

Mensural Rhythm, Syllable Placement, and Metrical Hierarchy in Sixteenth-Century Polyphony

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When we listen to music of the past, a basic issue arises concerning the extent to which our own experience mirrors that of listeners native to that time. The farther away in time and therefore cultural space we move, the less we can take for granted, it would seem, since our exposure to music written since then must surely color our present experience. This seems particularly true of rhythm and meter.

Is the vocal polyphony of the 16th century metrical? Answers to this question depend partially on the context in which it is asked. In some contexts, modern writers apply the term “meter” to early music unproblematically. In many such cases, “meter” seems broadly to denote a system of proportionally subdividing durations. In this sense it is equivalent to the term “mensuration.” It is implicit in mensural notation itself and thus its presence in early music can be taken for granted. By contrast, there exists a century-old musicological debate that does problematize meter with respect to 16th-century polyphony. At issue is a narrower definition of meter, one which denotes a systematic hierarchy of strong and weak positions in the measure. A long list of eminent musicologists, from Schünemann in 1908 to Dahlhaus in 1987, has denied that the music is metrical in this sense.¹ In support of its view, this camp often points to the suave musical texture, the lack of barlines in the singers’ parts, and the preoccupation of

¹Georg Schünemann, “Zur Frage des Taktschlagens und der Textbehandlung in der Mensuralmusik,” *Sammelbände der Internationalen Musikgesellschaft* 10 (1908-9): 73-114, and Carl Dahlhaus, “Die Tactus- und Proportionlehre des 15. bis 17. Jahrhunderts,” in *Hören, Messen, und Rechnen in der frühen Neuzeit*, ed. Frieder Zaminer (Darmstadt: Wissenschaftliche Buchgesellschaft, 1987), 333-61.

contemporaneous theorists with duration and proportion rather than emphatic marking. This naysaying tradition is still influential, I believe, in spite of arguments in favor of a metrical view of 16th-century rhythm, notably by Jeppesen in 1927 and Lowinsky in 1960.²

Against the backdrop of this debate, I wish to project my own view of the matter by presenting three converging lines of evidence: first, a key 16th-century theoretical discussion; then, a systematic analysis of a sample of Latin-texted motets; and finally, some recent experimental research into the perception of rhythm. My discussions will center on the interaction between textual accent and mensural rhythm, and the role that this interaction plays in creating a perception of hierarchy. I will use this evidence to argue that something akin to meter in its more narrowly defined sense did exist in vocal polyphony of the 16th century.

The Latin treatise *De musica verbali libri duo* by Kaspar Stocker represents for us the zenith of sixteenth-century text underlay theory, subsuming within itself and also far surpassing in detail previous discussions of text underlay by the likes of Lanfranco, Vicentino, and Zarlino.³ The primary goal of Stocker's treatise is to set forth and theoretically justify an ordered series of

²Knud Jeppesen, *The Style of Palestrina and the Dissonance*, trans. Margaret W. Hamerik (Copenhagen: Levin & Munksgaard Publishers, 1927), 18ff, and Edward Lowinsky, "Early Scores in Manuscript," *Journal of the American Musicological Society* 13 (1960): 126-73. For a fuller discussion of this debate, including many other references, see Graeme Boone, "Marking Mensural Time," *Music Theory Spectrum* 22/1 (2000): 1-43, especially 25-35.

³Gaspar Stoquerus, *De musica verbali libri duo* (Madrid: Biblioteca Nacional, Codex 6486); ed. and trans. Albert C. Rotola, *De musica verbali libri duo / Two Books on Verbal Music* (Lincoln: University of Nebraska Press, 1988).

Giovanni Maria Lanfranco da Terezno, *Scintille di musica* (Brescia, 1533; repr. in *Biblioteca Musica Bononiensis*, II/15 [Bologna: Forni, n.d.], 68-69; trans., Barbara Lee, "Giovanni Maria Lanfranco's *Scintille di musica* and its Relation to 16th-century Music Theory" (Ph.D. dissertation: Cornell University, 1970).

Nicola Vicentino, *L'Antica musica ridotta alla moderna prattica* (Rome, 1555; repr. in *Documenta Musicologica*, I/17, ed. Edward E. Lowinsky [Kassel: Bärenreiter, 1959], book IV, chaps. 29-30, ff. 85v-87; trans. Maria Rika Maniates, *Ancient Music Adapted to Modern Practice* (New Haven: Yale University Press, 1996): 269-74.

Gioseffo Zarlino, *Le istituzioni harmoniche* (Venice, 1558; repr. in *Monuments of Music and Music Literature in Facsimile*, II/1 [New York: Broude Bros., 1965], chaps. 32 and 33; trans. Vered Cohen, *On the Modes: Part Four of Le istituzioni harmoniche, 1558* (New Haven: Yale University Press, 1983).

rules for text underlay. These are presented in Figure 1 of your handout. You will notice that he divides his rules into categories of necessary, older, and newer. While the necessary rules are inviolable, the older and newer rules are discretionary, meaning that they encapsulate generally accepted practice but are prone to exception. The designations “older” and “newer” refer to generations of composers, the older centering on Josquin and the newer on Lasso and Rore. Stocker singles out Willaert as one who bridges the two generations, writing in both older and newer styles. According to Stocker, the older generation is not so strict in adhering to its rules, whereas the newer generation adheres to both the older and newer rules much more strictly. Thus the whole list of 15 rules remains descriptive of the practices of the younger generation, a generation including the composers whose motets I have analyzed for this study.

