

Anna Maria Busse Berger. *Mensuration and Proportion Signs: Origins and Evolution*. Clarendon Press, 1993. xiii, 271 pp.

Granted the masters instructed us in [the] noteshapes and also in the four principal mensurations. . . . Yet they did not teach us how we ought to discant perfect tempus of minor prolation over imperfect tempus of minor prolation (and conversely), and so on for the individual tempora that will clearly and individually be shown below. Because it would be very incongruous for that which can be performed not to be able to be written down, I took care to organize this little treatise.¹

Explaining the necessity for his own book, the anonymous author of the late fourteenth-century *Tractatus figurarum* quoted above was prescient in articulating the main rhythmic notational problem for the next two centuries: how to combine different mensurations in a single composition, thereby expanding the range of available rhythmic durations and proportional relationships between notes. Yet his solution, which was to codify a new set of strangely-shaped note forms to represent proportional shifts within different mensurations, was obsolete by the second decade of the fifteenth century; the contemporaneous practice of using signs to indicate proportions, while leaving the note shapes unaffected, became the method of choice for ensuing generations of composers. The author of the *Tractatus* furthermore could not anticipate the myriad ways different mensurations would be combined and the degree of variation in interpretation that was possible.

Five hundred years later, the theorist's justification for his own work eloquently argues the cause of Anna Maria Busse Berger's recent treatment of the subject. Her excellent book offers a full account of mensuration signs from their beginnings in the fourteenth century, and of their use and interpretation during the following two centuries. This is a topic for which, despite a number of important studies treating particular problems or individual composers' uses of mensuration signs, there has been

¹ "licet magistri instruxerunt nos in his figuris ac etiam in quatuor mensuris principalibus. . . . Tamen non docuerunt quomodo super tempus imperfectum minoris discantare deberemus perfectum minoris, et e converso, et sic de singulis temporibus quod clare singulariter inferius patebit. Quia essens multum inconueniens quod illud quod potest pronuntiari non posset scribi et clare ostendere tractatum hunc parvulum ordinari curavi." Anonymous [Phillipoctus Andrea?], *Tractatus figurarum*, ed. and trans. Philip Schreur (Lincoln and London: University of Nebraska Press, 1989), 70–73.

no comprehensive study until now.² Berger has examined every available treatise on the mensural system from between ca. 1300 and 1550, amounting to an impressive 149 treatises listed in her bibliography. Furthermore, she provides historical context for the development of the mensural system by looking at developments in other medieval and Renaissance measuring systems, so that she not only explains what every proportion sign might mean in every possible context—already an achievement of considerable dimensions—but also attempts to understand why the particular proportional relationships of the mensural system developed as they did. The book is as much about cultural history as it is about music theory, and what emerges from her account is a rich and intriguing picture of a culture that measured things in ways fundamentally different from our own.

Berger does not coddle her reader, and it is unlikely that anyone unfamiliar with the basics of mensural theory will be able to tackle the book easily, despite an introduction that lays out the vocabulary and structure of the system. The chief difficulty in understanding the system stems in part from the vast conceptual difference between the mensural system and the modern system of rhythmic notation, a difference that extends beyond the merely terminological. As Berger points out, the mensural system differs from common-practice rhythmic notation in that it allows certain note shapes to be divisible into either two or three parts, with no way of distinguishing visually between a binary or a ternary division (pp. 1–2). If we were to come upon a group of modern note shapes—quarter notes, half notes, eighth notes, etc.—we would be able to count them in relation to one another even if we had no meter sign or measures informing us how they were organized, because all the note values are in a binary relationship, that is, with each note always worth two of the next lower in value. Given a series of mensural note shapes, however, we would not be

