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Strangers to the World: Astronomy and the Birth of Anthropology in the Eighteenth Century

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Abstract

An important strain in the literature on the rise of anthropological thought in the early-modern world identifies anthropological thought's biggest insight as the ascription of unity to the human species via the encounter of travelers with cultural difference. This article counters, however, that culture is not a sufficient basis for ascribing unity to human beings and looks to astronomy as the basis for what became a unified anthropology. Using the work of the celebrated enlightened anthropologist Johann Gottfried Herder, it traces an astronomical sense of space back to the early Renaissance and shows how spatial thought was imported into anthropological thought by what it calls celestial anthropologists. As a result of work by Herder and other luminaries, such as Immanuel Kant, the Comte de Buffon, and Voltaire, by the end of the eighteenth century, anthropology had become, first and foremost, a spatial discipline. The cultural effects of this transformation are felt into our own day.

Resumen

Una importante tendencia de la literatura durante el ascenso del pensamiento antropológico a principios de la era moderna identifica como el más grande acto de comprensión antropológico la atribución de unidad a la especie humana a través del encuentro que tuvieron los viajeros con la diferencia cultural. Sin embargo, este artículo sostiene que la cultura no es una base suficiente para atribuir unidad a los seres humanos, y mira a la astronomía como la base a través de la cual la antropología se unificó. El trabajo del célebre antropólogo ilustrado Johann Gottfried Herder rastrea un sentido astronómico del espacio hasta principios del Renacimiento, y muestra cómo el pensamiento espacial era importado en el pensamiento antropológico, por lo que lo llama antropología celeste. Como resultado del trabajo de Herder y de otras luminarias, como Immanuel Kant, el conde de Buffon y Voltaire, a finales del siglo XVIII la antropología se había convertido, principalmente, en una disciplina espacial. Los efectos culturales de esta transformación se sienten hasta nuestros días.

Introduction

> "And Man how purblind, if unknown the whole!
> Who circles spacious Earth, Then travels here,
> Shall own, He was never from Home before!"
>
> Edward Young, *The Complaint: or, Night Thoughts on Life, Death and Immortality* (1742-45)[1]

Recent scholarship on the history of European anthropology has almost completely ignored outer space as a backdrop for the rise of anthropological thought.[2] The oversight is understandable, given that the discovery of humanity by travelers —from the ancient Greek Herodotus to the sixteenth-century Spaniard Bartolomé las Casas to the early eighteenth-century Frenchman Joseph-François Lafitau— was a terrestrial affair.[3] Later generations of anthropologists saw the world differently, with important

[1] Edward Young, *The Complaint: Or, Night Thoughts on Life, Death, and Immortality* (London: A. Millar, 1750), 316.

[2] For the unclassical world, see: Clyde Kluckhohn, *Anthropology and the Classics* (Providence, RI: Brown University Press, 1961). For a very useful overview, see Hans Erich Bödeker, "Menschheit, Humanität, Humanismus", in *Geschichtliche Grundbegriffe*, ed. Otto Brunner, Werner Conze, and Reinhart Koselleck (Stuttgart: Klett-Cotta, 1982). On the sixteenth century: Anthony Pagden, *European Encounters with the New World: From Renaissance to Romanticism* (New Haven: Yale University Press, 1993), Anthony Pagden, *Lords of All the World: Ideologies of Empire in Spain, Britain and France, C. 1500-C. 1800* (New Haven: Yale University Press, 1995), Anthony Pagden, *The Fall of Natural Man: The American Indian and the Origins of Comparative Ethnology*, 1st pbk. ed. (Cambridge: Cambridge University Press, 1986). Margaret T. Hodgen, *Early Anthropology in the Sixteenth and Seventeenth Centuries* (Philadelphia, PA: University of Pennsylvania Press, 1964). See also John Huxtable Elliott, *The Old World and the New, 1492-1650* (Cambridge: Cambridge University Press, 1970). On the seventeenth century: Harry Liebersohn, "Anthropology before Anthropology", in *A New History of Anthropology*, ed. Henrika Kucklick (Malden, MA: Blackwell Publishing, 2008). and Alan Barnard, *History and Theory in Anthropology* (Cambridge: Cambridge University Press, 2000). See also Murray Leaf, *Man, Mind, and Science: A History of Anthropology* (New York: Columbia University Press, 1979). which gives credit to Descartes as the source of modern anthropology. Also important in this context are these classic works: Wilhelm Dilthey, "Die Funktion Der Anthropologie in Der Kultur Des 16. Und 17. Jahrhunderts", in *Wilhelm Diltheys Gesammelte Schriften* (Leipzig: B. G. Teubner, 1921)., which puts anthropology into the context of sixteenth- and seventeenth-century philosophy's discovery of the philosophical subject and Jacob Burckhardt, *Die Kultur Der Renaissance in Italien* (Berlin: Deutsche Buch-Gemeinshaft, 1961), 67-85., which is oriented toward the discovery of the individual, especially the chapter entitled "Entwicklung des Individuums". On the eighteenth century: Michèle Duchet, *Anthropologie Et Histoire Au Siècle Des Lumières: Buffon, Voltaire, Rousseau, Helvétius, Diderot* (Paris: Albin Michel, 1995; reprint, Éditions Albin Michel, S.A.), Mareta Linden, *Untersuchungen Zum Anthropologie Begriff Des 18. Jahrhunderts* (Bern and Frankfurt am Main: Herbert Lang/Peter Lang, 1976), John H. Zammito, *Kant, Herder, and the Birth of Anthropology* (Chicago: University of Chicago Press, 2002). E. E. Evans-Pritchard, *History of Anthropological Thought* (London: Faber and Faber, 1981). Others go back only as far as the nineteenth century: George W. Stocking, *After Tylor: British Social Anthropology, 1888-1951* (Madison, WI: University of Wisconsin Press, 1995), George W. Stocking, *Victorian Anthropology* (NewYork: Free Press, 1987). George W. Stocking, ed., *Volksgeist as Method and Ethic: Essays on Boasian Ethnography and the German Anthropological Tradition* (Madison, WI: University of Wisconsin Press, 1996). H. Glenn Penny, *Objects of Culture: Ethnology and Ethnographic Museums in Imperial Germany* (Chapel Hill, NC: University of North Carolina Press, 2002), H. Glenn Penny and Matti Bunzl, eds., *Worldly Provincialism: German Anthropology in the Age of Empire* (Ann Arbor, MI: University of Michigan Press, 2003).

[3] Wilhelm E. Mühlmann, *Geschichte Der Anthropologie*, *Geschichte Der Wissenschaften* (Bonn: Universitäts-Verlag, 1948), Pagden, *The Fall of Natural Man*.

figures such as Voltaire, the Comte de Buffon, Immanuel Kant, and Johann Gottfried Herder infusing their visions of humanity with outer space. As a result, by the end of the eighteenth century, outer space had become *present* within anthropological thought and spaces that people occupied mixed freely with those no one had ever seen.

The dialogue between seen and unseen space was an early-modern phenomenon, occurring roughly between 1400 and 1800, and yielded what I call celestial anthropology. If anthropology is the science of "Man" in the widest sense —studying the diversity of humanity as, nonetheless, representative of a fundamental unity— then celestial anthropology yielded the broadest perspective from which this intensely variable creature could be understood. Unlike other anthropological currents of the early-modern era, which were based largely on the encounter with cultural difference, celestial anthropology was spatial and began its study of human beings by putting them in place. The tools for imagining unseen spaces —whether terrestrial or extraterrestrial— came from astronomy, as astronomers taught anthropologists how to imagine the contours of both their globe and their universe. Important anthropological themes such as culture, language, and physical appearance emerged within the early-modern world's construction of extraterrestrial space.

That changes in how Europeans imagined the heavens altered their anthropological sensibility is well established in areas outside the history of anthropology.[4] In 1975, the philosopher Hans Blumenberg argued that Nicolaus Copernicus' re-introduction of heliocentrism in 1543 constituted an anthropological moment, writing, "The anthropological model assimilates itself to the cosmological one, or the latter turns out to be only a projection

[4] There are also many works that find anthropology's origins in the emergence of academic disciplines. Astronomy is not represented in any of them. On aesthetics, see Gabriele Dürbeck, *Einbildungskraft Und Aufklärung: Perspektiven Der Philosophie, Anthropologie Und Ästhetik Um 1750*, *Studien Zur Deutschen Literatur, Bd. 148* (Tübingen: M. Niemeyer Verlag, 1998). On literature, Jürgen Barkhoff and Eda Sagarra, eds., *Anthropologie Und Literatur Um 1800* (München: Iudicium, 1992), Helmut Pfotenhauer, *Literarische Anthropologie: Selbstbiographien Und Ihre Geschichte, Am Leitfaden Des Leibes* (Stuttgart: Metzler, 1987). On medicine, Tanja van Hoorn, *Dem Leibe Abgelesen: Georg Forster Im Kontext Der Physischen Anthropologie Des 18. Jahrhunderts* (Tübingen: M. Niemeyer, 2004), Alexander Kosenina, *Ernst Platners Anthropologie Und Philosophie: Der 'Philosopische Arzt' Und Seine Wirkung Auf Johann Karl Wezel Und Jean Paul* (Würzburg: Königshausen u. Neumann, 1989). On the natural sciences, Walter Schmitz and Carsten Zelle, *Innovation Und Transfer: Naturwissenschaften, Anthropologie Und Literatur Im 18. Jahrhundert* (Dresden: Thelem bei w.e.b., 2004). Odo Marquard, "Zur Geschichte Des Philosophischen Begriffs "Anthropologie" Seit Dem Ende Des 18. Jahrhunderts", in *Collegium Philosophicum: Studien Joachim Ritter Zum 60. Geburtstag*, ed. Ernst-Wolfgang Böckenförde (Basel: Schwabe & Co., 1965). On philosophy, Arnold Gehlen, "Das Menschenbild in Der Modernen Anthropologie", in *Gesamtausgabe*, ed. Lothar Samson (Frankfurt am Main: Vittorio Klostermann, 1978), Arnold Gehlen, "Philosophische Anthropologie", in *Gesamtausgabe*, ed. Lothar Samson (Frankfurt am Main: Vittorio Klostermann, 1978). On psychology, see Soo Bae Kim, *Die Entstehung Der Kantischen Anthropologie Und Ihre Beziehung Zur Empirischen Psychologie Der Wolffschen Schule* (Frankfurt am Main: Peter Lang, 1994). On theater, Wolfgang Lukas, *Anthropologie Und Theodizee: Studien Zum Moraldiskurs Im Deutschsprachigen Drama Der Aufklärung (Ca. 1730 Bis 1770)* (Göttingen: Vandenhoeck & Ruprecht, 2005). On theology, Wolfhart Pannenberg, *Anthropologie in Theologischer Perspektive* (Göttingen: Vandenhoeck & Ruprecht, 1983), Wolfhart Pannenberg, *Was Ist Der Mensch? Die Anthropologie Der Gegenwart Im Lichte Der Theologie*, 7 ed. (Göttingen: Vandenhoeck & Ruprecht, 1962).

of the former."[5] And this view goes back two centuries, at least, since the eighteenth century openly celebrated the anthropological undercurrents of heliocentrism. In 1776, Johann Gottfried Herder observed the three hundredth anniversary of Copernicus' birth, which had occurred three years before, by publishing a biographical sketch in the journal *Der Teutsche Merkur*, writing, "Of course, here we speak of revolutions not of the heavens, but of the human spirit."[6] And Herder was merely adding his voice to a chorus. Almost thirty years earlier, the astronomer and mathematician Abraham Gotthelf Kästner, whose works Herder knew well, published an article in the journal *Hamburgisches Magazin* entitled, "In Praise of Astronomy". Of this burgeoning discipline he wrote, "Do you want to know how far the powers of human understanding extend? Study astronomy!"[7] In short, to know humanity in all its glory, know the stars.

Against this backdrop the deeper meaning of this essay's epigram becomes clear. Taken from *Night Thoughts* (1742-1745) by Edward Young, it gives a location to terrestrial space and its human inhabitants by juxtaposing both of them to celestial vastness. For Young there was no home without the universe and, by extension, no anthropology without either. Moreover, in the lines prior to the one included in the epigram, Young enthused:

> Thy Travels dost thou boast o'er foreign Realms?
> Thou *Stranger* to the *World!* Thy Tour *begin*;
> Thy Tour through *Nature's* universal Orb.
> *Nature* delineates her whole Chart at large,
> On soaring Souls, that sail among the Spheres;[8]

Sailing among the spheres, Young's soul explored a realm that no human had ever seen. And by the end of his journey, he had fundamentally redefined the context for "Man".

Young's exuberance is merely one reflection of outer space's broader cultural effect. In "Essay on Man" (1732-1734), *the* anthropological poem of the eighteenth century, Alexander Pope projected his mind through the universe, before returning to the Earth and its people.[9] Pope wrote:

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[5] Hans Blumenberg, *The Genesis of the Copernican World*, trans. Robert M. Wallace (Cambridge, MA: MIT Press, 1987), 103.

[6] Johann Gottfried Herder, "Etwas Von Nikolaus Kopernikus Leben", *Der Teutsche Merkur* 4 (1776): 170.

[7] Abraham G. Kästner, "Das Lob Der Sternkunst", *Hamburgisches Magazin, oder gesammlete Schriften, zum Unterricht und Vergnügen* 1, no. 2 (1747): 215. On Herder's reading of Kästner, see Hugh Barr Nisbet, *Herder and the Philosophy and History of Science* (Cambridge: Modern Humanities Research Association, 1970), 87,140.

[8] Young, *Night Thoughts*, 316.

[9] This work is usually understood as being part of what Arthur O. Lovejoy identified as the neo-platonic "Great Chain of Being" tradition, which infused the universe with creative energy produced by a classical demiurge. Pope did use neo-platonic language in this poem. Nonetheless, this language is expressly situated within the modern spatial universe. Arthur O. Lovejoy, *The Great Chain of Being: A Study of the History of an Idea* (Cambridge: Harvard University Press, 1964).

