SQUARING THE CIRCLE: DANTE'S SOLUTION

SUMMARY — By using the geometer's attempt to square the circle as a simile at the end of the Paradiso, Dante achieves a poetic fusion of theological and logical elements that have often been perceived as working at cross-purposes in the Commedia.

Throughout the Commedia, Dante insists not only upon the difficulty of the task he as a poet is performing, but upon its impossibility. Students of rhetoric correctly recognize such protestations as instances of the impossibility-topos, but the final adynaton in Paradiso is fraught with complexities and resonances that demand a commentary that only begins by recognizing the connotation. As Dante the pilgrim struggles to perceive literally and figuratively a vision simultaneously human and divine, Dante the poet offers a mathematical analogy:

Qual e 'l geometra che tutto s'affige
per misurar lo cerchio, e non ritrava,
pensando, quel principio ond'ell indige,
tal era io a quella vista nova:
veder voleva come si convenne
l'imago al cerchio e come vi s'indova
ma non eran da cio le proprie penne... (Par. XXXIII. 133—139)

In their remarks on the passage, Grandgent and Singleton direct readers to De Monarchia and to the Convivio, where Dante also refers to the impossibility of squaring the circle. In Paradiso XXXIII, however, Dante offers a solution, based on preparations made earlier in the canto, and earlier in the Commedia, which in turn may be derived from logical and from theological texts alike. The result, then, is Dante's final strategy for achieving a harmony between what critics have often perceived as his conflicting philosophical and religious impulses; in effect, by squaring the circle, he could arrange, if not a marriage, at least a federation between Mary and Aristotle.

Although the problem of squaring the circle seems to have had a practical origin in the attempt to compute the area of a circle, philosophers, poets, and magicians eventually adopted it as their own. Aristotle himself dismissed the problem as categorically insoluble: "The square is no more a circle than the rectangle for to neither is the definition of the circle appropriate." He gets particularly cranky about attempts to solve the problem through the use of

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1 All quotations from Dante are from Charles Singleton's edition, The Divine Comedy, Paradiso, Princeton, 1975.
2 De mon. III.ii.2: Geometra circuli quadraturam ignorat; Conv. II. xiii. 27: Lo cerchio per lo suo arco e impossibile a quadrare perfattamente; quoted by Singleton, ibid., pp. 584—585.
3 For Dante's problems with the conflicting claims of religion and philosophy, see Patrick Boyde, Dante: Philomysthes and Philosopher, Cambridge, 1981, particularly pp. 294—295.
4 As translated by W. D. Ross, Aristotle's Prior and posterior Analytics, Oxford, 1949, p. 27. For the three other passages in which Aristotle discusses the problem, see Ross, p. 491.
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diagrams. Dante, however, could not have drawn upon il maestro di color che sanno, since, as his use of Virgil in the encounter with Ulysses in the Inferno dramatically underlines, a fourteenth-century Florentine was not likely to have had Greek equal to the task. Instead, he had to rely upon Latin intermediaries, among whom Boethius was the translator and interpreter to whom most medieval readers resorted, or thought they were resorting. In his comments on Aristotle's dismissal, in the Categories, of the problem of squaring the circle, Boethius claims to be in possession of a solution made available to him by the march of science. After demonstrating how to compute the area of triangles and quadrilateral figures, he indicates that the same procedure will produce the area of a circle, but the demonstration would be too tedious. Boethius' solution would produce a number between three and four with which to compute the area of a circle, but would not satisfy any theoretical mathematician's demand for precision. Dante's needs, however, were those of a poet, not those of a theoretical mathematician; numbers and images associated with them would be sufficient to engross and dominate his imagination.

For such purposes, Boethius' commentary on Aristotle's Categories offers additional support, through diagrams, in some manuscripts, that map logical categories onto figures of circles, triangles, and squares. Such diagrams, as Patrick Boyde and others have shown, were medieval commonplace; that numbers and figures were reflections of each other is, of course, a mathematical commonplace, as Isidore of Seville clearly demonstrates in defining the number four: quattuor ver a figura quadrata nomen sumpserunt. Furthermore, in the entry devoted to the Creation, Isidore establishes a significant reciprocity between three and four as part of his attempt to define the perfection of modium: tertia die quattuor: maria, semina, sationes atque planetaria, quarta die tria: solem, lunam et stellas. The last line of Paradiso, then, recalls two of the three items created on the fourth day of creation: l'amor che move il sole e l'altra stelle.