In the course of his discussions, one can find several instances in which Stocker invokes systematic hierarchical relationships in justification of his rules. These instances culminate in his discussion of Older Rule #4. This rule states: “One syllable is sometimes granted two minimae or semiminimae[,] in which instance, the syllable adjoined to the first note is extended to the note following” (Chapter 23). In different words, if two minims or semiminims are set to a syllable, that syllable should begin on the first of them and extend through the second. The rule itself may seem self-evident, but Stocker offers the following commentary on it, which I have presented textually and visually in Figure 2: “When two minimae or semiminimae occur, the minima that begins the tactus is usually reckoned as the principal one, and in the case of semiminimae, the one that presents itself on either the thesis or the arsis of the tactus [is reckoned as the principal one]; the other note, however, is judged to be bound to it” (Chapter 23). The first of a pair of minims that falls on the tactus is the “principal one,” as is the first of a pair of semiminims that falls on

the thesis or arsis. The second of the pair is bound to the first, or implicitly ligated to it. Stocker makes these comments in the context of text setting, but they are indicative of his general conception of mensural rhythm. This passage, then, is a clear reference to systematic grouping and hierarchy in which one mensural position stands out in relation to another.

But Stocker goes further, as you can read in the caption for Figure 3: “*Symphonistae* [i.e., composers] are customarily especially careful that a dissonance not occur with *minimae* that occupy the first place of the *tactus*, that is, that are sung on the thesis of the *tactus*, and with *semiminimae* that present themselves first on either the thesis or arsis of the *tactus*. In a phrase, those notes obtain the foremost place that are situated on the odd place in the measure. The other notes are often not taken into account and are linked with any of them in any way. And so, no syllable, it seems, should be granted to these [other] notes, which are of practically no importance.” A little later, he says (and here I paraphrase), “[A note on an even place in the measure] is customarily reckoned to be. . . [an] accessory and supplement [to a note on an odd place in the measure]—because it supplements the *tactus*, and therefore occupies the same syllable as the first note” (Chapter 23). These statements reiterate and clarify the hierarchical relationship among different mensural positions. Odd places in the measure obtain the foremost place, so in a string of four minims filling out a breve measure, the first and the third would be reckoned as the principal ones, and in a string of eight semiminims, the first, third, fifth, and seventh would be reckoned as the principal ones. This hierarchy precedes the question of text setting and is also determinant in relation to it. Syllable placement is dependent on rules for the rhythmic treatment of consonance and dissonance, which in turn reflect systematic mensural hierarchy.

Words like “principal” and “foremost” indicate a stronger function, and phrases like “not taken into account” and “of practically no importance” identify a weaker function. Therefore, we have the formulation of a hierarchy of stronger and weaker positions on different mensural levels. It is striking that Stocker’s formulation occurs in the context of text underlay, since that illustrates the relevance of syllable placement to questions of meter.

Stocker’s formulation in terms of syllable placement and dissonance treatment is part of a broader web of perceptual cues that can be demonstrated through systematic analysis of the musical style. Graeme Boone has recently demonstrated through statistical analysis that, in addition to consonances, both note onsets and cadences are arranged according to a systematic hierarchical order in music by Machaut, Ciconia, Dufay, Ockeghem, and Rore.⁴ Elsewhere I have replicated his findings in a distinct sample of sixteenth-century music and extended them to include the domains of textual, agogic, and melodic accent.⁵

As detailed in Figure 4, my chosen sample for analysis today is a collection of seven settings of the *Pater noster* by three mid- to later-16th-century composers. All are written in the mensuration of *tempus imperfectum diminutum*, or cut-c, a common mensuration in the 16th century in which each type of note value is subdivided in duple proportion. Based as they are on a single text, these motets do not represent a random sample, but for present purposes they are broadly representative of the “younger generation” projected by Stocker. To analyze the sample, I used David Huron’s *Humdrum Toolkit*, a set of encoding conventions and software tools

⁴Boone, “Marking Mensural Time.”

⁵Joshua Veltman, *Textual Accent and Mensural Rhythm in Sixteenth-Century Settings of the “Pater noster”* (Master’s thesis: The Ohio State University, 2001).

developed for the computerized analysis of music.⁶ For encoding purposes, I used modern editions.⁷ This raises the question of circularity, such that my interpretation of the style would be based on an edition whose underlay may be based on the editor's interpretation of the style. To mitigate against this possibility, I selectively checked the editions against the early prints upon which they were based.⁸ The careful alignment of notes and text in certain prints renders the underlay patently obvious. In other prints with less obvious underlay, I found that the editions generally underlay the text according to the practice of the time encapsulated by Stocker. In short, since the editors transmit an underlay that is clear from the original and/or that conforms to Stocker's rules, it seems that no systematic bias will have been introduced into my results through the use of modern editions.