² A recent, concise survey of mensuration signs, geared toward performers, is Alejandro Planchart, "Tempo and Proportions," in *Performance Practice: Music Before 1600*, ed. Howard Mayer Brown and Stanley Sadie (London: MacMillan, 1989), 126–44. Of the numerous circumscribed studies of individual mensural problems or individual composers, see Charles Hamm, *A Chronology of the Works of Guillaume Dufay Based on a Study of Mensural Practice*, (Princeton: Princeton University Press, 1964); Arthur Mendel, "Some Ambiguities of the Mensural System," in *Studies in Music History: Essays for Oliver Strunk* (Princeton: Princeton University Press, 1968), 137–60; Philip Gossett, "The Mensural System and the *Choralis Constantinus*," in *Studies in Renaissance and Baroque Music in Honor of Arthur Mendel*, ed. Robert Marshall (Kassel: Bärenreiter, 1974), 71–107; Alejandro Planchart, "The Relative Speed of *Tempora* in the Period of Dufay," *Royal Music Association Research Chronicle* 17 (1981), 33–51; Eunice Schroeder, "The Stroke Comes Full Circle: Φ and \mathbb{C} in Writings on Music, ca. 1450–1540," *Musica Disciplina* 36 (1982), 119–66; Richard Taruskin, "Antoine Busnoys and the *L'homme armé* Tradition," *Journal of the American Musicological Society* 39 (1986), 255–93; and Rob Wegman, "What is *Acceleratio mensurae*?" *Music and Letters* 73 (1992), 515–24.

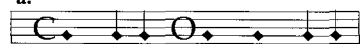
able to perform its rhythm without first determining the mensuration in which the note shapes were to be performed. Each mensuration was represented graphically by a sign, and it is to the usage and interpretation of these signs that the book is devoted.

There would be no problem, and hence no need for a book—either by the author of the *Tractatus figurarum* or by Berger—if all musical compositions remained in one mensuration throughout. But beginning in the final decades of the fourteenth century, composers began to juxtapose different mensurations within individual pieces, both horizontally (in a single line of music) and vertically (simultaneously in different polyphonic voices). The result was that one voice might be in perfect time, minor prolation, while another was in imperfect time, minor prolation, and the difference between the two needed to be represented visually. It was not always clear, moreover, from the context either of the music or of the theoretical discussion of mensuration signs, what the speed of the corresponding note shapes in each mensuration should be with respect to one another. Berger has isolated three major theoretical issues within this general problem, each comprising a chapter: the juxtaposition of perfect and imperfect time (chapter three); the juxtaposition of major and minor prolation (chapter four); and the problem of diminution (chapter five).

As Berger explains in chapter three, when perfect and imperfect time are combined, such as in example 1a, there are two possible results: either the minims of perfect and imperfect time are made to be equal (minim equality), causing a proportional change at the level of the breve, or the imperfect and the perfect breves are taken to be equal (breve equality), causing a proportional change in the duration of the semibreve and minim. To think about this problem in modern terms, if one wishes to combine a $\frac{2}{4}$ measure with a $\frac{3}{4}$ measure, either the eighth and quarter notes could be constant, causing a change in the length of the measure (example 1b, where one measure is worth two quarter notes and the other three) or the measures could be made equal in duration (example 1c), causing a change in the value of the quarter and eighth notes.

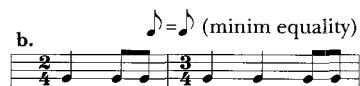
Example 1. Juxtaposition of perfect and imperfect time.

a.



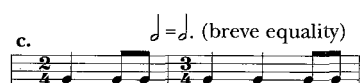
b.

$\text{♩} = \text{♩}$ (minim equality)



c.

$\text{♩} = \text{♩}$ (breve equality)



Berger contends that while both possibilities, breve equality and minim equality, had supporters from the mid-fourteenth through the mid-sixteenth centuries, breve equality was preferred at first, in the late fourteenth through late fifteenth centuries. Gaffurio and Tinctoris, who have been taken as canonical in their preference for minim equality, were in fact early reformers who advocated minim equality against the prevailing theoretical preference for breve equality in the late fifteenth century. By the early decades of the sixteenth century, minim equality was the standard both in theory and in practice.