That the combination of three and four is central and relentless in the Commedia can come as no surprise to anyone who has read a poem divided into three books, into cantos ("song," of course, but also "corner" and therefore implying a four-sided figure), and composed in terza rima. Within Canto XXXIII itself, shortly before Dante presents the puzzle of squaring the circle, he provides a vision of the depth of the eternal light expressed as a book scattered, squaderna, after having been gathered, interna:

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6 Migne, PL LXIV, cols. 230—231.
7 Etymologia, III.iii. 2
8 Ibid., XVI.xxii. 23.
Nel suo profondo vidi che s'interna,
legato con amore in un volume,
cioè che per l'universo si squaderna
sustanze e accidenti e lor costume
quasi conflati insieme, per tal modo
che cio ch'i dico e un semplice lume. (ll. 85—90)

J. Ahern has recently pointed out the implied three in *interna*, and the implied four in *squaderna* is probably even more self-evident. That Boethius in his commentaries on Aristotle's *Categories* provides diagrams that are composed out of triangles and squares to clarify the nature of substance and accidents may partially account for the presence in this passage of *sustanze e accidenti*. Moreover, such associations were not peculiar to Dante, Boethius, and Isidore, but were medieval commonplace, as the work of Dunbar, Hopper, Poulet, and others has demonstrated, although their examples are characteristically taken from poetic and theological, not from logical texts.

All three areas, however, overlap usefully in a thirteenth-century *scholia* on Walter of Chatillon's *Alexandriad*, showing how Aristotle and Boethius on the squaring of the circle might be used to the advantage of a Christian exegete faced with a text celebrating pagan heroism. In book two of the *Alexandriad*, Memphites Zoroas appears, a great magician and imminent foe of Alexander; that he is able to square the circle is a sign of dark magical ability, not of specifically intellectual attainments, and of course makes him a greater potential threat to Alexander. In his comments on the passage, the thirteenth-century scholiast quotes Boethius' comments on Aristotle's inability to square the circle, attributing Boethius' solution not to the march of science, as the Roman himself had claimed, but to the quadratic nature of the gospels:

Si baptismali sacro torrente fuisse lotus, Aristotelis, mensque
renata foret, seires quod nescis, ciculum quadrare rotundum.
Quattuor habent latera, quadrant spacio pare centro seque
referit medio cum pare quoque laetus. Primum, Marce, tibi datur;
et Matthee, secundum; Luca, tibi ternum; quantum tibi,
sancte Johannes.

Such an interpretation, of course, can win no prize for syllogistic reasoning, relying instead on what would later be called the "logic of metaphor." Such a logic characterizes Dante's other source for *Paradiso* XXXIII: medieval devotional and liturgical lyric, particularly verse composed on the Incarnation and to Mary.

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Canto XXXIII, where St Bernard apostrophizes Mary with a series of central Christian paradoxes:

Vergine Madre, figlia del tuo figlio,
umile a alta piu che creatura,
terme fisso d'eterno consiglio,
tu se' colei che l'umana natura
nobilitasti si, che 'l suo fattore
non disdegno di farsi sua fattura. (1—6)

Auerbach describes this prayer as a clear example of, "the fusion of Greek antithetic rhetoric with the paradoxes of the Christian faith." Mary serves as the focus of this rhetorical and theological apparatus for a single act, from which she gained all of the above qualities: she bore Christ. Christ's birth, as Alanus de Insula asserts in his *Rhythmus de Incarnatione* (as Peter Dronke points out in his chapter on the Fable of the *Four Spheres*), transcends the art of the geometer:

Suae Artis in Censura
Geometria fallitur,
Dum immensus sub mensura
Terrenorum sstitur;
In directorum curvatura
Circuli convertitur,
Sphaerem claudit quadratura
Et sub ipsa clauditur.  

The central paradox, of course, involves a human womb, often represented in stylized form as a square, bearing a divine creature, represented as a circle, a figure without beginning or end, and therefore a figure for eternal life. Dronke also offers a passage from Philip the Chancellor, suggesting a direct influence on *Paradiso* XXXIII. 133—139, although the figure of the geometer is missing:

Centrum capit circulus,
Quod est minor circulo,
In centro triangulis
Omni rectus angulo,
Sed fit minor angulus
Unus de triangulo,
Dum se mundi figurus
Inclusus in vasculo.  

Perhaps the most elaborate set of variations on the paradoxes developed from the Incarnation occurs in John Hoveden's thirteenth-century hymn to Mary; in

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13 Ibid.
the following passage he congratulates the mother of Christ for her geometric miracles:

Ut aurora, virgo, progreseris,
Solem tenens caelum efficeris,
Paradisus praeligne diceris,
Dum hunc vitae fructum protuleris.
Solem verum dum sinu retines,
Dum regyra, moves et sustines,
Omni caelo tu terra praemines,
Centrum sphaerem claudis et retines.

Linearis rectae creatio
Circulatur et fit perfectio,
Cum extrema coecit unio
Tuo, virgo, vernanti gremio.
Artem nosti quadrantem circulu,
Quem quadrasti carnis quadrangulum
Sphaerae Dei dans per miraculum
Sauciatum sanando seculum."}

Both Mary and Boethius, then, offered solutions to the problem of squaring the circle, and Dante did not hesitate to draw upon both solutions to establish his final harmony among the visionary company of love.

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