A hierarchical sense of stronger and weaker position is not created solely by dynamic accent. Even a performance devoid of dynamic accent, whose status is unclear in 16th-century performance, would contain many perceptual cues that create a sense of systematic hierarchy. Perhaps the most basic cue is simply the placement of note onsets. It is a simple enough matter

⁶David Huron, *The Humdrum Toolkit: Reference Manual* (Stanford, California: Center for Computer Assisted Research in the Humanities, 1995).

⁷Adrian Willaert, *Opera omnia*, ed. Hermann Zenck and Walter Gerstenberg (Rome: American Institute of Musicology, 1950-).

Orlando di Lasso, *Sämtliche Werke*, ed. Franz Xaver Haberl and Adolf Sandberger (Leipzig: Breitkopf & Härtel, 1894-1927). Also consulted: Orlando di Lasso, *The Complete Motets*, ed. Peter Bergquist and David Crook (Madison, Wis.: A-R Editions, 1996-).

G. P. da Palestrina, *Le opere complete*, ed. Raffaele Casimiri (Rome: Fratelli Scaleri, 1939-).

G. P. da Palestrina, *Werke*, ed. Franz Xaver Haberl et al. (Leipzig: Breitkopf & Härtel, 1862-1907).

⁸Adrian Willaert, *Motecta VI vocum liber primus* (Venice: Gardane, 1542).

Adrian Willaert, *Mottetorum IV vocum liber secundus* (Venice: Gardane, 1545).

Lasso, Orlando di. *Magnum opus musicum*, ed. Ferdinand and Rudolphe di Lasso (Munich: N. Henricus, 1604).

Orlando di Lasso. *Modulorum secundum volumen* (Paris: Le Roy & Ballard, 1565).

Orlando di Lasso. *Patrocinium musices, prima pars* (Munich: Adam Berg, 1573).

Orlando di Lasso. *Cantica sacra sex et octo vocibus* (Munich: Adam Berg, 1585).

G. P. da Palestrina. *Mottetorum liber tertius* (Venice: Gardane, 1575).

G. P. da Palestrina. MS from the archives of the Cappella Giulia in the Vatican. Date unknown. (This MS was not available to me).

to count the notes that begin in various positions within the basic mensural unit of the breve.

Figure 5 presents the results of such a tally for the *Pater noster* sample. The various abbreviations on the horizontal axis refer not to duration as such, but rather to mensural position; this analysis counts the notes of whatever duration that begin in the specified positions. Higher-level positions subsume the lower-level positions with which they coincide. Thus on the lowest level, every other fusa position is subsumed under semiminim positions, which in turn are subsumed under certain minim positions, and so on. The figure also establishes a numerical labelling that will be used in subsequent figures. The interpretation of these data becomes clear as different strata of note onsets emerge: breve and semibreve positions share the highest stratum, and intervening minim, semiminim, and fusa positions appear in distinct, successively lower strata. This concurs with any conception of meter that invokes a recurring pattern of strong and weak positions on multiple levels.

Let us now turn to the function of textual accent in contributing to a perception of hierarchy. Stocker's discussion, as detailed earlier, deals with syllable placement but does not differentiate among syllables with regard to word accent, so we are left to our own devices. We might hypothesize that accented syllables tend to begin on stronger mensural positions and unaccented syllables in weaker positions. In music of the common-practice era, such a positive correlation between textual accent and strong position is all but taken for granted, but to my knowledge, this relationship has not been rigorously explored in pre-common-practice music.

Before testing our hypothesis, a brief review of the rules of Latin accentuation is in order. Please refer to Figure 6. Each multisyllabic Latin word has an accent on either the penultimate or antepenultimate syllable. The placement of this accent depends ultimately on the configuration

of vowels and consonants, but the details of this need not detain us here. Since a two-syllable word has no antepenult, the accent necessarily falls on the penult, that is, on the first syllable. Monosyllabic words do not possess a predetermined accent as such. Secondary accents may occur on earlier syllables in words of four or more syllables, but these will not play a role in my analysis.

The key syllables are the penults and antepenults, one being accented in all multisyllabic words and the other unaccented. Figure 7a tabulates all the musical settings of antepenult-accented words of three to five syllables in my sample, as distributed across the various mensural positions. (For the sake of visual clarity, I have subsumed semiminim occurrences under minim occurrences, since so few syllables occur in semiminim positions.) This figure shows that accented antepenults tend to begin on stronger mensural positions, while their companions, the unaccented penults, tend to begin on weaker positions.

Figure 7b presents the results of the same type of analysis for penult-accented words of three to five syllables. The trend is precisely opposite of that found in the previous figure: accented penults tend to begin on stronger mensural positions, and their companions, the unaccented antepenults, on weaker positions. These results provide unequivocal evidence of the positive correlation between textual accent and strong mensural position in this representative sample.

In light of these results, final syllables present something of a surprise, as illustrated in Figure 8a. Final syllables are unaccented according to the rules of Latin accentuation, but in three- to five-syllable words, the final syllables tend to begin on stronger positions. This runs counter to our hypothesis, and suggests that word-finality also correlates with strong mensural

position, a correlation that can trump the unaccented status of final syllables. Such a special status for word-finality explains the setting of two-syllable words, as shown in Figure 8b. Here we encounter a seemingly counterintuitive situation in which both syllables tend to begin on stronger mensural positions.

