system of scientific education were exposed at young ages to geometry, geography, earth science, physics and so forth and can, thus, immediately recognize the blue thing in the background as our home planet. Moreover, we are able to do so in the context of another heavenly body that sits in the foreground, and which no more than a dozen human beings have ever visited. That is to say, in order to understand this photograph, modern viewers must orient themselves within the picture by projecting their perspective into a place that they have never been, while looking back upon a place they have never actually seen. How did it come to this point? And what does the ability to project space mean for the history of Western thought?

In classic intellectual historical terms, the ability to define and manipulate space is an example of what Lucien Febvre has characterized as *l’outillage mental*, mental furniture.<sup>2</sup> With respect to spatial thinking our furniture has a very long history, one that dates back at least to the Classical World and runs up through the European Middle Ages. The key period, however, in the construction of our modern mental furniture was the four centuries between 1400 and 1800, for it was during this time that two scientific disciplines, geometry and astronomy, emerged in a way (and at a time) that allowed the European sense of space to dominate the world. This spatial sense is what undergirds our ability to recognize and situate the Blue Planet with respect to ourselves.

This essay sketches a pale outline of what will be a much larger project on the significance of space to the Western philosophical tradition. Although I cannot go deeply into the matter here, a few general comments about how I see the problem are in order. Regardless of how far back we go in the

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<sup>1</sup> Hans Blumenberg, *The Genesis of the Copernican World*, trans. Robert M. Wallace (Cambridge, Mass.: MIT Press, 1987). Dennis Cosgrove, “Contested Global Visions: One-World, Whole-Earth, and the Apollo Space Photographs”, *Annals of the Association of American Geographers* 84, no. 2 (1994).

<sup>2</sup> Lucien Febvre, *The Problem of Unbelief in the Sixteenth Century: The Religion of Rabelais*, trans. Beatrice Gottlieb (Cambridge, MA: Harvard University Press, 1982).

Western tradition, we see that space and spatial thinking are deeply implicated in the processes of knowledge creation. Whether it be the early Gnostics, who saw the universe as a hostile place—a Cartesian fraud perpetrated by evil spirits on humans—the ancient Greeks and their intellectual descendents in medieval Europe and the Islamic world, whose spatial understanding was a cocktail of physics and metaphysics, or seventeenth-century thinkers such as René Descartes (1596-1650), Gottfried Leibniz (1646-1716) and Isaac Newton (1643-1727), who reformulated the medieval synthesis in a way that made space a mostly physical issue—if often for metaphysical purposes—each of these players defined knowledge via their understanding of space.<sup>3</sup> There is, after all, no “gnosis” without an evil universe and no Newtonianism without absolute space.

Against the backdrop of these general statements, this essay will concentrate more narrowly on one cultural current, the relationship of spatial thinking to the history of anthropological thought in the early-modern world. The explicit association of space with anthropology addresses a fundamental weakness of recent critiques of the history of western thought, namely the failure of the critics to recognize spatial ideas as constitutive of reason. Perhaps, the most famous contemporary critique comes from Michel Foucault.<sup>4</sup> Essentially, Foucault argues that western rationality is oppressive, because it has produced the tools with which societies have identified and constrained individuals who are different from the norm—a category that includes criminals, the physically and mentally ill, homosexuals and anyone else who deviated from generally accepted standards of any sort. Foucault’s critique has the peculiar characteristic, however, that although his analysis is driven by spatial language—using terms, such as grid, field and locus—he never actually discusses the spatial aesthetic of the periods that he analyzes/criticizes, but imposes his view of space on the early-modern world.<sup>5</sup>

A similar problem is apparent in the equally famous critique by Jacques Derrida of what he calls western logo-centrism. In his great work, *Of Grammatology*, Derrida deconstructs the history of western philosophy from the Classical World to the present and argues that the western emphasis on logic, to the exclusion of alternate styles of thought, created a false confidence in the subject as the cornerstone of all thinking.<sup>6</sup> The subject is, according to this view, a philosophical error that humanity must overcome, if human beings are to infuse freedom (or in Derrida’s terms, “play”) into reason itself.

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<sup>3</sup> Amos Funkenstein, *Theology and the Scientific Imagination from the Middle Ages to the Seventeenth Century*, (Princeton, NJ: Princeton University Press, 1986).

<sup>4</sup> Michel Foucault, *The Order of Things: An Archaeology of the Human Sciences* (London: Tavistock Publications, 1970), ———, *The Birth of the Clinic: An Archaeology of Medical Perception* (New York: Vintage Books, 1975), ———, *Discipline and Punish: The Birth of the Prison* (New York: Pantheon Books, 1977).

<sup>5</sup> Daniel Brewer, “Lights in Space”, *Eighteenth-Century Studies* 37, no. 2 (2004).

<sup>6</sup> Jacques Derrida, *Of Grammatology*, 1<sup>st</sup> American ed. (Baltimore, MD: Johns Hopkins University Press, 1976).

Following Derrida, Richard Rorty has made much the same argument in his classic *Philosophy and the Mirror of Nature*, in which he deconstructs the history of philosophical thought about the subject by emphasizing the constructed and contingent nature of both the subject and nature.<sup>7</sup> Even in Rorty, however, we see the same problem, namely the concentration on the subject as an historical-philosophical problem to the exclusion of the role(s) that spatial understanding played in the subject's understanding of itself. If we go back to the ancient Greeks, however —Plato, Aristotle, Euclid, Archimedes, etc.— we find that subjects have always existed within space. It is, therefore, a companion thesis to the larger project described above that changes in spatial sense have produced changes in the subject.

Finally, we must take note of another theorist who, although he critiques reason as fiercely as the others noted above, maintains his faith in its emancipatory potential, Jürgen Habermas. Habermas has also done his part to undermine the western tradition's confidence in the philosophical subject by propounding a theory of communicative action.<sup>8</sup> Reason is not the province of the individual, for Habermas, but of a group engaged in rational, public discussion —and this is the central theme of much of his scholarly production during the 1970s and 1980s. In response to the famous Cartesian cogito, Habermas posits the cogitamus. Habermas is, however, strangely silent on the question of the subject as a spatial construction. Indeed, his most significant contribution to the theory of communicative action is his insistence on the need to construct a robust public sphere to which people can contribute without regard to their physical location.

Habermas's public sphere would seem to have spatial overtones, but these are merely artifacts of translation. In his work Habermas does not speak of spheres, or even places, but of openness (*Öffentlichkeit* in the original), a term that bears no specific spatial connotations.<sup>9</sup> This search for openness is a legacy of Kantian thought. Immanuel Kant (1724-1804) also believed firmly in the utility of public debate and was fascinated by the possibilities that the explosion of print in the eighteenth century revealed for continental-wide discussions. Kant, for his part, could live happily in the relatively remote Königsberg, East Prussia, and still be a vibrant part of enlightened public debate through extensive reading and writing.<sup>10</sup> This perspective represents nothing less than Kant's (and Habermas's) best hopes for print, and the emphasis on hope is, perhaps, why the spatiality of the debating subject has

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<sup>7</sup> Richard Rorty, *Philosophy and the Mirror of Nature* (Princeton, NJ: Princeton University Press, 1979).

<sup>8</sup> Jürgen Habermas, *The Philosophical Discourse of Modernity: Twelve Lectures*, Studies in Contemporary German Social Thought (Cambridge, MA: MIT Press, 1987), ———, "The Unity of Reason in the Diversity of Its Voices", in *What Is Enlightenment?: Eighteenth-Century Answers and Twentieth-Century Questions*, ed. James Schmidt (Berkeley, CA: University of California Press, 1996).

<sup>9</sup> Jürgen Habermas, *Strukturwandel Der Öffentlichkeit: Untersuchungen Zu Einer Kategorie Der Bürgerlichen Gesellschaft* (Neuwied Luchterhand, 1962).

<sup>10</sup> Manfred Kuehn, *Kant: A Biography* (New York: Cambridge University Press, 2001).

been effaced from both men's discussions of publicity. Space was something that communicative reason was meant inherently to overcome.

