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PETER M. LEFFERTS

A RIDDLE AND A SONG: PLAYING WITH SIGNS IN A FOURTEENTH-CENTURY BALLADE

In a rich and learned article, Lawrence Gushee explored the *tabula monochordi* of Magister Nicolaus de Luduno.¹ The *tabula*, which was copied into a music theory manuscript of c. 1400 of southern Italian provenance (Rome/St. Paul),² consists of three associated parts. The first and third I shall call, following Gushee, the *tabula figurarum* (an elaborate musical example) and the *tabula numerorum* (an extremely elaborate table of corresponding information). Between them lies the enigmatic text of a six-stanza musical puzzle poem, 'Ut pateat evidenter', with which Gushee wrestled inconclusively.³ A concordance to the poem unknown to Gushee in an English music theory manuscript of about the same age (Bodley 842)⁴ associates

¹ L. Gushee, 'The *Tabula Monochordi* of Magister Nicolaus de Luduno', in G. M. Boone (ed.), *Essays on Medieval Music in Honor of David G. Hughes* (Isham Library Papers, 4; Cambridge, Mass., 1995), pp. 117–52. My indebtedness to this resourceful essay will be everywhere apparent below. I would also like to take the opportunity to thank a number of individuals who generously commented on earlier versions of this essay or have provided me with valuable information, including Neil Adkin, Margaret Bent, Bonnie Blackburn, Bert Hall, Harry Ide, Raymond Haggh, Leofranc Holford-Strevens, Thomas J. Mathiesen, Stefano Mengozzi, George Rigg, Anne Stone and Roger Wibberley.

² Summarising Gushee (pp. 117–28), whose inventory and account of the Rome/St. Paul source are now the best available, the original manuscript, perhaps from Angevin Naples, dates to c. 1400 plus or minus thirty years. In the eighteenth century it was in the Barberini collection, where it was dismembered so that one fascicle of eight folios (fols. 17–24) could be sent to Padre Martini, who in turn gave it to Martin Gerbert, who brought it to St. Blasien. Along with some other manuscripts from St. Blasien, this fascicle now resides in Sankt Paul im Lavantthal in Kärnten, Stiftsbibliothek (Archiv des Benedictinerstiftes), where it is MS 135.1. The manuscript from which this fascicle was taken is now Vatican City, Biblioteca Apostolica Vaticana, Barb. lat. 307. The *tabula monochordi* is found in the St. Paul fascicle, fols. 18^v–22.

³ Gushee considers the text on pp. 140–2. The *tabula figurarum* and poem are written out across the top half of the two-page opening of fols. 18^v–19. After *Ut pateat evidenter* but before the table of data there is an explicit (EXPLICIT TABULA MONOCHORDI MAGISTRI NICOLAI DE LUDUNO DEO GRATIAS AMEN). Thus on the face of it the *tabula monochordi* is simply the musical example and the poem is to be associated with it rather than with the following material. Nevertheless, I agree with Gushee that the *tabula figurarum* and *tabula numerorum* belong together, as will be made clear below.

⁴ Oxford, Bodleian Library, MS Bodley 842, fols. 45^v–46. According to John Snyder, Malcolm Parkes has dated the main hand of this manuscript to the very latest fourteenth or earliest

these cryptic verses with a polyphonic chanson, a two-voice ballade that has never been published.⁵ The ballade is a sophisticated demonstration piece for tonal and mensural behaviours, and I believe that this song is the original complement and key to the poem's meaning. It also offers a significant new point of entry into the complicated world of Anglo-French tonal theory as it developed in treatises and compositions of the fourteenth century.

The English source of *Ut pateat evidenter* is reproduced as Figure 1. Across a two-page opening, cantus and tenor are written out in separate parts, with the text carefully underlaid to the cantus line as if for singing. When the text is copied out according to its versification, it reveals itself to be a double ballade of six stanzas unified by a refrain and sharing rhyme scheme and syllable count. Versification is conventional for fourteenth-century ballades, namely, seven lines of eight syllables each, rhyming ababbC.⁶

fifteenth century, with a preference for the later side of this time range. See Snyder, 'A Road not Taken: Theinred of Dover's Theory of Species', *Journal of the Royal Musical Association*, 115 (1990), pp. 145–81, at p. 148, n. 18. This date concurs with Gilbert Reaney's assessment of the main hand in 'The *Breviarium Regulare Musicæ* of MS Oxford, Bodley 842', *Musica Disciplina*, 11 (1957), pp. 31–7, at p. 31. Reaney's assertion (p. 31–2) that *Ut pateat* is a later addition of the fifteenth century is an error; in fact, it is copied by the main hand. In the most recent inventory of the manuscript, Christian Meyer dated the hand very differently, ascribing it to the first half of the fourteenth century. See *The Theory of Music: Manuscripts from the Carolingian Era up to c.1500 in Great Britain and in the United States of America*, ed. C. Meyer, M. Huglo and N. C. Phillips (RISM B/III/4; Munich, 1992), pp. 110–15, at p. 110.

A manuscript whose recorded contents are identical in title and order to four of the treatises copied in the main hand of Bodley 842 was entered in a medieval catalogue of the library of the Augustinian Friars at York. See M. R. James, 'The Catalogue of the Library of the Augustinian Friars at York, now first edited from the Manuscript of Trinity College, Dublin', among the additions made 'not much later than the original' (p. 5), i.e., not long after 1372, 1372. Reaney believes Bodley 842 is a copy of this York codex (Reaney, 'The *Breviarium*', pp. 32–3). James believes Bodley 842 to be the original and thus claims it as one of the few extant remains of the York library ('The Catalogue', p. 96). Nothing rules out the latter possibility, which is supported by Meyer's minority view of the date of the main hand. This offers a possible terminal date for *Ut pateat* not long after 1372.

I was first alerted to the existence of this composition in 1980 by Dr Roger Wibberley in an unpublished conference paper. My attention was redrawn to it when I undertook to enter Dr Gushee's article, a coincidence which has led to the present study.

There are, for instance, five seven-line Machaut ballades with octosyllabic lines rhyming ababbC (nos. 2, 13, 24, 30, 37 in the Schrade numeration; ballade no. 38 is the most similar of Machaut: *A Guide to Research* (New York, 1993), pp. xviii, 289–386. As a rule, eight-syllable lines are used earlier in the century, ten-syllable lines later, but there is no strict cut-off

Figure 1 Ballade *Ut pateat evidenter*. Oxford, Bodleian Library, MS Bodley 842, fols. 45^v–46. By permission of the Bodleian Library

Both surviving versions of the text are flawed but, luckily, most imperfections in the Bodley 842 reading can be improved by reference to the Rome/St. Paul text and vice versa, and my edition proposes a few further emendations. For the text and a translation, see Appendix 1.

To understand how this is a double ballade, the music must first be transcribed (see Appendix 2), which is not a difficult task and reveals two crucial features. As is already apparent by a glance at the original notation, there is a proliferation of chromatic inflections. Less obvious to the eye at first, but falling out under the transcriber's pen due to the motivic, contrapuntal and mensural behaviour of cantus and tenor, is the fact that the composition, without the benefit of mensuration signs, moves through the four Vitrian prolations from 9/8 to 6/8, 3/4 and 2/4 under minim equivalence.⁷ A quick scan of the text is enough to realise that whatever its

⁷ This was first brought to my attention by Roger Wibberley. See above, n. 5.

detailed meaning, which will be pursued below, it is concerned with these very features: the first three stanzas discuss tonal behaviour while the second three discuss mensural behaviour. Ballades are normally three-stanza poems. Hence these twice-three stanzas form a double ballade, unconventional simply in that all text is to be sung to one melodic line, rather than assigning the two texts to be unfolded simultaneously in cantus and triplum parts.⁸

The layout of music and text have been carefully coordinated in Bodley 842. Two statements of the *prima pars* of the ballade (I.1, I.2) each occupy their own line of score, with accompanying text couplets beneath. The *secunda pars* is divided into three segments (II, III, IV). The third cantus staff holds the first two of these (II, III), underlaid by two text lines, and the fourth staff holds the final one (IV), which corresponds to the textual refrain. These larger periods are readily identifiable by cogent melodic and cadential gestures terminating in semibreve rests, and they are subdivided into shorter musical phrases ending in minim rests. The textless tenor is inscribed in four staves paralleling the layout of the cantus. The lyrics surely could have been sung to this music; underlaying them to a modern transcription it is not hard, and the resulting style of declamation, with one or two syllables per breve, is not atypical for a rather compact ballade. Our song's musical language, judging by the rhythmic-motivic web and prevalence of under-fifth harmonisations, could be termed middle-period Machaut.⁹ Lack of musical rhyme between the I.2 cadence and the final (refrain) cadence, and the lack of tonal coincidence in the cantus between the *clos* cadence and the final sonority (*b* versus *c*),¹⁰ both speak for a date in the middle years (perhaps early third quarter) of the century, although

it may be that the musical goals about to be investigated militated against a more conventional shape.

Unfortunately, the vagaries of transmission have provided us with an inconsistent musical text whose tonal ambiguities are not as immediately resolvable as its rhythmic-metric defects. The principal problem is in the *prima pars*, where one needs to decide whether I.1 and I.2 were intended as identical, or whether they have contrasting endings, differentiating *ouvert* and *clos*. Following the principle of *lectio difficilior potior*, my transcription reads intentionality into the conflicting manuscript accidentals in cantus and tenor over the last two breves of the section, interpreting them as defining first and second endings of varied tonal content.

I. TONAL BEHAVIOUR AND NOTATION

We clearly have on our hands what Thomas Brothers has called a '*musica ficta* essay'.¹¹ Notated accidentals in our ballade include four sharps (on F, C, G, D) and six flats (on B, E, A, D, G, C) for a total of seventeen notes around the cycle of fifths from D# to Cb. Because the tenor never descends below grave C, we do not know whether the composer thought in terms of a pitch collection with grave-register B# or Bb, a point whose relevance will become clearer below. The song begins in a bright realm of sharps and moves towards a dark realm of flats at the end of the *prima pars*, plunging in the *secunda pars* to its flattest point in section II before shedding flats in section III (though not without a brief feint to Db) and emerging into the light of white-note diatonicism in section IV. Moreover, section II is clearly a varied and compressed restatement of section I in which the same musical figures have been inflected with flats instead of sharps. This relationship is highlighted by the initial patterning of accidentals: in section I, they are acute d# and f#, lying a third apart and rising; in section II they are acute db and bb, again a third apart but falling.¹² As an additional novelty, while

⁸ Examples of polyphonic double ballades include Machaut, *Quant Theseus/Ne quier voir*, ed. L. Schrade, in *The Works of Guillaume de Machaut* (Polyphonic Music of the Fourteenth Century, 3; Paris and Monaco, 1956), no. 34; Grimaire, *Se Zephirus/Se Jupiter*, ed. G. K. Greene, in *French Secular Music* (Polyphonic Music of the Fourteenth Century, 18; Paris and Monaco, 1981), no. 15; and F. Andrieu, *Ames amours/O flour des fleurs*, ed. G. K. Greene, in *French Secular Music* (Polyphonic Music of the Fourteenth Century, 19; Paris and Monaco, 1982), no. 84. For a comprehensive bibliography on the Machaut and Andrieu ballades, see Earp, *Guillaume de Machaut*, pp. 362-4, 373-4, 386-7.

⁹ Among the Machaut ballades of corresponding line and syllable count (see n. 6), no. 13, *Esperance qui m'assure*, is most comparable in the rate of declamation; it also bears comparison in other style features.

¹⁰ Note names will not follow the Helmholtz code, but rather will be distinguished as follows. Pitch-class names are capitalised. Registerially localised notes are italicised and identified by octave as subgrave FF-GG (Gamma-ut), grave A-G, acute a-g, superacute aa-gg.

¹¹ T. Brothers, *Chromatic Beauty in the Late Medieval Chanson: An Interpretation of Manuscript Accidentals* (Cambridge, 1997), pp. 138-42.

¹² It would be more conventional to find them a fourth apart (D# and G# reflected by Db and Ab). This would provide the missing cantus G# and Ab, and there is a certain elegance not inappropriate to our piece in the juxtaposition of C#/D# and G#/Ab. However, F# is then not to be signed in the cantus in section I, nor Bb in section II. Note that the F# is later cancelled. (Perhaps F# was intended as part of a chromatic C, D#, E, F tetrachord.) If the

the means of notating non-diatonic notes of the gamut is by the use of the familiar signs for sharpening and flattening, the method of cancellation of these signs is unusual: the letter name of the note is written in the appropriate line or space at a later point. Both the extreme accidentals and their method of cancellation help to provide a context for our ballade.