There are other categories of syllable that the foregoing analysis does not consider. Since long words are comparatively rare, I hesitate to draw any conclusions about the setting of initial syllables in long words. Monosyllables may function on the suprasegmental level, but I have not directly tested any hypotheses concerning this level.

Having demonstrated the positive correlation between textual accent and strong mensural position in these motets, with a duly noted corollary for final syllables, let us turn our attention to the relationship between textual accent and two other forms of musical accent, namely agogic (or durational) accent and melodic accent. Figure 9 presents the results of a calculation of the mean duration, in minim units, of all syllable settings sorted according to different word lengths and accent classes. This calculation does not differentiate between syllabic and melismatic settings, because I intend to focus on syllable duration rather than note duration as such. In this figure the penults and antepenults are indicated as being textually accented or unaccented, depending on the word class. Two trends are apparent from this figure: first, there is an alternation between longer and shorter durations; second, accented syllables tend to receive the longer durations and unaccented syllables the shorter ones. The average duration of all syllables is 1.86 minim units, which means that the alternation is due as much to the shorter-than-average setting of unaccented syllables as to the longer-than-average setting of accented ones. Note also that the qualities of word-finality, and in this instance probably also phrase-finality, seem to

extend the duration of final syllables beyond what might be expected from their unaccented status. As a case in point, consider the results for antepenult-accented four-syllable words, line 4a in the figure: antepenults average 2.35 minims, penults average 0.94 minims, and finals average 1.90 minims, effecting the alternation and the positive correlation between textual and agogic accent discussed a moment ago.

Finally, let us consider melodic accent. By this I mean the features of melodic contour that tend to make a particular note stand out from its neighbors. The complexity of this process has prevented any single definition or model of melodic accent from becoming universally recognized. I will use a model of melodic accent derived experimentally by Joseph Thomassen working at the Institute for Perception Research in the Netherlands. Time prevents an explanation of this model, but suffice it to say that it has been shown by David Huron and Matthew Royal to conform more closely than any other model to musical practice across many repertoires. Thomassen's model assigns a melodic accent value between 0 and 1 to each note. Figure 10 shows the mean melodic accent value for the last three syllables of all three- to five-syllable words in my motet sample. In the case of a melismatically-set syllable, only the first note was taken for the calculation. The figure reflects the fact that accented syllables tend to possess a stronger melodic accent than unaccented syllables. The quality of word-finality appears to exert a partial influence here as well: final, unaccented syllables tend to possess a melodic accent that falls somewhere between the values of the preceding penults and antepenults. In general, we can observe that melodic accent correlates positively with textual accent, which in turn correlates positively with both agogic accent and strong mensural position.

The foregoing analysis has demonstrated certain hierarchical regularities in the distribution

of note onsets and various types of accent. By hinging the discussion on textual accent, I have attempted to draw this phenomenon into the core of an understanding of rhythmic perception. As we have seen, patterns of strong and weak syllables, along with agogic and melodic accents, contribute to the perceptible arrangement of strong and weak positions in the measure. Thus syllable placement both reflects metrical hierarchy and abets it.

In closing I would like to draw a connection between the foregoing analysis and broader issues of auditory perception and cognition. In recent decades, a great deal of experimental work has been done on how human listeners attend to and make sense of the complex temporal structures found in music. This research represents a treasure trove for our study of early music. A salient example is Dynamic Attending Theory, developed by Mari Riess Jones of Ohio State University on the basis of numerous experiments with human listeners.⁹ This theory claims that we dynamically direct pulses of attentional energy toward specific points in time. We pay more attention to points in time where we expect more salient events to occur. The amount of attentional energy is distributed according to patterns emerging from the music itself. As we have seen, these may include patterns of note onsets as well as patterns of various types of salient events such as textual, agogic, and melodic accents.

This theory suggests a cognitively-oriented definition of meter as the pattern of temporal expectations created by music and internalized by listeners. These expectations have two interacting sources. First, as a piece of music unfolds, veridical expectations form on the basis of

⁹The following references are highlights from among numerous articles on this topic. M. R. Jones and M. Boltz, "Dynamic attending and responses to time," *Psychological Review* 96 (1989): 459-491. E. W. Large and M. R. Jones, "The dynamics of attending: How people track time varying events," *Psychological Review* 106 (1999): 119-159. R. Barnes and M. R. Jones, "Expectancy, attention, and time," *Cognitive Psychology* 41 (2000): 254-311. M. R. Jones, H. Moynihan, N. MacKenzie, and J. Puente, "Temporal aspects of stimulus-driven attending in dynamic arrays," *Psychological Science* 13/4 (2002): 313-19.

the immediately past experience with that particular piece. Second, the piece is heard in the context of schematic expectations, formed on the basis of all past experience with listening to the style expressed by the current music. Schematic expectations are in turn conditioned by each new listening experience. Since each individual possesses a different constellation of past experiences, each will hear the music in a uniquely personal way.

No single cognitive schema for meter exists. Rhythmic expectations may be as multifarious as music itself. Thus, to argue that 16th-century vocal polyphony is metrical is not to impose an interpretive straitjacket that equates the rhythm of early music with that of common-practice music. Meter simply reflects a widespread cognitive strategy for apprehending the temporal structure of music.