None of this should be construed to mean that I intend to rework our understanding of the philosophical subject in this essay. Rather I aim to note here that the criticism of the modern subject that we see in the thinkers above emerges from a one-dimensional rereading of early-modern philosophy. In the cases of Foucault and Derrida, this meant a deep confrontation with Descartes's understanding of the subject, but not necessarily much else in his thought. And in the case of Habermas and many German critics, all philosophical roads had to pass through Kant's reformulations of Descartes (and others). Here, we should pause, however, to note a fundamental irony, namely that both Descartes and Kant were deeply involved in early-modern debates about the nature of space. When Descartes published his *Discourse on Method* (1637) he became the undisputed inventor of analytic geometry, in which equations are used to plot points in abstract space; and Kant founded his entire philosophy in *Critique of Pure Reason* (1781) on what he called the transcendental aesthetic, which was a universal ability of human reason to take up experience in terms of time and space. This is to say nothing of people such as Benedict Spinoza (1632-1677), who was a lens grinder and, thus, had to understand space in relation to the human eye's ability to understand it, Thomas Hobbes (1588-1679), who (falsely) fancied himself a geometer, and Isaac Newton and Gottfried Leibniz, who created the modern calculus, which is, in the end, a sophisticated method for finding a point on a curve in space. By the end of the seventeenth century, new ideas of space provided the essential substrate for just about every form of intellectual endeavor.

It is important to understand that the space I am discussing here begins as an abstraction, divorced from "real" space. Hence, all spatial knowledge, such as that in maps and globes, is imagined space, first and foremost, and cannot be understood as merely a representation of real space. This distinction may not seem significant now, but it will be apparent throughout this essay how fundamental the recognition of a difference between the two has been to the history of astronomy and other related disciplines. Moreover, this distinction also serves as a critical separator from modern students of space, such as Henri Lefebvre and Stephen Kern. In his brilliant theoretical work on modern urban space, *The Production of Space*, Lefebvre argues that space is "produced" through repeated use by people and without regard to class structures.<sup>11</sup> The class dimension of Lefebvre's work is part of his death struggle in the late 1960s and 1970s with the increasingly ossified academic Marxism that dominated French academia. Its significance for theoretical Marxism lies in the way that it associates historical change and social

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<sup>11</sup> Henri Lefebvre, *The Production of Space* (Oxford: Blackwell, 1991).

organization with daily practice very broadly defined, rather than with the means of production alone, which was the doctrinaire Marxist position.<sup>12</sup> Setting the problem of Marxism aside, Lefebvre's insights are especially important to anyone who works on urban spaces of any sort, although as should be readily apparent, they are not very helpful when trying to understand how people thought about non-human spaces, such as the lunar surface.

Stephen Kern brings a much different sensibility to space in his book *The Culture of Time and Space, 1880-1914*.<sup>13</sup> In this work, Kern argues that the cultural and literary avant-garde of the fin de siècle re-imagined space as discontinuous and fractured. Kern's thesis is plausible and well supported in the work. Its main limitation, however, for the purposes of this essay, is precisely how heavily it concentrates on the sensibilities of elite thinkers and writers. However fractured space may have become for writers, architects and sculptors, during the period in question, the rest of humanity then (and now) worked within a practical spatial realm that was dominated by Euclidian conceptions of space.

With Figure 1 in mind, let me provide you with two examples taken from the eighteenth century that illustrate how early-modern notions of space emerged from non-human spaces. The first example comes from 1786, when Immanuel Kant published a journal article entitled "What is Orientation in Thinking?"<sup>14</sup> He defined the concept thus: "To orient oneself means, in the literal meaning of the word: to find the sunrise from a given region of the world, [given that] we divide the Horizon into four parts. If I see the Sun in the sky, and know that it is afternoon, now I know how to find south, west, north and east. For this purpose, however, I require a feeling of a difference within my own subject, namely [that of] the right and left hand."<sup>15</sup> Kant is expressing something that was fundamental to his philosophy, namely that left and right, north and south, etc., only take on meaning in a world that our reason is designed to apprehend. That is to say, although our imaginations can extend to many places, our reason is rooted here, on this planet. It is significant, however, that the sense of place that undergirds Kant's ideas about orientation is based on the combination of celestial with terrestrial markers that cannot be experienced directly by the human subject. North, south, east and west do not actually exist, but are human projections onto the earthly sphere. In addition, our view of the Sun and the stars is obscured by our Earth's atmosphere, which means that we must correct the distortions that the atmosphere produces. Hence, Kant constructed his world with

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<sup>12</sup> On practice, see Pierre Bourdieu, *Outline of a Theory of Practice*, trans. Richard Nice (Cambridge: Cambridge University Press, 1977).

<sup>13</sup> Stephen Kern, *The Culture of Time and Space, 1880-1918* (Cambridge, MA: Harvard University Press, 2003).

<sup>14</sup> Immanuel Kant, "Was Heißt: Sich Im Denken Orientiren?" *Berlinische Monatsschrift* (1786).

<sup>15</sup> *Ibid.*: 307-08.

reference to things that were difficult or impossible to see. Although his philosophy is based in experience, in the end, his image of the world remains fundamentally imagined.

The approach to orientation that we see in Kant is also on display in a second example, a travel report from a group of explorers in New South Wales, Australia, written in the year 1791. Of one expedition the group's leader, Watkin Tench, wrote, "at a very short distance from Rose Hill we found that they [the aboriginal guides] were in a country unknown to them; so that the farther they went, the more dependent on us they became, being absolute strangers inland."<sup>16</sup> Things were not quite so bad for the English, according to Tench, because they had brought with them an astronomer, who tracked the group's movements and calculated their position daily with the result that, "we always knew exactly where we were and how far from home" —and this apparently even when the expedition was completely lost. This example highlights the central aspect of the revolution in spatial orientation that had occurred during the previous four centuries. Europeans had learned to calculate abstract space with reference to celestial phenomena and to apply those calculations to the spaces that they occupied. Phenomena that no one could actually experience were now fundamental to understanding experience in this world—at least for the Europeans.

Keeping these two examples of orientation in mind, we should pause to consider what it meant for the history of Europe and the world, for that matter, that Europeans could be "lost" and still know "where" they were. I cannot pursue this issue fully here, but is worth suggesting that spatial sense put Europeans in a dominant position with respect to almost all the people that they encountered during their explorations —the Chinese excepted, though even the Chinese recognized that the European way of knowing space was superior to their own— so that "local knowledge", whatever its form, could be dismissed by the European interlopers, which in the case of our English explorers is exactly what happened. (Just to give equal time to the aboriginal guides, I should note that they could not understand why the English carried so much gear into the countryside and also looked askance at English culinary tastes, calling their employers "shit-eaters").<sup>17</sup>

These anecdotes about Kant and the English in Australia reframe our understanding of the history of spatial orientation. Although we have the aid of Figure 1 in trying to keep an image of the Earth in our minds, people in Europe had been imagining the globe for centuries without the slightest bit of help from NASA. My project begins with the origins in early-modern Europe of the ability to imagine as real what, in fact, no one can experience directly. I ask the following three questions. First, how did Europeans learn to imagine

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<sup>16</sup> Quoted in Simon Schaffer, "Instruments, Surveys and Maritime Empire", in *Empire, the Sea and Global History; Britain's Maritime World, C. 1760-C.1840*, ed. David Cannadine (Houndmills: Palgrave Macmillan, 2007), 85.

<sup>17</sup> Ibid.

and orient themselves by places and spaces that they could not see? Second, what effects did this ability to orient oneself have on Europeans' daily experience of their world? Finally, what does all of this tell us about the foundations of knowledge in early-modern Europe —about how it was constructed, situated and used? (This latter question would, I think, have particular resonance for anyone who studies European Colonialism or the rise of the Atlantic World. In addition, it seems to me that since the word globalization is on everyone's lips these days, it may prove fruitful to think about how human beings acquired the same image of the globe).

From here, I divide this essay into two parts, and the reader should understand this division as mirroring the organization of the larger project. The first part will offer only a very broad overview of the earliest periods covered; it also corresponds, roughly, to the first question I just posed. The second part comes from part II of the book project and presents my recent ideas on astronomy and the rise of anthropology in the eighteenth century.

## *Part I*

Any understanding of Europe's age of orientation must begin in the fifteenth century with the translation into vernacular languages of Greek classics, particularly the major works of Euclid and Ptolemy. Euclid's *Elements* gave to Europeans a system of spatial imagination whose intuitive nature and elegant simplicity was so overwhelming that Euclidian conceptions of space dominated geometric thinking until the end of the nineteenth century.<sup>18</sup> Ptolemy's *Almagest* was, of course, equally important as a resource for astronomical investigation, and his *Geographia* set European geography onto a completely new path.<sup>19</sup> Although there were prior medieval attempts to recover the classical heritage —most notably via medieval, Arabic-speaking Spain— the early-modern process of translation began with the importation into Europe, during the fifteenth century, of Byzantine manuscripts written in the original Greek language, which were then translated into Latin.<sup>20</sup> The seed kernel of this process was planted in 1397 with the arrival in Florence of the scholar Manuel Chrysoloras (1355-1415), who taught Greek to, among others, the great Humanist Leonardo Bruni (1369-1444), thus making Greek study something of a vogue in Renaissance Italy.