Chapter four concerns itself with the even thornier problem of the relationship between major and minor prolation, that is, where semibreves worth two minims are juxtaposed with those worth three minims. In a masterfully lucid discussion, Berger identifies seven possible relations between the two, including minim equivalence, semibreve equivalence, and augmentation of various kinds (where the minim of major prolation is made equal either to the semibreve of minor prolation, or to some other duration). Given a line of music such as in example 2a, a transcription could look like any one of those in examples 2b-d.

Example 2. Juxtaposition of major and minor prolation.

a.

b.

c.

d.

In proportional changes involving prolation, a new issue comes into play, namely that of the tactus, the external “beat” against which the durations of mensural music are measured. The tactus by convention falls on the semibreve; thus whether the *tempus* is perfect or imperfect, the semibreve, and therefore the tactus, is always the same duration. But when the prolation is changed from major to minor, and minim equivalence is maintained so that the duration of the semibreve changes, the question of what happens to the tactus arises. Does the speed of the tactus change in real time along with that of the semibreve or does it keep the original duration, “against” the speed of the new semibreve? Berger’s chart shows

that theorists are not in agreement on this very important issue (p. 101). Although our intuition tells us that the tactus should change to conform with the semibreve, Tinctoris and some others advocate a tactus that remains on the imperfect semibreve even when the mensuration has changed to C , so that the tactus is beaten "against" what we consider to be the "strong beats" of the mensuration—the equivalent in modern terms of beats 1, 3, and 5 in $\frac{6}{8}$. Tinctoris even stipulates that when major prolation follows minor, the rules of dissonance treatment change so that the third minim of the semibreve (corresponding to the third eighth note in $\frac{6}{8}$) should be consonant, where normally it need not be.

The discussion of signs of diminution in chapter five focuses on how to interpret diminution signs—either circle-slash or circle-plus-number (*modus-cum-tempore*) signs—when they follow perfect *tempus*. Berger summarizes the various possibilities for circle-slash mensurations: diminution by one-half, by one-third, and by two-thirds—then goes on to demonstrate convincingly that although many musicologists have believed that these signs indicated diminution by one-third, the vast majority of Renaissance theorists advocated diminution by one-half. Berger offers a credible hypothesis as to the origins of the idea of diminution by one-third, suggesting that it was the result of a collective misreading by a small group of northern theorists of a passage from the early fourteenth-century *Libellus cantus mensurabilis* of Johannes de Muris.

* * *

Most interesting and ambitious in the book are two extensive forays into cultural history that offer insight into the intellectual and cultural context of the mensural system. In chapter two, "Origins of the Mensural System and Mensuration Signs," Berger examines other medieval measuring systems—for distance, time, money and so forth—to place into context the system that was developed for measuring music. The medieval European system of counting, we learn, originated with the Babylonians and was adopted in ancient Rome. Berger notes that the Roman system of computation relied exclusively on division and multiplication by two and three, creating a hierarchy of values analogous to that found in the medieval mensural system of notation. Time was (and still is) measured duodecimally: twelve months in a year, twelve times two hours in a day, and so forth. The Roman monetary system contained the *as*, comprised of four *quadrans*, themselves each divided into three *uncia*. Furthermore, written signs for the fractions of the *uncia* bore an unmistakable similarity to the mensuration signs of music: the *uncia* was represented by a circle, the *semiuncia* by a semicircle, and one-quarter of an *uncia* by an inverted

semicircle. The *uncia*, Berger suggests, played an analogous role in the Roman measuring system to that of the breve in the early fourteenth-century rhythmic system: both were at the center of the measuring hierarchy and were multiplied and divided to obtain other values. Thus the structure of the mensural system, with its capacity for duple and triple division and multiplication between note values, clearly reflects a wider cultural practice of counting and measuring.