Extreme accidentals

Concerning the accidentals, it must first be said that C♭ has no counterpart in compositions of the fourteenth and early fifteenth centuries, which otherwise do not venture beyond the sixteen notes around the cycle of fifths between D♯ and G♭.¹³ Furthermore, while better known, systematic *musica ficta* essays of the later fourteenth century such as the chansons *Fumeux fume*, *Calexton qui fu* and *Le mont Aon* pursue the implications of hexachordal thinking, driving *ficta* with characteristic sequential figures, parallel thirds and sixths, and cycle-of-fifth flattening, these are not the methods of our ballade.¹⁴

For comparable radicality, then, one must look into music theory, and even here the pickings are slim. Nevertheless, there is enough evidence for us to be able to distinguish two different theoretical concerns, and two different angles, that yield additions to the diatonic gamut approaching those as dramatic as in the ballade and that will help to situate it in time and place. One involves the rigorous, systematic expansion of the gamut specifically in order to incorporate more pitches methodically. From the twelfth up through the fourteenth century, this approach is particularly associated with a small number of northern French and English theorists who develop ways of generating pitches with tetrachords and

hexachords, especially in *synemmenon* and *coniuncta* theory.¹⁵ A seventeen-note system one step sharpwards from our ballade, thus with five flats through G♭ and five sharps through A♯, is already known from an English treatise, *Sequitur de synemmenis*, of the mid- to later thirteenth century, for instance.¹⁶ With an eye to the famous modern justifications *causa necessitatis* and *causa pulchritudinis* of *musica falsa*, we might call this approach the *causa generationis*, since tones beyond those of the diatonic gamut are being explicitly generated and accounted for.

The other theoretical concern can be called neo-Boethian. It involves how to describe all possible intervals according to their semitonal content and by means of proportional arithmetic, and how and where to locate them on the staff system. This approach is epitomised in the massive Second Book of the *Speculum musicae* of Jacques de Liège from the mid-1320s.¹⁷ Jacques proposes a total of fifty-one intervals, counting the unison, three intervals that he cannot represent on the gamut (the comma, the lesser tone of two minor semitones, and the greater tone of two major semitones), forty-four intervals that can be written in the gamut between *Gamma-ut* and *ee*, thirty-seven of which are diatonic and seven that can only be written using *musica falsa*, and three additional large intervals rising above the standard gamut from *Gamma-ut* to *ff*, *gg* and

understanding of the signs was hexachordal, F♯ would be provided automatically in a system with D♯ and G♯, and B♭ in a system with A♭ and D♭, but these signs do not operate unexplicably, as will be explained below. The missing signs for A♭ and G♯ therefore remain

¹³ See P. M. Lefferts, 'Signature Systems and Tonal Types in the Fourteenth-Century French Chanson', *Plain-song and Medieval Music*, 4 (1995), pp. 117–47, at pp. 122–3. For the notion that sixteen tones may be some kind of natural outer limit rooted in hexachordal practice, see K. Berger, *Musica ficta: Theories of Accidental Inflections in Vocal Polyphony from Marchetto da Padova to Gioseffo Zarlino* (Cambridge, 1987), p. 30.

¹⁴ See P. M. Lefferts, 'Subtilitas in the Tonal Language of *Fumeux fume*', *Early Music*, 16 (1988), pp. 176–83, and Brothers, *Chromatic Beauty*, for examples of *musica ficta* essays.

¹⁵ There is a convenient summary in Brothers, *Chromatic Beauty*, pp. 33–9, to which one certainly could add two items from pertinent sources, Theinred of Dover, *De legitimis ordinibus pentachordorum et tetrachordorum* (Bodley 842, fols. 1–44), edited by John Snyder (Ottawa, 2006), and an anonymous, unpublished diagram, the *rota compositionis monochordi* (Rome/St. Paul, fol. 17r). The Bodley 842 context for *Ut patent evidentia* associates the ballade with the preceding treatise of Theinred, whose greatest novelty is a highly original theoretical justification of chromatically altered notes in plainchant (E♯, F♯, C♯) via tetrachordal constructs. In the Rome/St. Paul fascicle, the *tabula monochordi*, including *Ut patent evidentia*, immediately follows two other elaborate diagrams, the first of which is the *rota compositionis monochordi*. The *rota* is tonally progressive, adding two hexachords, on B♭ and D, to the standard set of three, thus providing hexachordally for E♯ and F♯. Its pitch collection includes seventeen discrete notes per octave (accounting for all of the twelve minor semitones and five commas), defined as the white-note diatonic set of seven plus five sharps (to A♯) and five flats (to G♭); an anomalous nomenclature for raising A that Gushee has pointed out might indicate some sensitivity involving this note (see Gushee, pp. 130–3, 136–7).

¹⁶ The anonymous *Sequitur de synemmenis* has been newly edited in Prosdócimo de' Beldomandi, *Brief Trattato on Ratios that Pertain to Music and A Little Treatise on the Method of Deciding the Monochord*, ed. and trans. J. Herlinger (Lincoln, Neb., 1987), App. B, pp. 123–35. The *rota compositionis monochordi* (see the note above) is an array of pitches whose means of generation is unspecified, but in which the intention is nonetheless to display a particular collection; it has an obvious affinity with *Sequitur de synemmenis* in its 5+5 disposition of flats and sharps.

¹⁷ *Jacobi Lodiensis Speculum musicae*, 7 vols., ed. R. Bragard (Corpus Scriptorum de Musica, 3, [Rome], 1953–73), ii.

aa.¹⁸ These amount to twenty distinct intervals plus octave transpositions. (See Table 1, where where m is minor semitone, M is major semitone, the whole tone is M+m, and so forth.)

In his staff-notation examples, Jacques seldom strays from the white-note diatonic collection plus acute *b* and superacute *bb*. However, by remarks such as 'si non fiat falsa musica', and 'exclusa falsa musica', he acknowledges that the intervals he systematically reviews can be written in other places than those where he demonstrates them but that these locations would require chromatic inflections. In some instances, however, he cannot avoid *musica falsa*. For example, where he chooses to notate them, the *tetratonus* of four consecutive whole tones requires grave *E_b*, the *pentatonus* of five whole tones requires grave *D_b* and *E_b*, and the *hexatonus* of six whole tones requires a startling grave *F_b* along with *G_b* and *a_b*.¹⁹ Jacques derives his *hexatonus* by the whole-tone descent from acute *e* to grave *F_b*. (We could extrapolate the ballade's acute *c_b* by a similar descent of six whole tones from superacute *bb*, although Jacques never writes such a note.) As a neologism for this approach to the introduction of accidentals, which result as it were coincidentally or inadvertently from the inadequacy of the diatonic gamut for the demonstration and notation of certain intervals, let me propose *causa exemplificationis*. These two new terms, *causa generationis* for pitches and *causa exemplificationis* for intervals, help us to grasp more readily and distinctly two important currents in late medieval northern European tonal theory.

Two further theoretical sources go beyond Jacques de Liège in the intervallic justification of extravagant accidentals *causa exemplificationis* and can be tied in some manner both to the ballade and to England or northern France. The first of these is an unedited little treatise of neo-Boethian intervallic lore providing interval names,

¹⁸ *Speculum musicæ*, ed. Bragard, bk. 2, esp. as summarised in cap. CXXVI (ii, pp. 300-7). Jacques recognises the arbitrariness of the twenty-step gamut from *Gamma-ut* to *ee*. He acknowledges the possibility of notes both higher [*ff*, *gg*, *aaa*] and lower (implicitly *CC*, *DD*, *EE_b*, *EE*, *FF*, *FF_b*) when *Gamma-ut* is solmised as *re*, *mi*, *fa*, or *sol* - solmisations that also imply, among other pitches, grave-register *A_b* and *B_b*. See ii, pp. 300-2.

¹⁹ For these three intervals, see *Speculum musicæ*, ed. Bragard, bk. 2, ii, pp. 207-8 and App. XLVIII; ii, pp. 217-19 and App. LIIB; ii, pp. 224-8 and App. LVb. The remaining four intervals that cannot be written without *musica falsa* are the *semitritonus cum bis diapason*, *tritonus cum bis diapason*, *semitritonus minus cum diapente et bis diapason*, and *semitritonus minus cum diapente et bis diapason*. There are also intervals larger than the *hexatonus* that Jacques can imagine but will not write.

Table 1 Intervals from unison to octave in three sources

Interval name	Size in major [M] and minor [m] semitones	Anonymous, Reg. Lat. 1146/BL 763	Jacques de Liège, <i>Speculum musicæ</i>	Nicolaus de Luduno, <i>Tabula figurarum</i>	Pitch in the <i>Tabula figurarum</i>
1. unisonus	-	•	•	•	Gamma-ut
2. comma	M - m	•	•	•	A _b
3. diesis	1/2m	•	•	•	G _#
4. semitonium minus	m	•	•	•	A
5. semitonium maius	M	•	•	•	B _b
6. duo semitonia minora	2m	•	•	•	A _#
7. tonus	M + m	•	•	•	B
8. duo semitonia maiora	2M	•	•	•	C _b
9. semitritonus minus	M + 2m	•	•	•	C
10. semitritonus maius	2M + m	•	•	•	C _#
11. ditonus	M + 3m	•	•	•	D _b
12. diatesseron	2M + 2m	•	•	•	D
13. diatesseron	3M + 3m	•	•	•	E _b
14. semitritonus	3M + 2m	•	•	•	E
15. tritonus	3M + 3m	•	•	•	D _#
16. semidiapente	2M + 4m	•	•	•	E _#
17. diapente	3M + 4m	•	•	•	F
18. semitonium minus cum diapente	3M + 5m	•	•	•	F _#
19. semitritonus	4M + 3m	•	•	•	G _b
20. tritonus	4M + 4m	•	•	•	G
21. tonus cum diapente	4M + 5m	•	•	•	
22. semitritonus minus cum diapente	4M + 6m	•	•	•	
23. semipentatonus	5M + 4m	•	•	•	
24. pentatonus	5M + 5m	•	•	•	
25. ditonus cum diapente	5M + 6m	•	•	•	
26. semidiapason	4M + 7m	•	•	•	
27. diapason	5M + 7m	•	•	•	
Total number of intervals		27	20	19	

their size as measured in tones and semitones, and their representation in the staff system. It survives in two English codices of the first half of the fifteenth century.²⁰ (See Figure 2.) A general resemblance to the approach by Jacques de Liège in Book 2 of the *Speculum musicae* is striking.

The total of thirty-five intervals represented in this English material includes the standard diatonic ones (semitonium minus, tonus, ditonus, dyatesseron, diapente, dyapason, etc.) along with more esoteric ones that require chromatic tones for their notation (comma, semitonium maius, semiditonus minus, semiditonus maius, demidiatesseron, semitritonus, demidiapente, etc.). Of these intervals, twenty-seven fall within an octave, and the remainder are reduceable to one of the twenty-seven plus an octave. (See Table 1.) The logic of presentation is simple: incremental growth in size (m, M, 2m, M+m, 2M, etc.), with occasional irregularities in order to keep two intervals of the same type adjacent.²¹ For each interval there are two examples, usually a step apart and mostly written in the *C* to *c* octave. For one if not both examples, chromatic alterations are usually necessary. For instance, the diatesseron (2M+3m) is represented by two diatonic intervals, *C* to *F* and *D* to *G*, while the semitritonus (3M+2m) is notated as what we would now call an augmented third, *F* to *a*[♯] and *G*[♭] to *b*. The comma is exemplified by *G*[♯] to *a*[♭] and *a*[♯] to *b*[♭].²² The core pitch collection

²⁰ The more complete and accurate version of this material is in Vatican City, Biblioteca Apostolica Vaticana, Reg. Lat. 1146, fols. 58^v-62^r, which has a total of thirty-four intervals, some lacking clefs or manifestly wrong. The version in London, British Library, Lansdowne 763, fols. 91^v-93^r, also has thirty-four intervals, adding one to the Reg. Lat. 1146 collection but lacking another, and is less rationally ordered over the last ten examples; although it occasionally improves on a Reg. Lat. 1146 reading, it has more faults overall. In both cases this material follows directly upon, or is embedded within, a copy of a fourteenth-century treatise by Johannes Torkesey, *Declaratio trianguli et scali*, and it may very well date to that century. In Cambridge, Trinity College, MS O.9.29, fol. 55^r there is a similar but briefer music example that likewise follows directly upon a version of Torkesey's *Declaratio*.

²¹ For example, semidiapente and diapente (intervals 16 and 17) are adjacent, although the tritonius (interval 15) actually lies between them in terms of size.

²² Both sources begin with unison, comma, diesis (a term here used in its less common meaning as the interval dividing the minor semitone into two equal halves), and the minor semitone. The diesis, so defined, is in fact unnotatable. It is not surprising, therefore, to find error and confusion. In Reg. Lat. 1146 the accompanying music example represents the diesis by *F*[♯] to *G* and *G*[♯] to *a*, which are minor semitones (not what the text says is being shown, but in fact as the remarkable intervals *E*[♯] to *F*[♯] (which is actually a minor semitone plus two commas) and *F*[♯] to *G*[♯] (a comma); alas, the examples simply appear to have been copied from the previous ones with change of clef from C3 to F2.