The return of the Greek language to the former western half of the Roman Empire is of incalculable significance to the history of spatial thinking in the European world, as by the beginning of the fifteenth century, the Empire's ancient capital, Rome, had become a center of translation and republication

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<sup>18</sup> Jeremy Gray, *Ideas of Space: Euclidean, Non-Euclidean, and Relativistic*, 2<sup>nd</sup> ed., Oxford Science Publications (Oxford: Clarendon Press, 1989).

<sup>19</sup> Leo Bagrow, "The Origin of Ptolemy's *Geographia*", *Geografiska Annaler* 27 (1945).

<sup>20</sup> R. R. Bolgar, *The Classical Heritage and Its Beneficiaries* (Cambridge: Cambridge University Press, 1963).

of Greek knowledge on space. In 1409, for example, Jacopo Angeli da Scarperia (ca. 1360-1411), who had gone to Constantinople at the end of the fourteenth century to study with Chrysoloras, translated into Latin Ptolemy's *Geographia*. It was probably this translation that Christopher Columbus used, when he planned his voyage to China—a significant fact, since Ptolemy's estimate of the Earth's circumference was 25% smaller than actually is the case. Had Columbus understood the Earth's true size, would he have ever set sail?

Other important texts came to Italy a generation later, in 1439, under the care of Basilus, Cardinal Bessarion (1403-1472), a Byzantine monk who was desperately trying to save as much of Greco-Byzantine culture as he could in the face of the final Ottoman advance against Constantinople, which came in 1453. Bessarion set up shop in Rome, where he made available his massive library of Greek manuscripts to a host of scholars that included Nicholas of Cusa (1401-1464), Johannes Müller, aka Regiomontanus (1436-1476), Georg Peurbach (1423-1461) and Georg of Trebizond (1395-1486). Cardinal Bessarion's influence on Renaissance thought is amply documented. His contributions to the history of astronomy and of spatial thinking more generally are only beginning to be understood.<sup>21</sup> It was in Bessarion's library, for instance, that the astronomer Regiomontanus corrected and then published a series of translations of Archimedes' works, including *De sphaera et cylindro*, before turning to his translation of Ptolemy's *Almagest*, which became the most widely used version of that text, during the sixteenth and seventeenth centuries. Regiomontanus is extremely significant to the history of astronomy, because after returning to his native Germany he completed and published, in 1472, a text begun by his colleague Peurbach that became the first known European textbook in astronomy, *Theoricae novae planetarum*. This text, later, fell into the hands of none other than Nicolaus Copernicus (1473-1543), whose *De revolutionibus orbium coelestium* is the origin of early-modern heliocentrism.<sup>22</sup> (Regiomontanus followed Ptolemy's geocentrism).

The translation into Latin of Byzantine manuscripts made possible a flurry of subsequent re-translations into European vernaculars. For example, by the end of the sixteenth century there were English, French, German, Italian and Spanish versions of Euclid circulating around Europe.<sup>23</sup> What did these translations do for Europeans? They taught ever-greater numbers of them to think in terms of a space that had three characteristics, homogeneity, simultaneity and reflexivity. What I mean by this is that Euclidian space

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<sup>21</sup> Bessarion is unmentioned in Anton Pannekoek, *A History of Astronomy* (New York: Interscience Publishers, Inc, 1961). His influence is, however, covered in Michael A. Hoskin, ed., *The Cambridge Concise History of Astronomy* (Cambridge: Cambridge University Press, 1999), 85-86.

<sup>22</sup> Henry Guerlac, "Copernicus and Aristotle's Cosmos", *Journal of the History of Ideas* 29, no. 1 (1968).

<sup>23</sup> Bolgar, *Classical Heritage*.

allowed Europeans not only to understand the earth as a sphere, but also to see spheres as *lived* spaces, an insight that made it possible for us to imagine that people occupied the space opposite to ours on our sphere (or even on other spheres) and, in turn, to believe that these people were thinking about us, or looking back at us. The issue here is not the complete newness of this perspective. Medieval thinkers such as John of Holywood (1195-1256) and Robert Grosseteste (1175-1253) believed that the Earth was a sphere and there are extant medieval images that show people to be standing on the earth's surface at different points. (It is not true that medieval people believed that the Earth was flat. This idea was invented, in 1820, by Washington Irving.)<sup>24</sup> Nonetheless, there are important differences between medieval space and what came later. First, the medieval aesthetic of space was radically different from that of the Renaissance. Medieval space was fundamentally discontinuous, rather than continuous, and there were no effective theories of perspective within art.<sup>25</sup> Second, medieval physics and cosmology posited a radical discontinuity between terrestrial space and outer space. Anything above the earth's atmosphere was subject to different physical rules and existed in a qualitatively different space than the things on earth.<sup>26</sup> These discontinuities were overcome by an alternate Greek sense of abstract space that was summed up in the works of Euclid.

A key example of the new understanding of lived space is the spread of the word antipodes (literally: "opposite feet") throughout Europe's cultures. Although the term appeared in medieval treatises on the sphere and entered the English language in 1398, its steady use begins only in the sixteenth century and runs through the seventeenth, when geometry and astronomy were achieving positions of dominance. Antipodes also entered French usage in the late fourteenth century, but its heaviest usage comes in the seventeenth and eighteenth centuries by writers such as Molière (1622-1673), François Fénelon (1651-1715) and Voltaire (1694-1778). The story is similar for the German equivalent of antipodes, "Gegenfüsser", which enters the German language in the early sixteenth century and appears ever more frequently thereafter. Here is an example of the terms' use in a text published in Berlin in 1786, "The antipodes to Berlin must live at 211ø 2' 30'' longitude and 52ø 31' 30'' southern latitude. This area lies, according to the accompanying world map in the South Sea, east of the southern tip of New Zealand."<sup>27</sup> Now

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<sup>24</sup> David C. Lindberg, *The Beginnings of Western Science: The European Scientific Tradition in Philosophical, Religious, and Institutional Context, Prehistory to A.D. 1450*, 2<sup>nd</sup> ed. (Chicago: University of Chicago Press, 2007).

<sup>25</sup> Samuel Y. Edgerton, *The Renaissance Rediscovery of Linear Perspective* (New York: Basic Books, 1975), Martin Kemp, *The Science of Art: Optical Themes in Western Art from Brunelleschi to Seurat* (New Haven, CT: Yale University Press, 1990).

<sup>26</sup> W. G. L. Randles, *The Unmaking of the Medieval Christian Cosmos, 1500-1700: From Solid Heavens to Boundless Aether* (Aldershot: Ashgate, 1999).

<sup>27</sup> Johann Elert Bode, *Anleitung Zur Allgemeinen Kenntniss Der Erdkugel* (Berlin: Christian Friedrich Himburg, 1786).

you could be in Berlin (or Paris) with your book and world map and imagine a space appropriate for life human halfway around the globe.

Geometry became a very hot science, during the late sixteenth- and the entire seventeenth centuries, with its influence echoing throughout the learned world. Take, as an example, Figure 2, which contains the frontispiece of an English-language version of the *Elements* that was published in 1570. This text is only one of many, as by the end of the seventeenth century, dozens of versions of the *Elements* were published in a variety of languages. However, in order to understand how Euclidian geometry diffused throughout European society, we must recognize that in the sixteenth and seventeenth centuries, knowledge was organized differently than it is today. That is, disciplines that we may understand as separate were, originally, grouped together—and this gave early-modern knowledge a new, highly integrated character. Beginning in the sixteenth century we see the emergence of a group of disciplines called mixed mathematics, which included astronomy, geography, horology, optics, hydraulics, gnomonics, fortification, surveying and navigation.<sup>28</sup> Within this disciplinary basket, astronomy absorbed Euclid completely and, during the seventeenth and eighteenth centuries, passed his geometric thought on to all the other disciplines. Consider, as an example, this catchy title from a book published in Berlin in 1793, *Elements of Astronomy along with Mathematical Geometry, Navigation, Chronology and Gnomonics*.<sup>29</sup>

Before we leave behind the issue of disciplinary boundaries, let us take a closer look at the frontispiece to this version of the *Elements*. The images contained around the frontispiece's edges provide a glimpse of not only the disciplinary changes that were underway but also the role of Greek knowledge in impelling these changes. Let us begin at the bottom, where moving from left to right we see personifications of Geometry, Arithmetic, Music and Astronomy. These four disciplines comprise the ancient quadrivium that made up one part of the group of seven liberal arts. (The trivium was the other part and included Grammar, Rhetoric and Dialectic).<sup>30</sup> As we move up the right side of the frontispiece, we see personifications of great classical thinkers: Polybius (203-120 BC), the historian; Strabo (63 BC-AD 24), the geographer; Marinus (70-130), the geographer; Ptolemy (90-168), the astronomer-cosmographer; Aratus (315- 240 BC), the didactic, cosmological poet; Hipparchus (190-120 BC) the astronomer.