Berger's account in chapter six of the influence of arithmetic on mensural proportions in the fifteenth century is equally thought-provoking. While Boethius and Euclid were required reading in every university curriculum, their approach to mathematics was entirely theoretical and not useful to those needing knowledge of arithmetic for commercial or other practical use. To fill that need there was another world of numerical training, its textbooks mostly in the vernacular, and schools that taught computation for commercial purposes.³ One of the subjects covered in these textbooks was the "Rule of Three," a practical system for calculating proportional relationships where three numbers are known and the fourth is unknown (an example taken from a fifteenth-century textbook is: if one lira of saffron is worth seven lire of pizoli, how much will twenty-five lire of saffron be worth? [p. 202]). Berger argues convincingly that the increasing use and perfection of proportional relationships in music reflects the widespread teaching of the "Rule of Three" in the fifteenth century. She suggests, for example, that Tinctoris' censure of a proportion sign in Dufay's *Missa Sancti Antonii* arose because the proportion did not conform to the "Rule of Three," and she documents connections between music theory and commercial mathematics in other cases: Martin Agricola's discussion of musical proportions explicitly uses the language and techniques of the Rule of Three; Gaffurio taught in Milan with the mathematician Luca Pacioli and owned his mathematics treatise; and Glareanus himself was a mathematician who wrote a commercial mathematics treatise. Once again, as in chapter two, Berger has described an important link between ways of thinking about music-theoretical issues and about other, more worldly matters.

* * *

³ The fascinating subject of computation in the middle ages and the Renaissance is treated in *Reason and Society in the Middle Ages* by Alexander Murray (Oxford: Clarendon Press, 1978), chap. 7, "The Emergence of the Arithmetical Mentality," and chap. 8, "Men and Mathematics"; and Paul F. Grendler, *Schooling in Renaissance Italy* (Baltimore: Johns Hopkins University Press, 1989), esp. chap. 11, "Learning Merchant Skills."

The book's lucid presentation of the expansion of the mensural system in the Renaissance allows a number of formerly murky issues to be clarified, and undoubtedly will provoke much new thinking about a variety of topics related to the mensural system. I was drawn to one particular issue, that of breve versus minim equality in proportional changes. The issue has its origins in the early fourteenth-century theories of *musica mensurabilis*. As Berger explains, before the fourteenth century, the breve was the central note value in the mensural system, and was divided first in three, then at the end of the thirteenth century in various ways to create smaller note values. In the early fourteenth century, French *ars nova* theory, especially that of Johannes de Muris, reversed the relationship between the breve and the smaller note values so that the breve was a result of the multiplication of smaller values, rather than the smaller values being a result of the division of the breve. Italian fourteenth-century theory and practice retained the thirteenth-century primacy of the breve as the generator of smaller note-values, admitting the possibility of the co-existence within the system of minims that were one-fourth of a breve and minims that were one-sixth of a breve and thus not equal to one another.

During the course of the fourteenth century, the Italian system gave way to the French in practice. Berger suggests, however, that the central breve of the fourteenth-century Italian system survived in Italian theory and provided the foundation in the fifteenth century for the theorists who advocated the proportional relationships under an equal breve. This hypothesis is ingenious and thought-provoking, although there might be another explanation for the genesis of these proportions. If we consider the structure of the minim-based French system of the fourteenth century, it is obvious that only a limited number of proportional relationships can be created within that system—those that juxtapose perfect and imperfect breves or semibreves but keep the minim constant, creating a $\frac{6}{8}$ to $\frac{3}{4}$ kind of relationship (as in "I like to be in A-me-ri-ca" from Bernstein's *West Side Story*). If composers wanted to expand the range of durational possibilities of the system, they needed to create proportions that changed the value of the minim (for example, $\frac{3}{4}$ in $\frac{2}{4}$ as in example 1c above). In this situation, a note value other than the minim had to remain constant in order for the proportion to work—namely the semibreve or breve (in many cases, semibreve equality amounts to breve equality). Thus the expanded proportional relationships made possible by breve equality in the fifteenth century may not have resulted exclusively from a continuation of the centrality of the breve in Italian fourteenth-century theory, but additionally (and independently) from a pragmatic need to override minim equivalence as it had been adopted nearly universally by the end of the fourteenth century.

