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Author(s): Laurinda S. Dixon
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Giovanni di Paolo's Cosmology

Laurinda S. Dixon

This article explores the sources and meaning of several unusual aspects of Giovanni di Paolo's Expulsion from Paradise *in the Lehman Collection. The inclusion of an image of the circular universe within a scene of the Expulsion is explained theologically with reference to the configuration of the Zodiac in the panel. The source for the image of the geocentric universe is traced to the biblical/Aristotelian synthesis as documented in Johannes Sacrobosco's* Sphera mundi, *and the* mappamondo *in its center unites biblical tradition with Ptolemaic geography. The panel as a whole reflects the fifteenth-century struggle to reconcile two conflicting traditions: the medieval view based upon the Bible and Renaissance knowledge achieved through empirical observation.*

Giovanni di Paolo's *Expulsion from Paradise* (Fig. 1), a small, brilliant panel in the Lehman Collection, has fascinated art historians for many years.[1] The painting is problematic in that it depicts two separate scenes whose relationship to each other is not explained by traditional biblical narrative. Why did Giovanni di Paolo include the figure of God hovering above the universe within a scene devoted to the Expulsion from Paradise? Pope-Hennessy proposed that God is in the process of creating the earth and, in touching the circle of the Zodiac, sets the universe in motion. He perceived the Expulsion as the next step in the Genesis story.[2] Baránsky-Jób noted that God's gesture is not one of setting in motion, but rather of pointing. He suggested that God is simultaneously expelling Adam and Eve from Eden and banishing them to earth, a theory justified by Thomist iconography, in which this type of nonnarrative imagery is common.[3]

Neither explanation addresses all of the enigmas in the panel. What exactly is God's function in the iconography of the scene? If God is indeed pointing to the earth where Adam and Eve will be exiled, why did Giovanni di Paolo choose to place the divine hand and finger off-center to the right above the terrestrial world? Certainly this diffuses the impact of God's act of banishment, as the viewer's line of sight, when continued downward, does not follow the axis of the universe, but crosses it at a point on its edge. If the Creator is showing Adam and Eve their new home, why do they move away to the right, apparently oblivious to the meaning of God's gesture?

Also unsatisfactorily resolved is the question of a source for Giovanni di Paolo's brilliant vision of the earth enclosed by colorful concentric rings. Similar images occur in the history of art, but never in the context of the Expulsion from Paradise.[4] Pope-Hennessy, echoing the theories of Petrucci and Rossi, proposed that the artist was inspired by Dante's *Divine Comedy*, which describes the terrestrial world bounded by the orbits of the heavenly spheres.[5] Although Dante's masterpiece is of course based upon the notion of a geocentric universe,[6] the idea was already widespread in his time. Nonetheless, Pope-Hennessy's claim, made in 1937, was not challenged until 1959, when Baránsky-Jób compared the Lehman panel to early schematic diagrams of the geocentric universe, offering as models three manuscript illustrations (two French, one English)

[1] Tempera on panel with traces of gilding, 10½ × 17 15/16"; Lehman Collection (No. 1975.1.31) of the Metropolitan Museum of Art, New York. The panel is undated; however, Pope-Hennessy placed it ca. 1445 on the basis of Ugurgieri's 17th-century description of a "creazione del mondo (cose bellisime)" in the extreme left section of the predella of the Guelfi Polyptych (quoted in Pope-Hennessy, 1937, 17). See G. Szabo, *Lehman Collection*, New York, 1975, 48-49, for a color reproduction.

Research for this study was undertaken with the support of a 1984 Summer grant from the National Endowment for the Humanities. I wish to thank Professor Samuel Y. Edgerton for his critical reading and suggestions, as well as for his continued support for the study of the relationship of art and science. I also wish to acknowledge Miriam Mandelbaum of the Rare Books Division of the New York Public Library for her help in locating printed editions of Sacrobosco's *Sphaera mundi*, Gary Radke of Syracuse University for expediting the acquisition of photographs from Italian collections, and Mary Shepherd of the Metropolitan Museum of Art for her observations on the panel's stars and Zodiac. In addition, I wish to thank the *Art Bulletin*'s editorial reader in the history of science for citing and correcting weaknesses and guiding me through this interdisciplinary venture.

[2] Pope-Hennessy, 1947, 30.

[3] Baránsky-Jób, 3-6.

[4] Similar, though not identical, Italian images exist in Pisa, the Campo Santo (by Piero di Puccio), the Collegiata of S. Gimignano, and Florence Cathedral (Domenico di Michelino). For discussion of the type of image in the history of art, see M.J. Baltrusaitis, "Cercles astrologiques et cosmographiques à la fin du Moyen Age," *Gazette des beaux-arts*, XXI, 1939, 65-84; C. Sterling, "La mappemonde de Jan Van Eyck," *Revue de l'art*, No. 33, 1976, 69-82; and J. Zahltern, *Creatio Mundi: Darstellungen der sechs Schöpfungstage und naturwissenschaftliches Weltbild im Mittelalter*, Stuttgart, 1979.

[5] Pope-Hennessy, 1947, 30; R. Rossi, "L'ispirazione dantesca in una pittura di Giovanni di Paolo," *Rassegna d'arte senese*, XIV, 1921, 149.