> He, who through vast immensity can pierce,
> See worlds on worlds compose one universe,
> Observe how system into system runs,
> What other planets circle other suns,
> What varied peoples circle every star,
> May tell us why Heaven has made us as we are.

This mental journey —out and back— bled into the very structure of the text. The first epistle is subtitled, "Of the Nature and State of Man with Respect to the Universe". Thereon follow two epistles more under the subtitles, "Of the Nature and State of Man with Respect to Himself as an Individual", and "Of the Nature and State of Man with Respect to Society."[10] Moving rapidly from the sublime to the mundane, Pope wove outer space directly into humanity's understanding of itself.

The celestial backdrop to eighteenth-century anthropology is also obvious in the most famous, least explicated anthropological outburst ever written. Coming in the conclusion to *Critique of Practical Reason* (1787) by Immanuel Kant, it holds:

> 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.[11]

Kant's use of celestial imagery was standard practice, but his use of the verb "to see" (*sehen*) is especially important. Well informed on the latest ideas in physics and cosmology, he was also an avid reader of Pope, as is evidenced by his including an epigram from the "Essay on Man" in a cosmological work he had published some thirty years before, *General Natural History and Theory of the Heavens* (1755).[12] In this text Kant explained the structure of our solar system and the universe and also speculated on the origins of both, citing in support astronomers such as Tycho Brahe, John Flamsteed, Christiaan Huygens, and Edmond Halley.[13] (And this list includes only the work's preface). As a direct participant in the dialogue between seen and unseen, Kant was limited by his culture. He could not look to the heavens blankly and see mere points of light in the sky, because he knew what was out there. A centuries' old culture of imagining outer space made the universe into a

[10] Alexander Pope, *Essay on Man and Other Poems* (New York: Dover Publications, 1994), 53,60.
[11] Immanuel Kant, *Immanuel Kant Werkausgabe*, ed. Wilhelm Weischedel, 12 vols., vol. 7 (Frankfurt am Main: Suhrkamp Verlag, 1974), 300.
[12] And Kant cited Pope's poem five more times in the body of the text. Ibid., 271, 340, 75, 87, 93.
[13] Immanuel Kant, *Immanuel Kant Werkausgabe*, ed. Wilhelm Weischedel, 12 vols., vol. 1 (Frankfurt am Main: Suhrkamp Verlag, 1974), 219-396.

familiar tapestry on which humanity could do nothing else but paint its own image.

Reinventing Outer Space

Celestial anthropology's spatial approach to humanity was rooted in the emergence of early-modern astronomy. This vital, growing discipline reimagined the world in which human beings found themselves. As celestial anthropologists explored the extraterrestrial realm astronomers had made, they internalized three concepts from astronomy that became crucial to the anthropology: liminality, plurality, and infinity. Sending the human imagination into distant realms, celestial anthropologists encountered extraterrestrial positions from which they looked back to Earth, with the result that the discipline's agenda was founded on the movement inward from the outside. Moreover, while out there in space, celestial anthropologists also imagined a plurality of worlds, an idea championed by astronomers. Thus, anthropologists came to understand humanity with reference not merely to a multiplicity cultures, but also to a variety of beings. Finally, celestial anthropologists made the human ability to imagine impossibly large spaces the main criterion for valuing human existence itself. The human propensity to gaze at the stars and know them without close inspection was sufficient proof of the species' intelligence and significance.

In order to understand the foundations of astronomy and anthropology's interaction, we must examine what I will call the Renaissance's reinvention of outer space. Beginning around the middle of the fifteenth century, above all in Italy, Europeans began to develop sophisticated methods of projecting space onto areas beyond humanity's experience. Much of this apparatus was transferred from the medieval Christian and Islamic worlds, in a process that was both complex and long in duration, as texts from both realms were reprinted, read and discussed well into the seventeenth century.[14]

Renaissance astronomy emerged, therefore, against a still vital medieval backdrop, but its specific rise was due to four additional developments. First, in the fourteenth century a truly European system of universities emerged, as institutions were founded in Pisa (1343), Prague (1348), Cracow (1364), Vienna (1380), and Heidelberg (1386), which complemented the great centers of learning in Bologna, Paris and Oxford (all founded ca. 1100) and renegade

[14] An example of a popular medieval text: Johannes Sacrobosco, *Sphaerae Tractatus. Ioannis De Sacro Busto Anglici Viri Clariss. Gerardi Cremonensis Theoricae Planetarum Veteres. Georgii Purbachi Theoricae Planetarum Novae...* (Venetiis: Iunte, 1531). An example of an Arabic text: A□mad Ibn-Mu□ammad al- Farġānī, *Continentur in Hoc Libro. Rvdimenta Astronomica Alfragrani. Item Albategnivs Astronomvs Peritis-Simvs De Motv Stellarvm, Ex Obseruationibus Tum Proprijs, Tum Ptolemæi, ...Item Oratio Introductoria in Omnes Scientias Mathematicas Ioannis De Regiomonte, Patauij Habita, Cum Alfraganum Publice Prælegeret. Eivsdem Utilissima Introductio in Elementa Euclidis. Item Epistola Philippi Melanthonis Nuncupatoria, Ad Senatum Noribergensem. Omnia Iam Recens Prelis Publicata* (Norimbergae: Petreius, 1537).

institutions in Cambridge (1209) and Padua (1222).[15] Both new and older cosmological ideas could, thus, appear and spread across Europe via the flow of itinerant manuscripts and scholars. Second, and closely related to the first point, was the increasing willingness in the fourteenth century to question the physics of Aristotle (384 BC–322 BC) and the cosmology of Claudius Ptolemy (90–168), whose works had been re-imported, chiefly from the Muslim world, during the eleventh and twelfth centuries.[16] (Aristotle assumed a radical difference between celestial and terrestrial physics, while Ptolemy, extending the ideas of both Aristotle and Plato (427 BC–347 BC), embedded the planets and stars in a series of concentric, crystalline spheres that rotated diurnally about an Earth positioned at the center.) Third, Europe's geographic knowledge expanded rapidly. This trend began in the late Middle Ages, with travelers exploring the Eurasian landmass, and extended up through the fifteenth- and sixteenth-century explorations of Africa and the New World.[17] Overall, unseen space of both the terrestrial and extraterrestrial variety effervesced through Renaissance culture, with the result that Europeans became ever more comfortable with imagining and manipulating it.

The final development was the arrival from Constantinople of classical spatial texts —geometric, geographic and astronomical.[18] Beginning in the late fourteenth century, and increasing in intensity during the fifteenth-, Byzantine scholars fled advancing Ottoman forces and brought with them a trove of classical manuscripts.[19] Unlike the twelfth-century transmission of classical works, which had been piecemeal and travelled via Arabic, these texts formed a corpus and had never been translated out of Greek.[20] The mass

[15] The process of expansion extended through the seventeenth- and eighteenth centuries. The insights on universities are an extension of the arguments made in Joseph Ben-David, "Scientific Productivity and Academic Organization in Nineteenth-Century Medicine", *American Sociological Review* 25, no. 6 (1960). See also Alan B. Cobban, *The Medieval Universities: Their Development and Organization* (London: Methuen; distributed by Harper & Row, Barnes & Noble Import Division, 1975).

[16] R. R. Bolgar, *The Classical Heritage and Its Beneficiaries* (Cambridge: Cambridge University Press, 1963), Stephen C. McCluskey, *Astronomies and Cultures in Early Medieval Europe* (Cambridge: Cambridge University Press, 1998), W. G. L. Randles, *The Unmaking of the Medieval Christian Cosmos, 1500-1700: From Solid Heavens to Boundless Aether* (Aldershot: Ashgate, 1999). On universities and early-modern scientific innovation, see Toby E. Huff, *The Rise of Early Modern Science: Islam, China, and the West* (Cambridge: Cambridge University Press, 1993).

[17] Gilbert Chinard, *L'amérique Et Le Rêve Exotique Dans La Littérature Française Au Xvii Et Au Xviii Siècle* (Paris: Librairie Hachette Et Cie, 1913).

[18] The classic work on the broader process of recovery of classical culture is Bolgar, *Classical Heritage*.

[19] Pierre Maurice Marie Duhem, *Medieval Cosmology: Theories of Infinity, Place, Time, Void, and the Plurality of Worlds* (Chicago: University of Chicago Press, 1985), Edward Grant, *Planets, Stars, and Orbs: The Medieval Cosmos, 1200-1687* (Cambridge Cambridge University Press, 1996), Michael Hoskin, ed., *The Cambridge Concise History of Astronomy* (Cambridge: Cambridge University Press, 1999), McCluskey, *Astronomies and Cultures*, Anton Pannekoek, *A History of Astronomy* (New York: Interscience Publishers, Inc, 1961), Lynn Thorndike, *The Sphere of Sacrobosco and Its Commentators* (Chicago: The University of Chicago Press, 1949). On Copernicus and medieval Islamic astronomy, see F. Jamil Ragep, "Tusi and Copernicus: The Earth's Motion in Context", *Science in Context* 14, no. 1/2 (2001).

[20] On the early reception of Greek texts in medieval Europe, see Bolgar, *Classical Heritage*, 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), John Monfasani, *Byzantine Scholars in Renaissance Italy: Cardinal Bessarion and Other Émigrés: Selected Essays* (Aldershot: Variorum, 1995).

and ostensible purity of these works piqued the interest of European scholars, who consulted, edited and republished them. As the new editions began to flow, knowledge of how to project and discuss unseen space diffused across the Continent and outer space slowly became a part of early-modern culture.

Armed with a mass of imported cultural wealth, Renaissance scholars then initiated a great shift in astronomical practice that was of enormous significance for both astronomy and, later, anthropology, adding direct observation of the heavens to textual commentary on classical works.[21] The astronomer Johannes Müller, aka Regiomontanus (1436-1476) exemplifies the transformation.[22] Born in Bavaria, he attended the University of Vienna and studied under the Ptolemaic astronomer Georg Peurbach (1423-1461). Later, he went to Rome, which had become of center of translation with the arrival of Cardinal Basilios Bessarion (1403-1472) accompanied by his massive collection of Byzantine manuscripts.[23] Supported financially by Bessarion, Müller translated into Latin parts of Ptolemy's astronomical-cosmological work *AImagest* and produced in 1462, an epitome that remained widely read for over a century.[24] Later, he went to Nuremberg, where in 1471, he built an observatory and in 1474, published *New Theory of the Planets* a geocentric text that was originally written by Peurbach and purported to update Ptolemy.[25]

The *New Theory of the Planets* calls our attention to a series of important shifts within astronomy. This work marked the first stage of Renaissance astronomy's separation from medieval culture, as it was the first astronomical textbook published in Europe since classical times. More than just a commentary on ancient ideas, it was based on independent observations and analysis and also was republished into the seventeenth century, influencing many astronomers, including Nicolaus Copernicus.[26] Moreover, *New Theory of*

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[21] This system is in full swing by the late sixteenth century. See these works on Tycho Brahe: Adam Mosley, *Bearing the Heavens: Tycho Brahe and the Astronomical Community of the Late Sixteenth Century* (Cambridge: Cambridge University Press, 2007), Victor E. Thoren, *The Lord of Uraniborg: A Biography of Tycho Brahe* (Cambridge: Cambridge University Press, 1990). Also important are: Bernard R. Goldstein and Peter Barker, "The Role of Rothmann in the Dissolution of the Celestial Spheres", *The British Journal for the History of Science* 28, no. 4 (1995), Bruce T. Moran, "Christoph Rothmann, the Copernican Theory, and Institutional and Technical Influences on the Criticism of Aristotelian Cosmology", *Sixteenth-Century Journal* 13, no. 3 (1982).

[22] W. P. D. Wightman, *Science and the Renaissance*, 2 vols., *Aberdeen University Studies* (Edinburgh: Oliver and Boyd, 1962).

[23] Monfasani, *Byzantine Scholars*.

[24] Wightman, *Science and the Renaissance*, 13-15. Claudius Ptolemy, *Ioannis De Monte Regio Et Georgii Pvrbachii Epitome, in Cl. Ptolemaei Magnam Compositionem, Continens Propositiones & Annotationes, Quibus Totum Almagestum, Quod Sua Difficultate Etiam Doctiorem Ingenioq́[Ue] Præstantiore Lectorem Deterrere Consueuerat, Dilucida & Breui Doctrina Ita Declaratur & Exponitur, Ut Mediocri Quoq[Ue] Indole & Eruditione Prædiți Sine Negotio Intelligere Possint.*, trans. Johannes Regiomontanus and Georg Peuerbach (Basileae: Heinrich Petri, 1543).

[25] A. Rupert Hall, *The Scientific Revolution, 1500-1800: The Formation of the Modern Scientific Attitude* (London: Longman, 1962), 57. Regiomontanus and Peurbach's works were republished throughout the sixteenth century.

[26] André Goddu, *Copernicus and the Aristotelian Tradition: Education, Reading, and Philosophy in Copernicus's Path to Heliocentrism* (Leiden Brill, 2010), 162-66, Hall, *The Scientific Revolution, 1500-1800: The Formation of the Modern Scientific Attitude*.

the Planets also highlights the significance of new publication practices, as the text included drawings and illustrations, in contrast to medieval texts on astronomy and related disciplines, such as geometry, which only rarely included drawings. During the fifteenth century, however, with the rise of print, the inclusion of illustrations became a common practice, and it is in this context that we must understand the broader significance of Peurbach's text: it added more realistic portrayals of cosmological systems.[27] This work was, thus, a first step in making outer space real for a larger community.