Figure 2 Anonymous treatise on intervals. London, British Library, Lansdowne 763, fol. 91^v. By permission of the British Library

that one can extract from this English material is again a seventeen-note system, including five flats (through G♭) and five sharps (through A♯), with grave-register A♭ and B♭.²³ This English material is related to our Latin-texted ballade by its use of letter names for cancellation, a point to which I will return in a moment.²⁴

For a confirmed sighting of the ballade's exotic c♭, which occurs in a theoretical context of interval exemplification, I need to introduce one further treatise, the *Musica* (1357) of Johannes Boen, a Dutch priest who was educated around mid-century at Oxford and Paris.²⁵ In its third part, a rigorous exploration of the potential of flat and sharp signs, Boen creates a number of extraordinary examples of intervals. He notates, for instance, a comma, two and three consecutive minor semitones, the interval comprising two commas and a minor semitone (the difference between B♯ and C♭), and the interval comprising a comma less than a minor semitone (the difference between A♯ and C♭). In all, his examples take him as far as the sixth flat (acute c♭) and the seventh sharp (acute b♯).

Astonishingly, however, Boen then repents! Pricked by remorse ('remorsus me stimulan'), he retreats from the more extreme possibilities outside the conventional gamut ('extra naturam monocordi manualis') that have come up in the course of his intervallic demonstrations ('quas supra gratia exempli solum posui') to a less radical position still in advance of the ancients in its use and understanding of accidentals but more fully defensible.²⁶ In the terms we have just coined, we see Boen explicitly reverting from an intervallic context in which accidentals appear *causa exemplificationis* to a pitch context in which accidentals are justified *causa generationis*.

²³ The two versions of this material, while sharing most examples in common, vary somewhat in overall range and content. Reg. Lat. 1146, by rising only to *dd*, uses less than the standard adds three steps to the gamut, the *FF* below *Gamma-ut* and *supracute ff* and *gg* above *ee*, but Lansdowne 763 has only grave *B♭*, as it lacks the example with grave *A♭*. I am assuming a clef error in one octave. The general similarity here to the tonal space described in the Berkeley theory treatise (c. 1375) is noteworthy (see Jefferts, 'Signature Systems', p. 122).

²⁴ The *causa generationis* yields another exotic pitch in Lansdowne 763. In unrelated material that follows in Lansdowne 763 (fol. 93^v), but not in Reg. Lat. 1146, B♯ is used in the representation *b* to *c* by a comma.

²⁵ For biographical information on Boen and an edition of the *Musica*, see W. Frobenius, *Johannes Boen, Musica und seine Konsonanzlehre* (Stuttgart, 1971).

²⁶ This paragraph draws upon Boen, *Musica*, ed. Frobenius, pp. 62–3.

For the more limited but still exciting tonal possibilities to be put into writing, he argues, the necessary signs already exist to convert sounds into notation without inventing any further novelties, if the signs are used rationally at new locations in the gamut with the effects he has discussed.²⁷

Boen's methodology for pitch generation may be described in the following way. (See Table 2.) Imagining the diatonic gamut to be mapped by overlapping diatonic tetrachords, Boen allows these tetrachords to be distorted on account of consonance or simply the playfulness of the melody ('propter consonantias vel lasciviam ipsius cantus').²⁸ Defining as soft the part of a tetrachord that ends in a semitone, and as hard the part that ends in a tone, he allows the soft part to be extended and the hard part to be contracted by a semitone, thus expanding or compressing the tetrachord and incurring non-diatonic pitches requiring accidentals. If a tetrachord has the semitone in the middle, so that there are tones at both ends, then either extension or contraction may occur at either end. Boen's principal constraint on this procedure is that tetrachords a fourth apart need to be able to be conjunct, that is, overlapping by one note such that the last note of the first tetrachord and the first note of the second tetrachord are the same. Thus, for example, the *EF G a* (mTT) tetrachord could be allowed *E* or *E♭* and *a* or *a♭*. The *a b c d* (TmT) tetrachord could be permitted *a♯* or *a♭* and *d♯* or *d♭*. But since these two tetrachords must be conjunct, the *a♯* possibility is ruled out. By this logic, fully extended across a gamut in which B♭ is dictated in the grave register, a sixteen-note pitch collection results, consisting of the seven diatonic tones, four flats (B, E, A, D) and four sharps (F, C, G, D), plus A♯ in the grave register only. Boen recognises the registral diversity, noting that these things are not always the same at the fifth or at the octave ('Sic ergo non est semper simile in hac materia de clavibus dyatesseron constituentibus vel dyapason' [p. 64]).

²⁷ 'Ut hec lascivia iocunditas absque omnimoda novi monocordi compositione signari possit in scriptis, sicut habet fieri in sonis, ut signum signato respondeat, rationabiliter eas litteras et carum effectus in diversis clavibus usus admittit.' *Ibid.*, p. 63.

²⁸ The following two paragraphs draw upon Boen, *Musica*, ed. Frobenius, pp. 63–6. In this passage *consonancia* and *lascivia* (or *lasciva iocunditas*) are his equivalents for the *causa necessitas* and *causa pulchritudinis* of *musica falsa*.

Table 2 Projection of Boen's method of generation of the gamut, beginning with grave B natural, yielding new chromatic pitches at tetrachord boundaries

Flexibility	Terrachord	Note:
cc	bb	ce
cc	bb	dd
cc	bb	no gb
cc	bb	no aa
cc	bb	no G
cc	bb	no A
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C
cc	bb	D
cc	bb	E
cc	bb	F
cc	bb	G
cc	bb	A
cc	bb	C

As just observed, this result is arrived at for a pitch collection with grave *B* but not *Bb*. Given the appearance of grave *Bb* in Nicolaus de Luduno's *tabula*, as well as, for instance, in the English interval examples and in the Berkeley treatise (1375), it is of some historical significance that Boen does not consider the alternative pitch collection triggered by admission of this pitch. However, given a close, critical reading of the passage at hand, it is far from certain that Boen intended his conclusion to be absolute and complete for the moderns. He says 'this is how I respond for the present' ('Respondeo pro presenti'), and he acknowledges the use of acute *A#* 'an octave above grave *A#*', about which he can only say 'We know that a melody may be placed this way at other locations, which is allowable' ('scimus, quod huiusmodi cantus sub aliis clavibus, quibus hoc licitum est, ordinetur'; p. 64).

The result of applying Boen's register-sensitive tetrachordal logic to a gamut with grave *B♭* is, of course, to rotate his results a step flatward in the cycle of fifths. In the new sixteen-tone collection, *D♯* disappears while *G♭* is added, and grave-register *A♯* disappears while superacute *cc♯* emerges. (See Table 3). The sum of these two collections is a registrally inequivalent eighteen-note set with five sharps and six flats, i.e., from *A♯* to *C♭*, in which *B♭* occurs in all registers, *A♯* occurs only in the grave register, and *C♭* occurs only in the superacute register. We are very nearly at the pitch collection of the ballade.

Amplifying Boen is not merely an exercise in musicological flights of fancy. At the end of this extraordinary process we are within one note of the scale of the *Tabula monochordi* of Nicolaus de Luduno. The missing note that Nicolaus provides is acute *c*b, precisely the notated *c*b of the ballade. (See Table 1, no. 12.) This note falls almost at the mid-point of his forty-eight-note gamut, which is at the *b-c* half step just above. Boen used this note *causa exemplificationis* but then backed away from justifying it *causa generacionis*. Hence we may read a self-conscious significance into the most extreme notational choice displayed in the ballade, and we may be justified in suspecting that the association of poem and *Tabula* is anything but coincidental. Inescapably, it is time to look more closely at the *tabula figurarum* and the *tabula numerorum* of Nicolaus.

The *tabula figurarum* presents a gigantic staff of twenty-four lines and twenty-four spaces, each of which is identified with a distinct

Table 3 Projection of Boen's method of generation of the gamut, beginning with grave B flat, yielding new chromatic pitches at tetrachord boundaries

	Tertrachord		Flexibility	Note:
	T	T	bb ^b	cc ^b
	m	T	aa ^b	dd ^b
	T	m	cc ^b	cc ^b
	T	T	bb ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	cc ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	bb ^b	g ^b
	m	T	cc ^b	f ^b
	T	T	aa ^b	no c ^b
	m	T	bb ^b	no d ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	bb ^b
	T	T	bb ^b	bb ^b
	m	T	aa ^b	aa ^b
	T	T	cc ^b	cc ^b
	m	T	aa ^b	

note in a gamut of forty-eight notes running two octaves and a sixth from *Gamma-ut* to *ee*.²⁹ As implied above, this gamut not only incorporates the standard seven diatonic notes (F, C, G, D, A, E, B) but also six flats (B $\flat$, E $\flat$, A $\flat$, D $\flat$, G $\flat$, C $\flat$) and five sharps (F $\sharp$, C $\sharp$, G $\sharp$, D $\sharp$, A $\sharp$), for a total of eighteen notes not enharmonically equivalent, with flats lying a comma below their neighbouring sharps. B $\flat$ appears in the grave register as well as in the higher two registers, while A $\sharp$ appears only in the grave register and C $\flat$ appears only in the acute and superacute registers.

In this diagram the standard gamut names are written up the left-hand side, and the additional sharps and flats are written up the right-hand side with an indication of the size of the smallest interval they specify, *lyma* (minor semitone) or *comma* (here, the difference between the minor and the major semitone). There are twelve *lymas* and five *commas* per octave. Across the giant staff system are written numerous note and rest groups in the symbols of French *ars nova* mensural music, using red and black notation and including flagged semiminims. No one has ever successfully demonstrated that these note groups present a real piece of music,³⁰ and the fact that they often move conjunctly across the lines and spaces of the staff, thus tracing melodic figures employing an extremely high degree of direct chromaticism, makes it unbelievable that any kind of coherent piece is encoded.

The *tabula numerorum*, following the *tabula figurarum* and running across three and a half openings of the Rome/St. Paul manuscript, is a compact yet unparalleled *summa* of data relating to nomenclature, interval content and mathematical representation of interval proportions. It contains six columns of complex technical information on each pitch in the forty-eight-note gamut, expressed as an interval above *Gamma-ut*. This material includes the repetition of a numerical radix value (integer constant) for *Gamma-ut* (644,972,544); the name of the interval that the note makes with *Gamma-ut* and how

²⁹ For a black-and-white photograph of the *tabula figurarum*, see Gushee, p. 138. The *tabula* has been reproduced twice in quasi-facsimile: it forms the lower half of the frontispiece to *Scriptores ecclesiastici de musica sacra*, ed. M. Gerbert, 3 vols. (St. Blasien, 1784) [hereafter GS], iii, and is *ecclesiastici de musica sacra*, ed. M. Gerbert, 3 vols. (St. Blasien, 1784) [hereafter GS], iii, and is reproduced for O. Koller, 'Aus dem Archiv des Benediktinerstiftes St. Paul in Lavantthal in Kärnten', *Monatshefte für Musikgeschichte*, 22/3 (1890), pp. 35–45, as an unpaginated insertion relating to p. 40. Neither facsimile is entirely accurate, nor does any of these three

³⁰ Gushee, pp. 142-3.

to calculate its integer value; the integer value itself and the resulting integer difference between successive pitches; the letter name (A-G) and additional comments; the Greek pitch name in the *systema telion*, with some neologisms; and another integer associated with the Greek pitch name, modified from Boethius, Book 4.³¹ Some vocabulary and general concerns link this data closely to Jacques de Liège, and Gushee points to an exact correspondence between the forty-eight-note gamut of the *Tabula monochordi* and a table of forty-eight notes in a Catania manuscript.³² The total number of unique intervals upwards from *Gamma-ut* in these tables, removing octave transpositions but allowing for both A# and Cb, is, surprisingly, not quite as extensive in terms of interval variety as in the *Speculum musicae* or the English material. (See above, Table 1).

Together, the chromatically saturated gamut of the *tabula figurarum* and the interval data of the *tabula numerorum* can be related to the *causa generationis* (pitches) and the *causa exemplificationis* (intervals) respectively. We unfortunately lack any knowledge of the generating mechanism. Nicolaus may well have employed a rational process to come up with this gamut, perhaps by a method not far removed from that of Boen. Perhaps – given his chosen means of graphic representation – he was thinking of simply clambering up the gamut from *Gamma-ut* to *ee* by *lyma* and *comma*. Of course, climbing the ladder does not tell us why there would be both A# and

Cb, only one of which ought to have been necessary, and why there is not full octave equivalence. Extending Boen's method, as was done above, shows us how there could be a method yielding both A# and Cb, in different octaves, but whether this would even have made sense to Nicolaus, as well as what might have dictated for Nicolaus the choice of acute *cb* over acute *a#*, remain open questions.