If this is true, it gives rise to certain possibilities beyond those addressed by Berger. For example, it might affect the interpretation of theorists' views about the relationship between perfect and imperfect tempus that is offered in chapter three. The vast majority of theorists whom Berger consulted do not make overt reference to their preference for breve or minim equality when perfect and imperfect tempus are juxtaposed, and their views on this must be ferreted out of their discussions of other issues. Berger has done this by proposing that theorists who use certain mensuration signs to express certain proportions are *de facto* advocates of equal breve in general. For example, if a theorist states that O after C results in *sesquialtera* proportion (of the semibreve) this means that he advocates breve equivalence between the two mensurations. This is certainly correct. But if a theorist says that C after C or O indicates *sesquitertia*, a different situation may obtain. The sign C produces diminution, most often *tempus imperfectum diminutum*, and most commonly appears in the context shown in example 3.

Example 3. Modern transcription of C after C .



This proportional relationship is dependent on an equal breve between the two mensurations (reflected in the transcription by equality of the measures), and Berger suggests that theorists who advocate the use of this sign must also be *a priori* advocates of equal breve between mensurations. However, as Berger herself points out later, in musical practice of the late fourteenth and early fifteenth centuries, C was used by composers who in every other case assumed minim equivalence between mensurations—that is, it was the one mensuration sign that consistently overrode minim equivalence, which was otherwise the norm. Berger notes that Ciconia's *Sus une fontayne* uses C but also C and C with minim equivalence between them (p. 172). But *Sus une fontayne* is not the only piece in the late fourteenth-century repertory for which C is the only mensuration sign to be performed under equal breve; at least four others in late fourteenth-century sources use the signs in the same way.⁴ An additional ten pieces use a

⁴ Philipoctus da Caserta's *En attendant souffrir m'estuet*, Anthonello da Caserta's *Tres noble dame*, the anonymous *En un vergier*, and Sozoy's *Prophylis* by Suzoy. These and all subsequent works mentioned are edited in *Polyphonic Music of the Fourteenth Century* (hereafter PMFC), vols. 18–24 (Monaco: L'Oiseau-lyre, 1981–89).

variety of mensuration signs, though not C , under equal minim.⁵ Only four pieces in the *ars subtilior* repertory use the four standard mensuration signs (C , C , O , O) alone to create a proportional change under equal breve, and each of these pieces uses the signs in an eccentric way.⁶ Thus, C in this repertory seems to function as an exception to the rule of minim equivalence, which is in general maintained even when other mensuration signs are used.

Berger's grouping of theorists who support equal breve on the basis of indirect evidence (table 1 on page 58) in fact seems to emphasize similarities among quite divergent viewpoints. Prosdocimo de' Beldemandi and Guilielmus Monachus are placed there because of their discussion of C , the only mensuration sign they use to create a proportion; their viewpoint thus seems to follow that of the *Sus une fontayne* model, where C is the exception to the rule of minim equivalence. Another theorist, Anonymous XI, uses a variety of signs to achieve proportional relationships under equal breve, but none of the signs he uses is among the four standard mensuration signs: in addition to C , he uses O and D . He thus seems to shy away from using the common mensuration signs to create proportional relationships under equal breve, suggesting that for him breve equality is not the norm. Finally, Johannes Boen's *Ars* is listed among the group because mensuration signs accompany a figure in the text that shows the various Greek proportions long associated with pitch—diapente, diapacon, and so forth. Yet the figure is found in the context of a discussion of harmonic, not rhythmic, proportions, calling into question its relationship to the mensural system. Rather than place these four theorists in the equal-breve camp, perhaps at least the first three of them might better be labeled advocates of "equal minim except under special circumstances."

The issue of breve versus minim equivalence resurfaces in chapter six, where Berger discusses the fourteenth-century origins of rhythmic proportions. She points out that the proportions advocated by theorists at the turn of the fifteenth century, the earliest to discuss proportions, were only those proportions that could also be shown by combining mensuration signs under an assumed equal breve. This, logically enough, turns out to

⁵ Anthonello da Caserta's *Du val prilleus*, *Beaute parfaite* and *Dame d'onour c'on ne puet esprixier*, Jacob Senleches' *Tel me voit*, Franciscus's *De Narcissus*, Solage's *En l'amoureux vergier*, Suzoy's *Pictagoras*, Philipoctus da Caserta's *Il n'est nulz homs*, and two anonymous pieces, *Sans vous ne puis* and *Plus ne puet musique*.