These early forays marked only the beginning of outer space's cultural diffusion. Over the course of the sixteenth century, astronomy's institutional arrangements also changed, with significant long-term implications for both the discipline and European culture more broadly. Slowly, the discipline left the universities that had nurtured it and became associated with the rise of professional observatories.[28] This development was inherently spatial, too. Since observatories were easier to build than entire universities, many of the former began to sprout up in Europe, with the result that astronomers enjoyed many more places to do research. The proliferation of observatories was supported by two factors: princely interest in astronomy and astrology; and reform of the Julian calendar, which had gotten out of step with the seasons.[29] An example of the former is the German court city of Kassel, which became a center of astronomical research under Prince William IV of Hesse-Kassel (1532-1592). He maintained an observatory and was in contact with other astronomers, including Tycho Brahe (1546-1601).[30] The Papacy, on the other hand, supported the calendar reform and in 1582, the Vatican's chief astronomer Christopher Clavius (1537-1612) published the Gregorian calendar, which is the foundation of our own.[31] Clavius was active in other areas, as well, republishing classical and medieval astronomical texts, which diffused spatial knowledge even further.[32] As public interest burgeoned, the network

27 Isabelle Pantin, "Kepler's *Epitome*: New Images for an Innovative Book", in *Transmitting Knowledge: Words, Images, and Instruments in Early Modern Europe*, ed. Sachiko Kusukawa and Ian Maclean, *Oxford-Warburg Studies* (Oxford: Oxford University Press, 2006).

28 Nicholas Jardine, "The Places of Astronomy in Early-Modern Culture", *Journal for the History of Astronomy* 29 (1998), Robert S. Westman, "The Astronomer's Role", *History of Science* 18, no. 40 (1980). It is worthwhile to compare the changing notion of the astronomer's role in early-modern Europe with the medieval traditions of astronomy outlined in McCluskey, *Astronomies and Cultures*.

29 Brian P. Copenhaver and Charles B. Schmitt, *Renaissance Philosophy*, *A History of Western Philosophy* (Oxford; New York: Oxford University Press, 1992), 76, 159, Hans Ludendorff, "Zur Frühgeschichte Der Astronomie in Berlin", *Preussische Akademie der Wissenschaften: Vorträge und Schriften*, no. 9 (1942), Lloyd Motz and Jefferson Hane Weaver, *The Story of Astronomy* (New York: Plenum Press, 1995), 10-11.The Julian calendar was too short, which resulted in its migration forward through the seasons.

30 Moran, "Christoph Rothmann", Randles, *The Unmaking*.

31 Anthony F. Aveni, *Empires of Time: Calendars, Clocks, and Cultures* (New York: Basic Books, Inc., 1989). See also James M. Lattis, *Between Copernicus and Galileo: Christoph Clavius and the Collapse of Ptolemaic Cosmology* (Chicago: University of Chicago Press, 1995), McCluskey, *Astronomies and Cultures*.

32 Christoph Clavius, *Christophori Clavii Bambergensis in Sphaeram Ioannis De Sacro Bosco Commentarius* (Romae: Basa, 1585), Euclid, *Evclidis Elementorvm Libri Xv : Accesit Xvi. De Solidorvm Regvlarivm Cuiuslibet Intra Quodlibet Comparatione; Omnes Perspicuis Demonstrationibvs, Accuratisq́Ue Scholiis Illustrati, Ac Multarum Rerum Accessione Locupletati*, ed.

of observatories grew and by the end of the sixteenth century a truly European array of astronomers was observing the heavens, reading the classics, and, most significantly, publishing new works. Thus, emerged a virtuous cycle of research, publication, and debate that intensified the changes within astronomy that had begun in the fifteenth century.

Before continuing, I should note here that I am not specifically concerned with the Scientific Revolution, although its path intersects at many points with the trends in spatial thought that I am pursuing. There is a long-standing tendency among scholars to see early-modern astronomy largely in terms of science's advance toward a truer picture of the universe. The parade of heroes is well known, including Nicolaus Copernicus (1473-1543), Tycho Brahe (1546-1601), Johannes Kepler (1571-1630), Galileo Galilei (1564-1642), and Isaac Newton (1643-1727). I am pursuing, in contrast, the emergence of European-wide spatial aesthetic that was cultivated by a widely dispersed astronomical community. Many early-modern astronomers, such as the respected Jesuit Christopher Clavius (1537-1612), were "wrong" from a modern perspective, but their work diffused the basic elements of spatial thought, nonetheless. This culture permeated the rise of modern physics, which is the main theme in the literature of the Scientific Revolution, but it also spread beyond the community of astronomers and diffused through a swath of readers and writers who, in turn, put astronomical ideas at the service of their anthropological ones.

It is against the backdrop of spatial thought that I turn to Nicolaus Copernicus, grandfather to the Scientific Revolution and, as I will argue, celestial anthropology.[33] In 1491, Copernicus matriculated in Cracow. Later, he travelled to Italy, studying in Rome, Bologna and Padua, before settling in Frombork, Poland, where he maintained an observatory. Two significant works emerged, the *Little Commentary* (1514), which was a précis to his heliocentric theory and only distributed in manuscript, and *On the Revolutions of the Heavenly Spheres* (1543), which was published posthumously and substituted a heliocentric explanation of the universe for Ptolemy's geocentrism.[34] This text sparked wide interest among the astronomically literate and was well respected as a work of mathematics and geometry by scholars, even those who disputed its cosmology.[35] With this point in mind, it is important to recognize our own position within the Copernican tradition. Although we see *On the Revolutions of the Heavenly*

Christoph Clavius, Nunc tertio ed., summaq́, diligentia recogniti, atque emendati ed. (Colonia: Ioh. Baptistae Ciottus, 1591), S.J. Homann, Frederick A., "Christopher Clavius and the Renaissance of Euclidean Geometry", *Archivum Historicum Societatis Iesu Roma* 52, no. 4 (1983), Lattis, *Between Copernicus and Galileo*.

[33] Robert S. Westman, *The Copernican Achievement*, vol. 7, *Contributions of the Ucla Center for Medieval and Renaissance Studies* (Berkeley: University of California Press, 1975).

[34] Nicolaus Copernicus, *De Revolutionibus Orbium Coelestium, Libri Vi* (Norimbergae: Ioh. Petreium, 1543).

[35] Owen Gingerich, *The Book Nobody Read: Chasing the Revolutions of Nicolaus Copernicus* (New York: Walker & Company, 2004).

Spheres as an epochal work, we must recognize that it was both the product of traditional astronomy and the start of something new. It is important, thus, to maintain a Janus-faced perspective within the flow of events, because Copernicus can be read both forward and backward.

For my purposes here, *On the Revolutions of the Heavenly Spheres* directs our attention to the rise of a spatial agenda for celestial anthropology.[36] The first glimpse we have of this agenda comes in Copernicus' famous drawing of the heliocentric universe (Figure 1). The drawing is, no doubt, important as an alternative cosmology. It is important to recall, however, its status as an object of European culture, since it was reprinted and commented upon in many subsequent works. Hence, even if readers did not accept the cosmology, they were still exposed to the perspective it assumed. In this image Copernicus constructs a position from which the viewer looks down at the whole system, which was wholly consistent with the work of Peurbach. But the image also signals something new, since human beings now looked down on a system in which they no longer occupied the center. *On the Revolutions of the Heavenly Spheres* marked the point when the human approach to space began to break free of terrestrial experience.

The shift to heliocentrism changed the relationship between the human being and the Earth, since human's spatial realm was now fully independent of terrestrial perspective. This spatial independence intensified the significance of the three themes that I mentioned above, liminality, plurality, and infinity and thrust them ever more prominently into anthropological discussion. As was the case in Pope's "Essay on Man", the liminal perspective penetrated into the structure of Copernicus' text itself, with the first two books dealing with geometric topics before explaining how the universe, the Earth and all the planets and stars are spheres. Here are the titles of the first three chapters of the book: "That the universe is a sphere", "That the Earth is a sphere, too", and "How the Earth together with water makes up one globe."[37] Foreshadowing Edward Young's work, Copernicus moved, within the space of two pages, from the celestial to the global to the Earth's surface.

It is, however, important to recall that Copernicus' work was a mixture of old and new. Classical approaches to space coursed through his work, for example, as his understanding of spheres came from his studies of Euclid, undertaken while a student in Italy.[38] The return of Euclid offers another cultural backdrop against which the history of astronomy can be understood,

[36] On this point, see Blumenberg, *Genesis*, Gingerich, *The Book Nobody Read*, Miguel A. Granada, "Aristotle, Copernicus, Bruno: Centrality, the Principle of Movement and the Extension of the Universe", *Studies in the History and Philosophy of Science* 35 (2004).

[37] Nicolaus Copernicus, *De Revolutionibus Orbium Coelestium* (Norimbergae: apud Ioh. Petreium, 1543), 8-9. The latter insight on the nature of the terrestrial globe becomes the starting point for many geographic texts up through the eighteenth century. See, for example, John Mair, *A Brief Survey of the Terraqueous Globe* (Edinburgh: Kincaid & Bell, 1762).

[38] On the meaning of the shift in the universe's center, see Blumenberg, *Genesis*, Granada, "Aristotle, Copernicus, Bruno".

but the specific history of Euclid's reception and diffusion is outside the bounds of this essay. I will note here only that Euclid's works, above all the *Elements*, returned for the second time in the second half of the fifteenth century, becoming by the middle of the sixteenth a fundamental text in all systems of education. (There had been an earlier flurry of translations in the eleventh century, but theses appeared clumsy and out of date to the Renaissance reader.) Copernicus was greatly affected by Euclid's thought, as is evidenced by his publication of a work on geometry the year before his *On the Revolutions of the Heavenly Spheres* appeared.[39] In addition, Copernicus' definition of the Earth as a sphere that comprises both land and water came straight from Ptolemy's *Geography*, which had only been recovered in the fifteenth century.[40] Most of Copernicus's cosmology was traditional, too, as he assumed not only a closed universe but also the network of crystalline spheres that kept the planets in their place.[41]

If we glance forward, however, we see that Copernicus augurs a change in the meaning of liminality. Aristotelian-Ptolemaic cosmology, as a fully closed system, had been both liminal and inward looking. Aristotle's prime mover stood outside the universe, giving an initial nudge to the outermost crystalline sphere, which then transferred the motion downward to all the other spheres below.[42] This system was highly integrated in its physics and cosmology and was thoroughly infused with teleology, a combination that gave both a position and a purpose to everything, including the human being. Overall, the Aristotelian conception of space locked human beings into a place. In the heliocentric system, however, both the position and the purpose of humanity became open questions, because the Earth was no longer the focus of the universe and the teleology that was associated with geocentricity had commensurately dissolved. Looking in from the outside would soon mean something completely different.

With Aristotle in mind, we can better understand the long-term significance of Copernicus's work for anthropological thought. Aristotle saw the Earth as the center of the universe and not as a planet locked within a larger system, or even a system of systems. This had two implications. First, there was no use in looking back at our system from a great distance, since the meta-physical realm was truly beyond human experience. Second —and more significant— the notion of a plurality of worlds was self-evidently

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[39] Nicolaus Copernicus, *De Lateribvs Et Angvlis Triangulorum, Tum Planorum Rectilineorum, Tum Sphæricorum, Libellus Eruditissimus & Utilissimus, Cum Ad Plerasque Prolemæi Demonstrationes Intelligendas, Tum Uero Ad Alia Multa, Scriptus À Clarissimo & Doctissimo Uiro D. Nicolao Copernico Toronensi. Additus Est Canon Semissium Subtensarum Rectarum Linearum in Circulo* (Vittembergae: Johannes Lufft, 1542).

[40] Tony Campbell, *The Earliest Printed Maps, 1472-1500* (Berkeley, CA: University of California Press, 1987). The first edition was printed in Bologna. Two more editions followed, one published in Rome in 1478 and another in Ulm in 1486. Margriet Hoogvliet, "The Medieval Texts of the 1486 Ptolemy Edition by Johann Reger of Ulm", *Imago Mundi* 54 (2002).

[41] Peter Barker, "Copernicus, the Orbs, and the Equant", *Synthese* 83, no. 2 (1990).

[42] Jürgen Hamel, *Nicolaus Copernicus: Leben, Werk Und Wirkung* (Heidelberg: Spektrum, 1994).

absurd. Heliocentrism, however, implied both an extraterrestrial position and plurality, because it made the Earth into only one sphere among seven total (the Sun plus six planets).[43] Copernicus himself did not subscribe to this idea, but later astronomers explicitly said that his insight served as a precursor to their own speculations on the unseen. In 1697, the Dutch natural philosopher Christiaan Huygens wrote:

> 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.[44]

Although it took generations, before this constellation of ideas took full effect, the Copernican leap eventually transformed each sphere into potential homes for life.