Of course we cannot climb into the heads of 16th-century listeners to see if we experience their music in the same way they did, any more than we can climb into the heads of those sitting around us today. Lacking such direct evidence, we may attempt to infer similarity of mental process on the basis of documents and artifacts. One such document, Stocker's treatise, and several such artifacts, the *Pater noster* motets, seem to provide evidence consistent with the notion that a certain listening strategy has persisted across the centuries—a metrical strategy characterized by distributing auditory attention according to a systematic hierarchy.

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Figure 1. Stocker's rules for text underlay in *De musica verbali libri duo* (circa 1570; all translations by Albert C. Rotola, S.J.).

Category	Number	Rule
Necessary	1	A larger number of syllables should not be put to a smaller number of notes.
	2	The punctus claims the same syllable as its note.
	3	The ligature also has only one syllable, which is attributed to the first note and must be held over however many that remain.
	4	When several notes are put down in one and the same place [i.e. on the same pitch], each one ought to be given its own syllable.
	5	The first syllable must be assigned to the first note of a phrase, the last syllable to the last note.
Older	1	To the accented penultimate or antepenultimate syllable of any word many semiminimae can be adjoined.
	2	A syllable is frequently added to a semiminima put down alone, and if to the semiminima, a syllable must also be adjoined to the first note that follows.
	3	If two notes follow the punctus of a minima or semibrevis and together they are equivalent to the value of the punctus, no syllable is given to them separately nor frequently to the note that immediately follows them.
	4	One syllable is sometimes granted to two minimae or semiminimae... in which instance, the syllable adjoined to the first note is extended to the note following.
	5	Only one syllable is customarily added to a succession of several semiminimae or notes of lesser value, and this syllable ought to be given to the first note.
Newer	1	Individual syllables must be adjoined to a minima and individual notes larger than a minima.
	2	Only one syllable must be granted to semiminimae and notes smaller than semiminimae, regardless of their number.
	3	The note, too, that immediately follows the semiminimae or fusae, regardless of its value, shares the same syllable with the semiminimae themselves.
	4	Repetition of text must be avoided—more, however, of words than phrases.
	5	Short notes must be granted to short syllables, long notes to long syllables.

Figure 2. Stocker’s discussion of Older Rule #4: “When two minimae or semiminimae occur, the minima that begins the tactus is usually reckoned as the principal one [*principalis*], and in the case of semiminimae, the one that presents itself on either the thesis or the arsis of the tactus; the other note, however, is judged to be bound [*alligata*] to it” (Stocker, *De musica verballi libri duo*, Chapter 23).

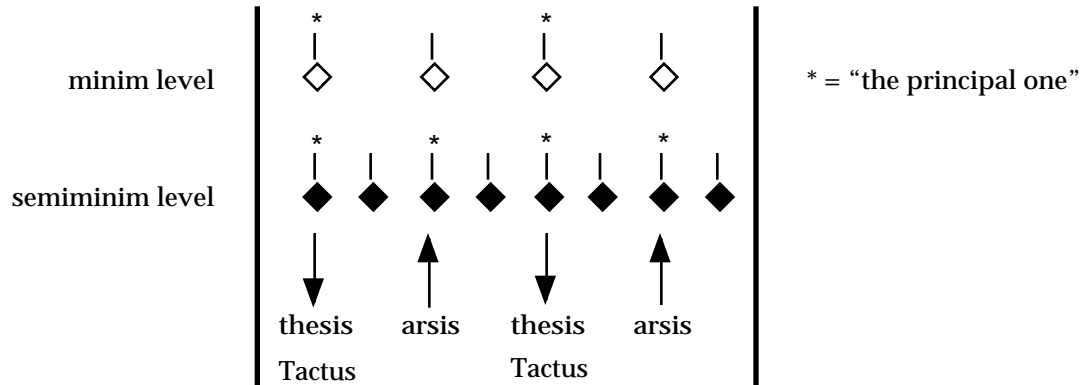


Figure 3. Stocker’s discussion of Older Rule #4 continued: “*Symphonistae* [i.e., composers] are customarily especially careful that a dissonance not occur with minimae that occupy the first place of the tactus, that is, that are sung on the thesis of the tactus, and with semiminimae that present themselves first on either the thesis or arsis of the tactus. In a phrase, those notes obtain the foremost place [*principem locum*] that are situated on the odd place in the measure. The other notes are often not taken into account and are linked with any of them in any way. And so, no syllable, it seems, should be granted to these notes, which are of practically no importance . . . [A note on an even place in the measure] is customarily reckoned to be . . . [an] accessory and supplement [to a note on an odd place in the measure]—because it supplements the tactus, and therefore occupies the same syllable as the first note” (Stocker, *De musica verballi libri duo*, Chapter 23).