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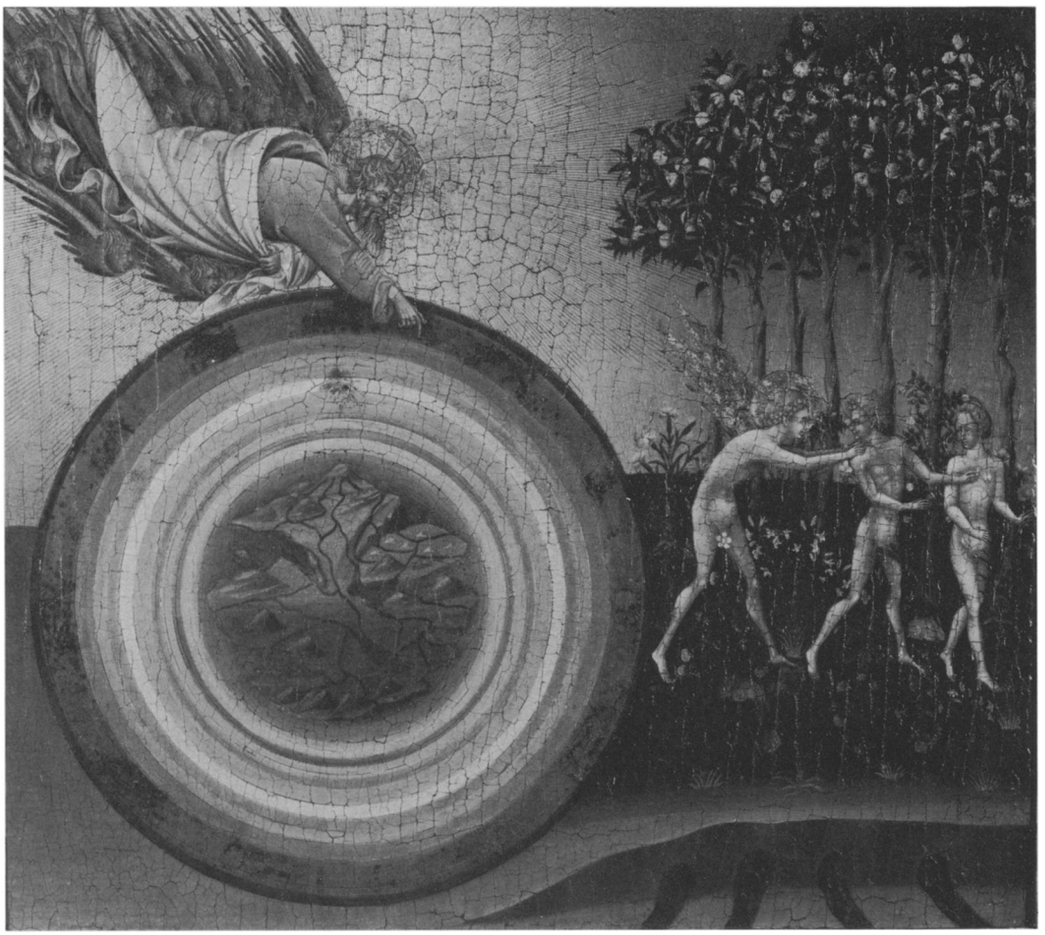

1 Giovanni di Paolo, *Expulsion from Paradise.* New York, Metropolitan Museum of Art, Robert Lehman Collection (1975.1.31) (photo: Museum)

dating from the ninth, twelfth, and fifteenth centuries.[7] Their only common element, however, is the visualization of the universe as a nest of concentric rings. The examples differ not only in the number of circles represented, but also in the general organization of visual elements. None corresponds in all details to the Lehman panel, nor were any of them likely to have directly inspired Giovanni di Paolo. Surely there was a closer, more accessible source that could have served as a model for the painter.

Baránsky-Jób eliminated Dante as the primary inspiration for Giovanni di Paolo by comparing the number of spheres in the painting with the number indicated in the *Divine Comedy.* Counting only eight circles in the panel instead of Dante's ten, he deduced that the painting leaves out two important spheres — the *primum mobile* and the empyrean heaven. On the basis of this evidence, he proposed instead the seventh-century writings of Isidore of Seville as the source.[8] Actually, the Lehman panel displays not eight distinct colored rings, as Baránsky-Jób counted them, but twelve. This study will suggest that although Giovanni di Paolo's painted circles do in fact correspond neatly to Dante's description, the artist and the poet were inspired by the same tradition, the "biblical-Aristotelian synthesis," a scheme of the universe that was formulated long before Isidore of Seville compiled his encyclopedias, and that held sway long after Copernicus advanced his revolutionary heliocentric scheme of the universe.[9]

Sacrobosco's *Sphera mundi*

Fifteenth-century astronomy and cosmography were based upon ancient Greek prototypes that designated earth as the center of the universe surrounded by the other three

[6] It is generally agreed that Dante reflected the prevailing views of his time (ca. 1300) regarding the structure of the universe. For background on Dante's knowledge of cosmography, see J.L.E. Dreyer, *A History of Astronomy from Thales to Kepler,* New York, 1953, 235-37; R. Moore, "The Astronomy of Dante," *Studies in Dante,* 3d ser., Oxford, 1903; 13-19; M.A. Orr, *Dante and the Early Astronomers,* London, 1956; and G. Sarton, *Introduction to the History of Science,* III, 1947, 486-501.

Modern editions of the *Divine Comedy* visually reconstruct Dante's universe. See, for example, the edition edited by D.L. Sayers, Harmondsworth, 1976, III, *Paradise,* "Appendix: Astronomy in Paradise," 350-51, and the diagram on p. 401.

[7] Baránsky-Jób, 3-4.

[8] *Ibid.*, 4.

[9] See P. Duhem, *Le système du monde: Histoire des doctrines cosmologiques de Platon à Copernic,* Paris, 1913-59, X; Randles, 10-11; W. Stahl, "Dominant Traditions in Early Medieval Latin Science," *Isis,* C, 1959, 98-111; and L. Thorndike, *History of Magic and Experimental Science,* New York, 1941, VI, 6-7; see S.K. Heninger, Jr., *The Cosmographical Glass. Renaissance Diagrams of the Universe,* San Marino, 1977, for selected reproductions and explanations of the Renaissance world view as expressed in scientific illustration.

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elements (water, air, and fire). These in turn were encompassed by the seven orbiting planets and a sphere of fixed stars (the Zodiac). Surrounding the Zodiac was the *primum mobile* (the "first moved"),[10] which regulated the motion and daily revolution of all the spheres beneath it. The empyrean heaven lay at the edge of the universe, and was regarded by the Christian tradition as the home of God and the angels. The most widely read source for this universal paradigm, and the one most available to Giovanni di Paolo, was the *Sphera mundi* of Johannes Sacrobosco.