Both the rise of liminality and plurality were consequences of Copernicus' heliocentrism. The third idea, infinity, was also a Renaissance invention, but did not share the same origins, as it emerged from areas that today count as theology and philosophy. In the case of theology the infinite universe was a product of medieval theological reflections. In the thirteenth century, for example, thinkers speculated on the infinite extension of the universe as a way of understanding the magnitude of God's will.[45] This intellectual trajectory reached its apex in the work of Nicolas of Cusa (1401-1464), who was the first to see that since God was understood as the coincidence of opposites —e.g., both infinitely small and infinitely large— space itself could be understood as infinite. In the case of philosophy, the infinite universe returned to Europe with the Renaissance recovery of non-Aristotelian systems of thought, such as Atomism, Stoicism and Platonism.[46] The first two classical schools accepted infinite space, although in the context of radically different cosmologies. Atomism extended the entire universe infinitely, while Stoicism imagined a closed spherical system that was, in turn, surrounded by an infinite void space.[47] Platonism, for its part, understood the concept of infinity in terms of a demiurge whose creative forces flowed throughout (and

[43] Owen Gingerich and James MacLachlan, *Nicolaus Copernicus: Making the Earth a Planet* (New York: Oxford University Press, 2005).
[44] Christian Huygens, *The Celestial Worlds Discover'd: Or Conjectures Concerning the Inhabitants, Plants and Productions of the Worlds in the Planets* (London: Timothy Childe, 1698), 1-2.
[45] Duhem, *Medieval Cosmology*, Alexandre Koyré, *From the Closed World to the Infinite Universe* (New York: Harper & Brothers, 1957), Dermot Moran, "Nicholas of Cusa and Modern Philosophy", in *The Cambridge Companion to Renaissance Philosophy*, ed. James Hankins (Cambridge: Cambridge University Press, 2007).
[46] Jill Kraye, "The Revival of Hellenistic Philosophies", in *The Cambridge Companion to Renaissance Philosophy*, ed. James Hankins (Cambridge: Cambridge University Press, 2007).
[47] David J. Furley, "The Greek Theory of the Infinite Universe " *Journal of the History of Ideas* 42, no. 4 (1981), David E. Hahm, *The Origins of Stoic Cosmology* (Columbus, OH: Ohio State University Press, 1977).

animated) the entire universe. All three traditions were absorbed into the speculations of the late Renaissance thinker Giordano Bruno (1544-1600), who was the first to support a true doctrine of the infinite.[48]

Initially, there was resistance to the doctrine of infinite space within the community of the astronomically informed. Johannes Kepler (1571-1630), Galileo Galilei (1564-1642), and René Descartes (1596-1650) all dismissed it, although for different reasons in each case. The first full use of infinite space in an astronomical context came from the Copernican astronomer Thomas Digges (1546-1595) in *A Perfit Description of Caelestiall Orbes* (1596).[49] Other astronomers, in turn, spread the idea by citing Digges' work. Over time, however, as the idea of infinity spread beyond astronomy, it proved to be inherently unsettling. Blaise Pascal cried out in his *Pensées* (1654), "The eternal silence of these infinite spaces frightens me. How many realms are unaware of us!"[50] Lost in space, Pascal called attention to the sub-text of early-modern astronomy's cultural mission: it intended to calm people by teaching them how to think about massive spaces. The middle of the seventeenth century marked a turning point, in this respect, as ever more natural philosophers, including such luminaries as Christiaan Huygens and Isaac Newton, declared their allegiance and offered methods for finding one's place within the infinite.[51]

By the eighteenth century all doubt among the elite was gone and the infinite universe spread into popular works. Johann Heinrich Lambert (1728-1777), the Alsatian mathematician and member of the Berlin Academy of Sciences, is a good example. In his popular work *Cosmological Letters on the Arrangement of the World-Edifice* (1761), he wrote:

> I have thereby stretched the imagination as far as the world-edifice reaches, and it is now no problem for me to take the distance of our sun from a fiftieth magnitude star as a yardstick, and, by laying it off a million times, to set it up as a measure against the limits of the system of those stars which we see with telescopes and of those which are still beyond.[52]

In contrast to Pascal's hand wringing, Lambert did not merely express his belief in the infinite universe, but also reveled in the spaces it offered the

[48] Hilary Gatti, *Giordano Bruno and Renaissance Science* (Ithaca, NY: Cornell University Press, 1999).

[49] Thomas Digges, *A Perfit Description of the Caelestiall Orbes* (London: 1576), Francis R. Johnson, Sanford V. Larkey, and Thomas Digges, "Thomas Digges, the Copernican System, and the Idea of the Infinity of the Universe " *The Huntington Library Bulletin* 5 (1934), Grant McColley, "The Universe of De Revolutionibus", *Isis* 30, no. 3 (1939): 463-67, Steven Shapin, *The Scientific Revolution* (Chicago: University of Chicago Press, 1996).

[50] Blaise Pascal, *Pensèes* (Paris: GN-Flammarion, 1976), 110.

[51] Koyré, *From the Closed World*, Seyyed Hossein Nasr, *Religion & the Order of Nature* (New York: Oxford University Press, 1994).

[52] Johann Heinrich Lambert, *Cosmological Letters on the Arrangement of the World-Edifice*, trans. Stanley L. Jaki, 1st ed. (New York: Science History Publications, 1976).

human mind to explore.

The significance of astronomical work to the early-modern culture of space looms even larger, when we consider a limit on public knowledge of the era: no one had ever seen the Earth, or even the smallest chunk of the universe. (The first photographic image of the entire Earth was taken by Apollo 8 astronauts only in 1968!)[53] Nor did the public have access to many books or other forms of media. In contrast, already in the sixteenth century astronomers had access to medieval works, contemporary publications and, most importantly, observatories. This advantage became even more profound with the rise of telescopes in the seventeenth century, which allowed astronomers to catch glimpses of neighboring planets and, in turn, to transfer images of what they had seen to the public.[54] An excellent example is *Selenographia: or Description of the Moon* (1647) by the astronomer Johannes Hevelius (1611-1687). Largely forgotten today, this text not only argued in favor of the Copernican heliocentrism but also offered stunning illustrations, including detailed lunar maps. Hevelius's work and that of others, such as the Jesuit astronomer Giovanni Riccioli (1598-1671), made the Moon's spaces real for those living on Earth.[55]

Every image of the extraterrestrial realm began with astronomical observation. Galileo offers a classic example, as he joined observation with the production of images in his *Starry Messenger* (1610). A report of Galileo's telescopic observations, this book first revealed that the Moon's surface was not smooth, as Aristotelians had long assumed, and that Jupiter had moons. It also included images in support of both ideas.[56] In other cases, the connection was less direct, although just as significant. Isaac Newton relied heavily on the observational data of professional astronomers, such as John Flamsteed, the Astronomer Royal in the Greenwich Observatory.[57] The same was true of Johannes Kepler whose greatest accomplishments were based on Tycho Brahe's invaluable collection of observations. And the reliance of Newton and Kepler on professional astronomers was unexceptional, as globe makers, mapmakers and geographers were in the same subordinate position.

The patient construction of a universe created a cultural realm in which anthropology was rethought. The emerging relationship between astronomy

[53] The Apollo photographs were taken during the Apollo 8 mission. NASA has made them available on the web at <http://www.nasa.gov/topics/history/features/apollo_8.html>

[54] Gerald Rottman, *The Geometry of Light: Galileo's Telescope, Kepler's Optics* (Baltimore, MD: Gerald Rottman, 2008), Albert van Helden, "The Telescope in the Seventeenth Century", *Isis* 65, no. 1 (1974).

[55] Johannes Hevelius, *Selenographia: Sive, Luneaue Descriptio; Atque Accurata, Tam Macularum Ejus, Quam Motuum Diversorum Aliarumque Omnium Vicissitudinum, Phasiumque, Telescopii Ope Deprehensarum, Delineatio* (Danzig: Hünfeld, 1647). On Riccioli, see Hevelius, *Selenographia*.

[56] A modern translation is available in Mordechai Feingold, *Jesuit Science and the Republic of Letters* (Cambridge, MA: MIT Press, 2002).

[57] Galileo Galilei, *Discoveries and Opinions of Galileo: Including the Starry Messenger (1610), Letter to the Grand Duchess Christina (1615); and Excerpts from Letters on Sunspots (1613), the Assayer (1623)*, trans. Stillman Drake (New York: Anchor Books, 1957).

and anthropology is apparent in the work of Johannes Kepler. Consider the image in Figure 2, which comes from *Cosmographic Mystery* (1596), Kepler's first cosmological work and defense of Copernicus.[58] This drawing depicts the orbits of the planets by inscribing the system with the five Platonic solids: tetrahedron, cube, octahedron, dodecahedron, and icosahedron. From the perspective of celestial anthropology two aspects of the image are significant. First, consistent with Renaissance approaches to space, Kepler put the viewer into generic space above and outside the system. Second, the image portrays the universe in the manner of celestial and terrestrial globes, which were also a Renaissance reinvention and, over the course of the sixteenth century, became increasingly numerous.[59] The history of globes is outside this essay's scope. It is important to note, however, that the edifice of Kepler's system rests on a pedestal and is tilted slightly in imitation of the tilt in the Earth's axis. Hence, the perspective from above and beyond that I mentioned with respect to Peurbach and illustrated through Copernicus had become the accepted way to represent space.

Although Kepler repudiated the physical explanations in the *Cosmographic Mystery*, he never ceased imagining the cosmos from this extraterrestrial position. It is here, in the realm of projected space that we find direct textual evidence for the connection between astronomy and celestial anthropology: Kepler was the first person since classical times to write a book about extraterrestrial life.[60] Called *The Dream*, Kepler's work was published posthumously in 1634, but its first version dates back to 1593, which was around the time when he formulated the ideas that appeared in *Cosmographic Mystery*.[61] The story relates, in the form of a dream, a journey by Duracotus, a student of Tycho Brahe to the Moon.[62] Durocatus magically ascended to Levania, a Lunar realm, where he encountered a non-human civilization.

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58 Simon Schaffer, "Newton on the Beach: The Information Order of Principia Mathematica", History of Science xlvii (2009).

59 Johannes Kepler, Prodromus Dissertationvm Cosmographicarvm, Continens Mysterivm Cosmographicvm, De Admirabili Proportione Orbivm Coelestivm, Deqve Cavsis Cœlorum Numeri, Magnitudinis, MotuumqUe Periodicorum Genuinis & Proprijs, Demonstratvm, Per Qvinqve Regularia Corpora Geometrica / a M. Ioanne Keplero, ... Addita Est Erudita Narratio M. Georgii Ioachimi Rhetici, De Libris Reuolutionum, Atq[Ue] Admirandis De Numero, Ordine, & Distantijs Sphærarum Mundi Hypothesibus, Excellentissimi Mathematici, Totiusq[Ue] Astronomiæ Restauratoris D. Nicolai Copernici (Tvbingae: Georg Gruppenbach, 1596).

60 Elly Dekker and P. C. J. van der Krogt, Globes from the Western World (London: Zwemmer, 1993).

61 Karl Guthke, The Last Frontier: Imagining Other Worlds, from the Copernican Revolution to Modern Science Fiction, trans. Helen Atkins (Ithaca and London: Cornell University Press, 1990).

62 On Somnium's significance for literary history, see Ibid, Johannes Kepler, Kepler's Somnium: The Dream, or Posthumous Work on Lunar Astronomy, trans. Edward Rosen (Madison, WI: The University of Wisconsin Press, 1967). or discussions of the plurality of worlds debate, of which Somnium must be reckoned a part, see Michael J. Crowe, The Extraterrestrial Life Debate, 1750-1900: The Idea of a Plurality of Worlds from Kant to Lowell (Cambridge Cambridge University Press, 1986), Steven J. Dick, Plurality of Worlds: The Origins of the Extraterrestrial Life Debate from Democritus to Kant (Cambridge: Cambridge University Press, 1982), Patricia Fara, "Heavenly Bodies: Newtonianism, Natural Theology and the Plurality of Worlds Debate in the Eighteenth Century", Journal for the History of Astronomy 35 (2004), Karl Guthke, "Nightmare and Utopia: Extraterrestrial Worlds from Galileo to Goethe", Early Science and Medicine 8, no. 3 (2003).

Unlike later works in this genre, however, *The Dream* does not discuss this civilization's characteristics. The reason is that Kepler wanted to justify Copernicus' heliocentrism by showing how someone on the Moon would not detect lunar motion, but would interpret his position as stable, with the Earth in orbit above.[63]

The Dream reveals the growing cognizance of how perspectival terrestrial experience was. It is, thus, significant that Kepler carefully described how Levanians organized their own geographic space, writing:

> Halfway between the poles there is a circle corresponding to our terrestrial equator, by which name it too may be denoted. It twice intersects both the divisor and the Midolva in opposite points. At all places on the equator the sun at noon passes almost exactly overhead daily, and exactly overhead on two opposite days of the year. For all the others, who live on either side of the equator toward the poles, the sun deviates from the zenith at noon.[64]

Levanians oriented themselves on their world with the same intellectual tool favored by humans, geometry. Kepler used geometry to export human spatial sense to the extraterrestrial realm.

Kepler's work calls attention to how astronomy *produced* the universe. This trend goes back a long way, as medieval astronomers offered a variety of media for public consumption, including star charts, armillary spheres and astrolabes.[65] In the early-modern period, however, there appeared an ever-greater variety of media, including traditional star charts, cosmological works, textbooks, dialogues, magazine articles, globes, children's books, and even astrological calendars and almanacs. (I will set aside more specialized astronomical instruments, such as sextants and telescopes, since they were much more expensive.)[66] A good example of how projected space was transformed into media is *Short Introduction to Noble Astronomy* (1708) an astronomical textbook published by the German astronomer Johann Gabriel Doppelmayr (1677-1750). He wrote:

> We begin in the middle of our system and suppose that we are standing in the middle of the Sun [looking out] with our own eyes and that in no

[63] William C. Heffernan, "The Singularity of Our Inhabited World: William Whewell and A. R. Wallace in Dissent", *Journal of the History of ideas* 39, no. 1 (1978): xvii-xviii.
[64] Kepler, Kepler's Somnium, 18.
[65] Ibid.
[66] J. A. Bennett, "Geometry in Context in the Sixteenth Century: The View from the Museum", Early Science and Medicine 7, no. 3 (2002), Olaf Pedersen, "Astronomy", in Science in the Middle Ages, ed. David C. Lindberg (Chicago, IL: The University of Chicago Press, 1978).

> direction is there a hindrance, neither from the [Sun's] body nor [its] strong light.[67]

Books such as Doppelmayr's constructed a space that the mind's eye could imagine, but the physical eye could not see. In this context, it is significant that Doppelmayr was also a respected globe maker. Working in multiple cultural realms, Doppelmayr made space.

As was the case for Copernicus, the projection of space also created worlds. The astronomer Sir William Herschel (1738-1822), who gained everlasting fame for his discovery in 1781 of the planet Uranus, also sent his own mental mission to the Sun, where he discovered a planet.[68] In 1795, Herschel published in *Philosophical Transactions*, the journal of the Royal Society in London, a record of his observations of our system's star.[69] After explaining the Sun's dimensions and imagining its topography —not altogether accurately— Herschel added:

> The Sun, viewed in this light appears to be nothing else than a very eminent, large, and lucid planet evidently the first, or in strictness of speaking, the only primary one of our system; all others being truly secondary to it. Its similarity to the other globes of the solar system with regard to its solidity, its atmosphere, and its diversified surface; the rotation upon its axis, and the fall of heavy bodies, leads us on to suppose that it is most probably also inhabited, like the rest of the planets, by beings whose organs are adapted to the peculiar circumstances of that vast globe.[70]

Herschel's solar observations became the foundation of a world, albeit one that he obviously could not see clearly. Nonetheless, he imagined a sphere and put beings on it —which is exactly what celestial anthropologists did.