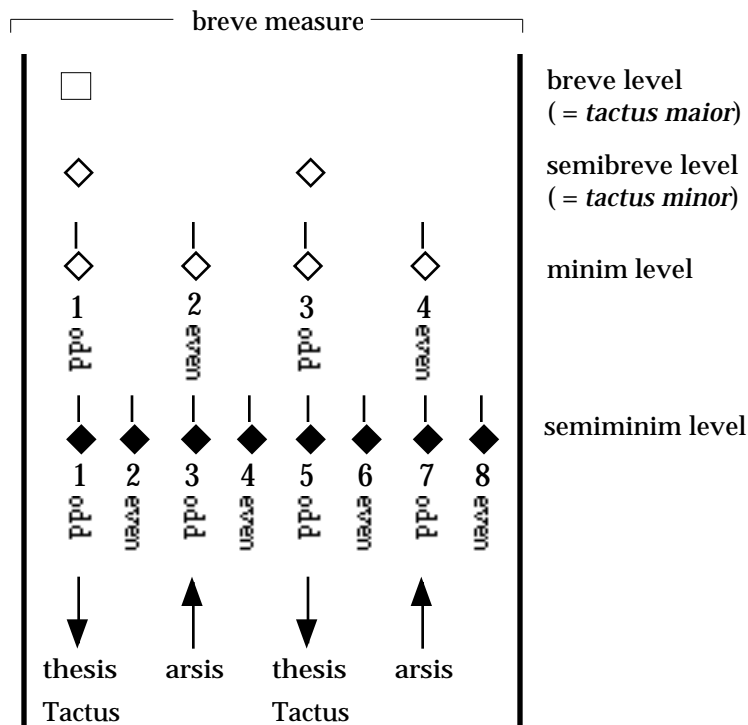
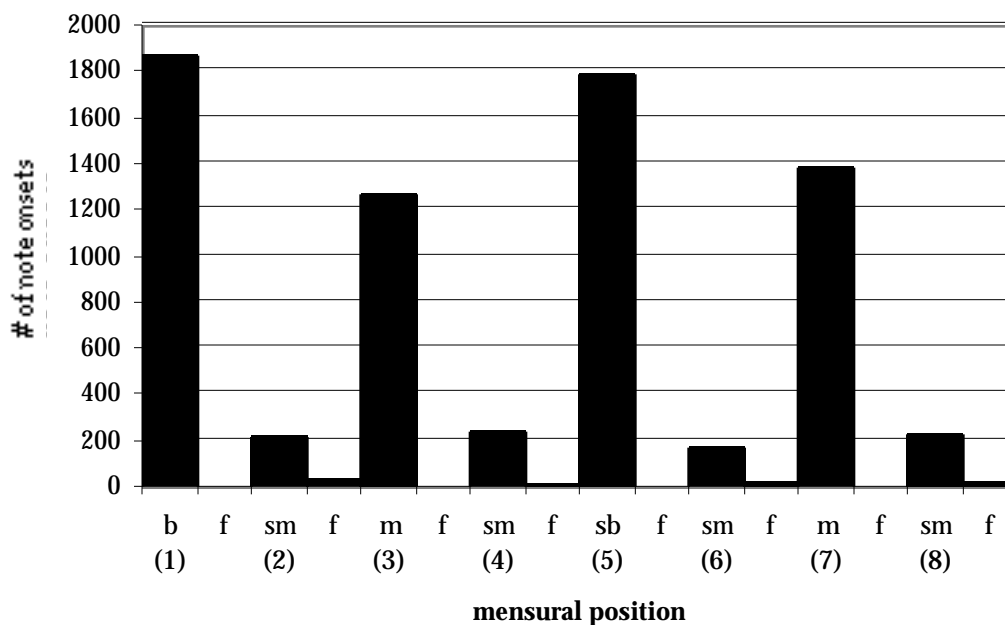


Figure 4. Musical sample: *Pater noster* settings by three composers of Stocker’s “younger generation.”

- 1) Adrian Willaert. 6 voices. 1542.
- 2) Adrian Willaert. 4 voices. 1545.
- 3) Orlando di Lasso. 6 voices. 1565.
- 4) Orlando di Lasso. 4 voices. 1573.
- 5) Orlando di Lasso. 6 voices. 1585.
- 6) G. P. da Palestrina. 5 voices. 1575.
- 7) G. P. da Palestrina. 8 voices. Date unknown.

Figure 5. Note onsets across mensural positions in the *Pater noster* sample.



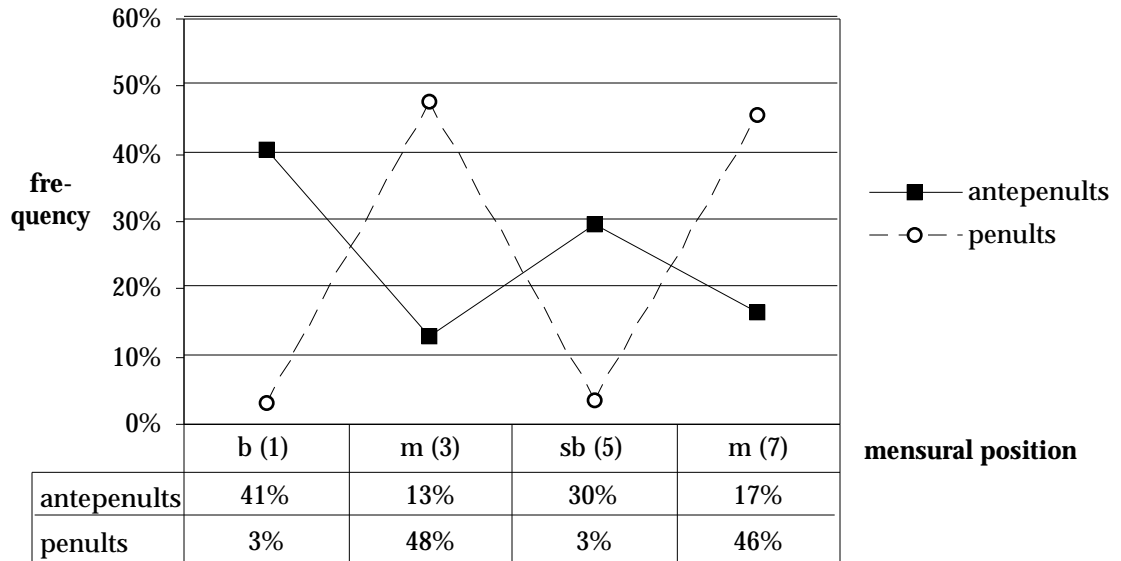
Legend: b = breve; sb = semibreve; m = minim; sm = semiminim; f = fusa.
 All positions except those on the fusa level are also labelled numerically for ease of reference in subsequent figures.