Cancelling accidentals

Leaving aside pitch collections for the moment, let us turn to the second issue provided by the ballade's tonal behaviour, namely its method of cancelling accidentals by letter names. All other examples of this method known to me are also in English sources. The earliest are two isolated later fourteenth-century score format settings in discant, a Kyrie and the hymn *Gloria laus et honor*.³³ The third example is found in the English material on intervals from Reg. Lat. 1146 and Lansdowne 763 already mentioned above. Finally, letter-name cancellation is not uncommon in English fifteenth-century music sources, including, for example, the additions to the Old Hall manuscript made by second-layer scribes, and the English sources of Dunstable's music.³⁴

³¹ *Ibid.*, pp. 143–50.

³² Catania, Biblioteca Riunita Civica e Antonia Ursino Recupero, Ursino Recupero D.39, fol. 116^r. The Catania table is edited by Herlinger in Prosdodico de' Beldomandi, *Brief Treatise*, App. D, pp. 139–47. This material is linked to the *tabula numerorum* by its tabular format, the kind of data it transmits, some technical details involving numbers, nomenclature Greater and Lesser Perfect Systems of Greek music theory (see Gushee, pp. 144, 149–50). According to James Haar, the table's peculiarly unorthodox Greater Perfect System is shared (by two other treatises in the Catania manuscript, namely a version of the *De musica* of Boethius (fols. 44^r–115^r) that immediately precedes the table, and a *Summa Bocci* (fols. 155^a–156^b). Further, the *De musica* and the *Summa* are linked to another treatise in the same manuscript, the *Comentum super cantum* of the Englishman Roger Caperton (fols. 126^a–153^b), which immediately precedes the *Summa*, by unusual terminology for the top pitch *ee* (*crisis*) and the bottom pitch *Gamma-ut* (*coruff*) in the gamut. Thus these four treatises in the Catania manuscript are Haar, 'Roger Caperton and Ramos da Parcia', *Acta Musicologica*, 41 (1969), pp. 26–36). A earlier monochord treatise to the Catania table (and thus, I might add, to the *tabula figurarum* and *tabula numerorum* of Nicolaus) is discussed in C. Meyer, 'Le De Synemmenis et sa tradition: Contribution à l'étude des mesures du monochorde vers la fin du XIII^e siècle', *Revue de Musicologie*, 76 (1990), pp. 83–95, at pp. 87–8.

³³ The Kyrie is in Pisa, Biblioteca Catheriniana del Seminario, MS 176, fols. 217^r–218. For a facsimile, see *English Fourteenth-Century Polyphony: Facsimile Edition of Sources Notated in Score*, ed. W. J. Summers (Tutzing, 1983), plates 209–10. It has been edited in *English Music for Mass and Offices*, 1, ed. F. L. Harrison, E. H. Sanders and P. M. Lefferts (Polyphonic Music of the Fourteenth Century, 16; Paris and Monaco, 1983), pp. 23–4. The fragmentary *Gloria laus et honor* is in Worcester, Cathedral Library, MS Additional 68, Fragment six, fol. c1^r. See W. J. Summers, 'Unknown and Unidentified English Polyphonic Music from the Fourteenth Century', *Royal Musical Association Research Chronicle*, 19 (1983–5), pp. 57–67, at p. 63, n. 4. For a good image, see the Digital Image Archive of Medieval Music (online at <http://www.diamm.ac.uk>), where the page is identified as Frag. xix, fol. 3^r. For a poor facsimile in which the cancellation letters are unfortunately not visible, see Worcester Add. 68, H Westminster Abbey 33327, Madrid, Bibl. Nac. 192: Facsimile, Introduction, Index and Transcriptions, ed. L. Dittmer (Publications of Mediaeval Musical Manuscripts, 5; Brooklyn, 1959), p. 39. For an edition, see *The Worcester Fragments*, ed. L. Dittmer (Musicological Studies and Documents, 2; Rome, 1957), no. 86.

³⁴ See M. Bent, 'The Old Hall Manuscript: A Paleographic Study' (Ph.D. thesis, Cambridge University, 1969), pp. 133–46 and 407. One further example is a previously overlooked fifteenth-century score-format three-voice discant setting in void notation (with unidentified cantus firmus in the lowest voice) that has been entered by a later hand onto a leaf (Oxford, Bodleian Library, MS Latin liturg. d. 20, fol. 35^r) that was originally part of a thirteenth-century music manuscript and then a flyleaf in Bodleian MS Bodley 862. The music was apparently entered before the original codex was dismembered.

In the ballade, it would appear that accidentals hold (inconsistencies aside) either until cancelled or until the end of the staff or musical unit. Of greater significance, the inflection applies to the single note but does not carry the logic of the hand. That is, there is no implication of any wider hexachordal environment. For example, D#, even if the singer might call it *mi*, does not here automatically invoke a hexachord built on B-ut with C#, F# and G# automatically available as *re, sol, la*. Nor does the notation of an E♭, for instance, remove the necessity of the explicit cancellation of a G♭, whereas if one were thinking hexachordally, the E♭ ought to cancel the G♭. That is because if E♭ were solmised as *fā*, a hexachord built on B♭ as *ut*, with G♭ as *la*, would be implied.

Rather than merely functioning as the passive marker of the location of the upper or lower member of a half-step interval, sharp and flat signs here function actively as the agents of pitch change. This gives them two roles to play. Each can pull a note away from its diatonic pitch location (upward or downward by a major semitone), and each can cancel the effect of the other by restoring the diatonic pitch. A note, while remaining in its *clavis* (say, acute *g*) can have one of three different pitches or *cordae* (*g♭*, *g*, *g♯*). Not surprisingly, a theorist who describes this new agency for flat and sharp signs, with vivid language, is Johannes Boen, in his *Musica*: 'And as much as one *littera* distorts and disorders a note, so to the same degree a following *littera* can relocate and put back in place that note, and consequently lead it back to its usual station' ('Et quantum una littera notam extorquet et distemperat, tantum sequens littera temperat et retorquet et per consequens reducit ad suam proprium mansionem').³⁵ By *littera* Boen here means not letter name but accidental sign – and of course, these signs are letters, namely *b-quadratum* and *b-rotundum*.

There are at least two immediate consequences of this kind of agency for flat and sharp signs, one more obvious and one more subtle. The more obvious consequence is that one cannot write only act once; a second flat would only be redundant or meaningless. (A note can only be stretched just so far from home. The note

D can be tugged up to D# or down to D♭, but to nowhere else.) And Boen ponders this fact, with music examples.³⁶ The more subtle consequence is that you cannot notate two consecutive major semitones, an observation with interesting resonances in Jacques de Liège's proposal of a *tonus maior* containing two major semitones, which he also regarded as impossible to notate.³⁷

To advance the art beyond Boen's position requires the ability to assign an unambiguous single meaning and effect to the signs for lowering and raising. For this to be possible, one of their functions needs to be removed, and this is most naturally the power to cancel a sharp or flat, restoring a note to its natural pitch. That function is precisely what has been taken over in our English sources by the use of the letter name as the sign of cancellation; the letter name is akin in function to the modern natural sign. And most tellingly, in the interval examples of Reg. Lat. 1146 and Lansdowne 763, this way to indicate cancellation is precisely what allows the writing of consecutive major seconds in the same *clavis* (G♭, G, G#; A♭, A, A#).³⁸ Thus both in pitch content and in the implications of its method of cancelling accidentals, our ballade is just a step beyond Boen's position in the mid-1350s.

II. THE TEXT: THE REFRAIN LINE

What light does the text shed on this tonal behaviour? As in any ballade, the place to begin to examine the text is the refrain line. We would hope for it to make sense for all six stanzas, but it would not be surprising if it were tailored more closely to the opening three of our double ballade, in the assumption that they were the first to be written.³⁹ The two sources of our text disagree over the first word of the refrain: Bodley 842 has *tribulor*, while Rome/St. Paul reads, with

³⁶ *Ibid.*, p. 59, ex. 3, 4, 5 et *passim*.

³⁷ *Speculum musicae*, ed. Bragard, bk. 2, cap. XLIII (ii, p. 104); see also Gushee, pp. 147–8. The impossibility of notating two major semitones is Boen's corollary to his fourth conclusion concerning the effects of flat and sharp signs (*Musica*, ed. Frobenius, p. 59).

³⁸ The letter A is also used later to cancel A♭, but a sharp sign is used to raise B♭ to B♮. That is logical if there is no B# in the system: the sharp sign can be used to cancel in a *clavis* with two *cordae*.

³⁹ Each of the first three stanzas has exactly twenty-two words, while the subsequent three have nineteen, seventeen and twenty-two words. The internal consistency of word counts may indicate the priority of the first three stanzas. My thanks to Thomas J. Mathiesen for this observation.

³⁵ Boen, *Musica*, ed. Frobenius, p. 55. For a similar use of *extorquere* and *retorquere*, see also *ibid.*, pp. 52–3.

light amendment, *cribrorum*. In abbreviated form these two words would be very closely related palaeographically, and it is surely credible that one could have emerged from a misreading of the other; alternatively, they may both be misreadings of some other word, probably a relatively unfamiliar one, that scribes were having trouble with.

Tribulor itself is not a common word, but it is biblical (Psalms 30: 10, 68: 18, 101: 3 and Lamentations of Jeremiah 1: 20), and it is therefore also found in biblical commentaries such as those by Augustine of Hippo and Cassiodorus. In these contexts it is a passive verb in constructions like 'quoniam tribulor', where the psalmist calls out to the Lord 'because I am in distress'. If *tribulor* is indeed a misreading, it may be a corruption of *turbator*, something or someone who causes trouble, who stirs things up. In any event, our refrain could put into the mouth of the singer the sentiment that the poem and ballade are vexing, discomfiting or challenging. The biblical overtones of distress may be intentional, and especially if not taken too seriously, they would be appropriate to the difficulty of the text and the sophistication of the composition.

The refrain line in Rome/St. Paul reads *Cribrorum demonstratio*. A *cribrum* is a tool for sifting dry material like grain and is usually made in the form of a wire lattice secured inside a rectangular wooden frame.⁴⁰ The word is rendered into English as sieve or riddle (as a tool, a riddle is a coarse-meshed sieve); it can also mean a dry measure, i.e., a sievel. Thus the refrain might mean, most literally, that here is a demonstration of sieves. Lawrence Gushee relates *cribrum* to the sieve-like appearance of the twenty-four-line staff system of the *tabula figurarum*,⁴¹ and Leo Franc Holford-Strevens has observed to me that in Bodley 842, the way lines have been drawn from the end of each verse to the refrain makes it look as if the words are going into a sieve. Thus *cribrum* may simply refer, by extension, to the normal musical staff. Since *cribrorum* is a plural

⁴⁰ A *cribrum* could be elongated, thus like a ladder, and the term is also used to refer to the chain-lines made in paper manufacturing by the wire weights used to press down the damp sheets. My thanks for Prof. Bert Hall, Institute for the History of Philosophy of Science and Technology, University of Toronto, for these references (private comm.).
⁴¹ Gushee, p. 140. Gushee assumes that the poetic text addresses the musical notation of the *tabula figurarum* of Nicolaus de Luduno, explaining a way 'for filtering out some of the notational signs in order to produce something that makes sense', or that it 'less likely' refers simply to the huge

form – multiple sieves, or perhaps the yield of multiple siftings – we need to find an explanation appropriate to its plurality. At the very least it might refer to multiple staves; as another possibility, we may need two sieves, one for tonal and the other for mensural behaviour.

The term first occurs in two much earlier Continental music treatises, the *Musica* (before 1068) of Wilhelm of Hirsau (d. 1091), and the derivative *Mensura quadripartita figure* of Otker of Regensburg (fl. eleventh or twelfth century). In both, *cribrum monochordi* is synonymous with *theoremata troporum*, referring to a figure that explains the varied tonal content and interrelationship of the melodic modes by means of tetrachords and the staggered alignment of four or five diagrams of the gamut, producing a dense thicket of lines at right angles to one another resembling a sieve. In Otker's treatise and in the *De musica* of another nearby German contemporary of Wilhelm, Aribio of Freising (fl. 1068–78), this grid is also called by the name *quadripartita figura*.⁴² This German material, although not the specific term we are seeking, is still being addressed in the fourteenth century.⁴³ Although the monochord of Wilhelm's expression *cribrum monochordi* is simply the diatonic gamut as derived via the monochord, his sieve is a tonal sieve, and it is certainly within the realm of possibility that the term was borrowed and the concept somehow extended to help conceptualise chromatic additions to the gamut.