⁶ The pieces are Matteo da Perugia's *Dame qui j'aym* and *Le greynour bien*; the anonymous *Ung lion say*; and Baude Cordier's *Belle, bone, sage*; for a further discussion of the eccentric uses of the signs, see Anne Stone, *Writing Rhythm in Late Medieval Italy: Notation and Style in the Manuscript Modena Alpha.M.5.24* (Ph.D. diss., Harvard University, 1994), chap. 2.

be arithmetic multiples of two and three: 2:1, 3:1, 3:2, 4:3, 9:8, 9:4, and less frequently, 4:1 and 8:3. It is hard, in fact, to imagine any other proportions being used within the mensural system. As chapter two so compellingly demonstrates, the mensural system is grounded in a larger way of conceptualizing measurement that is duodecimal, and therefore concerned with multiplication and division of twos and threes. When the system was expanded in the late fourteenth century, it was done by juxtaposing various twos and threes (and their multiples) to create rhythmic proportions. This overrode minim equality and established breve equality, but also remained conceptually within the duodecimal framework. Once again, the concept of breve equivalence does not seem to be essential to explaining the proportions that developed.

Furthermore, at least in the repertory of the late fourteenth-century *ars subtilior*, the first generation of musical compositions to experiment with rhythmic proportions, proportional relationships do occur that override minim equivalence but do not result in breve equality. One example of a relatively common proportional change is found in the cantus part of Anthonello da Caserta's *Beauté parfaite*, where the use of a mensuration sign plus coloration in m. 6 forces a *sesquialtera* change at the minim level, but also causes the value of the breve to grow by one-half (from two dotted quarters to three dotted quarters in the transcription) (example 4).

Example 4. Anthonello da Caserta, *Beauté parfaite*, opening.

The image shows a musical score for the opening of "Beauté parfaite" by Anthonello da Caserta. The score is written in mensural notation on a five-line staff with a C-clef and a common time signature. The vocal line is on the top staff, and the lute accompaniment is on the bottom two staves. The lyrics are "Beau -" and "beaute par fai". The score includes mensuration signs and coloration signs, as well as rhythmic markings such as "2" and "7".

The proportion created here is based on the equivalence of a major and a minor semibreve, something that, as Berger points out, late fifteenth-century theorists would criticize using the terminology of the "Rule of Three" (pp. 74, 208).⁷

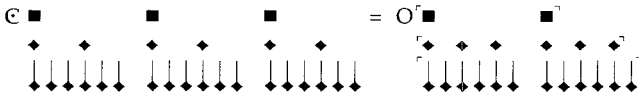
Berger's account of the fourteenth-century origin of proportions in music points to two possible sources of the interest in proportions that began in the late fourteenth century: first, a passage from Muris' *Notitia artis musicae* stating that the breve can be divided into anywhere from two to nine parts, not just into multiples of two and three, and second, the Italian mensural system of the fourteenth century, where *sesquialtera* (3:2) and *sesquitertia* (4:3) proportions were permitted. Thus "one can well imagine that composers in the second half of the fourteenth century were inspired to use proportions by the writings of Johannes de Muris and, in part, by the Italian notation system" (p. 179).

The well-known Muris passage that Berger cites, from Book Two of the *Notitia*, can be interpreted in two ways, only one of which supports the use to which Berger puts it:

Ninth conclusion: that *tempus* can be divided into as many equal parts as you please, as is clear from this. Every continuum is divisible into any number of parts of the same proportion, thus in two or three or four et cetera. Time is a continuous thing, therefore it can be divided into any number of equal parts.