Figure 6. Latin accentuation: multisyllabic words are either penult-accented or antepenult-accented.

# of syllables	penult-accented	antepenult-accented
2	pá - ter	
3	in - dú - cas	lí - be - ra
4	sa - lu - tá - re	di - mít - ti - mus
5	ten - ta - ti - ó - nem	de - bi - tó - ri - bus
etc.		

Figure 7.

a) Mensural position of syllables for all three- to five-syllable **antepenult-accented** words (N[total number]=348). Accented antepenults tend to begin on stronger mensural positions, while unaccented penults tend to begin on weaker positions.



b) Mensural position of syllables for all three- to five-syllable **penult-accented** words (N=361): accented penults tend to begin on stronger mensural positions, while unaccented antepenults tend to begin on weaker positions.

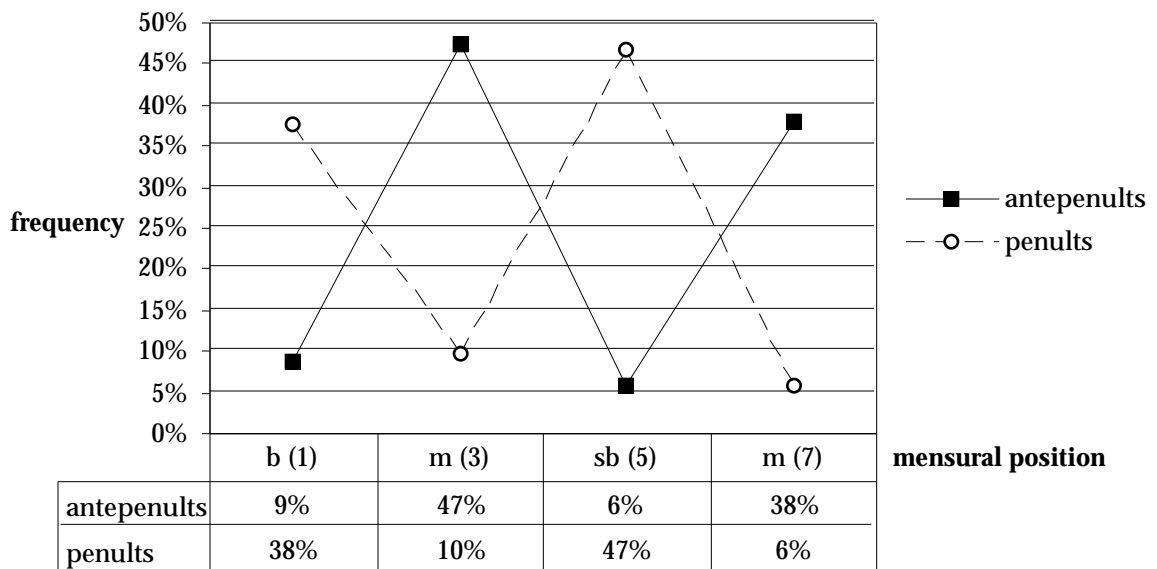
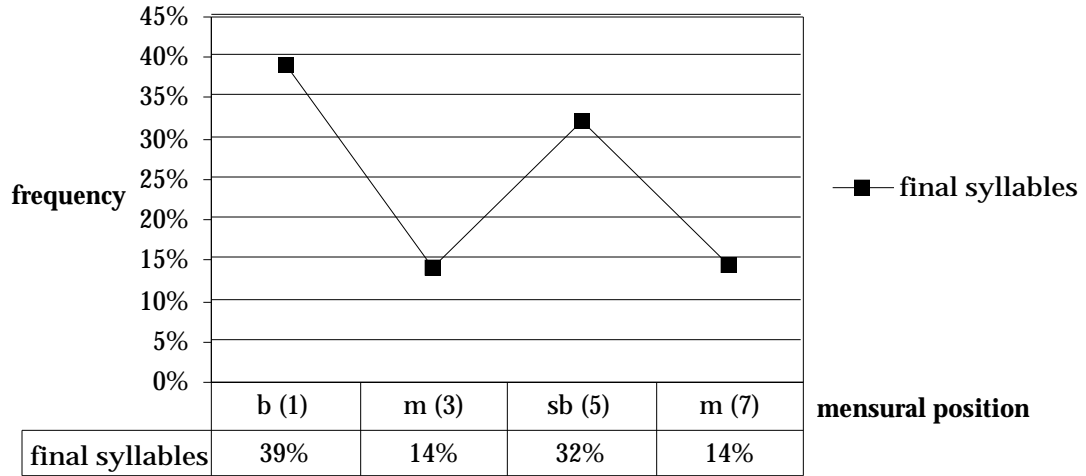