Written in the early thirteenth century as a condensation and simplification of Greek, Arabic, and Christian traditions, this little book was, according to Thorndike, ". . . the clearest, most elementary, and most used textbook on astronomy and cosmography from the thirteenth to the seventeenth century."[11] The invention of printing increased the unparalleled success of Sacrobosco's *Sphera* which, by the mid-fifteenth century, had not only become established at the core of the university curriculum, but also had been revised for young readers. Giovanni di Paolo could have had access to countless manuscript copies and multiple translations and commentaries upon the *Sphera* before the year 1445, the proposed date of the Lehman panel.[12] Printing expanded the influence of Sacrobosco's text, which was reproduced in at least six fifteenth-century editions.[13]

To the fifteenth century, however, Sacrobosco's *Sphera* presented an elementary introductory view of the universe. Pedersen warns that ". . . it would be a mistake to view Sacrobosco as evidence of the astronomical knowledge of more advanced scholars."[14] Because universities had no higher faculty of science other than medicine, advanced investigation was, of necessity, carried on outside the confines of formal education. Hence, even though the *Sphera* was part of the university curriculum, it was clearly intended for beginners. Literate lay persons who read the book typically had the same knowledge as a university student who read it in preparation for the medical profession.[15] Sacrobosco's *Sphera* therefore demonstrated a rare marriage of the virtues of simplicity and authority, and would have been a natural choice for a painter schooled in the tradition of the *abbaco* (secondary school) to consult as a model for the appearance and form of the universe.[16]

The *Sphera* successfully incorporated Greek cosmology into a Christian matrix. It is therefore a likely model for the Lehman panel, which also unites biblical and scientific images. In fact, the first chapter of the *Sphera* usually contained a diagram entitled *Divisio spherae mundi* (Figs. 2-5), which corresponds closely to Giovanni di Paolo's image of the universe.[17] Both painting and diagram clearly reflect the organization of earthly and heavenly elements according to a vision of mathematical precision that Sacrobosco called the *machina mundi*. The text of chapter 1 describes the universe as a uniform, harmonically united duality consisting of the "elementary" and "ethereal" regions. Beginning, as Sacrobosco does, with the familiar "elementary" world in which mortals live, one can begin to deduce the meaning and context of Giovanni di Paolo's problematic image.

The Elementary Region

Sacrobosco writes:

> The elementary region, existing subject to continual alteration, is divided into four. For there is earth, placed, as it were, as the center in the middle of all, about which is water, about water air, about air fire, which is pure and not turbid there and reaches to the sphere of the moon . . . and these are called the "four elements" . . . Three of them, in turn, surround the earth on all sides spherically, except insofar as the dry land stays the sea's tide to protect the life of animate beings.[18]

Accordingly, the Lehman panel presents the world in the shape of the medieval *oikoumene* (inhabited world), situated in the center of the universe. The element of earth, colored brown, appears flat on the surface of the sphere of the world. Water, colored green, is the second element, and begins the series of concentric rings by surrounding and penetrating the earth. Next is a circle whose delicate blue color identifies it as the element of air. This ring in turn is bounded by a bright red circle, unmistakably the "pure . . . not turbid" ring of fire, the fourth and highest element.

[10] The translation is by Thorndike, 118.

[11] *Ibid.*, 42.

[12] *Ibid.*, see also Dreyer (as in n. 6), 233; Grant, 294; F.R. Johnson, "Astronomical Text-Books in the Sixteenth Century," *Science, Medicine and History. Essays on the Evolution of Scientific Thought and Medical Practice in Honor of Charles Singer*, ed. E. Underwood, Oxford, 1953, I, 290-93; O. Pedersen, "The Place of Astronomy in Medieval Europe," in *Science in the Middle Ages*, ed. D.C. Lindberg, Chicago, 1978, 315-16.

[13] Giovanni di Paolo's baptism is recorded in the year 1403. His death was unrecorded, but is placed by Pope-Hennessy, 1937, 5, in the year 1483, and by C. Brandi, *Giovanni di Paolo*, Florence, 1947, 104, in 1492.

[14] Pedersen (as in n. 12), 315-16.

[15] See R. Hastings, *The Universities of Europe in the Middle Ages*, ed. F.M. Powicke and A.B. Emden, London, 1936; P. Kibre and N.G. Siraisi, "The Institutional Setting: The Universities," in *Science in the Middle Ages*, ed. D.C. Lindberg, Chicago, 1978; 139; and J.A. Weisheiple, "Classification of the Sciences in Medieval Thought," *Mediaeval Studies*, XXVII, 1965, 54-62.

[16] We know nothing about the education of Giovanni di Paolo; however, the traditional education of a painter usually consisted of four years of primary school, or *botteghuzza*, and secondary school (*abbaco*) until about the age of fifteen. See M. Baxandall, *Painting and Experience in Fifteenth-Century Italy*, Oxford, 1972, 86-108; and C. Bec, *Les marchands ecrivains*, Paris-The Hague, 1967, 383-91.

[17] Printed illustrations of chapter 1 of the *Sphera* are used in this article because of their clarity and uniformity. Although they date after 1445, the figures illustrate the simple description in the 13th-century treatise. See n. 19 for mention of illustrated manuscripts of the *Sphera*.

[18] Johannes Sacrobosco, *On the Sphere*, in E. Grant, ed., *A Source Book in Medieval Science*, Cambridge, Mass., 1974, 443; Grant's translation is taken from Thorndike, 118-29.