Therefore, a song is made of 2, 3, 4, 5, 6, 7, 8, or 9 equal semibreves of the same shape. It is not moreover possible to exceed this last in the voice. [A song] is sung from three equal and two [semibreves]; two and three are five, two and two are four, three and three are six, four and three are seven, four twos are eight, three times three is nine. All these are equal. Thus from all equal [semibreves] a song can be made.⁸

⁷ Berger identifies the relationship as $\text{C} \blacklozenge = \text{r} \blacklozenge \blacklozenge$ (p. 170); it is more accurately and thoroughly summarized as



⁸ "Nona conclusio: Quod autem tempus possit dividi in quotlibet partes aequales, patet ex hiis. Omne continuum divisibile est in quotlibet partes eiusdem proportionis, sicut in duas vel tres vel quatuor et cetera. Tempus est de genere continuorum, ergo potest dividi in quotlibet partes aequales.

Fiet igitur cantus ex 2, 3, 4, 5, 6, 7, 8, 9 semibrevisibus aequalibus eiusdem figurae. Non est autem multum bene possibile voci ulterius pertransire. Canitur ex tribus aequalibus et ex

Berger takes this passage to mean that the breve can be divided into different numbers of temporally equal parts so that the semibreve has no fixed value, but can be $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, etc., of a breve. If this interpretation of the passage is correct, it theoretically allows all kinds of proportions between one divided breve and another, using integers from 1 to 9—for example, 4:7 or 3:5. But the passage as Berger interprets it does not explain the emergence of the specific proportions that came into use at the end of the century; the passage only provides a source for the idea of proportions in general, which on this view were developed in accordance with the central breve theorized in Muris' writings.

Berger disagrees with Michael Long's interpretation of the ninth conclusion of the *Notitia's* Book Two, in which he argues that the term "equales" refers to the shape of the semibreve, not to its temporal value (p. 179).⁹ On Long's interpretation, semibreves that divide a breve are treated exactly like breves with respect to longs, so that three semibreves within a breve are equal, while two undergo alteration to form a perfection. The breve can still be divided into up to nine parts, but the parts themselves are not temporally equal; rather, the note shapes that represent them are visually identical. Taking Long's reading one step further, this passage of Muris supports a minim-based, rather than breve-based, mensural hierarchy.

Long's reading, in my opinion, is supported by earlier chapters in the *Notitia*, where it is clear that Muris orients his system mathematically from the minim up. In chapter five of book one, a table of note shapes and their value (table 1) shows three different values for the semibreve: a *semibrevis minima* is given the value 1, a *semibrevis minor* is 2 and *semibrevis parva* is 3. Likewise, three different-sized breves are assigned numerical values, as are longs and *maxime*, up to the largest note-value, equal to 81 *semibreves minimae*.

The structure of the mensural system as laid out in Table 1 is clearly at odds with the "ninth conclusion" quoted above; the former implies a system based upon a central minim, while the latter makes the breve the central note value. Although it is difficult to say why or how such a contradiction came about in the texts of the *Notitia*, it is worth pointing out that the ninth conclusion borrows heavily from Aristotelian terminology and concepts regarding the nature of time, a subject that was much debated in

duobus; duo et tria sunt quinque, bis duo "sunt" quatuor, bis tria sunt sex, quatuor et tria sunt septem, bis quatuor sunt octo, ter tria sunt novem. Haec omnia sunt aequalia. Igitur ex totidem aequalibus potest fieri cantus" (Johannes de Muris, *Notitia artis musicae, Corpus scriptorum de musica* 17 [1972], ed. Ulrich Michels, 104–05).

⁹ Michael Long, *Musical Tastes in Fourteenth-Century Italy: Notational Styles, Scholarly Traditions, and Historical Circumstances* (Ph.D. diss., Princeton University, 1981), 35–47.

Table 1
 Note Values from Johannes de Muris, *Notitia artis musicae*

note shape	numerical relationship	value in minims	note name	grade of perfection ¹⁰
■	3	81	longissima	primus gradus
■	2	54	longior	
■	1	27	longa	
■	3	27	perfecta	secundus gradus
■	2	18	imperfecta	
■	1	9	brevis	
■	3	9	brevis	tertius gradus
■	2	6	brevior	
◆	1	3	brevissima	
◆	3	3	parva	quartus gradus
◆	2	2	minor	
◆ ¹¹	1	1	minima	

¹⁰ For an explanation of the intellectual context of the term “gradus” (grade), see Dorit Tanay, *Music in the Age of Ockham* (Ph.D. diss., University of California at Berkeley, 1989), 50–62.