Let us consider this cast of all-stars as a group. First, all were Greek speaking, regardless of the place or time in which they lived. Second, all of

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<sup>28</sup> John L. Heilbron, *Elements of Early Modern Physics* (Berkeley, CA: University of California Press, 1981).

<sup>29</sup> Georg Simon Klügel, *Anfangsgründe Der Astronomie Nebst Der Mathematisch Geographie, Schiffahrtskunde, Chronologie Und Gnomonik* (Berlin and Stettin: Friedrich Nicolai, 1793).

<sup>30</sup> Marcia L. Colish, *Medieval Foundations of the Western Intellectual Tradition, 400-1400*, Yale Intellectual History of the West (New Haven, CT: Yale University Press, 1997).

them confronted physical space, either in the earthly or terrestrial realm. Third, some of these men, such as Polybius, Strabo and Marinus represent emerging disciplines, in the late sixteenth century, that did not fit neatly into the liberal arts tradition. And if we look to the top of the frontispiece, we see that these men surround and support the early-modern imagination of the globe, as we have a terrestrial globe in the center, flanked on the right by some kind of geometer (notice the compass in the fellow's hands) and on the left a royal personage, who is presumably supporting the production of spatial knowledge. The Latin motto beneath the two men and the globe reads in English "truth grows strong from a wound".

Although further research on this point is necessary, the Latin phrase would seem to be a gloss on a popular sixteenth-century motto *virescit vulnere virtus*, which means, "virtue grows strong from a wound". If so, we may have stumbled on a point at which the rising interest in Stoic cosmology, during the sixteenth and seventeenth centuries, has crossed into the efflorescing discipline of geometry, which would provide an important connection between geometry and the great cosmological debates of the seventeenth century. This would be very significant, since the return of the stoic *pneuma* to early-modern cosmological discussion fundamentally altered early-modern discussions about the universe's structure. The stoic understanding of a continuous universe permeated by the same substance, the *pneuma*, served as corrosive element within the medieval Aristotelian-Ptolemaic universe, which had posited a radical difference between terrestrial and celestial substances.<sup>31</sup> Having a coherent vision of substance as universal and unchanging gave medieval Europeans an alternate cosmology that could be used to critique the existing one.

Equally important to geometry's rise was the appearance of institutions dedicated to its study. In 1619, Sir Henry Savile (1549-1622), a noted expert in Greek (he published an important edition of the Greek works of John Chrysostom), endowed two chairs at the university of Oxford. One was the Savilian Chair in Astronomy, the other was a Chair in Geometry. Much to his chagrin, Savile could not, initially, find anyone to occupy the latter chair, so he occupied it himself and delivered a slew of lectures on geometric topics. Indeed, Savile's commitment to geometry was so serious that, in 1621, he also published a textbook on geometry to encourage basic study in the field. Another enthusiastic geometer was Thomas Hobbes, who became so taken with geometry that he used it as the foundation for his political theory in the first section of the *Leviathan* (1651). Geometry was a big deal in France, too, where Peter Ramus (1515-1572), the founder of modern discursive logic, published a work on its fundamentals, while his greatest student, Jean Pena

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<sup>31</sup> Pierre Maurice Marie Duhem, *Medieval Cosmology: Theories of Infinity, Place, Time, Void and the Plurality of Worlds* (Chicago: University of Chicago Press, 1985), Steven J. Dick, *Plurality of Worlds: The Origins of the Extraterrestrial Life Debate from Democritus to Kant* (Cambridge: Cambridge University Press, 1982).

(1528-1558) translated and published Ptolemy's *Optics*, which was read and influenced heavily Johannes Kepler.<sup>32</sup> Of course, as was mentioned above, René Descartes also published a number of works relating to geometry.

Having surveyed the backdrop provided by the sixteenth and seventeenth centuries, we can see the effects of all this geometric thought most clearly, if we look ahead to 1751. In that year appeared an article on geometry appeared in the *Encyclopédie*, and in which we find this view expressed, "It is by a simple abstraction of the spirit, that one regards the lines as being without width and the surfaces without depth: geometry envisages, thus, bodies in a state of abstraction, where they do not really exist. The truths that geometry discovers and demonstrates about bodies are, thus, truths of pure abstraction, of hypothetical truth. But these truths are not less useful."<sup>33</sup>

With that I have reached the end of an extremely schematic presentation of some early research on the problem of space. Now, let me summarize in away that will adequately frame the second part of this essay. Although there were important medieval precursors such as John of Holywood and Bishop Robert Grosseteste, Euclid and his conception of space returned to Europe with a vengeance during the fifteenth and the sixteenth centuries, a process of recovery and diffusion that set in motion significant changes in a host of emerging disciplines, the most transformative of which was astronomy. Now I turn to the second part.

## *Part II*

In 1787, Immanuel Kant published the second of his three critiques, *Critique of Practical Reason*. In the conclusion to this text we find these famous words, "Two things fill the mind with ever new and increasing admiration and awe, the more often and steadily reflection is occupied with them: the starry heaven above me and the moral law within me. Neither of them need I seek and merely suspect as if shrouded in obscurity or rapture beyond my own horizon; I see them before me and connect them immediately with my existence."<sup>34</sup> More often quoted than explicated, this famous phrase allows us to understand the depths of astronomy's cultural influence in the eighteenth-century, and particularly with respect to the rise of eighteenth-century anthropology.

Kant is considered by all students of eighteenth-century anthropology to be one of the great thinkers of the field. Curiously, however, the standard

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<sup>32</sup> Walter J. Ong, *Ramus: Method, and the Decay of Dialogue, from the Art of Discourse to the Art of Reason* (New York: Octagon Books, 1979).

<sup>33</sup> "Géométrie", in *Encyclopédie*, ed. Denis Diderot and Jean le Rond D'Alembert (Paris: Chez Briasson, 1754).

<sup>34</sup> Immanuel Kant, *Immanuel Kant Werkausgabe*, ed. Wilhelm Weischedel, 12 vols., vol. 7 (Frankfurt am Main: Suhrkamp Verlag, 1974).

works in the field, including those by Werner Krauss, Michèle Duchet, Wilhelm Mühlmann and Anthony Pagden mention neither Kant's starry heavens nor the influence of astronomy overall.<sup>35</sup> For the most part these scholars' works concentrate on the sense of difference produced by the European encounter with peoples and cultures that were new to them. Much the same holds true for an important subset of the literature, the lively research on German Anthropology—and here the oversight of the heavens is all the more notable, given that every one of the scholars involved, including John Zammito, Wolfgang Lukas and Hans-Jürgen Schings, has surely run across not only Kant's dictum but also his famous work of cosmology, *General Natural History and Theory of the Heavens*, which appeared in 1755.<sup>36</sup> From here the thrust of my comments will relate to German Anthropology.

Before I proceed, though, I should define what German Anthropology was. This school of thought is not connected to modern anthropology, which emphasizes the study of cultures, but is best described as a philosophical cosmopolitanism that unified all of humanity's drives, experiences and contradictions in a vision of the human being as a terrestrial (that is spatial) phenomenon. German Anthropology began in the early eighteenth century as a Cartesian investigation of the human being's dual nature (body and soul), and during the second half of the century thinkers such as Kant and, more importantly in my view, Johann Gottfried Herder (1744-1803) transformed it into the study of humans as earthly creatures whose spirit could only be understood via their development on this world.<sup>37</sup>

The transition from a dualist vision of the human being to what I will call a "terrestrial" one must be understood in the context of a deep change in the

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<sup>35</sup> Werner Krauss, *Zur Anthropologie Des 18. Jahrhunderts. Die Frühgeschichte Der Menschheit Im Blickpunkt Der Aufklärung* (Berlin: Akademie-Verlag, 1978), Michèle Duchet, *Anthropologie Et Histoire Au Siècle Des Lumières* (Paris: Albin Michel 1972), Wilhelm E. Mühlmann, *Geschichte Der Anthropologie*, 2<sup>nd</sup> ed. (Frankfurt am Main: Athenäum Verlag, 1968).