⁴² For Wilhelm's figure, see Willelhelmus Hirsaugensis, *Musica* (GS, ii, pp. 154–82) at figure B between pp. 164 and 165, and Willelhelmi Hirsaugensis *Musica*, ed. D. Harbison (Corpus Scriptorum de Musica, 23; [Rome], 1975), p. 38. For Otker's figure, see Otker Ratichonensis *Monachi aetatis incertae mensura quadripartitae figurae*, GS, ii, p. 348, and C. Adkins, 'Otker of Regensburg', *New Grove Dictionary of Music and Musicians*, rev. edn (2001) [New Grove II], xviii, p. 799. For Aribio's diagram, see Aribio, *De musica*, ed. J. Smits van Waesberghe (Corpus Scriptorum de Musica, 2; [Rome], 1951), p. 4, and for both diagrams, see A. Hughes, 'Aribio', *New Grove II*, i, pp. 897–8, at p. 897. See also L. Bronarski, 'Die Quadripartita figura in der mittelalterlichen Musiktheorie', in K. Weinmann (ed.), *Festschrift Peter Wagner zum 60. Geburtstag* (Leipzig, 1926; repr. Farnborough, 1969), pp. 27–43, with the diagrams of Otker and Aribio reproduced at pp. 32–3. The lineage of this kind of diagram can be traced back to Boethius, *De musica*, bk. 4. See also plates 33–6 in J. Smits van Waesberghe, *Musikerziehung: Lehre und Theorie der Musik im Mittelalter* (Leipzig, 1969), and C. Berger, 'Cithara, cribrum und caprea: Wege zum Hexachord', in M. Kintzinger, S. Lorenz and M. Walter (eds.), *Schule und Schüler im Mittelalter: Beiträge zur europäischen Bildungsgeschichte des 9. bis 15. Jahrhunderts* (Weimar and Vienna, 1996), pp. 89–109.

⁴³ The diagram is reproduced by Jacques de Liège when he quotes from Aribio in bk. 6, cap. LVIII of the *Speculum musicae*, ed. Bragard, vi, pp. 158–9. Furthermore, Johannes Ciconia reproduces the two elements of Wilhelm's *cribrum monochordi* in his *Nova Musica* (1410–11) as his 'monochord of the eight modes' and 'monochord of the nine modes', calling the latter the monochord of monochords (*monochordum monochordorum*). Ciconia makes no reference to *cribrum* and asserts that these diagrams are his own work (Johannes Ciconia, *Nova Musica and De Proportionibus*, ed. and trans. O. Ellsworth [Lincoln, Neb., 1993], in *Nova Musica*, pp. 86–95).

The only appearance of *cribrum* in medieval English music theory that I have found is in the title 'Cribrum proportionum', used in a later fifteenth-century manuscript to identify a triangular diagram of proportions.⁴⁴ In this figure, a series of uniformly spaced lines rising from the base of an isosceles triangle is drawn parallel to each side. These lines intersect within the triangle to form a symmetrical lattice in whose diamond-shaped interstices are written the names of the proportions that can be represented by the whole numbers from 1 to 10. *Cribrum* is obviously being used here in the sense of 'sieve', and the context is surely less pertinent to the behaviours in our chanson than Wilhelm's *cribrum monochordi*.⁴⁵

This does not, however, close the issue of the term *cribrum*. Gushee points to another use of *cribrum* that would have been familiar to mathematically astute musicians, in the expression 'the sieve of Eratosthenes'.⁴⁶ This sieve is a bit of elementary number theory, a method of finding primes in a set of numbers by striking out all multiples of known primes (of 2 beyond 2, of 3 beyond 3, of 5 beyond 5, and so forth). The method was invented by Eratosthenes (fl. 276–195 BC), described by Nicomachus of Gerasa in his *Introductio arithmetica*, and transmitted to the later Middle Ages by Boethius, whose *De institutione arithmetica* is a Latin translation and adaptation of Nicomachus.⁴⁷

⁴⁴ Cambridge, Trinity College, MS R.14.52, fol. cclv^r (256b^v). I would like to thank the Trinity College sub-librarian Alison Sproston for her generous assistance in providing me with a photocopy of this folio. The *triangulum proportionum* is not an unfamiliar diagram. In English fol. 56^r, where it is labelled 'Figura proportionum in quantitate discreta', and a closely related figure appears in Thomas Morley, *A Plaine and Easie Introduction to Practicall Musick* (London, 1597), p. 33. A similar but larger and unlabelled figure representing the proportions of the whole numbers from 1 to 16 is in Oxford, Bodleian Library, MS Bodley 313, fol. 2.

⁴⁵ Without reference to any earlier instances, Gushee (p. 140, n. 33) mentions the much later use of the term in the title of Marco Scacchi's *Cribrum musicum ad triticum Sifericum* (Venice, 1643), a 'Musical sieve for the Syfert wheat' that polemically enumerates the compositional errors of Szwekowski, 'Scacchi, Marco' *New Grove II*, xxii, pp. 363–5.

⁴⁶ Gushee makes this observation (p. 140, n. 33), and I thank Leo Franc Holford-Stevens for independently calling it to my attention.

⁴⁷ For the Nicomachus treatise, see *Nicomachi Geraseni Pythagorae Introductionis Arithmeticae Libri II*, ed. R. Hoche (Leipzig, 1866), trans. M. L. D'Ooge as *Nicomachus of Gerasa, Introduction to arithmetic libri duo*, For the Boethius treatise, see *Anicij Manlii Torquati Severini Boetii De Institutione arithmetica libri quinque, accedit Geometria quae fertur Boetii*, ed. G. Friedlein (Leipzig, 1867; repr. Frankfurt, 1966), trans. M. Masi as *Boethian Number Theory: Translation of the De Institutione Arithmetica* (Studies in Classical Antiquity, 6; Amsterdam, 1983).

Its citation by Boethius is sufficient guarantee of its familiarity, but later authors refer to it as well.⁴⁸

Of what relevance is this to us? Well for one, we do not need Wilhelm's *cribrum monochordi* to evoke a sieve. Moreover, the mathematical context of the expression resonates with other language of number in our lyric, as we will see in a moment (*calculus, ratio, rata*). Perhaps the cancellation of non-primes is meant to be associated with the cancellation of accidentals. Less obviously, prime numbers are incomposite (not able to be factored) in Boethius' terminology in the *Arithmetica*, and the *trihemitonium* of the chromatic tetrachord (of which more in a moment) is incomposite (not compounded of smaller intervals) in Boethius' terminology in the *Musica*. Thus even if specific prime numbers are not what we should be looking for in our ballade, an indirect suggestion of mathematics and some shared terminology of mathematics and music theory might well be intended by the word *cribrum*.

I cannot restrain myself from floating one further remote speculation. If the Latinate author of our poem was a native speaker of English, he may have intended a pun here. In English, then as now, there are two meanings of riddle with entirely different etymologies: as sieve and as puzzle (conundrum, problem, mystery). Further, a riddle is a 'dark saying' or 'dark speech' (obscure, indistinct, veiled), a colouring that is also strongly associated with enigma, a word with which puzzle is often paired.⁴⁹ The *Oxford English Dictionary*, 2nd edn, defines enigma as 'A short composition in prose or verse, in which something is described by intentionally obscure metaphors, in order to afford an exercise for the ingenuity of the reader or hearer in guessing what is meant'.⁵⁰ This could easily describe *Ut patet eidenter*. Darkness, in turn, may pun on the darkening – the coloration – of our ballade's chromaticism.⁵¹

⁴⁸ Boethius, *Inst. Arith.*, ed. Friedlein, I, xvii, 20–1 (p. 33): 'quam scilicet Eratosthenes cribrum nominabat'. See also, for example, Adelard of Bath (fl. 1116–42), *De eodem et diverso* (written by 1116): 'quam et Eratosthenes et ejus sequaces cribrum appellaverunt' (*Beiträge zur Geschichte der Philosophie des Mittelalters*, IV/1 (1903), pp. 3–34, at p. 25).

⁴⁹ See *Oxford English Dictionary* entries for enigma, riddle and sieve, where Latin–English word lists equating the terms *cribrum* and riddle are cited.

⁵⁰ See the Vulgate Old Testament at Numbers 12: 8 ('per enigmata') and the New Testament at 1 Corinthians 13: 12 ('in enigmati'), in which passages *enigma* is translated as 'darkness' in the Wycliffite bible and as 'dark speech' or 'a dark speaking' in later pre-Authorized Version translations.

⁵¹ The chromaticising of musical figures is a shading, tingering or darkening; the concept mixes sight and sound. The reference need not just be to the effect of lowering and raising, but may

This move from sieve in Latin to riddle in English as tool and on to riddle as enigma is quite a stretch, I will admit. In the end, whatever the first word of the refrain was intended to be, the poem is a challenge directly thrown out to the reader, self-consciously announcing its intention to be difficult and to mean more than it says outright. The humorous irony of the first line ('Ut pateat evidenter') cannot be missed, and a cross-eyed portrait illuminating the 'U' of 'Ut' in the St. Paul fascicle may be intended to reveal perplexity at this manifestly confusing text.

III. THE TEXT: STANZAS 1 TO 3 AND TONAL BEHAVIOUR

Turning now from the refrain line to the first three stanzas, which refer to tonal behaviour, the first thing that needs to be said is that their language is difficult. Of course this can now be understood as deliberate, although one suspects that their intentionally puzzling nature is exacerbated by the demands of the rhyme scheme and syllable count, as well as perhaps by a lack of native poeticising talent. On the other hand, there are aspects of language and versification that suggest a very sophisticated mind at work. To begin with, we have a complex syntactic structure in which a single sentence runs through all six stanzas, governed by the imperative form of a 'knowing or thinking' verb, *puta* (line 16) and its requisite passive infinitives of indirect statement with subject accusative, *pandi* (line 8) and *dari* (line 24). The refrain line does not seem to be integrated syntactically, but rather operates as a parenthetical comment, except perhaps, as in the present translation, in the fifth stanza. In classical Latin, *puto* has arithmetic overtones of counting or computing in addition to the sense of pondering or reasoning, and mathematical connotations may have influenced the choice of this particular verb. Indeed, as in any good riddle we will see that the author has left obvious clues in catch phrases and word associations that would have illuminated his meaning more readily for his medieval audience than for us today. I make no claim to have ferretted out all of these clues.

also refer to the use of additional (black) notational signs. The sixteenth century's *madrigali cronacati* are a *note nere* because they use shorter [black] notes. See J. Haar, 'Madrigal: §2, 3: Italy, 1535-50', *New Grove II*, xv, p. 550.

The first stanza is relatively straightforward in meaning and declares its intention openly. It asserts that one can generate on the monochord many pitches beyond the ordinary medieval gamut that are possible to represent on the staff, and through arithmetic one can compute their values. They are different, yet still beautiful, and can be sung by the many who do not understand their underlying mathematical justification. Clearly, this stanza alone would be enough to prompt the association of ballade text and *Tabula monochordi*, and it might possibly have been what caught the eye of whoever brought them together.

The expression 'ut calculi fert racio' (line 6) directly evokes medieval treatises on calculation.⁵² By it we are reminded that musical pitches have numerical values and that such knowledge of the numbers underlying the everyday world distinguishes the learned man from the ignorant. (Implicitly, the *musicus/cantor* dichotomy is being invoked.) Isidore offers a classic statement of this general sentiment in the section concerning the importance of number, 'Quid praestent numeri' ('What do numbers show'), from Book 3, *De Mathematica*, of the *Etymologiae*. This passage undoubtedly affected our poet's choice of language, especially via its concluding peroration, which is as follows: 'Remove numbers from all things, and all perish. Take away computation in this world and all will be enveloped by blind ignorance, nor can man be differentiated from the other animals, who are ignorant of an understanding of calculation' ('Tolle numerum in rebus omnibus, et omnia pereunt. Adime saeculo conputum, et cuncta ignorantia caeca conplectitur, nec differri potest a ceteris animalibus, qui calculi nesciunt rationem').⁵³ The concluding words not only use *calculus* and *ratio* but also the *nescio* of the ballade's *nescienter*.

Stanzas 2 and 3 share the vocabulary of 'old and new' and 'colour'. It is unclear just what the new and old are (*nota, figura, forma, signa*?), but the available feminine plural that is the most obvious

⁵² Calendrical computations are justified 'de ratione calculi'. See *Patrologia Latina*, xxvii, pp. 1004 and 1178; further, a little treatise sometimes attributed to Bede is the *Libellus de ratione calculi* (see *Patrologia Latina*, xc, p. 677). More generally, Alexander Murray has observed that in 'both classical and medieval Latin . . . *ratio* appeared with other terms - *computus, calculus*, and their derivatives - in reference to accounts and calculations'; *Reason and Society in the Middle Ages* (Oxford, 1978), p. 205.

⁵³ *Isidori Hispalensis Episcopi Etymologiarum sive Originum Libri XX*, 2 vols., ed. W. M. Lindsay (Oxford, 1911), i, Lib. 3, Cap. 4.

referent is *corda* (*cordis*, line 5), invoking the monochord. If one thinks of strings, the visual aspect is not so different from the staff, but *corda* refers to one individual pitch, in opposition to the lines and spaces of the staff (typically, *claves*, or *lineas et spacias*), each of which may be the location of more than one pitch. Boen calls the diatonic genus *cantus communis*, a unique designation so far as I can ascertain, which affirms the common-sense reading of stanza 1's 'diversis a communibus cordis' (lines 4–5) as unusual chromatic tones. These new pitches are a recent phenomenon. The old are most likely the standard notes of the diatonic medieval gamut; the newer but not very newest notes would be more familiar yet unstandard chromatic notes, such as perhaps F# and E♭.