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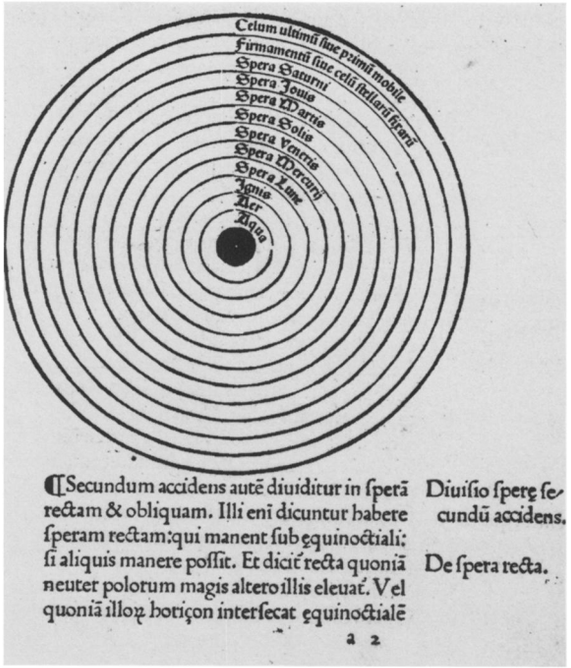
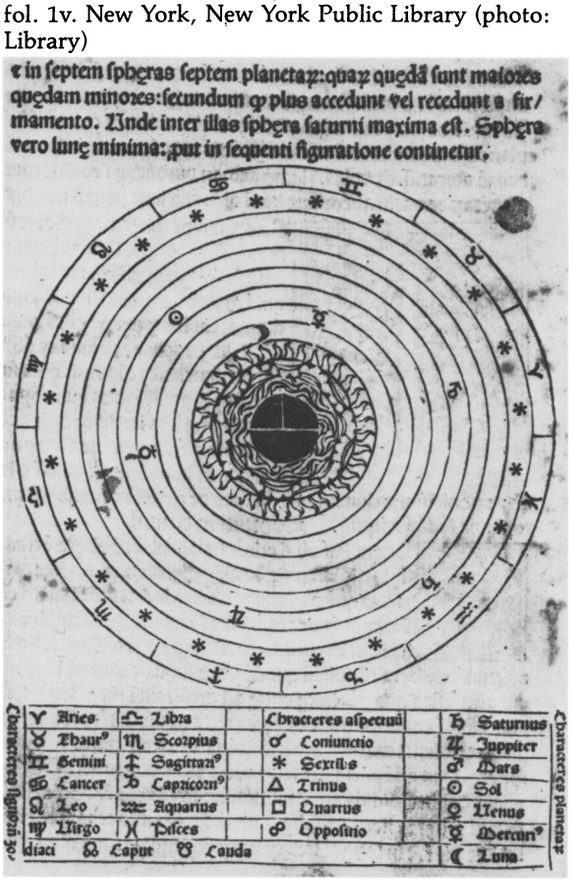
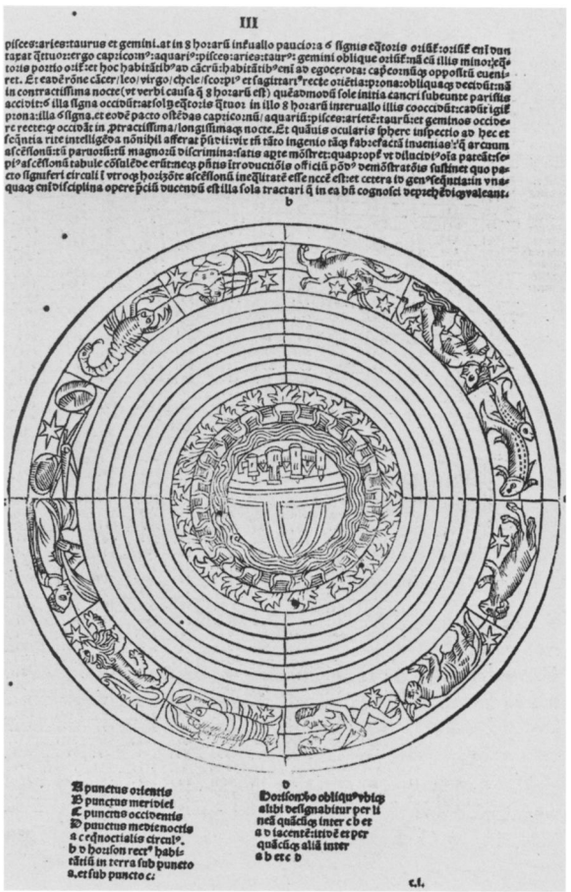
2 Johannes Sacrobosco, *Sphaera mundi*, Venice, 1472, fol. 1v. New York, New York Public Library (photo: Library)



3 Johannes Sacrobosco, *Sphaera mundi*, Venice, 1478, fol. a2. New York, New York Public Library (photo: Library)



4 Johannes Sacrobosco, *Sphaera mundi*, Venice, 1482, fol. a2v. New York, New York Public Library (photo: Library)



5 Johannes Sacrobosco, *Textus de sphera*, ed. Jacques Le Fevre d'Etaples, Paris, 1500, fol. CI. Santa Barbara, Huntington Library (photo: Library)

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Manuscript illustrations of the geocentric universe color the circles of the elements in the same manner, according to their characteristic properties.[19] Printed editions of the *Sphera* did not, of course, have the advantage of color, and usually either labeled the elementary spheres (as in Figs. 2 and 3) or indicated them by waves, clouds, or flames drawn within their respective circles (as in Figs. 4 and 5). Nevertheless, subsequent owners of these books sometimes applied their own colors to the encircling rings (as in Fig. 2). Earth is always brown, water green, and air blue. Most conspicuous of all in colored diagrams is the red sphere of fire, which stridently marks the boundary between the earthly and heavenly realms in Giovanni di Paolo's painting.

The *Mappamondo*

The coloring and division of elements in Giovanni di Paolo's painting correspond to the traditional vision of the world according to the biblical-Aristotelian synthesis. However, the depiction of the element earth as a *mappamondo* (Fig. 6) is a departure from the accepted medieval scheme. Pope-Hennessy dismissed the image as ". . . a purely pictorial symbol which aims at no geographic verisimilitude."[20] He and others compared the Lehman *mappamondo* to medieval T-O maps,[21] diagrams that combined the Roman concept of a circular earth with the Christian division of the land mass into three parts populated by the descendants of Noah. The three continents were stylized, with the East (containing Asia and the earthly paradise) in the upper half, Europe at the lower left, and Africa at the lower right. The upper Asian half was separated from the other two quadrants by a horizontal line through the center. This line represented the Don and Nile rivers, while the Mediterranean Sea formed the vertical division between Europe and Africa. The entire scheme formed a "T" with Jerusalem at the junction in the center of an enclosing "O."[22] The Holy City therefore claimed the position at the center of the world, a location that reflected the Christian placement of Christ at the center of each human life.

The purpose of T-O maps was symbolic rather than utilitarian, with the world's geography confined and delineated by Christian iconography. The form was still current in the fifteenth century and appears in some printed versions of Sacrobosco's text symbolizing the element earth (as in Figs. 4 and 5). However, the earth in the Lehman panel, composed of two asymmetrical land masses marked by sinuous rivers, jagged coastlines, and delicately shaded mountains, bears no resemblance to the medieval T-O scheme.

It appears that the Lehman *mappamondo* is not a T-O map after all, but a sophisticated rendering of a much more advanced cartographic system. In fact, it has much in common with the famous Este Map (Fig. 7) and the so-called Map of Fra Mauro (Fig. 8), both of which were in Italy in 1450. Both were copied at that time, and certainly Giovanni di Paolo may have seen the originals or one of the reproductions.[23] Characteristically, these maps preserve some medieval features, such as the *oikoumene*, yet show the influence of sources new to the Early Renaissance, such as Ptolemy's *Geographica*,[24] the travels of Marco Polo and Mandeville, the charts of Catalan navigators, and Arabic cartography. The Este and Mauro maps are large and detailed, yet their likeness to the miniature earth (only about five inches in diameter) in the Lehman panel is striking, especially in the division and contour of the land.