<sup>36</sup> Carl Niekerk, *Zwischen Naturgeschichte Und Anthropologie: Lichtenberg Im Kontext Der Spätaufklärung* (Tübingen: Niemeyer, 2005), Carsten Zelle, "Vernünftige Ärzte": *Hallesche Psychomediziner Und Die Anfänge Der Anthropologie In Der Deutschsprachigen Frühaufklärung* (Tübingen: Max Niemeyer, 2001), Walter Schmitz and Carsten Zelle, *Innovation Und Transfer: Naturwissenschaften, Anthropologie Und Literatur Im 18. Jahrhundert* (Dresden: Thelem bei w.e.b., 2004), Jörn Garber and Heinz Thoma, *Zwischen Empirisierung Und Konstruktionsleistung: Anthropologie Im 18. Jahrhundert* (Tübingen: Niemeyer, 2004), Tanja van Hoorn, *Dem Leibe Abgelesen: Georg Forster Im Kontext Der Physischen Anthropologie Des 18. Jahrhunderts* (Tübingen: M. Niemeyer, 2004), Wolfgang Lukas, *Anthropologie Und Theodizee: Studien Zum Moraldiskurs Im Deutschsprachigen Drama Der Aufklärung (Ca. 1730 Bis 1770)* (Göttingen: Vandenhoeck & Ruprecht, 2005), Hans-Jürgen Schings, *Der Ganze Mensch: Anthropologie Und Literatur Im 18. Jahrhundert : Dfg-Symposion 1992* (Stuttgart: Metzler, 1994).

<sup>37</sup> The trend toward what I will call the "terrestrialization" of Man is most evident in the revisions Ernst Platner was forced to make in his fundamental work *Anthropologie für Aerzte und Weltweise*. The first edition is a Cartesian meditation on the mind/body relationship, while the 2<sup>nd</sup> edition tries desperately (and fails) to embed this dualist vision within the ever more complicated vision of the globe. Ernst Platner, *Neue Anthropologie Für Aerzte Und Weltweise. Mit Besonderer Rücksicht Auf Physiologie, Pathologie, Moralphilosophie Und Aesthetik*, vol. I (Leipzig: Siegfried Lebrecht Crusius, 1790), ———, *Anthropologie Für Aerzte Und Weltweise. Erster Teil* (Leipzig: Dyckischen Buchhandlung, 1772). For early definitions of *Anthropologie*, see Johann Georg Walch, *Philosophisches Lexikon* (Leipzig: Joh. Friedrich Gleditsch, 1740), 106.

early-modern understanding of space.<sup>38</sup> The need for a new way of contemplating space was a direct result of astronomy's discovery that the universe was exceedingly large and impersonal, which left not a few people feeling adrift. In 1611, for example, John Donne wrote:

T'is all in peeces, all cohaerence gone;  
All just supply, and all Relation:  
Prince, Subject, Father, Son, are things forgot,  
For every man alone thinkes he hath got  
To be a Phoenix, and that then can bee  
None of that kind, of which he is, but hee.<sup>39</sup>

And Donne's pique was nothing compared to the anguish of Blaise Pascal, who in 1654 cried out in his *Pensées*, "The eternal silence of these infinite spaces frightens me. How many realms are unaware of us!"<sup>40</sup> Thanks to astronomy, many cultural commentators in Europe began to feel awfully alone. In 1686, Bernard de Fontenelle confirmed the resonance of these fears in his *Conversations on the Plurality of Worlds*, when he had Madame la Marquise G\*\*\* say, "But with a universe so large, I will be lost, will no longer know where I am, will no longer know anything. All this immense space that comprise our sun and our planets will only be a small parcel of the universe? As many similar spaces as there are fixed stars? This confounds me, troubles me, terrifies me."<sup>41</sup>

Fontenelle's *Conversations* was written, in part, to help alleviate the stress of empty space and it became a famous element in a much larger pedagogical program in astronomy that extended through the eighteenth century and across much of the Continent.<sup>42</sup> An example is Figure 3, which is the frontispiece to a 1783 edition of the *Conversations* that was published in French in Berlin. As the frontispiece suggests, Europe's scientific elite responded to all the fear and trembling by, on the one hand, inventing better ways of projecting space and, on the other, diffusing the results of their work in order to calm the populace. The chief result was a European program in astronomical pedagogy that emphasized astronomy's utility for practical orientation and that dated back at least to the seventeenth century. In 1669, for example, a small book was published in Tübingen entitled, *Short*

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<sup>38</sup>On this point, see Brewer, "Lights in Space".

<sup>39</sup>Charles M. Coffin, ed., *The Complete Poetry and Selected Prose of John Donne* (New York: The Modern Library, 2001), 192-205.

<sup>40</sup>Blaise Pascal, *Pensées* (Paris: GN-Flammarion, 1976), 110.

<sup>41</sup>Bernard de Fontenelle, *Entretiens Sur La Pluralité Des Mondes. Digression Sur Les Anciens Et Les Modernes* (Oxford: Clarendon Press, 1955), 130.

<sup>42</sup>Margaret C. Jacob, *The Newtonians and the English Revolution, 1689-1720* (Ithaca, N.Y.: Cornell University Press, 1976), Simon Schaffer, "Authorized Prophets: Comets and Astronomers after 1759", *Studies in Eighteenth-Century Culture* 17 (1987), James A. Secord, "Newton in the Nursery: Tom Telescope and the Philosophy of Tops and Balls, 1761-1838", *History of Science* 23 (1985), Sarah Hutton, "Emilie Du Chatelet's Institutions De Physique as a Document in the History of French Newtonianism", *Studies in the History of the Philosophy of Science* 35, no. 3 (2004).

*Instruction on Making Artificial Maps According to Proper Grounds...*<sup>43</sup> The book's author was Wilhelm Schickard (1592-1635), the astronomer who succeeded Michael Maestlin (1550-1631) to the chair in astronomy at the University of Tübingen. It is important to understand that this Chair in Astronomy was relatively old, having been founded in 1511, as well as historically significant, since Maestlin was Johannes Kepler's (1571-1630) teacher. The introduction announced that the book's purpose was to use astronomy to stimulate the improvement of Germany's maps, with the ultimate goal of, "Giv[ing] a hand not only to the traveler but also the homebody that amuses and improves himself by reading works of...world history, [should they be] led astray in the darkness and become ensnared in error—in body or mind—and [find themselves] at a loss, lost in the world. And for this reason the geographers, who here carry the light forward and help [us] out of this error, prefer Astronomy."<sup>44</sup>

More than a century later, the same idea that astronomy was important for knowing the world was also being trumpeted in the Netherlands. In 1776, an anonymously written children's book on astronomy was published in bad French in Amsterdam. The text held, "those who know geography have a great advantage when reading history. And they recognize that the map gives them great clarity in all affairs. They avow that nothing less befits man over beasts than to know the layout of his home and to receive pleasure from traveling without peril in distant regions."<sup>45</sup> Figure 4 is the frontispiece to that work, and it brings together many of the themes that I have just discussed, the most important of which is that it was astronomers who made possible the safe and comfortable contemplation of terrestrial space. On the one hand, you see all sorts of people looking to the sky. On the other, we have a very precocious Atlas holding up the celestial sphere that all the observation and calculation had produced.<sup>46</sup> In addition, the ships in the harbor call our attention to a theme I broached earlier, with reference to the English in Australia, namely the connection between astronomy and the construction of empire. I will have more to say about this issue in a moment.

Astronomy projected Euclidian space onto the universe and, in doing so, quelled the terror of those who, like Madame de la Marquise G, were lost in space. It did so by constructing two spheres, the celestial and the terrestrial—and it is important to recognize that these two went together. Figure 5 is a

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<sup>43</sup> Wilhelm Schickard, *Kurze Anweisung Wie Künstliche Land-Tafeln Auss Rechtem Grund Zu Machen/ Und Die Biss Her Begangne Irrthumb Zu Verbessern/ Sampt Etlich New Erfundenen Vörtheln/ Die Polus Höhin Auff's Leichtest/ Und Doch Scharpff Gnug Zu Forschen* (Tübingen: Johann Georg Cotta, 1669).

<sup>44</sup> *Ibid.*, Introduction (unpaginated).

<sup>45</sup> Pierre Duval, *Traité De Geographie Qui Donne La Connoissance Et L'usage Du Globe Et De La Carte Avecque Le Figures Necessaires Pour Sujet* (Paris: Chez l'Auteur, en l'Isle du Palais sur le Quay de l'Orloge, au coin de la Rue de Harlay, 1672), preface (unpaginated).

<sup>46</sup> On Atlas imagery in early-modern astronomy, see Adam Mosley, *Bearing the Heavens: Tycho Brahe and the Astronomical Community of the Late Sixteenth Century* (Cambridge: Cambridge University Press, 2007).