The *Philosophical Transactions* was an elite publication, but popular European culture had long been saturated with unseen worlds and the beings who lived on them. In France, Bernard Fontenelle (1657-1757), the permanent secretary to the *Académie des Sciences*, published a dialogue entitled *Conversations on the Plurality of Worlds* (1686), in which he explained to a

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[67] J. A. Bennett, "The English Quadrant in Europe: Instruments and the Growth of Consensus in Practical Astronomy", *Journal for the History of Astronomy* 23 (1992): 32.

[68] Johann Gabriel Doppelmayr, *Kurze Einleitung Zur Edlen Astronomie, in Welcher Zum Fundament Derselben Das Systema Solare & Planetarium Nach Des Weitberühmten Herrn Chrisiani Hugenii Copernicanischen Grund-Sätzen Erkläret/ Und in Unterschiedlichen Neu-Verfertigten Homännischen Charten Allen Wahren Freunden Der Sternen-Wissenschaft Deutlich Vor Augen Gelegt Wird* (Nürnberg: Joh. Baptistae Homann, 1708), Michael A. Hoskin, *William Herschel and the Construction of the Heavens* (New York: W. W. Norton & Co., 1964).

[69] Simon Schaffer, "Uranus and the Establishment of Herschel's Astronomy", *Journal for the History of Astronomy* 12 (1981).

[70] William Herschel, "On the Nature and Construction of the Sun and Fixed Stars", *Philosophical Transactions of the Royal Society in London* 85 (1795): 63. More broadly, see Herschel, "On the Nature and Construction of the Sun and Fixed Stars".

lay audience the structure of our solar system, populated each planet with intelligent beings, and posited that other such systems existed in the universe.[71] This work was wildly popular and went through multiple editions and translations. Other national cultures also contributed didactic energy. In England, in the second half of the eighteenth century, a literary character named Tom Telescope taught children the wonders of the universe.[72] And in Germany the globe maker Johann Philipp Andreae (1700-1757) took another route, producing an astronomical card game.

Appearing under the title *Newly Invented Educational and Amusing Astronomical Card Game* (1719), Andreae's contribution was a unique and revealing part of astronomy's didactic strategy.[73] It comprised a standard fifty-two-card deck with four suits, four aces, and twelve face cards, with the latter being dedicated to the twelve zodiacal signs. Figure 3 is the cover card from the collection and recapitulates early-modern astronomy's sense of space. Depicted are two young people standing on the Earth around a celestial sphere and using instruments to locate the bodies in the heavens. The celestial sphere underscores the spatial themes that I discussed above. Such spheres were inherently liminal, affording the viewer a perspective from the "outside", and could only be used by a person that had dispensed with the terrestrial perspective. Moreover, much like Kepler's image of the universe in Figure 2, the sphere is placed on a stand and viewers can manipulate it with reference to an equator and a meridian, both of which were imagined circles whose conceptual origins dated back to the classical world.

Andreae's cards reveal that the intellectual framework within which space appeared remained rooted in the Renaissance notion of space that we have seen in Copernicus and Kepler. This point is most obvious in the context depicted in the cover card, as the celestial sphere stands on the Earth and below a banded representation of the twelve zodiacal signs, with the sun passing through them. The band further illustrates how space diffused and taught human beings to understand themselves as living within a spatial bubble. Figure 4 is an image of a face card that depicts the zodiacal sign for Sagittarius. The significance of the image lies in the inclusion of the ecliptical line, which runs through all of the face cards. The ecliptic is a line that one imagines being drawn on the Earth by the Sun's movement across the Heavens. This line is not coincident with the equator, because the Earth is tipped approximately 23.5 degrees off vertical. This line is imaginary but also essential to common methods of orientation in the real world. Moreover, in a heliocentric world, the line becomes nothing more than a human artifice,

71 I had access to a subsequent edition: Robert J. Manning, "John Elliot and the Inhabited Sun", *Annals of Science* 50 (1993).

72 Bernard de Fontenelle, *Entretiens Sur La Pluralité Des Mondes* (Amsterdam: Etienne Roger Marchand, 1719).

73 Josef Benzing, "Andreae, Johann Philipp", in *Neue Deutsche Biographie*, ed. Historischen Kommission bei der Bayerischen Akademie der Wissenschaften (1953), James A. Secord, "Newton in the Nursery: Tom Telescope and the Philosophy of Tops and Balls, 1761-1838", *History of Science* 23 (1985).

projected onto the universe for the convenience of human beings. By the end of the eighteenth century, space had become something that humanity constructed for itself.

These images reveal the incredibly dense nature of the spatial realm within which an ever-larger proportion of Europeans were living. And the projection and manipulation of unseen space in this manner had, as I have argued, direct anthropological effects. Further evidence for my contention comes from the Netherlands in the form of a book entitled *New Atlas for Children* (1776). A children's book on astronomy and geography it held with reference to astronomy:

> This science, necessary and agreeable in whatever condition one be, is brought today to such a point of perfection that to our eyes the entire world is scarcely a large city and all the people that occupy it together a great family.[74]

Moreover, this attitude was etched into the frontispiece (Figure 5), which includes people looking to the sky amidst a precocious Atlas holding up the celestial sphere.[75] By the end of the eighteenth century, the cultural production of extra-terrestrial space remade the context for "Man".

Anthropology and the Celestial Realm

I began the previous section by noting that celestial anthropology was a fundamentally spatial approach to the human being. The history of spatial thought in general has, however, only influenced the anthropological literature marginally.[76] In general, the literature has emphasized the discovery of humanity's unity through the experience of "otherness" via terrestrial travels. In 1946, the literary historian Alphonse Dupront argued, "The true fruit of the 'discovery of the world' is the certainty of a common humanity."[77] Two years later, the anthropologist Wilhelm Mühlmann added, "only contact with exotic [*fremdartigen*] people made the phenomenon of Man [*Mensch*] a problem."[78] This emphasis on the discovery of difference extends into the contemporary literature. In his classic *The Fall of Natural*

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74 Johann Philipp Andreae, *Neu Inventirtes, Belehrendes Und Ergötzendes Astronomisches Karten Spiel: Das Ist Kunstrichtige Abbildung Aller Gestirn Des Gantzen Firmamentes. Zu Sonderbahren Nutzen Der Kunstliebenden Jugend Vorgestellt Durch Johann Philipp Andreae.* (Nürnberg: Self, 1719), v.

75 On Atlas imagery in early-modern astronomy, see *Nouvel Atlas Des Enfans, Ou Principes Clairs Pour Apprendre Facilement Et En Fort Peu De Tems La Geographie, Suivi D'un Traité Méthodique De La Sphere, Qui Explique Le Mouvement Des Astres, Les Divers Systemes Du Monde, & L'usage Des Globes*, (Amsterdam: Chez B. Vlam, 1776).

76 Mosley, *Bearing the Heavens*.

77 Alphonse Dupront, "Humanisme Et Renaissance", *Bibliothèque D'Humanisme Et Renaissance: Travaux & Documents* 8 (1946): 47.

78 Alphonse Dupront, "Espace Et Humanisme", in *Genèses De Temps Modernes: Rome, Les Réformes Et Le Nouveau Monde*, ed. Dominique Julia and Philippe Boutry (Paris: Gallimard Le Seuil, 2001).

Man (1986) the historian Anthony Pagden pinpointed the birth of anthropology (Pagden uses the term enthnology, which is favored by Europeans) in the work of the Spaniards Bartolomé las Casas (1484-1566), José de Acosta (1539-1600) and the Frenchman Joseph-François Lafitau (1681-1746), because each travelled to the New World and credited its indigenous peoples with having a culture.[79] In a subsequent work, *European Encounters with the New World: from Renaissance to Romanticism* (1993) Pagden has extended his argument up through Johann Gottfried Herder. The question, however, is: given that these early anthropologists encountered radical differences between their cultures and that of others, from whence did their conception of unity come?

In this section, I will show how, in the eighteenth century, it was spatial thought that made humanity whole. I will highlight, in this context, the work of Johann Gottfried Herder, because he enjoys a prominent place in the anthropological canon. In addition to Pagden, who has argued that Herder fits into the final stages of a development that began with Europe's arrival in the New World, other prominent scholars have given Herder more than his anthropological due. John Zammito has argued in *Kant, Herder and the Birth of Anthropology* (2001) that anthropology emerged when Herder parted ways with his great teacher Immanuel Kant. For Zammito the divergence between the two Germans liberated the emerging discipline of anthropology from philosophy and, above all, from the emphasis on the philosophical subject that began with the *cogito* of René Descartes.[80] Wolfgang Pross has, however, argued that Herder's thought emerged via the French Enlightenment's reception of the German philosopher Gottfried Wilhelm Leibniz (1646-1716). Pross has highlighted, in this respect, the influence of the *lumières* Denis Diderot (1713-1784), Étienne Bonnot de Condillac (1715-1780) and Jean-Baptiste Robinet (1735-1820), all of whom Herder read in the course of his studies.[81] Finally, David Denby has associated Herder's thought most closely with another Frenchman, Georges-Louis Leclerc, Comte de Buffon (1707-1788), arguing that the great French naturalist's idea that human beings are characterized by flexibility in dealing with their environments allowed Herder to understand humanity via the diversity of the spaces it occupied.[82]

For all its internal diversity, however, the scholarship on Herder mirrors the general problem in the literature on anthropology: it fails to discuss astronomy's contribution to anthropological thought. All the early-modern thinkers whose names I mentioned in the previous paragraph were influenced

[79] Wilhelm E. Mühlmann, *Geschichte Der Anthropologie*, 2., verb. und erw. Aufl. ed. (Frankfurt am Main: Athenäum Verlag, 1968), Pagden, *European Encounters*, Pagden, *The Fall of Natural Man*, Anthony Pagden, ed., *Facing Each Other: The World's Perception of Europe and Europe's Perception of the World*, 2 vols., vol. 31, *An Expanding World* (Aldershot: Ashgate/Variorum, 2000).

[80] Pagden, *Lords of All the World*.

[81] Zammito, *Kant, Herder, and the Birth of Anthropology*.

[82] Wolfgang Pross, "Herder Und Die Anthropologie Der Aufklärung", in *Johann Gottfried Herder: Werke*, ed. Wolfgang Pross (Munich: Carl Hanser Verlag, 1987).

by astronomical thought. Buffon, for instance, was up to date on all the latest theories and even participated in astronomical debates about the origins and development of the Earth.[83] Even more significant, astronomy's influence on Herder ran just as deep. As Hugh Nisbet has put it:

> Herder was interested in astronomy throughout his life. He mentions over thirty writers on the subject in his works, and his library contained further works, which he does not cite. He often writes rhapsodically of the stars, thus showing that the motives behind his interest in astronomy, as with many actual astronomers, included his aesthetic and mystical admiration for the vastness and harmony of the stellar universe.[84]

Herder studied astronomy with Kant at the University of Königsberg in the period 1762-64, and also taught the subject in a school in Riga, where he took a teaching position after leaving the university.[85] In fact, there is an unpublished manuscript from Herder's Riga period that bears the title, "First Principles of Astronomy", which, according to Nisbet, contains:

> a detailed description of the constellations with their main stars, systems of astronomical measurement, the numbers of stars according to contemporary catalogues and computations, the structure of nebulae and the Milky Way, the planets and their satellites, the sun and sunspots, the moon and its surface, and eclipses; further statistics are added concerning the shape, size and structure of the earth.[86]

Later in life Herder maintained contact with the latest astronomical work coming out of the new University of Göttingen, which was founded in 1737 and rapidly became the model for the modern research university. He also published a series of articles for German journals on scientific topics, including the one on Copernicus mentioned above, and four on Isaac Newton, in 1802.[87] The following year, he also published a poem "The Stars", which opened with the lines, "Beautiful starry realm, your worlds unending meadows/Beside myself with rapture, my eye trembles before you."[88] The poem sounds no better in the original German, but it is a measure of how the

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[83] David Denby, "Herder: Culture, Anthropology and the Enlightenment", *History of the Human Sciences* 18, no. 1 (2005), Giovanni Solinas, "Newton and Buffon", *Vistas in Astronomy* 22, no. 4 (1979).

[84] Jeff Loveland, "Buffon, the Certainty of Sunrise, and the Probabilistic Reductio Ad Absurdum " *Archive for History of Exact Sciences* 55, no. 5 (2001): 140.

[85] Nisbet, *Herder and the Philosophy and History of Science*, 57, 66.

[86] Rudolf Malter, *Immanuel Kant in Rede Und Gespräch* (Hamburg: Felix Meiner Verlag, 1990).

[87] Herder, "Etwas Von Nikolaus Kopernikus Leben", Johann Gottfried Herder, "Isaak Newtons Gesetz Der Schwere", *Adrastea* 3 (1802), Johann Gottfried Herder, "Newtons Teleskop", *Adrastea* 3 (1802), Johann Gottfried Herder, "Newtons Theorie Des Lichts Und Der Farben", *Adrastea* 3 (1802), Nisbet, *Herder and the Philosophy and History of Science*, 147.

[88] Johann Gottfried Herder, "Newton Und Keppler", *Adrastea* 3 (1802).

eighteenth-century based its anthropological sensibility on the contemplation of the celestial realm.