Colour issues begin with the matter of black lines and white spaces, the *nigris tractibus* and *marginibus albis* of stanza 2 (lines 9–11). This is unique terminology if, as in my translation, what is being described are the lines and spaces of the musical staff.⁵⁴ *Margo* most commonly means margin or border, and in music notation *tractus* usually refers to a vertical stroke on a notepad, so as an alternative we might translate *margo* as staff and *tractus* as musical note. The principal difficulty with this reading can be framed as a question: why is the staff described as white? Nonetheless, surprising support for it can be found in a much later vernacular English musical proverb of the early 1520s from Leconfield Manor that also associates pureness, whiteness, margins and monochords:

Musike hath her coloures of dyuersites
Black voyde, black full. alteraciones of curiosite
But the white is more comely and to clemnes doth accorde
For purenes in the margent makithe a trew monacorde.
Blake color moste comely in armys the syluer shene
Of virginnall purenes whiche is farrest seane
In musyke makithe melody soundynge from all blame
Of the whiche shynthe the clere voce of a pure name
The margent sylver and the notis sabill
Shulde move vs to remembrance of the Joyes Intermynabill.⁵⁵

⁵⁴ The only reference I can find where *margo* may be technical jargon for a space in a staff is in the *Introductorium musicae* (1442) of the German Benedictine writer Johannes Keck (c. 1440–50), in GS iii, pp. 319–29, at p. 326, and Peter Slemon, *Introductorium musicae of Johannes Keck* (Ottawa, 2001), p. 28: 'Vides ergo sonorum proportionis secundum locorum distantiam per marginum linearumque interpositionem' (my emphasis). Slemon translates the last four words as 'by boundaries and interposed lines' (p. 29).

⁵⁵ See E. Flügel, 'Kleinere Mitteilungen aus Handschriften: Cornyshe's Treatise hitwene Trowth and Enformacion; Die Proverbs von Leconfield und Wresil', *Anglia*, 14 (1892), pp. 466–97, at

The proverb describes the margin (staff) as white (silver) and notes as black (sable). Very possibly, given the musically conservative tone of the Leconfield proverbs as a whole, white's purity and cleanness refer to diatonicism – a lack of chromaticism. Black in this reading could then refer, at least in part, to chromaticism ('colours of dyuersites').

Such vernacular English support for my alternative reading, coming as it does a century and a half after the creation of our ballade, does not dissuade me from preferring my original interpretation of *tractus* and *margo* and as line and space, however unusual a choice of words this may be. As I understand what is being said, the author is creating a parallel between black and white, line and space, so that he can place chromatic notes in an imagined space between them. These notes are intermediate colours, variously tinged.⁵⁶ Further, our author is positive about this innovation. He likes the distinction of new from old, of the chromatic from the diatonic, and through his choice of the word *distincio* in stanza 2 (line 13) he also introduces a connotation of decorative beauty.

This inbetweenness prompts a number of observations. First, our author presumably counts B♭ as a chromatic inflection no longer neutrally occupying the same *clavis* (line or space) as B♮ but rather in a sense bending or pulling that *clavis* down towards the adjacent *clavis* below, to use Boen's concepts here, encouraged by the fact that Boen privileges B♮ (*prestantior sit*) over B♭ in just this way.⁵⁷ Furthermore, all these new pitches create a tension between *corda* and *clavis*, since there are more *cordae* than *claves*. These new pitches can be explicitly represented only on a monochord or in diagrams

p. 479. I owe this reference to R. Woodley, *John Tucke: A Case Study in Early Tudor Music Theory* (Oxford, 1993), p. 119, n. 12, and thank Dr Woodley also for providing me with his unpublished 1998 conference paper, 'The Musical Proverbs of Leconfield Manor'. The Leconfield proverbs are closely related to the earlier *Parable between Information and Music* in the 'Treatise' of William Cornyshe likewise published by Flügel, in which *margyn* also appears to be synonymous with musical staff (Flügel, p. 470).

⁵⁶ Such a reading suggests a resolution to one difficult textual crux at line 19. The second word may be read with initial *s* or *f* and medial *e* or *t*, and with or without an *r* following the disputed medial consonant: thus *sustis*, *sustris*, *fustis*, *fustris*, etc. The locution *fustris tangensibus* could be read as 'touching the note stems (or staff lines)'. Leofranc Holford-Strevens has suggested to me that the reading *fustris*, from *frustum* (fragment), which has the advantage of perhaps referring to the reading *frustis*, from *fusum* (dark, dyed, blackened), which has the advantage of 'colour', I have adopted *fustis*, from *fusum* (dark, dyed, blackened), which has the advantage of a direct connection to the Latin tradition of Aristotelian colour theory (on which see below), and which has prompted me to the equally bold replacement of *tangensibus* by *tingentibus*.

⁵⁷ Boen, *Musica*, ed. Frobenius, p. 52.

like the *rota compositionis monochordi* and *tabula figurarum* of the Rome/St. Paul manuscript. A monochord effectively grants each pitch its own *corda*, while the *tabula figurarum* creates for every pitch its own new *clavis*. Although our author ignores the Guidonian hand and hexachord as a means of representing and navigating through tonal space, by retaining Guido's staff he must face the incompatibility of *corda* and *clavis*, which he does by emphasising inbetweenness as a way of imagining just where the new pitches are. The ballade's lyrics and music work together to characterise this fundamental problem and offer both practical and theoretical solutions to it.⁵⁸

It is clear that the first three stanzas are not a black and white text, and to begin to explore their grey areas – to enrich our understanding of the intellectual contexts possibly being evoked by our enigmatic riddle and thereby possibly to understand our ballade better – it will be helpful briefly to explore some of the multiple meanings that *color* bore for medieval readers in respect to the visual spectrum, musical chromaticism and rhetoric.⁵⁹

Colour referencing the visual spectrum

For a starting place in an exploration of the resonances of colour, there is of course its most concrete sense, as a visual perception. The standard medieval theory of the visual spectrum is that colours lie along a continuum between black and white, mixing the attributes

⁵⁸ By championing the monochord over the hand and hexachord, our author stakes out a position with important parallels to that of Ciconia in the *Musica Nova* (1410–11). Ciconia avoids the use of Guidonian solmisation syllables in his treatise and repeatedly critiques those hexachordists whom he calls *Guidoniste* (followers of Guido), as in the following passage (*Musica Nova*, ed. Ellsworth, pp. 302–5): 'If one wishes to know a song of music . . . one should then select one of two things: either the hand, like the Guidonists, or the monochord, which, like a good teacher, never misleads (Si quis cantum musicæ scire . . . Post hec unum e duobus eligat. Aut computum, ut Guidoniste, aut monochordum, qui nunquam fallit, ut bonus magister).' My thanks to Stefano Mengozzi, for directing my attention to Ciconia's position on these matters. See Mengozzi, 'The Ciconian Hexachord', in P. Vendrix (ed.), *Johannes Ciconia, musicien de la transition* (Turnhout, 2003), pp. 297–301.

⁵⁹ For uses of *color* in medieval music theory, see the entry in *Lexicon musicum Latinarum mediæ ævi: Wörterbuch der lateinischen Musikterminologie des Mittelalters bis zum Ausgang des 15. Jahrhunderts*, ed. M. Bernhard (Munich, 1992–) in fasc. 5 (2001), cols. 550–9. See also G. Reaney, 'Color', *Die Musik in Geschichte und Gegenwart*, ii (1952), 1566–78; E. H. Sanders and M. Lindley, 'Color', *New Grove II*, vi, p. 155, and G. Boone, 'Tonal Color in Dufay', in J. A. Owens and A. M. Cummings (eds.), *Music in Renaissance Cities and Courts: Studies in Honor of Lewis Lockwood* (Warren, Mich., 1997), pp. 57–99.

of blackness and whiteness in varying degrees. Red, for instance, lies half way between black and white, and blue lies between red and black; further subdivision of the red–black limb of the spectrum yields purple and green. Because of their intermediateness, visual shades are variously referred to as *colores medii*, *intermedii*, *medietates*, *mixti*, *secundarii*, *collaterales*, and so on. Thus the *mediis coloribus* (line 12) and *colore vario* (line 20) of our poem invoked a familiar meaning for the alert medieval reader.

For the Middle Ages, this doctrine had its roots in Aristotle. Its most explicit sources in the philosopher's writings are twofold: passages on contrariety and passages on sensible qualities. Concerning the first of these, Aristotle recognises contrariety as one of the four kinds of opposition. White and black, being contraries in the same genus – a genus in which there are intermediates derived from the extremes – are his single most frequently invoked example of this relationship. The white–black comparison surfaces frequently in almost all his major works, but the principal locus for the material is the *Categories*, one of the best-known Aristotelian works in the Latin Middle Ages. The main discussion is in chapter 10, concerning opposites that are contraries, which is found at 11^b32–12^a25. Here black and white are identified as opposite colours, between which are intermediates including dark and pale and all other colours ('fuscum et nitelinum et quicumque alii colores').⁶⁰

Concerning sensible qualities, the principal extended treatments are in *On the Soul* (*De anima*) and *Sense and Sensibilia* (*De sensu et sensibili*).⁶¹ According to Aristotle the sensibles corresponding to each sensory organ are five in number (colour, sound, odour, savour, touch), and these naturally invoke contrariety, because 'contraries are

⁶⁰ For the various medieval Latin versions of the *Categories*, see Aristotle, *Categoriae vel Praedicamenta*, ed. L. Minio-Paluello (Aristoteles Latinus, I, 1–5; Leiden, 1961) [AL]. For the passage with *fuscum* and *nitelinum*, see the mid-thirteenth-century Latin translation by William of Moerbeke (AL, 'Translatio Guillelmi', p. 109); the 'Translatio Boethii' has *venetum* and *pallidum* (AL, pp. 32–3), while the 'Editio Composita' has *fuscum* and *pallidum* (AL, pp. 70–1). There are other scattered references in the *Categories*. The white–black pair as an example of contrariety can perhaps be most easily traced through all of Aristotle's works via the general index of *The Complete Works of Aristotle: The Revised Oxford Translation*, ed. J. Barnes, 2 vols. (Bollingen Series, 71; Princeton, 1984). The theory of colour I am discussing is not developed in the pseudo-Aristotelian *De coloribus libellus* sometimes attributed to Theophrastus (available as *On Colours in Complete Works*, ed. Barnes, i, pp. 1219–28).

⁶¹ Both *De anima* and *De sensu* were 'available in Latin translation by the mid-twelfth century'; C. Page, 'Reading and Reminiscence: Tinctoris on the Beauty of Music', *Journal of the American Musicological Society*, 49 (1996), pp. 1–31, at p. 28.

extremes, and every object of sense-perception involves contrariety; e.g., in colour, white and black; in savour, sweet and bitter, and in all the other sensibles also the contraries are extremes'.⁶² It should further be noted that the species of sensible qualities are limited, for 'in all classes of things lying between extremes the intermediates must be limited'.⁶³ There are seven principal species of colour, thus white and black plus five intermediates – yellow, red, purple, green, blue – and 'from these all others are derived by mixture'.⁶⁴

Beyond direct knowledge of Aristotle in the later Middle Ages, transmission of Aristotelian colour theory by numerous other authors is easy to demonstrate. It is found in commentaries on the *Categories*, for example.⁶⁵ The doctrine is familiar to Isidore of Seville and later encyclopedists.⁶⁶ Another place to find late medieval colour theory is in treatises on heraldry, where some authorities attempted to reconcile the heraldic and Aristotelian tradition.⁶⁷ And Aristotelian concepts and terminology even have a role in some treatises on music.⁶⁸

⁶² Aristotle, *De sensu*, 445^b24–6 (*Complete Works*, ed. Barnes, i, p. 707); see also *De anima*, for example, at 429^b22–30. Odour shares with savour the extremes of bitter and sweet, and sound has the extremes of high and low (or sharp and flat); only touch lacks a single pair of opposed extremes (it has more than one, including hot and cold, dry and moist, hard and soft, etc.). See *De anima*, 421^a17, 421^a27 and 422^b10, along with *De sensu*, 443^a7.

⁶³ Aristotle, *De sensu*, 445^b23 (*Complete Works*, ed. Barnes, i, p. 707).