In early maps, East, rather than North, was understood as occupying the top of the page. One of the most significant breaks with cartographic tradition evident in the Mauro and Este maps was the transfer of East to a less prestigious position at the right edge of the page, a move that banished the Holy City of Jerusalem (visually, at least) from its former place of honor at the center of the world.[25] If the Lehman *mappamondo* is oriented with South at the top, as the Este and Mauro maps are, the familiar form of the Mediterranean Sea appears upside-down in the right mid-section, and the continents of Africa, Europe, and Asia become immediately apparent. The resemblance becomes even more evident by tilting the Lehman map slightly

[19] Colored circles appear in many manuscript illustrations of the geocentric universe. Some of the most interesting that correspond to the color scheme of the elements in the Lehman panel are: London, British Library MS Add. 15,696, fol. 4; S1. 2435, fol. 113; Oxford, Bodleian Library MS Savile 7, fol. 122v. An edition of Sacrobosco's *Sphera* printed in Venice in 1472 (New York Public Library) also has identical coloring of elements added by hand after printing (see Fig. 2).

[20] Pope-Hennessy, 1947, 30.

[21] F.B. Petrucci, "Il mappamundo di Ambrogio Lorenzetti nel Palazzo pubblico di Siena," *Rassegna d'arte senese*, VII, 1914, 1-13; Pope-Henessy, 1937, 20; and Szabo (as in n. 1), 48.

[22] See R. Lister, *Old Maps and Globes*, London, 1979, 17; Randles, 15-17; A.H. Robinson, *Early Thematic Mapping in the History of Cartography*, Chicago, 1982, 9-11; N.J.W. Thrower, *Maps and Man*, Englewood Cliffs, N.J., 1972, 31-32; and R.V. Tooley, *Maps and Mapmaking*, London, 1978, 11-13.

[23] The Este Map, dated ca. 1450, is preserved at Modena and resembles Catalan maps produced in the 14th century. See Crone, 19-25, and G.H. Kimble, *The Catalan World Map of the R. Biblioteca Estense at Modena*, Royal Geographical Society, London, 1934. Fra Mauro was a Venetian monk who was commissioned by the king of Portugal to construct a world map. The original is lost, but the copy destined for the Seignory of Venice (now in the Biblioteca Marciana) was completed in 1459. See Crone, 27-33, T.G. Laporace and R. Almagià, *Il mappamondo di Fra Mauro*, Venice, 1956, and C.P. Daly, "On the Early History of Cartography, or What We Know of Maps and Mapmaking Before the Time of Mercator," *ACTA Cartographica*, II, 1958, 31-87.

Fourteenth-century prototypes of the Este and Mauro maps exist in the Bodleian Library: the map of Bruno Latinii, MS Douce 319, fol. iii; and that of Marino Sanuto, MS Tanner 190, fols. 1209v-210r. The map of Andreaus Walsperger, Vat. MS Pal. Lat. 1362b, dated 1448, is a Northern version of this type. The tradition continued through the 16th century, as evidenced by the map of Al-Idrisi, ca. 1533, Bodleian MS Pococke 375, fols. 3v-4r.

[24] For the background of the rediscovery of Ptolemy in the Renaissance and the effect upon the artistic tradition in Italy, see S.Y. Edgerton, *The Renaissance Rediscovery of Linear Perspective*, New York, 1975, 97-123.

[25] See Crone, 19-35.

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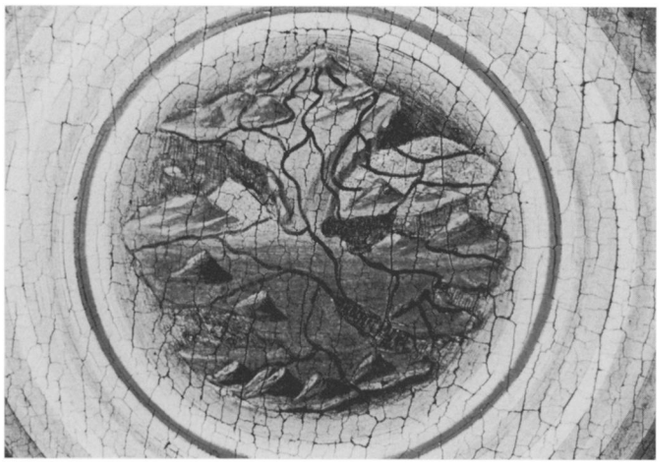
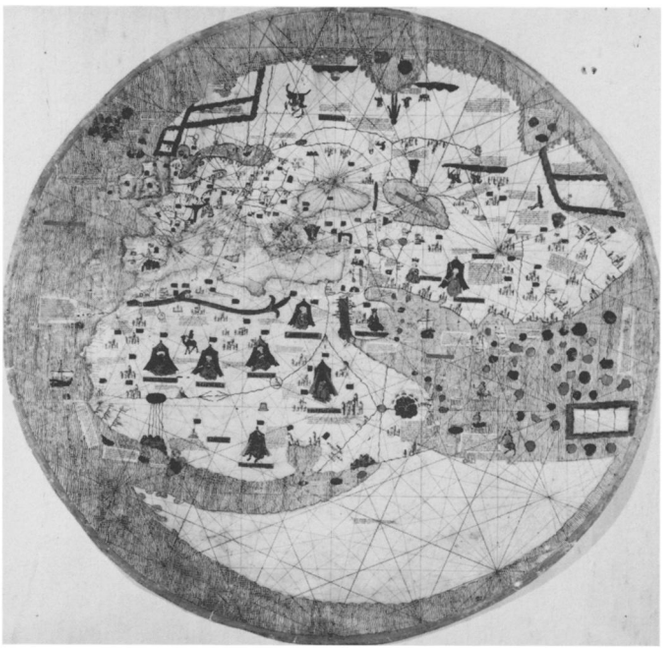


6 Detail of Figure 1

clockwise to the right so that the center bottom aligns with Mauro's East, marked by Adam and Eve in the lower left corner.