German example of a celestial sphere that comes from the frontispiece to part one of Johann Wolfgang Müller's *Instruction on the Understanding and Use of Artificial Celestial- and Terrestrial Globes...*<sup>47</sup> This book and its companion volume, whose frontispiece I will discuss in a moment, served as a user's manual for the globes Müller hoped to sell to the public. In the center of the image is a celestial globe, around which lie the tools that, according to the text, make possible the globe's proper use.<sup>48</sup> Two assumptions determined what was proper. First, the globe must be oriented, which was done by finding both true north, using a compass that is located on the globe's base, and the true horizon, using a lead-weight scale that is not depicted. Second, the text makes clear that however well oriented the sphere may be, it is a complete fiction, since the stars are actually located at different distances from earth.<sup>49</sup> What we have, therefore, is an abstract, imagined sphere that was projected onto the universe.

Now, let us come back down to Earth via Figure 6, which contains the frontispiece to part two of Müller's *Instruction*.<sup>50</sup> Here we see the terrestrial sphere, a representation of the earth that was assumed to be at the center of the celestial one. (Historians of the ancient world may note that we have come full circle, as this is reflective of the cosmological arrangement that Plato originally proposed in the fourth century BC).<sup>51</sup> According to the text, the user also had to orient this object correctly, again using scientific instruments.<sup>52</sup> More importantly, the text also notes that this sphere was a fiction, too.<sup>53</sup> On the one hand, the earth is not actually a sphere, and on the other, the latitudinal and longitudinal lines were understood to be projections onto the earth from the celestial sphere.<sup>54</sup> In short, celestial space has colonized our terrestrial space, in so far as the latter cannot be imagined effectively without the former.

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<sup>47</sup> Johann Wolfgang Müller, *Anweisung Zur Kenntnis Und Dem Gebrauch Der Künstlichen Himmels- Und Erdkugeln Besonders in Rücksicht Auf Die Neuesten Nürnberger Globen, Für Die Höhern Classen Der Schulen Und Liebhaber Der Sphaerologie*, 2 vols., vol. 1 (Nuremberg: Johann Georg Klinger, 1791).

<sup>48</sup> *Ibid.*, 63-67.

<sup>49</sup> "Wenn man ferner die Fixsterne betrachtet, so sieht man bald dass sie eine verschiedene *scheinbare* Grösse haben. Ich sage scheinbar, denn von ihrer wahren Grösse, die sich wegen ihrer ausserordentlichen Entfernung von uns, nicht wohl bestimmen lässt, aber eben deswegen auch sehr beträchtlich seyn muss, ist hier die Rede nicht. Denn wir handeln ietzt blos vom Weltgebäude wie es unsern Augen erscheint, und nicht von dessen eigentlicher Beschaffenheit, die erst durch tiefere Untersuchungen erforscht wird. Nur diese Bemerkung ist dabey zu machen, dass wir die Beschaffenheit des Weltgebäudes wie sie in die Sinne fällt, nicht der wahren unterschieden, und etwann voreilig schliesen, weil die Fixsterne alle in einer unbeträchtlichen Grösse und einerley Entfernung von uns an einer hohlen Kugel angeheftet erscheinen, also ist diess in der That so." *Ibid.*, 8.

<sup>50</sup> ———, *Anweisung Zur Kenntnis Und Dem Gebrauch Der Künstlichen Himmels- Und Erdkugeln Besonders in Rücksicht Auf Die Neuesten Nürnberger Globen, Für Die Höhern Classen Der Schulen Und Liebhaber Der Sphaerologie*, 2 vols., vol. 2 (Nuremberg: Johann Georg Klinger, 1792).

<sup>51</sup> Lindberg, *Beginnings of Western Science*.

<sup>52</sup> Müller, *Anweisung Zur Kenntnis Und Dem Gebrauch Der Künstlichen Himmels- Und Erdkugeln Besonders in Rücksicht Auf Die Neuesten Nürnberger Globen, Für Die Höhern Classen Der Schulen Und Liebhaber Der Sphaerologie*, 2.

<sup>53</sup> *Ibid.*, 3-4.

<sup>54</sup> This is especially clear in the chapter "Von der mathematischen Abtheilung der Erdoberfläche", *Ibid.*, 27-80.

Before I continue with astronomy, I want to return to the theme of empire and global imagination that I raised with the English explorers in Australia.<sup>55</sup> You will note in this frontispiece that the terrestrial globe lies amidst references to the eighteenth-century's imperial competition. On the left a ship flies the Tricolor, while on the right British soldiers fire on Hawaiian islanders –which is probably a reference to James Cook's death in 1776. The impression given is of a world divided up spatially by eighteenth-century Europe's great powers, France and Great Britain, with the dwindling Dutch role noted through the inclusion of Australia under the name of Hollandia. Given what I said earlier about the Englishmen tromping about in New South Wales, it seems clear that astronomy allowed Europeans not only to imagine their empire but also to construct it.

Still, one did not need to have an empire in order to wish to orient oneself with globes. Consider Figure 7, which contains the frontispiece to a German pedagogical work on astronomy published in 1723, and in which we have Ratio teaching young boys about the universe via the two globes. Figure 8 offers another unique example of the global imagination, a pocket globe that was produced in England in the late eighteenth century and that allowed the owner to study, while away from home, both the terrestrial and the celestial spheres. I think this evidence cements how significant these two abstract spheres became to people in eighteenth-century Europe. However, were these things insufficient to make the case, Figure 9 displays another frontispiece to a work that had nothing to do with astronomy, or even geometry. Entitled *Der Hausvater*, this work was a multi-volume encyclopedia on farming that was first published in 1766 in Hannover. The image is supposed to represent the office of a well off peasant farmer (*Hausvater* in the German economic lexicon of the period), which is chock full of means for orienting oneself in the natural world, including a barometer, thermometer, mineral cabinet, a telescope on the desk, alongside a compass and if you look to the top of the two bookshelves you see the ultimate in spatial orientation, the two globes.<sup>56</sup> Now, I cannot say why a farmer might have needed any of these things, except to note that astronomy had become a cultural phenomenon, something that everyone simply had to know about. And lest anyone think that farmers were out of the loop, let me point out that the first person to view the return of Comet Halley in 1758 was Johann Georg Palitzsch, a well off Saxon farmer who was also an amateur astronomer.

The fiction of the celestial and terrestrial spheres became fundamental to the eighteenth-century's organization of knowledge. More importantly, these spheres also encouraged the development of a very specialized anthropological way of thinking. I have already mentioned the first sustained

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<sup>55</sup> Mary Louise Pratt, *Imperial Eyes: Travel Writing and Transculturation* (London: Routledge, 1992).

<sup>56</sup> On early-modern German economic thought, see Keith Tribe, *Governing Economy: The Reformation of German Economic Discourse, 1750-1840* (Cambridge: Cambridge University Press, 1988).

discussion of extraterrestrial intelligence, Fontenelle's *Conversations On the Plurality of Worlds*, which sparked an even broader discussion of the likelihood of life on other planets. The most important response to Fontenelle came in 1698, with the publication in English of the Dutch scientist Christiaan Huygens' *Cosmotheoros*, in which is written, "A Man that is of Copernicus's Opinion, that this Earth of ours is a Planet, carry'd round and enlighten'd by the Sun, like the rest of them, cannot but sometimes have a fancy, that it's not improbable that the rest of the Planets have their Dress and Furniture, nay and their Inhabitants too as well as this Earth of ours."<sup>57</sup> Fanciful scientific tales led, in turn, to fanciful literary ones, an example of which is Voltaire's *Micromégas*, published in 1752, in which a visitor named Micromégas comes to earth from near the star Sirius and discovers that human beings are, well, ridiculous.

The German philosopher Christian Wolff (1679-1754) took up the plurality of worlds issue in 1746 in his *Reasonable Thoughts on the Workings of Nature*. In this text he discussed every imaginable detail of God's universe, including extraterrestrial life, an idea that he cribbed straight from Huygens, though without having the common decency to cite him.<sup>58</sup> Overall, he began by explaining bodies and matter in the abstract, that is geometry, before describing our solar system and then ending with the earth, its weather, geography and organic life. Almost every subsequent survey of the universe that I have come across in the German literature followed this approach, moving from geometry and trigonometry to the universe and then our world.

Against this astronomical backdrop, let us turn our attention to the two founders of German Anthropology, Immanuel Kant and Johann Gottfried Herder. The stirrings of a space-based "anthropology" already appeared in 1755 with the publication of Immanuel Kant's *General Natural History and Theory of the Heavens*. In this text Kant notes on the matter of the plurality of worlds that, "The Earth's and Venus' inhabitants cannot exchange their homes without their mutual destruction."<sup>59</sup> For the early Kant, sentient beings were of the planet they inhabited. The later Kant suggested the same thing in his *Critique of Pure Reason*, published in 1781, but here aliens probably had their own form of reason that was inaccessible to us, a point that he also picked up in 1798, in his *Anthropology from a Pragmatic Point of View*.<sup>60</sup> None

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<sup>57</sup> Christiaan Huyghens, *The Celestial Worlds Discover'd: Or, Conjectures Concerning the Inhabitants, Plants and Productions of the Worlds in the Planets* (London: Timothy Childe, 1698).