Whatever their views on astronomy's role in Herder's thought, no scholar would disagree that Herder's chief contribution to anthropology is his *Ideas on the Philosophy of the History of Humankind*, an unfinished multi-volume opus (twenty of a planned twenty-five books were completed) that was published between 1784 and 1791.[89] The literature on this work is expansive and cuts across disciplines, bleeding into theology, philosophy, and literary studies.[90] How curious, then, that no one has commented on the significance of the text's first line, which runs, "Our philosophy of the history of humanity must start with the Heavens, if it is to be considered worthy of the name."[91] Like Young and Pope, Herder expressly began with a liminal position, before moving back to the Earth. Moreover, almost as if to avoid misunderstanding on the celestial backdrop, Herder added:

> Since our domicile, the Earth, is nothing in itself, but receives from heavenly forces that extend through the universe its composition and form, its ability to organize [itself], and to maintain its creatures, so must one behold it, in the first place, not as alone and lonely, but as part of a choir of worlds, among which it is placed.[92]

Herder's expansive notion of outer space created the backdrop for speculation on extraterrestrial life, even if he was dubious that we could understand other worlds without actually going there.[93] (On this point, he agreed with Kant.)[94] We also know where Herder's cosmological ideas came from, because in the first paragraph of the text he cited Copernicus, Kepler, Newton, Huygens, and Kant as examples of astronomy's contribution to anthropology.[95] He then added:

> Thus, when I open the great book of heaven [*Himmelsbuch*] and see before me this immeasurable palace that only the divine, alone and

[89] A modern version, regrettably edited, is available in Johann Gottfried Herder, "Sterne", *Adrastea* 6 (1803). Wherever possible, I will include this edition in the citations.

[90] Johann Gottfried Herder, *Herders Werke in Fünf Bänden*, ed. Regine Otto, 5 ed., 5 vols., vol. 4 (Berlin: Hermann Duncker, 1978), Wolfhart Pannenberg, *Anthropology in Theological Perspective*, 1st ed. (Philadelphia, PA: Westminster Press, 1985), Wolfhart Pannenberg, *What Is Man? Contemporary Anthropology in Theological Perspective* (Philadelphia: Fortress Press, 1970).

[91] Johann Gottfried Herder, *Ideen Zur Philosophie Der Geschichte Der Menschheit*, 4 vols., vol. 1 (Riga: Johann Friedrich Hartknoch, 1784), 17, Max Scheler, *Die Stellung Des Menschen Im Kosmos* (München: Nymphenburger Verlagshandlung, 1947), 3.

[92] Herder, *Werke: 4*, 3, Herder, *Ideen: 1*, 17.

[93] Herder, *Werke: 4*, 3, Herder, *Ideen: 1*, 17.

[94] In his *Anthropology from a Pragmatic Point of View* (1798) Kant writes, "Wir können, um unseren Begriffen von vernünftigen Wesen Anschauung unterzulegen, nicht anders verfahren, als sie zu anthropomorphisieren", Herder, *Werke: 4*, 76.

[95] Dick, *Plurality of Worlds*, Immanuel Kant, *Immanuel Kant Werkausgabe*, ed. Wilhelm Weischedel, 12 vols., vol. 4 (Frankfurt am Main: Suhrkamp Verlag, 1974).

> above all, can measure up to, so I infer, in as undivided a manner as I can, from the whole to the specific, from the specific to the whole.[96]

As was the case with Kant's use of the verb "to see", Herder's use of the term "book of heaven" is more than just a simple metaphor, but represents the vast reservoir of astronomical knowledge produced and collated since, at least, the Renaissance. Like all educated people of his age, Herder understood the universe via books and other media that recounted the universe's basic characteristics, which by the eighteenth century included both the plurality of worlds and infinity. Hence, the three big themes of the previous section —liminality, plurality and infinity— are all present within the first few pages of Herder's most important anthropological work.

Herder's construction of extraterrestrial space set the agenda for his discussion of the history of humankind. Here, I will summarize the vision he proffers in Book One. This book is devoted entirely to creating the spatial realm in which human beings lived. After acknowledging, in the first chapter, astronomy's fundamental role in expanding our understanding of the universe, Herder turned, in chapter two, to our solar system, which allowed him to put the Earth in its place:

> The Earth has below it two planets, Mercury and Venus, with Mars (and perhaps another hidden above it), Jupiter, Saturn, and Uranus above--and whatever others may still be above, until the regular zone of the Sun trails off and the eccentric orbit of the final planets jumps off into the wild ellipses of the comets' trajectories.[97]

He continued to construct our world in chapter three by describing how the Earth formed as a planet and cited the speculations of Buffon, Kepler, and Newton.[98] In particular, Herder took the notion that the Earth had evolved into a planet from Buffon's great anthropological work, *Natural History, General and Particular, with a Description of the Royal Cabinet* (1749-1788).[99] Herder then geared down even further and considered the Earth as the Sun's satellite in the fourth chapter, to which he gave the subheading, "Our Earth is a sphere that rotates around itself and, with respect to the Sun [is] askew."[100] This phrase could have appeared in any eighteenth-century textbook on astronomy and is certainly in line with the perspective that Doppelmayr offered in his textbook. Continuing downward, chapter five explains the presence of an atmosphere and its contribution to diversity in the

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96 Michael J. Crowe, *The Extraterrestrial Life Debate, 1750-1900* (Mineola, NY: Dover Publications, Inc., 1999), 5-6, Herder, *Ideen: 1*, 18.
97 Herder, *Werke: 4*, 8-9.
98 Herder, *Ideen: 1*, 17-18.
99 *Ibid.* See the second introductory discourse, "History and Theory of the Earth", Buffon, *Histoire Naturelle*. 168-203
100 Georges-Louis LeClerc Buffon, Comte de, *Histoire Naturelle, Générale Et Particuliére Avec La Description Du Cabinet Du Roy*, 29 vols., vol. 1 (Paris: L'Imprimerie Royale, 1749-1788), 22-23.

environment.[101] Chapter six examines the Earth's surface and defines it as divided between land and water, which is the foundation of another sort of diversity.[102] Chapter seven, in turn, covers the Earth's topography and explains how the diversity in environments supports a broad array of life.[103]

Herder's philosophy of the history of humanity absorbed astronomy's spatial agenda and, in the process, re-created our world from the outside in. Herder's philosophy of the history of humanity began with the heavens. And this celestial approach set the agenda for the rest of the work. Books Two and Three, taken together, begin with plants and end with animals and human beings, thus creating the biological network in which human life is suspended.[104] Books Four and Five traced the emergence of the human spirit (in the sense of *Geist*), arguing that the human being is a rational creature that is designed to believe in God and is only a small part of a larger, universal process of development.[105] Book Six through Book Twenty then offer a tutorial in humanity's historical interaction with its globe, discussing the organization of tribal peoples and their practices, before turning to documented history.[106] In one chapter in Book Ten Herder even took the same position above our planet, as did Edward Young, contemplating our home from orbit and concluding that it is *designed* to support human life.[107] By the eighteenth century, to think anthropologically, one first had to construct a world. Put another way: anthropology did not begin with human beings, but ended with them.

In order to understand more fully astronomy's role in constructing anthropology's universe, I turn to one of the people Herder cited, the Dutch natural philosopher Christiaan Huygens (1629-1695). Huygens has never been associated him with anthropological thought, although he is famous for many other things. In addition to being the inventor of the pendulum clock, he published important works in the realms of physics and optics, and was affiliated with the *Royal Society* in London and the *Académie de Sciences* in Paris.[108] He also began as a supporter of Copernicus, before later becoming a

101 Herder, *Ideen: 1*, 29-35.
102 Ibid., 35-50.
103 Ibid., 50-59.
104 Ibid., 97-182.
105 Herder, Werke: 4, 183-318, Herder, Ideen: 1, 36-94.
106 Herder, Werke: 4, Johann Gottfried Herder, Ideen Zur Philosophie Der Geschichte Der Menschheit 4vols., vol. 4 (Riga: Johann Friedrich Hartknoch, 1791), 97-462, Johann Gottfried Herder, Ideen Zur Philosophie Der Geschichte Der Menschheit 4vols., vol. 3 (Riga: Johann Friedrich Hartknoch, 1787), Johann Gottfried Herder, Ideen Zur Philosophie Der Geschichte Der Menschheit, 4 vols., vol. 2 (Riga: Johann Friedrich Hartknoch, 1785).
107 Herder, Werke: 4, 279-80, Herder, Ideen: 2, 218.
108 Herder, Werke: 4, 187-88.O n the world from which Huygens came, see Christopher Baker, ed., Absolutism and the Scientific Revolution, 1600-1720: A Biographical Dictionary (Westport, CT: Greenword Press, 2002), 37-67. On Huygens in Paris, see Klaas van Berkel, Albert van Helden, and Lodewijk Pal, eds., A History of Science in the Netherlands: Survey, Themes and Reference (Leiden: Brill, 1999), 119-23. On Dutch higher education, see Geoffrey V. Sutton, Science for a Polite Society: Gender, Culture, and the Demonstration of Enlightenment (Boulder, CO: Westview Press, 1995), 569-75.

convinced Newtonian and was, thus, part of the broader culture of space that I outlined above. Significantly, Huygens was also a practicing astronomer.[109] Among his most famous astronomical works is the *System of Saturn* (1659), in which, following Galileo's lead, he explained the phases of Saturn, identified its moons, and also first established that the planet had rings.[110] Nicely illustrated, the *System of Saturn* was popular and remained widely cited into the eighteenth century.

System of Saturn fits into the spatial realm of celestial anthropology, because like Kepler's *Cosmographic Mystery* it constructed an unseen world and registered it with images. Additionally, it is part of an anthropological pair. In a subsequent work, *Cosmotheoros* (1697), Huygens surveyed the entire solar system for the purpose of ascribing life to each planet.[111] Originally published in Latin, an English translation appeared in 1698 under the title *The Celestial Worlds Discover'd: or, conjectures Concerning the Inhabitants, Plants and Productions of the Worlds in the Planets*.[112] I will cite this edition throughout. Using all the latest scientific knowledge, Huygens elaborated the space for celestial anthropology.[113] As I noted in the previous section, he began by expressly connecting Copernicanism to the rise of speculation on the status of life on other planets.[114] Huygens then touched on the relationship between seen and unseen in the early-modern world, arguing that just because we cannot see these places does not mean they are lifeless:

> Since then the greatest part of God's Creation, that innumerable multitude of Stars, is plac'd out of the reach of any man's Eye; and many of them, it's likely of the best Glasses, so that they don't seem to belong to us; is it such an unreasonable Opinion, that there are some reasonable Creatures who see and admire those glorious Bodies at a nearer distance?[115]

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[109] Jonathan I. Israel, The Dutch Republic: Its Rise, Greatness, and Fall, 1477-1806, Oxford History of Early Modern Europe (Oxford: Oxford University Press, 1995).

[110] Albert van Helden, "The Beginnings, from Lipperhey to Huygens and Cassini", *Experimental Astronomy: Astrophysical Instrumentation and Methods* 25, no. 1-3 (2009). On Huygens and astronomy, see Owen Gingerich, "Henry Draper's Scientific Legacy", *Annals of the New York Academy of Sciences* 395 (1982), Christiaan Huygens, *Systema Saturnium, Sive De Causis Mirandorum Saturni Phaenomenôn Et Comite Ejus Planeta Novo* (The Hague: Adriani Vlacq, 1659).

[111] van Helden, "The Beginnings, from Lipperhey to Huygens and Cassini".

[112] Christiaan Huygens, *Cosmotheoros Sive De Terris Coelestibus, Earumque Ornatu, Conjecturae Ad Constantinum Hugenium*, Editio altera ed. (Hagae-Comitum: Apud Adianum Moetjens, 1699). It was also retranslated and republished in 1762. Huygens, *Celestial Worlds Discover'd*.

[113] Crowe, *The Extraterrestrial Life Debate, 1750-1900: The Idea of a Plurality of Worlds from Kant to Lowell*, Dick, *Plurality of Worlds*, Christiaan Huygens, *Cosmotheoros: Or, Conjectures Concerning the Inhabitants of the Planets. Translated from the Latin of Christian Huygens.* (Glasgow: Printed for Robert Urie, 1762).

[114] George Basalla, *Civilized Life in the Universe: Scientists on Intelligent Extraterrestrials* (Oxford: Oxford University Press, 2006), 1-2.

[115] Huygens, *Celestial Worlds Discover'd*, 7-8.

Huygens here is laying out the realm in which Kant assessed the value of his own existence and within which Herder began his anthropology. In this case of the former, it is significant that Kant cited Huygens several times in his *General Natural History and Theory of the Heavens* (1755), in addition to including an appendix entitled "On the Inhabitants of the Planets", whose structure mirrors almost exactly Huygens' work.[116] Hence, knowledge of the starry heavens demanded that human viewers put life on every planet. For that reason Huygens not unreasonably assumed that each of the stars above was a Sun, even if human eyes had never seen any of them up close.

Huygens' interpretation of the starry heaven reveals the same the spatial realm that I highlighted in Andreae's card game and the Dutch *New Atlas for Children*. For example, Huygens juxtaposed his mental travels in the extraterrestrial realm to earthly travel, writing:

> So, like Travellers into other distant Countrys, we shall be better able to judge of what's done at home, know how to make a true estimate of, and set its own value upon every thing.[117]

Thus, did Huygens' tour begin. Significantly, the extraterrestrial part of his journey was made possible by geometry, which I have already mentioned with reference to Copernicus. In this context, it is important to note that, in addition to providing a way of thinking about space, geometry also licensed analogy as a means of investigating the universe. Both Herder and Buffon, for instance, accepted analogy as a legitimate scientific tool. For his part, Huygens used geometry to export life and argued that, as spheres, other planets in our system probably hosted life, as did our own.[118]

> Tis therefore an Argument of no small weight that is fetch'd from Relation and Likeness; and to reason from what we see and are sure of, to what we cannot, is no false Logick. This must be our Method in this Treatise, wherein from the Nature and Circumstances of that Planet which we see before our eyes, we may guess at those that are farther distant from us.[119]

Analogy worked within projected space. Thus, Huygens argued that as spheres all the planets have water, which means they have plants, higher animals that eat the plants, and higher beings that eat everything. He then populated each with intelligent beings that are endowed with reason, senses, and language.[120]

[116] Ibid., 262, 313-15, 77-94.
[117] Kant, *Werkausgabe*, 10.
[118] Huygens, *Celestial Worlds Discover'd*, 17-19.
[119] Ibid., 18-19.
[120] Ibid., 37-39.