The inclusion in Mauro's map of the walled Garden of Eden in the eastern corner reflects the common belief that Paradise was located somewhere in the Orient, remaining inaccessible to man as punishment for the Original Sin.[26] The Lehman map copies the innovative orientation of the Mauro and Este maps, yet it implies familiarity with current quattrocento theories that placed the location of Eden in the south rather than the East. This location appears in the legends written on the Este map, and is also put forth in the writings of the fifteenth-century theologian Jacob Perez de Valencia. The purpose of Perez' treatise *Commentaria in Psalmos* was to integrate the content of Ptolemy's *Geographica* with biblical text.[27] Using Psalm 103 as a base, he wrote about the structure of the medieval *oikoumene* in terms of its mountains and valleys.[28]

Perez' description of the mountains of the earth is taken from Ptolemy. Accordingly, he listed five important chains bordering the seas and oceans: one each at the northern and southern edges of the earth, and three others edging the Indian Ocean and Mediterranean Sea. He postulated that Eden was located at the top of the "Mountain of the Moon," the highest point of the range bordering Africa and extending to the southern shore of the Indian Ocean. Although covered with snow, the top of this mountain was always shrouded in clouds and therefore believed to be temperate. The Mountain of the Moon was reasonably thought to be an ideal location for the earthly paradise — livable yet inaccessible because of its great height. The snows covering its mid-section were believed to melt sea-



7 Este Map. Modena, Biblioteca Estense (photo: Bib. Estense)

8 Fra Mauro, *Map of the World.* Venice, Biblioteca Marciana (photo: Bib. Marciana)

[26] The Christian legend that Asia had living conditions equal to those of the earthly Paradise found justification in Hippocrates' treatise on "Airs, Waters and Places." See Hippocrates, *Works*, trans. F. Adams, London, 1938.

[27] Jacob Perez de Valencia's *Commentaria in Psalmos*, Valencia, 1484, is acknowledged to be a commentary on an earlier treatise that is unknown to us. See Randles, 22-26, for translations into French of passages from Perez.

[28] The Latin text of Psalm 103: 5-9 is:

Ascendunt montes et descendunt campi
in locum quem fundasti eis.
Terminum posuisti quem non transgredientur:
neque convertentur operire terram.

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sonally and flow northward to supply the rivers and seas of the world. This feature is indicated on the Este Map, where all rivers begin at the Mountain of the Moon and feed into tributaries, oceans, and seas.[29]

The geography of the earth in the Lehman panel corresponds with Perez' synthesis of the Ptolemaic and biblical traditions. Its carefully painted and subtly shaded mountains are divided into five groups: one along the top (southern edge) of the earth, another along the bottom (the northern edge), a smaller range in Asia (at the upper left corner), and two groups on either side of the Mediterranean Sea (center right). Giovanni di Paolo distinguished the mountain peak at the top of his earth — the tip of Africa — by painting it lighter and enlarging it. It appears to rise above all the other mountains and corresponds in location to the Mountain of the Moon described by Perez and Ptolemy.

The mountain's dual function as earthly Eden and source of all waters is indicated by four rivers that emerge from its middle section, recalling the rivers that flow from the center of the Mountain of the Moon. The painted rivers curve and branch into calligraphic streams and tributaries that spread to cover the entire surface of the *mappamondo*. These streams also suggest the four rivers of Paradise, which resemble muddy ditches pouring from beneath Adam, Eve, and the angel in the adjoining scene. Thus, the prominent mountain at the center top of the Lehman *mappamondo* serves as the terrestrial paradise that will, from this point on, remain inaccessible to Adam, Eve, and their progeny. The image, like the writings of Perez, preserves the medieval biblical paradigm, while acknowledging Ptolemaic theories of geography.

The cartographic tradition to which the Lehman *mappamondo* belongs marks a transition between medieval and Renaissance views of the world. In the spirit of empirical investigation, nothing is represented without evidence. On the other hand, the realm of "evidence" still encompasses the traditional legends of the Bible as well as the first-hand accounts of explorers and navigators. Hence, the shape of the land retains the traditional form of the *oikoumene*, a flat disk surrounded and interpenetrated by an encircling ocean much smaller in area than the land which it encloses. Likewise, the cartographic tradition has been secularized by the relegating of East to a less prominent geographical position, yet Eden is still perceived as existing on the forbidding peak of the highest mountain on earth. Such concessions to medieval precedence attest to the power of the biblical-Aristotelian paradigm even when confronted with the undeniable evidence of explorers and navigators.

The Ethereal Region

Of the heavens, Sacrobosco wrote:

> Around the elementary region revolves with continuous circular motion the ethereal . . . of which there are nine spheres, as we have just said: namely, of the Moon, Mercury, Venus, the Sun, Mars, Jupiter, Saturn, and the fixed stars, and the last heaven [called the *primum mobile* early in the chapter]. Each of these spheres encloses its inferior spherically.[30]

The spheres of the seven known planets appear between the ring of fire and the Zodiac in the Lehman panel. Likewise, they are identified either by name (as in Figs. 2 and 3) or by symbol (as in Figs. 4 and 5) in most printed editions of Sacrobosco's *Sphera*. These, in conjunction with the *primum mobile* and the empyrean heaven, constitute the ethereal region of the universe. In Giovanni di Paolo's scheme, the first three blue planetary rings beyond the red circle of fire belong to the moon, Mercury, and Venus. The next circle, belonging to the sun, is white, a color that enhances the planet's brilliance and distinguishes it from the others. Its brightness is reinforced by the remains of a gilded sunburst still visible in the circle.[31] Traditionally, the sun occupied the fourth orbit from the earth, with three lesser planets orbiting on either side like a ". . . wise king in the middle of his kingdom," or ". . . as the heart in the middle of the body."[32] Indeed, Oresme considered the sun ". . . more perfect than Saturn, Jupiter, or Mars, which are all higher up."[33] Macrobius magnified the role of the sun, calling it ". . . leader, chief and regulator of the other lights, mind and moderator of the universe, of such magnitude that it fills all with its radiance."[34] These words also apply to the figure of God in the Lehman panel, around whom the sky seems to shimmer and glow with delicate gilded rays.

The circles beyond the sun belong to Mars, Jupiter, and Saturn. The first of these is painted pink rather than blue, the color of the other planetary spheres. According to Sacrobosco's system, this orbit belongs to Mars which is, and always has appeared, pinkish to the naked eye. Macrobius described it as "ruddy,"[35] and its orbit is usually colored pink or red in diagrams of the geocentric universe.[36] Next is the blue sphere of Jupiter, which is distinguished as the only planetary sphere containing a six-pointed star. This feature is explained by the legendary astrological powers of the planet, which ruled civic servants, particularly judges. Jupiter's attribute is illustrated in the popular Flor-

[29] Randles, 22-26; Crone, 4.

[30] Sacrobosco, in Grant (as in n. 18), 444.

[31] A gold sunburst also appears in the fourth circle of the diagram in MS Add. 15,696, fol. 4, London, British Library. The convention was repeated in printed books, as in Aristotle, *Libri de caelo et mundo*, Augsburg, 1519, fol. 29v, and Venice, 1494, fol. 44. See also Fig. 10.