⁶⁴ Aristotle, *De sensu*, 442^a21–5 (*Complete Works*, ed. Barnes, i, p. 702). Barnes translates the intermediates as yellow, crimson, violet, leek-green and deep blue. See also G. R. T. Ross, *Aristotle, De sensu and De memoria: Text and Translation with Introduction and Commentary* (Cambridge, 1906), p. 69, where the intermediates are translated from the Greek simply as yellow, crimson, purple, green and blue. Just for the record, in *Meteorology*, 372^a1–10 and 375^a1–20 (*Complete Works*, ed. Barnes, i, pp. 600, 603–4), Aristotle describes the rainbow as having only three colours, in the order red, green and purple/violet, though he admits that yellow/orange is sometimes seen between red and green.

⁶⁵ Boethius, for one, particularly elaborates the doctrine of *medii colores* in his commentary on *Categories*, 10^a12. See Boethius, *In categorias Aristotelis* (Patrologia Latina, lxiv, pp. 159–93, at p. 253).

⁶⁶ Isidore, *Etymologiae*, ed. Lindsay, ii, bk. 19, no. 28, 7–8. Colour theory receives an extended treatment by the great English Franciscan Bartholomew Anglicus (fl. 1230–50) in *De proprietatibus rerum*, bk. 11, 'De accidentibus scilicet de coloribus et saporibus sive liquoribus et odoribus', in which ch. 5 is 'De colorum mediorum generatione'. See *On the Properties of Things: John Trevisa's Translation of Bartholomaeus Anglicus De Proprietatibus Rerum, a Critical Text*, 2 vols. (Oxford, 1975), ii, p. 1276.

⁶⁷ See, e.g., the *Tractatus de armis* (shortly after 1394) of Magister Johannes de Bado Aureo (Bishop John Trevor), an Englishman, in *Medieval Heraldry: Some Fourteenth-Century Heraldic Works*, ed. E. J. Jones (Cardiff, 1943), pp. 95–109, and the edition in *Magistri Johannis de Bado Aureo Tractatus de armis*, ed. Sir E. Bysshe (London, 1654), pp. 2–5.

⁶⁸ One clear statement of classic colour theory in a late medieval music treatise is Ugolino di Orvieto's *Declaratio musicae disciplinae* (c. 1430–5), glossing the *Libellus cantus mensurabilis* of Muris

Color referencing chroma

If our alert medieval reader of the ballade text were also a well-schooled musician, especially of the fourteenth century, with its Boethian revival, an additional familiar, even automatic, association of *color* would be to *chroma*. There is a traditional locus associating visual colour, semitones, beauty (softness, sweetness) and inbetweenness with the chromatic melodic genus and the chromatic tetrachord. This synaesthetic blending of sight and sound was inherited by the Middle Ages from Greek music theory.⁶⁹ A few details prove to be particularly relevant to the ballade's melodic language and also its invocation of intermediate colours.

The chromatic tetrachord consists of a perfect fourth (diatesseron) divided into three intervals: two adjacent semitones followed by an interval spanning three half steps (*trihemitonium*). According to Aristoxenus, the two independent semitones are equal (Boethius, Book V), while following Boethius (Book IV), they are a minor semitone and a major semitone. The Boethian division predominates in later medieval discussions. Though the largest interval measures a distance of three semitones, its internal structure is undefined; it is an unbroken span not understood as being compounded from smaller intervals in any specific order, and is thus described as incomposite. This is the one interval that is unique to the chromatic genus, and its status as the defining interval of the

on red and void notes. See Ugolini *Vibetani Declaratio Musicae Disciplinar*, ed. A. Seay, 3 vols. (Corpus Scriptorum de Musica 7; Rome, 1959–62), ii, p. 201. Among other musical-theoretical instances, see also Anon., *Summula tractatus metricus de musica*, ed. E. Vetter (Divitiae Musicae Artis, A/VIIIa; Buren, 1988), pp. 39–101, at p. 75.

⁶⁹ As an introduction to the topic, the non-expert reader can do no better than to turn first to the articles 'Chroai' and 'Greece I, 3*q*' in *The New Harvard Dictionary of Music*, ed. D. Randal (Cambridge, Mass., 1986), and 'Diatonik-Chromatik-Enharmonik' by P. Cahn in *Die Musik in Geschichte und Gegenwart*, 2nd edn (Kassel, 1994–), proceeding for more detail next to the excellent article by A. Barbera, 'Arithmetic and Geometric Divisions of the Tetrachord', *Journal of Music Theory*, 21 (1977), pp. 294–323, and turning finally to readily available English translations of major Greek theorists. For the latter, see especially *Greek Musical Writings*, ed. A. Barker, 2 vols. (Cambridge, 1984); Aristides Quintilianus, *On Music*, in *Three Books*, trans. T. J. Mathiesen (New Haven, 1983); and Anicius Manlius Severinus Boethius, *Fundamentals of Music*, trans. C. M. Bower and ed. C. V. Palisca (New Haven, 1989). Greek theory puts the largest interval on top when describing the genera. Medieval theory at times reverses interval order, so that in the chromatic we find the largest sometimes as the uppermost interval, sometimes as the lowermost. For an introduction to medieval treatments of the spelling of tetrachords (mainly diatonic) upwards or downwards, see Snyder, 'Theinred of Dover's Theory of Species', pp. 145–7.

chromatic genus was well understood by sufficiently sophisticated medieval and Renaissance theoreticians.⁷⁰

Invocation of the chromatic genus might seem a bit of a leap, since this expression is not in our poem, but its status as a clue to our puzzle cannot be denied. The ballade, in fact, makes prominent aural use of the single most characteristic interval of the chromatic tetrachord, the *trihemitonium*. In our ballade this interval appears three times, in very exposed positions, in musical readings that we might otherwise be inclined to doubt, even keeping in mind the principal of *difficilior lectio potior*. Most assertive is the first such instance, the striking acute-register ascent from *c* to *d*# at the opening of the cantus (bar 1), which is immediately imitated by the tenor at the octave beneath (bar 1). This rising interval is mirrored considerably later by the descending acute *e* to *d*b in the cantus in the *secunda pars* at the end of section III (bar 23). I will return to the spelling of these intervals in a moment.

The lore of the melodic genera is derived from ancient Greek theory, and the detailed information on them that one finds in classical Greek texts is not, for the most part, a significant element in medieval *Elementarlehre*.⁷¹ But for the curious, ample detail was readily available in Boethius, *De musica*, and from Aristides Quintilianus via Martianus Capella.⁷² It is the requisite introduction

to Bb in many later medieval treatises, in a few of which the subject is revisited in great detail, albeit sometimes with more of a sense of obligation than of enthusiasm. Indeed, it is a commonplace of most later medieval theorists that the diatonic is championed as the only melodic genus in use, a point found elaborated in the fourteenth century, with its renewed interest in Boethius. (It is an observation especially applicable to the melodies of plainchant.) The rehashing of Boethius in the *Quatuor principalia* is characteristic.⁷³ But where there is smoke there is fire, and the intensity of some reactions to the lore of the genera indicates that a contrary view championing the chromatic genus is being put forth elsewhere with significant force. Johannes de Muris, for instance, gives an elaborate outpouring in defence of the diatonic against more exotic possibilities in *Musica speculativa* (1323), an outpouring whose very prolixity carries the implication of special pleading.⁷⁴

The principal sticking point to the admission of the chromatic genus into practice, beyond its irrelevance to chant, was its inability to be notated in staff notation. And here the semitones are the responsible party, or to be more precise, the major semitone. The *trihemitonium* can be located in many places, and the minor semitone has several locations as well. But the major semitone is only found at two locations, acute *b-fa-#-mi* and superacute *bb-fa-#-mi*, and a prohibition against direct melodic chromaticism (singing Bb and Bb consecutively), usually expressed as a prohibition against mutation in this *clavis*, is standard. Jacques de Liège allows a window of opportunity, relaxing this stricture though admitting that the situation is not common. The chromatic genus is not *musica falsa* per se, but the two are related contextually at *b-fa-#-mi*. For Jacques, the chromatic tetrachord is the standard Boethian variety with minor and major semitones, and if it is to be written in the traditional gamut, it must be located at A, Bb, B, D (see Example 1a).⁷⁵

⁷⁰ It is perhaps unexpected for a modern reader, although logical, that the *semitonus*, rather than the two half-steps, is the uniquely defining feature of the chromatic genus; the modern equivalent is the unique role of the tritone in defining a major scale and key. On the integral or incomposite minor third as belonging to the chromatic genus, see, e.g., *The Lucidarium of Marbette of Podua: A Critical Edition, Translation, and Commentary*, ed. and trans. J. W. Herlinger (Chicago, 1985), at 9.1.23 (p. 320): 'Omnis semitonus in uno intervallo cromaticum genus est.' See also Jacques de Liège, *Speculum musicae*, bk. 5, cap. 10, line 7 (ed. Bragard, v, p. 33). The exclusive association of the minor third with the chromatic genus is at the crux of Vicentino's notorious sixteenth-century debate about the genera. See Nicola Vicentino, *Ancient Music Adapted to Modern Practice*, trans. M. R. Maniates and ed. C. V. Palisca (New Haven, 1996), at pp. xl-xlii.

⁷¹ K.-J. Sachs, 'Musikalische Elementarlehre im Mittelalter', in F. Zaminer (ed.), *Rezeption des Antiken Fachs im Mittelalter* (Geschichte der Musiktheorie, 3; Darmstadt, 1990), pp. 165-61, at p. 155.

⁷² The large compilation of Aristides Quintilianus, 'On Music' (c. 200 AD), was a principal source for the musical information in bk. 9 of Martianus Capella, *De nuptiis Philologiae et Mercurii* (c. 425 AD), which was widely read in the later Middle Ages. On Martianus and Aristides Quintilianus, see L. Gushee, 'Martianus Minneus Felix Capella', *New Grove II*, xv, p. 905, and on the medieval transmission of Martianus, see also M. Bernhard, 'Überlieferung und Fortleben der antiken lateinischen Musiktheorie im Mittelalter', in Zaminer (ed.), *Rezeption des Antiken Fachs im Mittelalter*, pp. 7-35, at pp. 20-2. The standard commentary on Martianus by Remy of Auxerre was another widely distributed source for this information; see L. Gushee and B. J. Tucker, 'Remigius [Remy] of Auxerre', *New Grove II*, xxi, p. 178.

⁷³ *Quatuor principalia*, ed. E. de Coussemaker, *Scriptorum de musica mediæ ævi nova series a Gerbertina altera* (hereafter CS), 4 vols. (Paris, 1864-76), iv, pp. 200-98, at Princ. 2, iv, p. 214. See also Princ. 3 at CS, iv, p. 350.

⁷⁴ For the prolix passage to which I refer, see C. Falkenroth, *Die Musica speculativa des Johannes de Muris* (Beihette zur Archiv für Musikwissenschaft, 34; Stuttgart, 1992), Version A, pp. 262-6, and for a translation, see T. J. McGee, *The Sound of Medieval Music: Ornamentation and Vocal Style according to the Treatises* (Oxford, 1998), pp. 84-5.

⁷⁵ For Jacques on the chromatic genus and mutation on *b-fa-#-mi*, see the *Speculum musicae*, ed. Bragard, bk. 2, ch. 34, line 13, and App. XVIIIb (ii, pp. 85-6), and see also bk. 2, ch. 38, line 24 (*ibid.*, p. 93) and bk. 5, ch. 10, line 9 (*ibid.*, v, p. 33).

Example 1 Boethian chromatic tetrachords ($m+M+X$) at *b-fa-#-mi* with $X=M+2m$: (a) Jacques de Liège; (b) Johannes Boen

Example 2 Some Boethian chromatic tetrachords at other locations

Just a few decades later in the century, Johannes Boen is more optimistic, insisting that 'cantus chromaticus inter claves nostras leviter figuratur'.⁷⁶ (His example shows a descending tetrachord: C, B, B $\flat$, G; see Example 1b.) Of course, writing a chromatic tetrachord at any other location for the major semitone than *b-fa-#-mi* requires more, and more exotic, inflections, for instance, D, F, F $\sharp$, G and E, F, F $\sharp$, A (see Example 2). Boen is an enthusiast of new tonal possibilities such as these, arguing that modern musicians, like dwarves who can see farther by standing on the shoulders of giants, can now extend chromatic alterations from *b-fa-#-mi* to other locations in the gamut, making possible the invention of a new kind of melody that is neither diatonic, nor chromatic, nor enharmonic, but indeed 'commatic'.⁷⁷ What Boen

⁷⁶ Boen, *Musica*, ed. Frobenius, p. 54.

⁷⁷ 'Moderni maiori ductu lascivia, quasi nani super humeros gygantium plus longe respicientes quam veteres, tamquam cotidiana positione clavium fastiditi, ad subtiliores positiones dictas litteras befa $\sharp$ mi etiam in aliis clavibus statuendo, se rationabiliter profundarunt. . . . Sic ergo novum genus modulaminis, quod nec dyatonicum nec chromaticum nec enarmonicum ynamo commaticum dicitur, posset inveniri'; *Johannes Boen Ars (musicae)*, ed. F. A. Gallo (Corpus

Example 3 Non-Boethian chromatic tetrachords implicit in *Ut pateat* ($m+m+X$) with $X=2M+m$

calls the *genus commaticum* might be music in which commas are sung directly, since he does in fact show commas can be notated. It might also include the writing of melodic intervals with excessive commas or deficiencies in commas, which he also shows. (Singing the musical lines of the *tabula figurarum* of Nicolaus de Luduno would most definitely involve the *genus commaticum*.)