In sum, like Herschel a century later, Huygens began with spheres and ended with planets.

The link between space and celestial anthropology is clearest, however, in Huygens's discussion of otherworldly systems of knowledge.[121] Having populated all the planets with intelligent beings, he turned to an analysis of how these extraterrestrials must experience their own worlds. He began with astronomy and argued that any intelligent being's eyes must be drawn to the heavens. For that reason all intelligent life in our system will have developed astronomy, as well as other methods of producing knowledge, including arithmetic, writing, music, optics and, above all, geometry:

> But Geometry stands in no need of being proved after this manner. Nor doth it want assistance from other Arts, which depend on it, but we may have a nearer and shorter assurance of their not being without it in those Earths. For that science is of such singular worth and dignity, so peculiarly implys the Understanding, and gives it such a full comprehension and infallible certainty of Truth, as no other Knowledge can pretend to: it is moreover of such a nature, that its Principles and Foundations must be so immutably the same in all times and places, that we cannot without Injustice pretend to monopolize it, and rob the rest of the Universe of such an incomparable Study.[122]

Not coincidentally, all of the disciplines I listed above were understood as inherently spatial. Space had penetrated every aspect of early-modern culture. With respect to anthropology, as astronomers published more works and expanded into a variety of media the early-modern world wrapped itself in unseen space.

Having considered someone whom Herder cited in his work, I turn now to someone he never mentioned, José de Acosta. A Jesuit sent by his order to the New World, Acosta is one of the sixteenth-century thinkers that Anthony Pagden credited with an early role in the emergence of an anthropological tradition that he, as I noted above, extended up through Herder. Pagden has celebrated Acosta's greatest work *Natural and Moral History of the Indias* (1590) and put particular emphasis on its argument that cultural differences served to classify peoples.[123] There is no doubt that Acosta's respect for cultural difference humanized his thought and yielded a profound respect for the achievements of the indigenous cultures of the New World. My interest here is, however, in the source of Acosta's belief in the essential unity of humanity. Acosta did not have access to notions of species or race, since both of these emerged only in the eighteenth century. Nor, as I will discuss further below, did he have the spatial perspective that undergirded the thought of

[121] Ibid., 61-66.
[122] Ibid., 84.
[123] Ibid., 156-57.

Pope, Kant, Herder and Huygens. Acosta lived in an altogether different spatial realm.

In order to accentuate the contextual differences between Herder and Acosta, I begin with an overview of *The Natural and Moral History of the Indias*. This work is divided into seven books, of which the first two are dedicated to reconciling classical and biblical geographic knowledge with the New World.[124] The next five books constitute a second part and are dedicated to describing the New World's environments in detail. Book Three covers the local climate and topography, highlighting especially the winds, waters, and soils.[125] Book Four covers the New World's wealth, including silver and gold deposits, before considering the variety of foods and fauna.[126] Book Five examines indigenous religious practices, which Acosta argued revealed the predisposition of the indigenous to believe in God.[127] Book Six debunked what Acosta called the commonly held view that the indigenous peoples were beasts and explained, to that end, how the produced a complicated culture that included methods of time reckoning, language and writing, systems of law and government, burial practices, and also detailed the locals' political history.[128] Book Seven covers Mexican history more specifically, beginning with the first settlement of the area that is now Mexico and running up through the Spaniards' arrival and their killing of the last king of the Aztecs, Moctezuma II (ca. 1466-1520).[129] The book ends with a discussion of the religious meaning of the Spaniards' victory.

Even this cursory overview makes clear that Acosta lived in realm very different from that of the celestial anthropologists. First, Acosta's universe bore no relationship to Renaissance spatial thought. Although a product of the "Salamanca School", an Aristotelian group of scholars that was awash in the spatial knowledge that poured into colonial-era Spain, Acosta never once mentioned an early-modern astronomer, such as Peurbach, Regiomontanus or Copernicus. This oversight is significant, since it is known that Salamanca hosted cautious streams of discussion about the Copernican cosmology.[130] Nor did he consider works by Renaissance cosmographers/geographers/cartographers, such as Martin Waldseemüller (1470-1520), Sebastian Münster (1448-1552), Peter Apian (1495-1552), Johannes Schöner (1477-1547), who published a variety of works in the first half of the sixteenth century that put the New World and the globe into geographic space. It is also important to note that none of these scholars was a Copernican, which suggests that the Renaissance rediscovery of space was

[124] Pagden, *The Fall of Natural Man*, 13-115.
[125] José de Acosta, *Historia Natural Y Moral De Las Indias* (Madrid: Alonso Martin, 1608), 117-92.
[126] Ibid., 193-299.
[127] Ibid., 303-93.
[128] Ibid., 395-449.
[129] Ibid., 451-535.
[130] Ibid.

not, by its nature, inapplicable to Acosta's world. Acosta simply paid exclusive attention to different authorities.

Acosta's global imagination was extremely traditional. Largely cut off from the advances being made by Renaissance astronomers, his cosmology was a mix of Peripatetic philosophy and classical and early-Christian geography. As a result, although aware of an array of classical authorities, including also the work of Pliny, Plutarch, Lactantius, Seneca, Dioscorides, and Plato, he completely ignored outer space in his anthropology:

> there is no doubt but that Aristotle and the other Peripatetics, together with the Stoics, felt that the entire figure [of the universal orb was] rounded and rotated in circular fashion and, in turn, this is precisely correct, as we have seen with our own eyes in Peru...[131]

And in his discussion of geography Acosta continually cited the Bible and Patristic thought —above all St. Augustine— even when correcting the deficiencies of these authorities. The point for Acosta was to use his own experience to support a "true" reading of classical works. There is, however, no sense in Acosta's work that the spatial projections associated with ancient texts had become outdated, or at least subject to review. Instead, Acosta remained deeply indebted to a system of thought that Renaissance cosmographers were, at the very same time, doing so much to overcome.

Given that Acosta existed in a different spatial context, it stands to reason that his approach to the unity of human beings rested on different foundations than those accepted by celestial anthropologists. Here, we need to recognize the influence of the church's traditional combination of Aristotelianism with its vision of God. Acosta united the indigenous populations with European ones not on the basis of the former's admirable cultural achievements, but on their redeemability. The unity of humanity came, ultimately, from God. Differences in cultural practices, far from justifying difference itself, were merely evidence of a common rationality that God had implanted in all human beings. As Acosta noted in a prologue that he had inserted between Books Two and Three:

> The subsequent books will say of [the indigenous peoples], that they appear worthy of relations [between us], and since the goal of this history is not only to report what is happening in the Indias, but also to put this history in such order that the fruits that can be derived from the knowledge of such things, are to help these people [gain] their salvation and to [give] glory to the Creator and Redeemer, to take them out of the

[131] Victor Navarro Brotons, "The Reception of Copernicus in Sixteenth-Century Spain: The Case of Diego De Zuniga", *Isis* 86, no. 1 (1995): 16.

> slippery shadows of their unbelief, and to convey to them the admirable light of His Gospel.[132]

A brief glance back at Herder suggests how much had changed in the previous two centuries. Like Acosta, Herder was trained in religious thought and also worked, at different times, as both a theologian and a cleric. Yet, if we compare his anthropological world to that of Acosta, we find not only a different vision of the universe but also a completely different vision of God. At the end of the First Book of his *Ideas*, Herder summed up his celestial vision of humanity thus: "Wherever and whoever I may be, …[I am] a being in the unforeseeable Harmony of one of God's worlds."[133] Herder's expansive vision of outer space, which was largely Newtonian, but had its roots in the Renaissance, highlighted humanity's relationship to God via the multiple spaces for life that He had made. God the redeemer had truly become God the geometer.

There was room for both God and Man in Herder's universe, but the assumptions that underlay both concepts had undergone a profound (and disorienting) change. In 1611, the English poet John Donne gave voice to the resulting despair, writing:

> T'is all in peeces, all cohaerence gone;
> All just supply, and all Relation:
> Prince, Subject, Father, Son, are things forgot.[134]

Donne's world lay in shards, because his fellow Europeans, having put the world in a place, had displaced both God and Man. He took a similar stance twenty-two years later, writing in "A Valediction: of Weeping" (1633):

> On a round ball
> A workman that has copies by, can lay
> An Europe, Afrique, and an Asia,
> And quickly make that, which was nothing, All.[135]

Space, which had been nothing, was now everything.

Donne's laments highlight the difference between Acosta and Herder: each based the unity of their respective anthropologies on completely different approaches to unity. Hence, we must take with a grain of salt the notion that Acosta is part of a tradition that extends from the discovery of the New World up through eighteenth-century Königsberg. Acosta wrote about

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[132] Acosta, *Historia Natural*, 300-01.
[133] Ibid., 20. This approach remains enormously influential in theology.
[134] Herder, *Werke: 4*, 192.
[135] Charles M. Coffin, ed., *The Complete Poetry and Selected Prose of John Donne* (New York: The Modern Library, 2001), 30.

human beings and, so too, did Herder. But this biological continuity cannot justify an intellectual tradition. Herder's anthropology was based not on Man's capacity for redemption in a geocentric world, but on the ability to extend the human mind into a heliocentric, pluralistic universe that God had created for life. This approach to anthropology would have been incomprehensible to a person, such as Acosta, who failed to cite Copernicus. By the late eighteenth century, however, no one seriously disputed the Copernican revolution and the question of "Man's" redemption had separated itself from this creature's status as an occupant of *one* of the universe's worlds. God still redeemed humanity, but only by giving the human species a universe to imagine.

Conclusions

The eighteenth century completed the work of three centuries of stargazing by applying a collectively imagined cosmovision to anthropology. If we want to find "Man", we must first look to the starry heaven above. I only mentioned him briefly above, but Voltaire offers a useful summary position, because he was both an anthropologist —in terms of his literary production— and a popularizer of the new cosmovision.[136] In 1752, Voltaire published *Micromégas*, a mordant story, in which a traveler from near the star Sirius comes to our solar system and joins a friend from Saturn, before both of them head to Earth, where they discover that human beings are pathetic.[137] Voltaire's text is not to be taken seriously as science; it is purely a literary invention that borrows heavily from Jonathan Swift's *Gulliver's Travels*, among other works. It does represent well, however, the growing reach of astronomical thought, as one of Voltaire's aliens hails not from the Moon, or from another planet in our system, but from deep space.

Moreover, like the work of Kepler and Huygens, Voltaire's *Micromégas* is part of an anthropological pair. Fourteen years before publishing this work, Voltaire had published a didactic scientific work, *The Philosophy of Newton* (1738).[138] This text explicated mostly Newton's theory of light and assumed the spatial realm within which celestial anthropology was appearing. Rather than go deeply into the text I will highlight only the frontispiece (see Figure 6). At the top left is God the geometer, presiding over the celestial sphere (and bearing a remarkable resemblance to Isaac Newton). At the bottom is a terrestrial sphere in a scholar's study accompanied by the scholar himself, who also happens to be bent over in contemplation of things that he cannot see. A compressed representation of an age, this image reminds us that knowledge had to be distilled and distributed through the patient work of an army of scholars.

Voltaire's intellectual role also suggests an important pivot point for scholars of anthropology. In general scholars credit the early-modern era with having created the mental categories on which contemporary anthropological sensibilities are built, even if there is no agreement on which century produced the most significant breakthroughs. If we consider the literature broadly, however, its becomes apparent that the contemporary scholarship is more likely to anoint an eighteenth-century thinker as an anthropologist, even if that thinker never left Europe. Without realizing it, perhaps, the literature

[136] Ibid.
[137] Voltaire, *Élémens de la Philosophie de Neuton: Mis à las portée de tout le Monde* (Amsterdam: Jacques Desbordes, 1738), ———, *Le Micromégas de Mr. de Voltaire avec une Histoire des Croisades & un Nouveau Plan de l'Esprit Humain* (London: J. Robinson, 1752), Duchet, *Anthropologie Et Histoire*. I am indebted to Prof. Oscar Kenshur of Indiana University at Bloomington for recommending *Micromégas* to me.
[138] Ibid, Guthke, *The Last Frontier*.

has made the ability to project one's mind through space an essential component of anthropology. Although there are exceptions, such as Michel de Montaigne (1533-1592), the most celebrated anthropologists of the sixteenth century, including Bartolomé las Casas and José de Acosta, all visited foreign peoples and places.[139] In the literature on the seventeenth century, however, the balance shifts, as scholars are as wont to claim for anthropology Joseph-François Lafitau, who visited the New World, as René Descartes, who never left the Continent.[140] By the eighteenth century, however, the center of gravity shifts even further towards the sedentary scholar, as the majority of the discipline's anthropologists stayed put in Europe. The tendency to look to the eighteenth century suggests that both contemporary scholars and eighteenth-century thinkers are part of a common culture that is based, to no small degree, on space.