[32] Grant, quoting Themon Judaeus, 279.

[33] Grant, quoting Oresme, 279.

[34] Macrobius (b. 360), *Commentary on the Dream of Scipio*, trans. W.H. Stahl, New York, 1952, 155.

[35] *Ibid.*

[36] The orbit of Mars is colored pink in London, British Library MS Sl. 2435, fol. 113, and red in Oxford, Bodleian Library MS Savile 7, fol. 122v. The hand-colored page in the 1472 Venetian edition of the *Sphera* in the New York Public Library (Fig. 2) pictures the orbit of Mars as pink even though other planetary rings (including the flames in the circle of the Sun) appear in shades of red.

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9 After Bacio Baldini, *Child of Jupiter*. Vienna, Albertina (photo: Albertina)

entine prints called *Children of the Planets*, one of which shows a child of Jupiter seated on the raised throne of judgment (Fig. 9).[37] The star in Jupiter would then comment upon the judgment of Adam and Eve and their sentence to the prison of the material earth as punishment for their sin. The last planetary sphere belongs to Saturn, and is followed by the stars of the Zodiac.

The Zodiac and the Hand of God

If Giovanni di Paolo's Zodiac circle is perceived as the face of a clock, the sign of Pisces (the least ruined and therefore most identifiable sign) lies at about 11:00. This marks

10 Detail of Figure 1

a departure from the usual orientation of the Zodiac, which places Pisces at around 3:00 or 4:00 (as in Figs. 4 and 5). Although the change makes little difference to an astrological understanding of the Lehman image, it does reinforce a secondary meaning related to the theme of Christian sin and redemption.

The sign at 11:00 is Pisces; therefore, the next sign to its right (now barely visible) would be Aries, followed by Taurus at 1:00. In confirmation, the barely discernible shapes of four-footed beasts appear where the signs of the goat and bull should be. In medieval cosmography the time of year ruled by Aries is late February and most of March, while Taurus rules late March and early April.[38] In general, these signs belong to the season of spring; however, most important to the meaning of the panel, they also indicate the time of the Feast of the Annunciation (March 25), which happens within a few days of the vernal equinox. As if to emphasize this, the hand of God points deliberately to the place on the Zodiac that marks the date — between the signs of Aries and Taurus (Fig. 10). The light surrounding the Creator is therefore linked both to the lengthening days of spring and the light of Christ heralded by the Feast of the Annunciation.

The position and placement of God's hand are important to the Christian context of Giovanni di Paolo's painting. Their significance is explained by a chapter in the *Golden Legend* devoted to the Annunciation, which states that "the Incarnation . . . took place to repair not only the Fall of

[37] The Florentine planet series, attributed to Bacio Baldini, dates ca. 1460, and relies upon earlier manuscript sources for its imagery. Many later series, including one dated 1531 by H.S. Beham, copy the Italian prototype. See A. Hauber, *Planetenkinderbilder und Sternbilder: zur Geschichte des menschlichen Glaubens und Irrens*, Strasburg, 1916; F. Lippman, *Die sieben Planeten*, Berlin, 1895; R. Klibansky, E. Panofsky, and F. Saxl, *Saturn and Melancholy, Studies in the History of Natural Philosophy, Religion and Art*, Cambridge, Mass., 1964; J. Seznec, *The Survival of the Pagan Gods: The Mythological Tradition and Its Place in Renaissance Humanism and Art*, New York, 1969, 27-82; I.M. Veldman, "Seasons, Planets and Temperaments in the Work of Maarten van Heemskerck. Cosmo-Astrological Allegory in Sixteenth-Century Netherlandish Prints," *Simiolus*, II, 1980, 149-178; and A. Warburg, "Italienische Kunst und internationale Astrologie im Palazzo Schifanoia zu Ferrara," in *Ausgewählte Schriften und Wurdigungen*, ed. E. Wuttke, Baden-Baden, 1979, 173-99.

[38] The relationship between astrology and Christianity is demonstrated in the "Book of Hours" tradition, which linked the liturgical calendar with the Labors of the Months and Signs of the Zodiac. This link was common knowledge, and would not necessarily have come from familiarity with books of hours, even though they were prized and plentiful in 15th-century Italy. See O. Neugebauer, *The Exact Sciences in Antiquity*, Providence, 1970, 3-28, for an explanation of the astrological images in the *Très riches heures* of the Limbourgs.

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11 Giovanni di Paolo, *Expulsion and Annunciation.* Washington, D.C., National Gallery of Art, Kress Collection (photo: National Gallery)

Man, but the ruin of Angels."[39] The time of year implied by God's gesture reminds us of the Annunciation, which leads to meditations upon the purpose of the coming of Christ — to "repair the Fall" enacted by Adam and Eve in the adjoining sector of the panel, and to redeem the sins of man, which their Expulsion represents. Argan, in his explanation of Fra Angelico's *Expulsion and Annunciation* (Cortona), calls this connection ". . . obvious . . . that the original sin was the cause whose effect became the mission of redemption for which Christ was born."[40]

The theological relationship of the Annunciation and the Expulsion is strongly stated in another work by Giovanni di Paolo, the *Expulsion and Annunciation* (Fig. 11). There, the vignette of God hovering above the fleeing figures of Adam and Eve actually shares the picture space with a fully realized enactment of the Annunciation. Although the two scenes do not follow traditional chronological narrative, they are linked by a cause and effect relationship. Baránsky-Jób accounted for the similar lack of narrative sequence in the Lehman panel by linking its organization to the Dominican *Osservanza,* which stressed theological rather than chronological sequences of events. Although he did not notice the subtle allusion to the Annunciation in the Zodiac configuration of the panel, he did point out that the non-narrative linking of the Expulsion and Annunciation was an iconographical convention that became a central theme in Dominican art toward the end of the trecento.[41]

The linking of the Annunciation and Expulsion in the Lehman panel is important from the viewer's standpoint. God points to the date of the Annunciation while gazing intently at the fleeing Adam and Eve, who represent all men and women. They, however, pay no heed to his ominous stare, being more immediately concerned with the angel who prods them out of Eden. A similar connection between gesture and gaze appears in Figure 11, where God points to the Expulsion while gazing at the Annunciation — rather than pointing to a symbol of the Annunciation while gazing at the Expulsion, as happens in the Lehman panel. In both paintings, a connection between gesture and gaze is strongly implied, and in both instances Adam and Eve are ignorant of the meaning of God's gesture, and oblivious to his presence. However, the viewer is reminded by God's gesture and the direction of his glance that the Annunciation took place to redeem the inherited sin that Adam and Eve represent. God's single gesture therefore has a dual meaning, indicating both punishment and redemption.