<sup>58</sup> Christian Wolff, *Gesammelte Werke*, ed. et al. J. Ecole, vol. 6 (Hildesheim: Georg Olms Verlag, 1981), 225-6.

<sup>59</sup> Kant, *Werkausgabe*, 385.

<sup>60</sup> *Ibid.*, 3: 76. In his *Anthropologie* Kant writes, "Wir können, um unseren Begriffen von vernünftigen Wesen Anschauung unterzulegen, nicht anders verfahren, als sie zu anthropomorphisieren." Immanuel Kant, *Schriften Zur Anthropologie Geschichtsphilosophie Politik Und Pädagogik*, ed. Wilhelm Wieschedel, 6 vols., vol. 6, Immanuel Kant: Werke in Sechs Bänden (Darmstadt: Wissenschaftliche Buchgesellschaft, 1998), 473. See also, "Es könnte wohl sein: dass auf irgend einem anderen Planeten vernünftige Wesen wären, die nichts anders als laut Denken könnten, d. i. im Wachen, wie im Träumen, sie möchten in Gesellschaft oder allein sein, keine Gedanken haben könnten, die sie

of this is to say that Kant's philosophy was based solely in his contemplation of the starry heavens, but to note that astronomy provided an essential backdrop for his view of humanity.

The importance of the universe as a backdrop to anthropological discussion is clearest in Johann Gottfried Herder's *Ideas on the Philosophy of the History of Mankind*, an unfinished multi-volume work that was published between 1784 and 1791. The first chapter is entitled, "Our Earth is one Star among Stars." The first sentence reads, "Our philosophy of the history of humanity must start with the Heavens." And by the end of the first paragraph, Herder has expressly cited the work of Copernicus, Kepler, Newton, Huyghens and Kant.<sup>61</sup> He then follows the same plan that Wolff used, beginning with a description of the earth's place in the universe before moving to its topography and, finally, organic life. Moreover, in the second book of the *Ideas*, Herder contemplates the earth as a giant organism and imagines the earth from a position in orbit, looking down on our planet and (implicitly) glancing back to the other planets and the distant stars. This god-like perspective was essential to Herder's conclusion, "Wherever and whoever I may be, ...[I am] a being in the unforeseeable Harmony of one of God's worlds."<sup>62</sup>

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nicht aussprechen". Kant, *Werke in Sechs Bänden*, 688. He then notes that we are different and must live *within* society.

<sup>61</sup> Johann Gottfried Herder, *Herders Werke* vol. V, Part I (Stuttgart: Union deutsche Verlagsgesellschaft, 1889), 17.

<sup>62</sup>Herder, *Herders Werke*, 4: 20.

**FIGURE 1**



Earth Rising (1968)

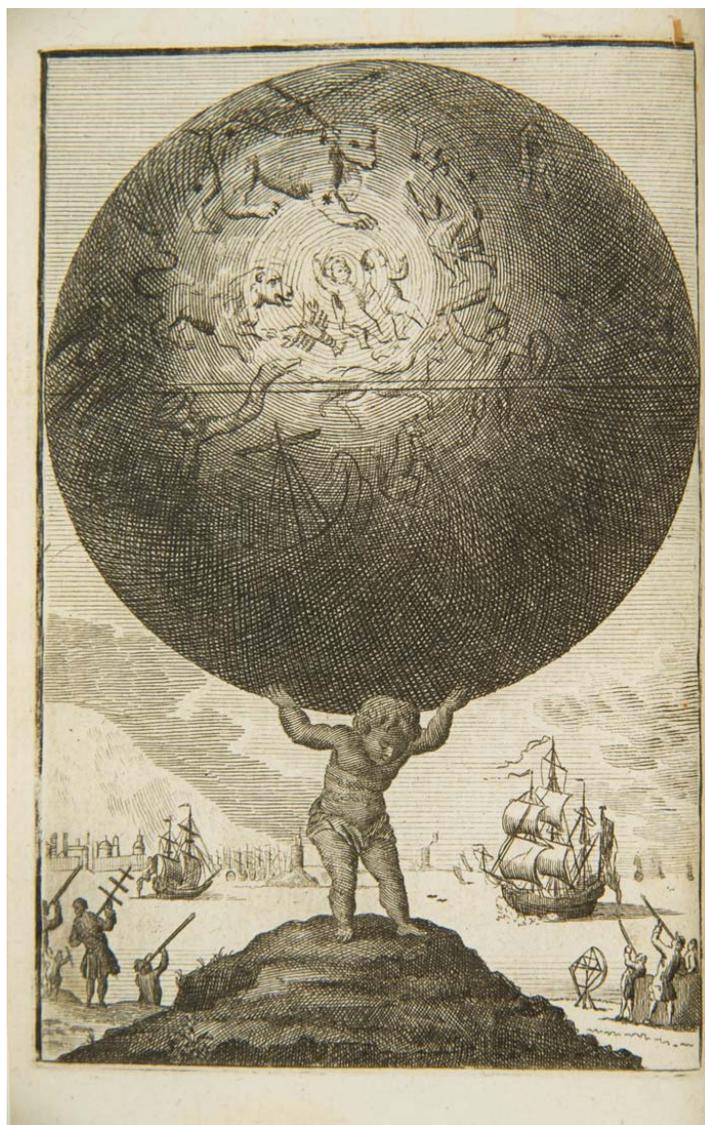


FIGURE 3



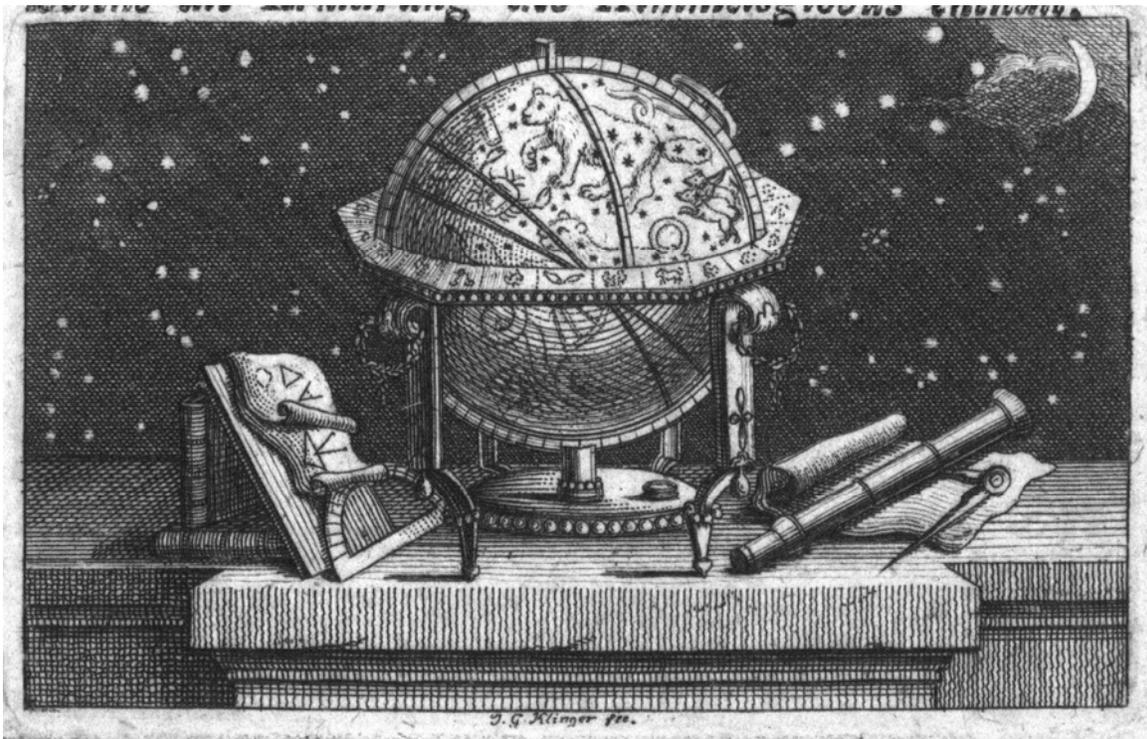
Fontenelle, *Entretiens* (1783)