Figure 8.

a) Mensural position of **final syllables** for all three- to five-syllable words (N=709). Although final syllables are unaccented according to the rules of Latin accentuation, they show a contour similar to that for accented syllables, suggesting that word-finality is also associated with stronger mensural position.



b) Mensural positions of syllables for **two-syllable** words (N=1079). Both types of syllable display a tendency to begin on stronger mensural positions, apparently due to the operation of both textual accent (1st syllables) and word-finality (2nd syllables).

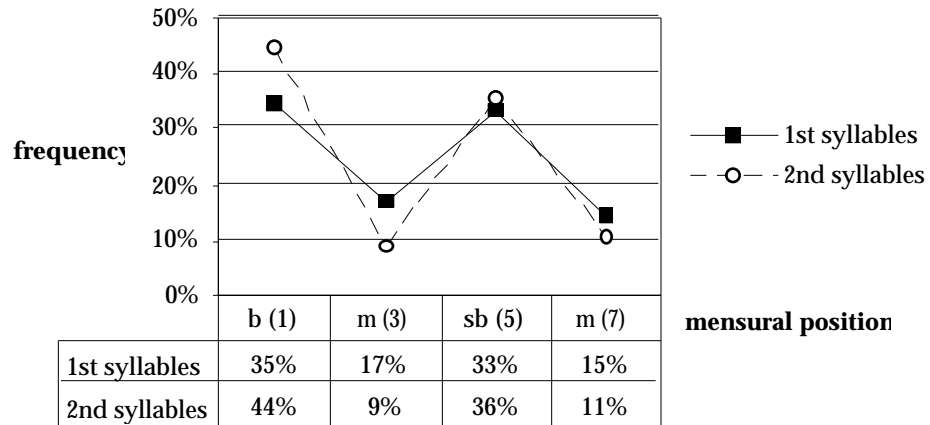


Figure 9. Mean duration in minim units for syllables in each word class (incorporating both single notes and melismas). The numbers 1 to 5 on the y-axis indicate number of syllables; the letters ‘a’ and ‘p’ indicate antepenult-accented and penult-accented words, respectively. / and \smile indicate accented and unaccented syllables. Mean duration of all syllables is 1.86 minim units.

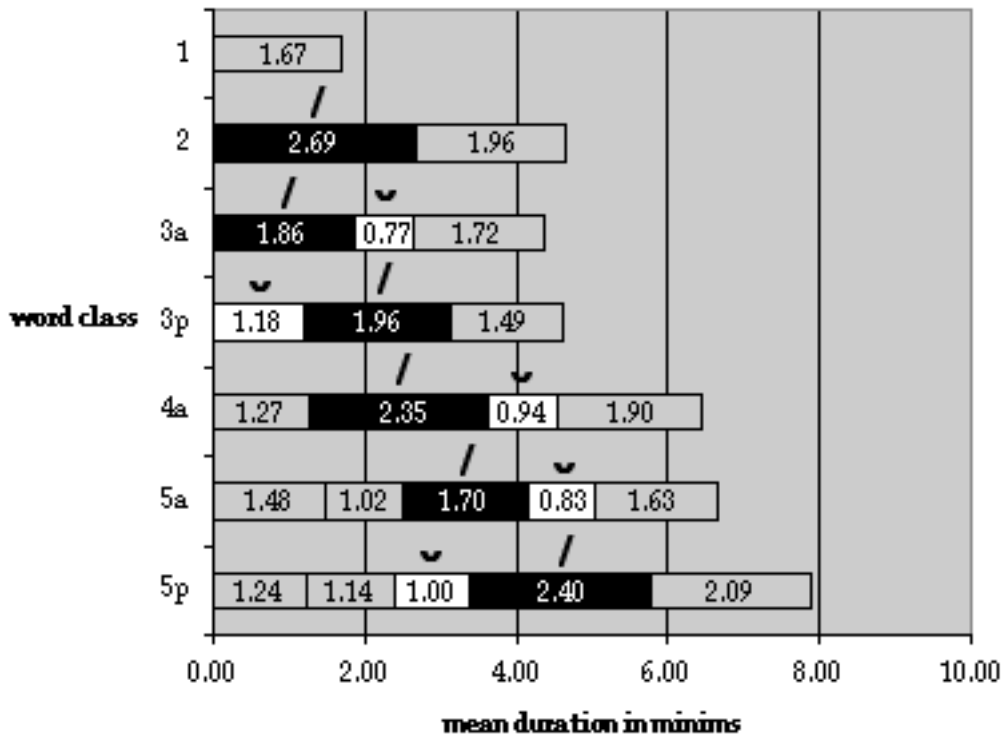


Figure 10. Mean melodic accent for the last three syllables of all three- to five-syllable words (N=709), using Thomassen’s experimentally-derived model of melodic accent (values range between 0 and 1).