Dante's Cosmology

The question of Dante's relationship with the cosmography illustrated in the Lehman panel must be reconsidered. Did Giovanni di Paolo eliminate the important *primum mobile* and empyrean heaven that Dante described? An understanding of the roles of these spheres in the biblical-Aristotelian tradition is helpful in answering the question. The *primum mobile* was believed to mark the boundary between things perceived by the senses (the elements, planets, and stars) and those measureless things known only to God and the angels. Located just beyond the Zodiac, it regulated the motion of all the spheres beneath it, with the exception of the earth, which was immobile.[42] Sacrobosco's illustration depicts the *primum mobile* as a circle beyond the Zodiac (it is labeled as such in Figs. 2 and 3). In similar fashion, a single dark blue circle is clearly visible beyond the Zodiac in the Lehman panel, which placement corresponds to Sacrobosco's *primum mobile.*

Finally, the question of the location of Dante's empyrean heaven must be addressed. Did Giovanni di Paolo choose not to include the home of God, saints, and angels in his *machina mundi?* Natural philosophers and theologians debated the nature of the empyrean heaven: whether it occupied a finite sphere, or was infinite and unknowable, and therefore defied the limits of shape and form.[43] This uncertainty posed a problem for artists faced with giving form to the invisible, since the only certainty was that the heav-

[39] Jacobus de Voragine, *The Golden Legend,* trans. G. Ryan and H. Rysperger, New York, 1969, 204.

[40] G. Argan, *Fra Angelico,* London, 1954, 18-19. The same composition also appears in Fra Angelico's painting of the same subject in the Prado, Madrid.

[41] Baránsky-Jób, 2, 4-6.

[42] Several theorists speculated on the position of the *primum mobile.* Aristotle named it as the eighth sphere, whereas others placed it in the ninth or tenth sphere of the universe. Geoffrey of Meaux placed the *primum mobile* within the Zodiac itself. See Thorndike (as in n. 9), III, 292; and Heninger (as in n. 9), 31-44.

[43] Aristotle thought that nothing existed beyond the *primum mobile.* However, Christian theologians speculated on the placement and form of the outer sphere and what was included in it rather than whether or not it existed. For a summary of various attitudes toward the nature of the empyrean heaven, see Grant, 265-76.

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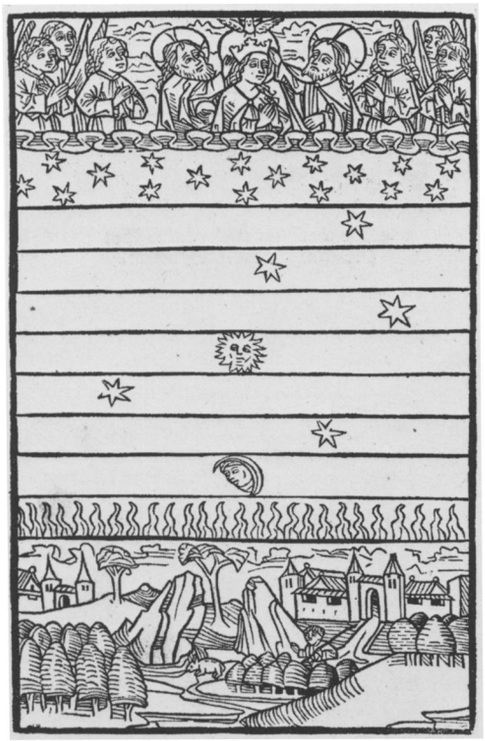
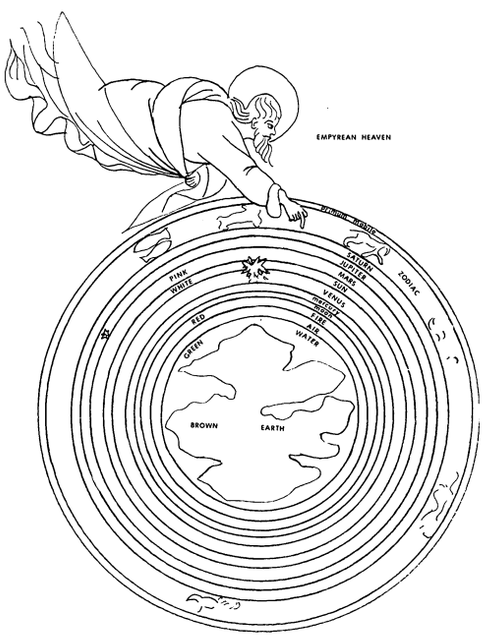


12 Konrad von Megenberg, *Das Buch der Natur*, Augsburg, 1499, fol. C5v. Santa Barbara, Huntington Library (photo: Library)



13 Schematic rendering of Figure 1, with colors and spheres labeled

ens belonged to an order of being different from the universe known to man.

One solution is represented in Konrad von Megenberg's *Buch der Natur* (Fig. 12) in which the artist places the Trinity and angels in the top register of the hierarchy of elements and planets, just above the stylized clouds of the *primum mobile*. In the same way, the illustrators of the *Sphera* did not confine the realm of the unknowable to the boundaries of a distinct sphere, but chose instead to indicate an empyrean, perceived rather than experienced, beyond the *primum mobile*. Giovanni di Paolo similarly solved the problem by placing God and the angels outside the spheres of the universe and beyond the sight of human eyes. He did not confine the empyrean heaven to a sphere, but placed it beyond the physical world, thereby implying that it could not be contained by a circular boundary.

Dante and Giovanni di Paolo therefore construct the universe similarly, since all of the traditional components accepted by Dante, from the four elements to the empyrean heaven, can be identified in the Lehman panel (Fig. 13). Furthermore, both painter and poet employed the image of the *machina mundi* as a vehicle for commentary upon Christian sin and redemption. Like the *Divine Comedy*, Giovanni di Paolo's *Expulsion From Paradise* combines scientific tradition, empirical knowledge, and Christian theology into a microcosmic reflection of the universe.

Laurinda Dixon's writings have centered on the relationship between art and science, with particular emphasis on the work of Hieronymous Bosch, whose alchemical imagery is the focus of her book published by the UMI Press in 1981. [Syracuse University, Syracuse, NY 13210]

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