**FIGURE 4**



*Nouvel Atlas des Enfants (1776)*

FIGURE 5



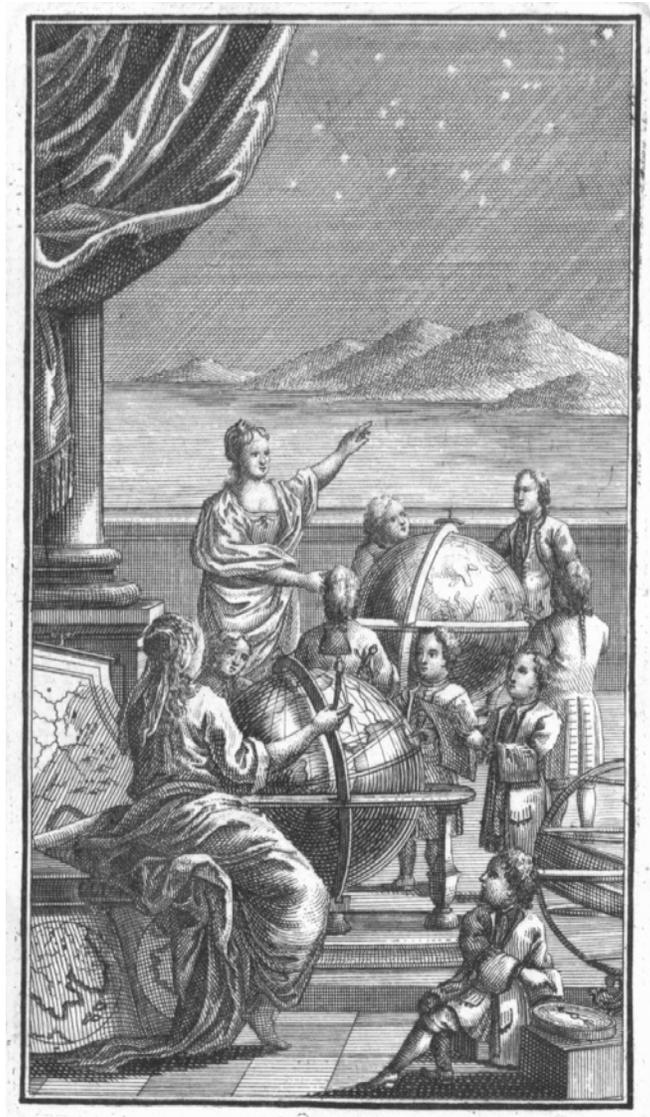
Müller, *Anweisung v. 1* (1791)

FIGURE 6



Müller, *Anweisung*, v.2 (1792)

FIGURE 7



Rost, *Atlas Portatilis*.

**FIGURE 8**



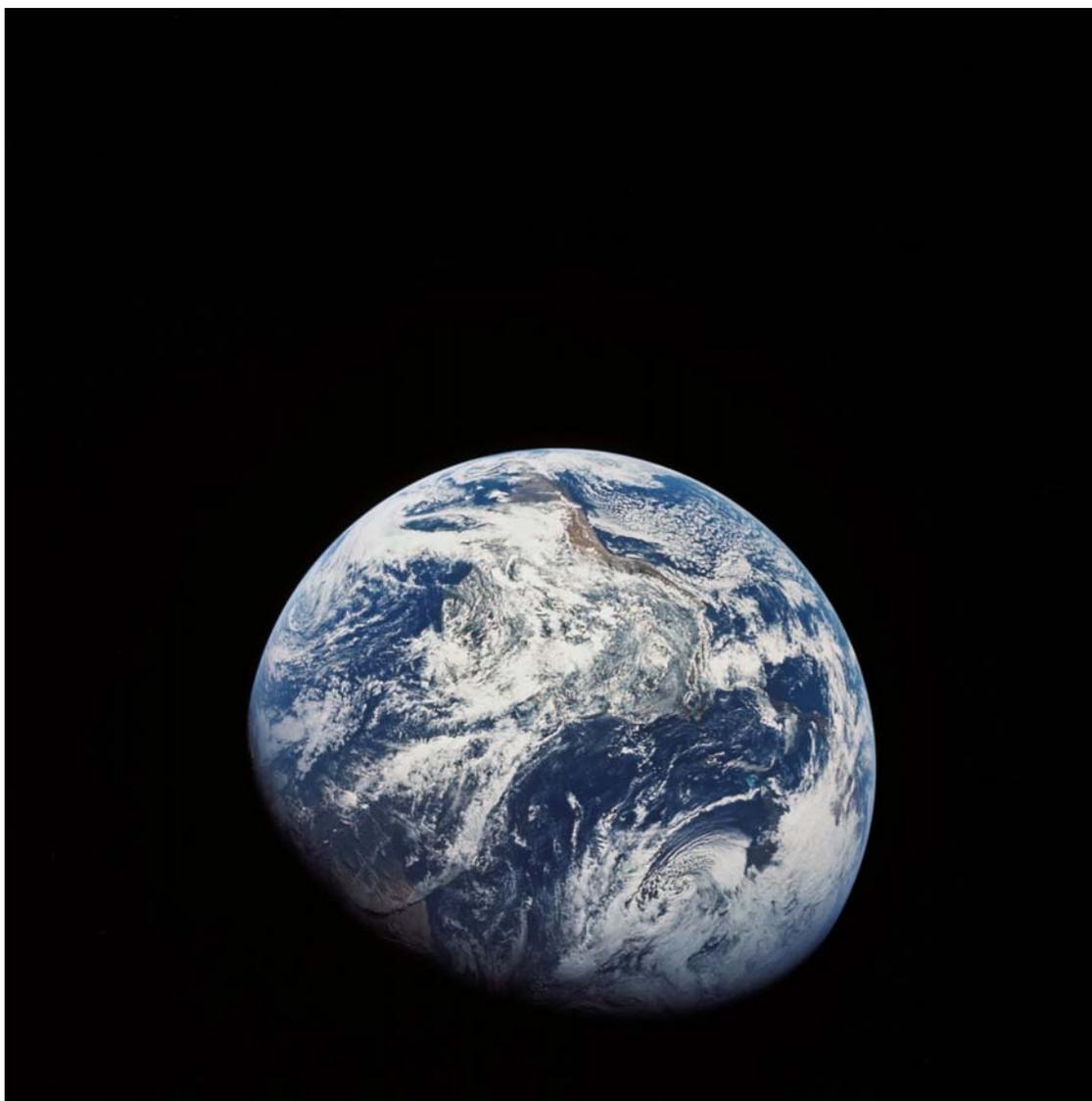
Pocket Terrestrial Globe (ca. 1770)

FIGURE 9



Münchhausen, *Der Hausvater* (1766)

**FIGURE 10**



Earth (1968)

## Conclusions

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The eighteenth-century's appropriation of astronomy resonated well into the next century. In 1848, Alexander von Humboldt published his famous multi-volume work *Cosmos*, a text that, for me, marks the end of the Enlightenment, because it collates and summarizes every aspect of eighteenth-century science—and does so against the backdrop of astronomy. Consider these words from the introduction, “Beginning with the depths of space and the regions of remotest nebulae, we will gradually descend through the starry zone to which our solar system belongs, to our own terrestrial spheroid, circled by air and ocean, there to direct our attention to its form, temperature and magnetic tension, and to consider the fullness of organic life unfolding itself upon its surface beneath the vivifying influence of light. In this manner a picture of the world may, with a few strokes, be made to include the realms of infinity no less than the minute microscopic animal and vegetable organisms which exist in standing waters and on the weather-beaten surface of our rocks.”<sup>63</sup> Astronomy's domestication of space yielded, in Humboldt, a universal perspective from which all earthly life could be categorized and understood—including us.

The assumptions behind this approach even reached into the twentieth century. In 1984, Helmut Thielicke, one of the most important German theologians of the last century, published his memoirs under the title *A Guest on Beautiful Star*, thus displaying not only the sentiments Herder had expressed two centuries before but also the homogeneous, simultaneous and reflexive space that had emerged in the fifteenth century.<sup>64</sup> To be merely a guest on a beautiful star suggests that there can be other guests on other ones, with each being living life in each place and, perhaps, taking note of our star along the way. Against this backdrop, let us consider the final image in Figure 10. Also taken during the Apollo 8 mission, it underscores again how geometry and astronomy re-oriented the human being in his world. To gaze on our Blue Planet is, for heirs to the European intellectual tradition, to reflect immediately not only on humanity's place in the universe but also on the very foundations of what human beings are.

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<sup>63</sup> Alexander von Humboldt, *Cosmos: A Sketch of the Physical Description of the Universe*, trans. E. C. Otté, 5 vols., vol. I (Baltimore, MD: Johns Hopkins University Press, 1997).

<sup>64</sup> Helmut Thielicke, *Zu Gast Auf Einem Schönen Stern: Erinnerungen Aus Meinem Leben* (Giessen: Brunnen Verlag, 2007).

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