With this overview in mind, I will evaluate some important works on eighteenth-century anthropology. In her classic work *Anthropology and History in the Century of the Enlightenment* (1971) Michèle Duchet identified five thinkers as key players in the creation of a general science of humanity, Buffon, Voltaire, Jean-Jacques Rousseau (1712-1778), Claude Adrien Helvétius (1715-1771), and Denis Diderot. None of these people ever left Europe to confront the "other", so why should they be included in an anthropological canon? Voltaire may have contributed to the "invention" of Eastern Europe, as Larry Wolff has put it. Nonetheless, given the long-standing cultural connections between Central and Eastern Europe, dating back to the Middle Ages, this cannot equate to visiting the indigenous peoples of the New World.[141] The same disconnect is apparent in another fundamental work, *History of Anthropological Thought* (1981) by the social anthropologist E. E. Evans-Pritchard. Evans-Pritchard identifies Charles-Louis de Secondat, baron de La Brède et de Montesquieu (1689-1755) as the first anthropologist, because he was the first to understand that, on matters of culture, everything relates to everything else.[142] Others have joined Evans-Pritchard in this assessment.[143] The problem with this assertion is that, although Montesquieu completed an extensive tour of Europe, he never traveled farther east than Hungary nor farther west than England. Moreover, when he described "others" in his work, they hailed from Persia, which had a long been present

[139] Donald M. Frame, *Montaigne's Discovery of Man: The Humanization of Humanist* (New York: Columbia University Press, 1955), Larry Wolff, *Inventing Eastern Europe: The Map of Civilization on the Mind of the Enlightenment* (Stanford, CA: Stanford University Press, 1994).

[140] Wilhelm Dilthey, "Auffassung Und Analyse Des Menschen Im 15. Und 16. Jahrhundert", in *Wilhelm Diltheys Gesammelte Schriften* (Leipzig: B. G. Teubner, 1921), Werner Krauss, *Zur Anthropologie Des 18. Jahrhunderts: Die Frühgeschichte Der Menschheit Im Blickpunkt Der Aufklärung* (Berlin: Akademie-Verlag, 1978), Mühlmann, *Anthropologie*. On Descartes, see Linden, *Untersuchungen*, Mühlmann, *Anthropologie*, Pagden, *The Fall of Natural Man*.

[141] Leaf, *Man, Mind, and Science*.

[142] Wolff, *Inventing Eastern Europe*.

[143] Along the same lines, see Evans-Pritchard, *History of Anthropological Thought*, David Francis Pocock, *Social Anthropology*, *Newman History and Philosophy of Science Series* (London: Sheed and Ward, 1961).

in the Western imagination, dating back to classical Greece.[144] Moreover, it is more than slightly ironic that Evans-Pritchard would highlight a sedentary scholar as his intellectual ancestor, when the former made his name with a study of the North African Nuer tribe that was based on extensive field work.[145] It would seem that the discipline developed multiple ways of "being there".

A similar critique extends to the massive quantity of work on Kant and Herder, given that the former never left East Prussia (and was defensive about it), while the latter saw many European countries, but nothing else of the world. There are studies of German travelers, such as Johann Reinhold Forster (1729-1798) and his son Georg (1754-1794), but their number pales by comparison to the literature on the two Prussian giants, as well as that on other thinkers, such as the writer Gotthold Lessing (1729-1781) and the natural philosopher Georg Friedrich Lichtenberg (1742-1799), both of whom thought deeply about humanity even as they stayed at home in Germany.[146]

Seeking a broader theoretical perspective on anthropology's origins highlights two problems. First, some scholars have invented a tradition of anthropological discussion that spans three centuries —from las Casas to Herder— but without recognizing the effect of the new cosmology on conceptions of "Man". Second, there is a robust scholarly tradition that credits people who never saw non-Europeans with having invented a discipline that, nonetheless, currently presupposes field research among them.[147] We can address both problems by recognizing that we moderns live in a fundamentally different universe from the first generation of anthropologists. These thinkers may have discovered "Man" as a unity, but they did so within a cosmology that no longer exists and without reference to a celestial plurality that was fundamental to the eighteenth century. Hence, we cannot simply connect the dots from las Casas to Herder and call it a tradition, but need to recall that, as the human understanding of outer space has changed, the nature of the human being has changed with it.

Conversely, as we moderns celebrate eighteenth century scholars for their proleptic anthropological thoughts, we should also keep in mind that we turn easily to them, because we live in essentially the same universe and work within the same information order as they. Any contemporary who was educated in a western-style school system learned the basic outlines of the universe, the solar system, and the Earth, and probably also received a good dose of geometry and geography. This collection of disciplines does not differ

144 Georges Balandier, *Political Anthropology* (London: Allen Lane, 1970).
145 Pagden, ed., *Facing Each Other: The World's Perception of Europe and Europe's Perception of the World.*
146 E. E. Evans-Pritchard, *The Nuer: A Description of the Modes of Livelihood and Political Institutions of a Nilotic People* (Oxford: Clarendon Press, 1940).
147 Clifford Geertz, *Local Knowledge: Further Essays in Interpretive Anthropology* (New York: Basic Books, 1983), Clifford Geertz, *The Interpretation of Cultures: Selected Essays* (New York: Basic Books, 1973), Hoorn, *Dem Leibe Abgelesen.*

significantly from those that were tagged as fundamental by eighteenth-century textbooks on astronomy. Hence, when we read Voltaire, Kant, Herder, or any the enlightened students of "Man", we confront not only a common image of the universe, but also a common system of producing and diffusing information. Any fan of science fiction can report having "seen" a universe that, even to this point, is barely accessible even to specialists who posses the most advanced equipment. Modern anthropology is not, therefore, simply a product of a changing (or even growing) understanding of the human being's unity, but also of a broader system of knowledge construction that undergirds the very conception of what unity is.[148]

I will conclude by citing the work of someone who knew eighteenth-century anthropology well, Alexander von Humboldt (1769-1859). A student of both anthropologists and astronomers at the University of Göttingen and also resident for many years in Paris, which was another important center for both disciplines, Humboldt absorbed celestial anthropology from multiple sources and traditions.[149] Late in life, when seeking to summarize all the knowledge he had acquired, Humboldt wrote the ambitious *Cosmos: A Sketch of a Physical Description of the Universe* (1845-52)[150] This work was the last word in celestial anthropology, as its five volumes summarized almost every aspect of human knowledge that Europe had acquired and collated in the previous century and a half. It was rapidly translated into English, French and Spanish, and became one of the great reference works of all time, appearing in not only libraries but also bourgeois parlors.[151]

Much like Herder and other celestial anthropologists whom I have discussed, Humboldt expended great effort to construct a universe in which human beings lived, before analyzing the history of human interaction with the globe. 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

148 Homi K. Bhabha, *The Location of Culture* (London: Routledge, 1994). On this point, see Roger Smith, *The Norton History of the Human Sciences*, 1st American ed., *Norton History of Science* (New York: W. W. Norton & Company, 1997).

149 Peter Hanns Reill, "Science and the Construction of the Cultural Sciences in Late Enlightenment Germany: The Case of Wilhelm Von Humboldt", *History and Theory* 33, no. 3 (1994).

150 Alexander von Humboldt and Jabbo Oltmanns, *Astronomische Und Hypsometrische Grundlagen Der Erdbeschreibung, Order Untersuchung Und Sammlung Von Orts-Bestimmung, Nach Theils Gedruckten, Theils Ungedruckten Von Alexander Von Humboldt Gelieferten Materialien Berechnet Von Jabbo Oltmanns* (Stuttgart and Tübingen: J. G. Cotta, 1831).

151 Alexander von Humboldt, *Cosmos: A Sketch of Physical Description of the Universe* (New York: Harper & brothers, 1852), Alexander von Humboldt, *Kosmos: Entwurf Einer Physischen Weltbeschreibung*, 5 vols. (Stuttgart: J. G. Cotta'scher Verlag, 1845-1862).

> 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.[152]

There is no more succinct definition of celestial anthropology. The echoes of Kant and Herder are plain, but so too are the perspectives of Buffon, Voltaire and many others. They and we together live in a common cosmological space that is constructed for us by books and other media. Humboldt's work is, thus, a stark reminder that, after the eighteenth-century, no educated person could stare blankly at the starry heavens above.

Without ever seeing anything directly, we humans still know what's out there —and that very fact changes what human beings find within. One of the most important contemporary examples of the results that came from mixing astronomical knowledge with anthropological themes is Carl Sagan's *Cosmos* (1980). Beginning as an oft-watched PBS television series and ending in a best-seller, this work held:

> The size and age of the Cosmos are beyond ordinary human understanding. Lost somewhere between immensity and eternity is our tiny planetary home. In a cosmic perspective, most human concerns seem insignificant, even petty. And yet our species is young and curious and brave and shows much promise. In the last few millennia we have made the most astonishing and unexpected discoveries about the Cosmos and our place within it, explorations that are exhilarating to consider.[153]

Sagan's comments frame all the insights gathered by Europeans since the middle of the sixteenth century. Moving between liminality and infinity, Sagan leaves terrestrial space in wonder and, in the same breath, returns to note how celestial science constructs our world. One of the illustrations in the book shows the famous photograph "Earth Rising", (Figure 7), which was taken from the Moon on December 24, 1968, by the crew of the Apollo 8 mission. Sagan's caption reads, "The Earth from the Moon: The view that Kepler dreamed of."[154] Completing an historical circle, Sagan also reminds us that, even today, there is no anthropology without astronomy; and there is no humanity without the Cosmos.

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[152] Alexander von Humboldt, *Cosmos; Essai D'une Description Physique Du Monde*, trans. H. Faye and Ch Galuski, 4me ed. (Paris: Librairie Théodore Morgand, 1866).
[153] Alexander von Humboldt, *Kosmos: Entwurf Einer Physischen Weltbeschreibung*, 5 vols., vol. 1 (Stuttgart: J. G. Cotta'scher Verlag, 1845), 1.
[154] Carl Sagan, *Cosmos* (New York: Ballantine Books, 1980), unpaginated.

FIGURE 1. THE COPERNICAN COSMOLOGY (1543)

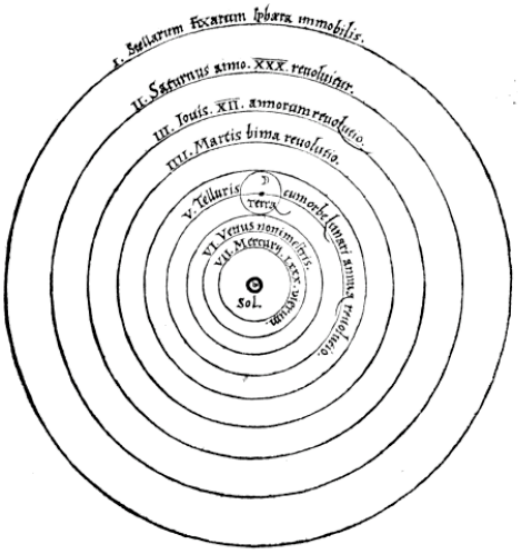

FIGURE 2. KEPLER, MYSTERIUM COSMOGRAPHICUM (1596)
(Removed image due to copyright)

FIGURE 3. ANDREAE, ASTRONOMICAL CARD GAME (1719)
(Removed image due to copyright)

FIGURE 4. ANDREAE, ASTRONOMICAL CARD GAME (1719)
(Removed image due to copyright)

FIGURE 5. NOUVEL ATLAS DES ENFANS (1776)
(Removed image due to copyright)

FIGURE 6. VOLTAIRE, LA PHILISOPHIE DE NEUTON (1738)

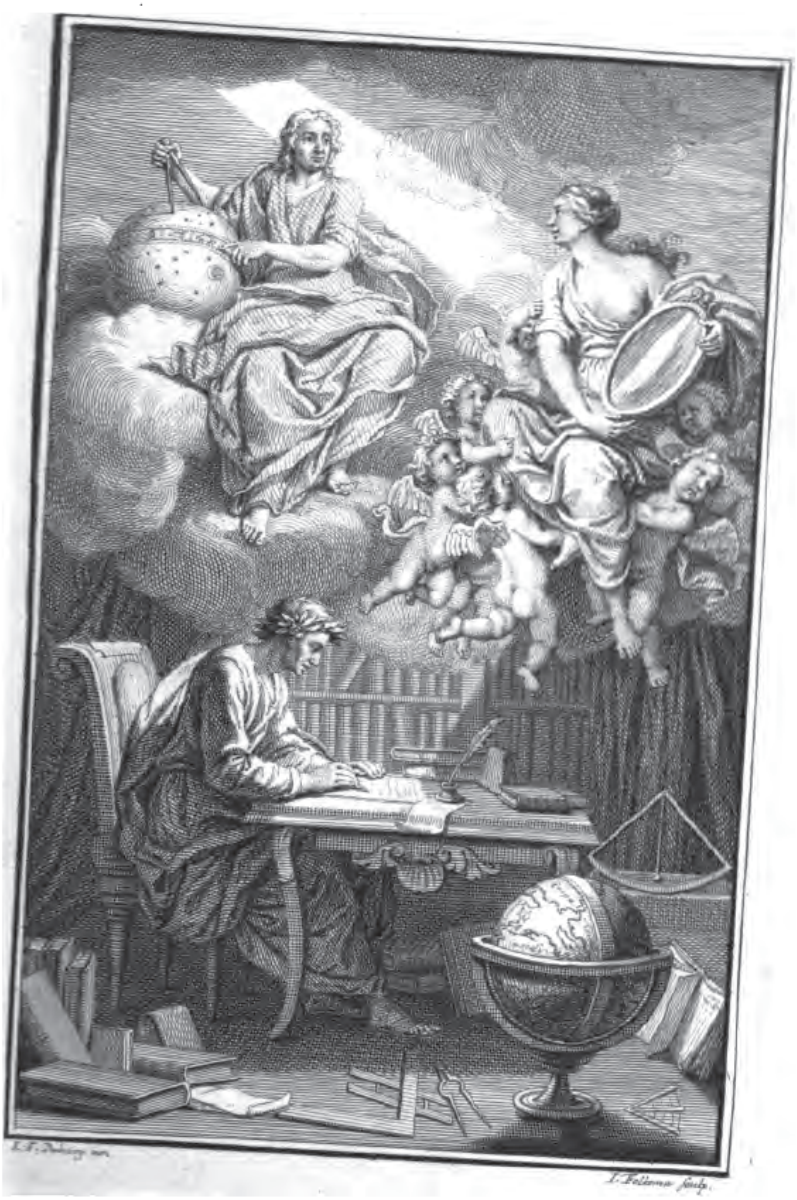

FIGURE 7: "EARTH RISING" (1968)

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