¹¹ It is worth noting that although the edition from which this chart is copied represents this as a minim, a facsimile of one source reproduced in the edition shows the table with this note shape as a semibreve, further supporting Long’s suggestion. I have not been able to examine all the sources of the treatise to see how they present this figure.

this period.¹² The focus of the debate was whether time was a continuous, infinitely divisible quantity as described by Aristotle, or whether time was a substance made up of atoms that had magnitude. This issue, debated since antiquity, had philosophical, metaphysical, religious, and also practical consequences. The consequences for musical practice are found in the construction of the hierarchy of rhythmic values. A system that took the breve as its central value and divided it up into various equal parts, as described by Muris in the ninth conclusion, imagined time to be infinitely divisible, thus conforming to Aristotelian doctrine. A system that took the minim—the smallest possible note value and thus analogous to the “atom” of time—as its starting-point was conceptually linked to a view of time as composed of indivisible atoms. A relationship between these philosophical ideas and the nuts and bolts of musical practice was provided by theorists themselves, who appealed to one or the other theory of time for justification of their theories of musical mensuration.¹³

Muris seems to have wanted to have his definition of time work both ways. His presentation of the hierarchy of mensural note values was based on the central minim as the “unit” or “atom” of the system. The “ninth conclusion,” however, described time to be an infinitely divisible continuum, just as described by Aristotle in the fourth book of the *Physics*. The ninth conclusion may be Muris’ attempt to add Aristotelian lustre to his theory of *musica mensurabilis* by describing his system of musical *tempus* using Aristotle’s definition of general time, even though the latter contradicts musical practice as well as the system outlined by Muris himself earlier in the treatise. This reading of Muris may serve as an example of how the opposition between central breve and central minim in music

¹² Aristotle’s discussion of time is found in Book four of the *Physics*, an English translation of which is found in Richard McKeon, *The Basic Works of Aristotle* (New York: Random House, 1941), 289–300. For discussions of the natural philosophy of time in the fourteenth century, see Richard Sorabji, *Time, Creation and the Continuum: Theories in Antiquity and the Middle Ages* (Ithaca: Cornell University Press, 1983), and Norman Kretzmann, ed., *Infinity and Continuity in Ancient and Medieval Thought* (Ithaca: Cornell University Press, 1982). The relationship between philosophical discussions of the nature of time and music theory in the fourteenth century is explored in Tanay, *Music in the Age of Ockham*, chap. 3 and 4, and Stone, *Writing Rhythm in Late Medieval Italy*, chap. 6. For an explanation of the importance of Aristotelian language and concepts to treatises on *musica mensurabilis* generally, see Jeremy Yudkin, “The Influence of Aristotle on French University Texts,” in André Barbera, ed., *Music Theory and its Sources: Antiquity and the Middle Ages* (Notre Dame: University of Notre Dame Press, 1990), 173–89.

¹³ See Fabrizio della Seta, “*Utrum musica tempore mensuretur continuo, an discreto*. Premesse filosofiche ad una disputa del gusto musicale,” *Studi musicali* 13 (1984), 169–219, and Tanay, *Music in the Age of Ockham*, 65–95.

theory can be mapped onto a larger philosophical issue that preoccupied fourteenth-century thinkers.

It should be obvious that the issues raised above about breve versus minim equivalence constitute no criticism of the book's content and scope. As is the case with any pathbreaking work, Berger's study, organization, and lucid presentation of an enormous amount of material has enabled questions like those above to be raised at all. Her book has set out to fill two enormous voids: our understanding of mensuration signs and their interpretation in the Renaissance; and the conceptual origins of the mensural system itself. It has unquestionably fulfilled its ambitions, and it will be both required reading for scholars and performers of late medieval and Renaissance music, as well as a starting point for more investigations into the complex cultural background of the early development of musical notation.

—*Anne J. Stone*