In our ballade, the notated *trihemitonion* are spelled as what we would now call augmented seconds (C to D $\sharp$, D $\flat$ to E), or major semitones ($M+m+M$) in the jargon of the English interval lore explored above. Assuming that they form either the top or bottom interval in some tetrachord, we can demonstrate that each implicitly defines chromatic tetrachords of non-Boethian tonal content, namely *lyma*, *lyma*, *trihemitonium*: A $\sharp$, B, C, D $\sharp$ or C, D $\sharp$, E, F incorporating the first semitone, and B, C, D $\flat$, E or D $\flat$, E, F, G $\flat$ incorporating the second (see Example 3). The striking interval succession of two consecutive minor semitones that these show is a melodic construction which Boen, for instance, enthusiastically champions, though he does not use it to construct or describe tetrachords. Given the two equal smaller semitones, these tetrachords are closer to the Aristoxenian forms described in Boethius, Book 5 than to the Boethian division of Book 4. They have the virtue of avoiding the embarrassment of direct chromaticism, which, indeed, is noticeably absent from the ballade.

These non-Boethian tetrachords prompt the following generalizations. A dyatesseron contains two tones and a minor semitone, or in other words, two major semitones and three minor semitones. Representing the minor semitone as m , the major semitone as M , and the trihemitonion or semiditone as X , the Boethian chromatic tetrachord can be specified as $m+M+X$, where X consists of

Scriptorum de Musica, 19; [Rome], 1972), pp. 35-6. For another vivid reference to innovations that the young like more than older musicians, including the *genus commaticum*, see also Boen's *Musica*, ed. Frobenius, pp. 77-8.

Example 4 Non-Boethian chromatic tetrachords: (a) reversing *m* and *M* at *b-fa-#-mi* ($M+m+X$); (b) ($M+M+X$) with $X=3m$

$M+2m$ (in some order). In Greek theory X is incomposite so we need not worry about its internal composition, but when projected onto the staff system, the structure of X will vary depending on its placement and how we imagine the whole tone to be divided. Reversing the order of the two independent semitones creates non-Boethian $M+m+X$ tetrachords. These are created, for example, when the clavis *b-fa-#-mi* is at one boundary, as in the tetrachords $B\flat$, B , C , $E\flat$ and $F\sharp$, A , $B\flat$, B (see Example 4a). Further, our ballade's implied tetrachords are $m+m+X$, where X larger than the Boethian *semitonus* by a comma, is some permutation of $2M+m$. And finally, we can posit a tetrachord with two equal and consecutive major semitones, $M+M+X$, in which X consisting of $3m$, is smaller than the Boethian *semitonus* by a comma and yet is spelled as a variety of fourth (doubly diminished). This tetrachord could be written as $A\flat$, A , $A\sharp$, $D\flat$, or $G\flat$, G , $G\sharp$, $C\flat$, for instance (see Example 4b). Thus in non-Boethian chromatic tetrachords we find some of the unusual intervals and interval successions ($2m$, $2M$, $3m$) that are of interest to Jacques de Liège and Johannes Boen, and that take us as well into the realm of our ballade's composer.

The chromatic genus also has a relationship to the visual, and to intermediate colours. A good place to centre this discussion is again the *De musica* of Boethius. In Book 1, Boethius explains that the chromatic genus is a departure or mutation of the diatonic, and that the name chroma is appropriate because 'this word *chroma*, as has been said, is derived from surfaces which are transformed into

another colour when they are turned'.⁷⁸ Thus the chromatic is like all the intermediate shades of light and colour that play across a surface as the light which is directed upon it changes orientation. The steady repetition, paraphrase and summary of this explanation can be followed for centuries. To give but a single, particularly charming instance, Engelbert of Admont (d. 1331) writes in his *De musica* (before 1320/25): 'The chromatic genus is said to be a flexible and diversely coloured mixture or medium ... whose melodies are more beautiful and delightful ... *chromaticum* derives from *chromate*, that is to say a bright object which, when appearing before a light, has a variegated appearance of diverse colours, like a peacock's tail and certain silken cloths'.⁷⁹

In Book 5, cap. 16, Boethius, now paraphrasing Aristoxenus, offers a slightly different and more complicated account of the relationship of the genera, an account that in some form is also transmitted by many other Greek theorists. It also yields an analogy of inbetweenness. According to Aristoxenus, 'the division of genera is twofold, one being softer, the other sharper; the enharmonic genus represents the softer, while the diatonic represents the sharper. The chromatic occupies a place between these, participating in sharpness and softness'.⁸⁰ Further, Aristides Quintilianus explicitly relates the intermediateness of the chromatic genus to the theory of visual colour: 'the genus intensified through semitones [is called] color, for just as what is between white and black is called color, so also the genus considered between both of the others is named color'.⁸¹ For the Latin Middle Ages, this passage would have been familiar from its transmission by Martianus Capella and his glosses.⁸² Ugolino of Orvieto, in his *Declaratio musicae disciplinae* (1430–5), provides an account of this doctrine that shows its

⁷⁸ Boethius, *Fundamentals of Music*, trans. Bower, p. 40.

⁷⁹ 'Chromaticum vero, id est, flexibile vel diversicolor dicitur medium sive mixtura. ... Est enim chromaticum genus melodiae pulchrius & delectabilius ... unde vocatum est chromaticum a chromate, quod est corpus lucidum secundum varium aspectum ad oppositionem lucis apparet diversorum colorum, sicut sunt pennae pavonis et quidam panni serici.' GS, ii, pp. 340–1.

⁸⁰ Boethius, *Fundamentals of Music*, trans. Bower, p. 173.

⁸¹ *Greek Musical Writings*, ed. Barker, ii, pp. 417–18; Aristides Quintilianus, *On Music*, trans. Mathiesen, pp. 83–4.

⁸² Martianus Capella, *De nuptiis Philologiae et Mercurii*, ed. A. Dick (Leipzig, 1925), bk. 9, pp. 469–335, at p. 510; Rémy of Auxerre, *Musica*, GS, i, pp. 63–94, at p. 73. See also n. 72 above.

familiarity down to the fifteenth century and links chromaticism directly to intermediate colours.⁸³

The word *color*, curiously enough, is rarely found in theoretical passages on music outside discussions of the melodic genera and tetrachords (except for scattered rhetorical uses, on which see below). But there are instances, and, not surprisingly, they also involve chromatic alteration. For example, in his *Compendium de musica*, Jacques de Liège says 'sub vario colore signamus' in describing passages written with or without B $\flat$.⁸⁴ Marchettus speaks of 'feigned colour' when he shows the whole tone chromatically divided in a melodic descent (D, C $\sharp$, C; G, F $\sharp$, F): 'Hec enim bipartitio toni debet fieri cum colore ficticio.'⁸⁵ And in what is apparently a reference to a disjunct hexachordal mutation (*dismutatio*) between the soft hexachord (with B $\flat$) and the hard hexachord (with B $\natural$), an anonymous fifteenth-century author wrote 'dismutatio est mutacio a uno modo ad modum alterum vel a colore ad alium colorem'.⁸⁶

Color referencing rhetoric

Beyond the visual spectrum and musical chromaticism, an additional familiar medieval meaning of *color* has to do with rhetoric, in the sense of *colores rhetorici*. This expression refers to figures of speech, that is, literary devices that embellish and beautify ordinary language. A canon list of sixty-four in the pseudo-Ciceronian *Rhetorica ad Herennium* formed the basis for extensive medieval repetition and amplification.⁸⁷ Modification – purposeful change – especially for the sake of beauty and variety, provides comparability of two different states of the subject (coloured and uncoloured). It is in this sense that Johannes Boen defines colour in his *Ars musicae*: 'Est ergo color ... aliquarum figurarum in aliqua similitudine com-

⁸³ Ugolino, *Declaratio*, ed. Seay, iii, p. 208.

⁸⁴ Jacques de Liège, *Compendium de Musica*, ed. J. Smits van Waesberghe (Divitiae Musicae Aet. A/IXa; Buren, 1988), pp. 88–122, at p. 105.

⁸⁵ Marchettus, *Lucidarium*, ed. Herlinger, p. 154; see also p. 220.

⁸⁶ Oxford, Bodleian Library, MS Bodley 842, fol. 77^r.

⁸⁷ For a standard treatment, see J. J. Murphy, *Rhetoric in the Middle Ages: A History of Rhetorical Theory from Saint Augustine to the Renaissance* (Berkeley, 1974), esp. at pp. 20–1, 184–93, and the Appendix, pp. 365–74, 'Figures of Diction and of Thought from *Rhetorica ad Herennium*, Book IV'.

parabilitas'.⁸⁸ Most generally, colour may mean *qualitas*, and the verb may mean to give a special meaning or aspect to, or to modify or put a particular spin on.⁸⁹ But by far the most frequent synonym for colour is *pulchritudo*, and for the verb *colorare* we find *decorare*, *variare*, *purpurare*.⁹⁰ Without expressly using the Latin *pulcher* in any form (perhaps deliberately avoiding it?), the beauty that is the purpose of the *colores rhetorici* can be imputed to our ballade text by the connotations of *decens* and *distincio* in the expressions 'cordis decentibus' (line 5) and 'ut sit distincio' (line 13).

Under this governing rhetorical concept one can distinguish two principal usages in medieval music theory that emerge in the later thirteenth and early fourteenth centuries. First, colour may refer to a change made to an individual note, which may be modified by the addition of a sharp or flat chromatic inflection (as seen above) for the sake of beauty, or be directly changed in visual colour from black to red for mensural purposes (a use to which we will return to below). Second, colour may refer to musical elaboration by the generation, repetition and variation of musical figures (sometimes structurally, other times as elaborations or embellishments) in one or more voices.

Concerning the second of these usages, a number of distinguishable applications stand out. First is change to an individual note encompassing rhythmic elaboration or the substitution of a more elaborate melodic figure. Colour may instead refer to larger-scale melodic repetitions that occur in one and the same voice (in a monophonic or polyphonic context), or in different voices of a polyphonic work (as in polyphonic rondellus, imitation and voice exchange). Finally, colour as repetition may apply to the description

⁸⁸ Boen, *Musica*, ed. Frobenius, p. 29.

⁸⁹ See Jacques de Liège, *Speculum musicae*, ed. Bragard, bk. 7, vii, pp. 21 and 23. In *Speculum musicae*, bk. 6 (vi, p. 247) Jacques observes that when one defines a given final in plain-song, then the other notes are seen and 'colored' by their relationship to that final: 'per finalem colorantur et decolorantur ceterae voces'. The same point was made in an anonymous commentary on Guido's *Micrologus*, with 'colorantur id est decorantur' for 'colorantur et decolorantur' (*Expositiones in Micrologum Guidonis Arvini*, ed. J. Smits van Waesberghe (Amsterdam, 1957), p. 133).

⁹⁰ For *color* as *pulchritudo*, see, e.g., Johannes de Garlandia, *De mensurabili musica*, ed. E. Reimer, 2 vols. (Wiesbaden, 1972), i, pp. 74, 95. For *colorare* as *decorare*, see previous note; Jacques de Liège also equates *colorari* with *decorari* in *Speculum musicae*, ed. Bragard, bk. 6, vi, p. 98. For *variare* and *purpurare*, see *De musica mensurata: The Anonymous of St. Emmeram*, ed. J. Yudkin (Bloomington, Ind., 1990), p. 170, line 37 ('propter colores musicae decentius purpurandos ac etiam variandos') and p. 206, line 34 ('propter colorem musicae purpurandae et variandae').

Example 5 Cantus line: extension by varied repetition

of isorhythmic tenors of fourteenth-century *ars nova* motets, differentiating between melodic and rhythmic figures as *color* and *talea*.

Returning to the musical fabric of the ballade, we thus can understand it not only as coloured by chromatic inflection, but also as coloured by repetition and varied repetition. Most broadly, this rhetorical meaning is referenced by the choice of song type – ballade – with its conventional threefold (here sixfold) performance and the double verse (I.1, I.2) constituting the *prima pars*. One of the other fixed forms, or even an isorhythmic motet, would have fulfilled this meaning equally well. In a carefully constructed *ars nova* polyphonic song, however, a web of interrelated rhythmic-melodic motifs dominates the musical surface, contributing to a sense of both continuity and coherence. Thus the ballade also can be understood as an apt vehicle for more local repetitions, a potentiality thoroughly exploited by the composer of this one.

Polyphonic imitation is a distinguishing feature of bar 1, whose opening cantus motif and its echo down an octave layer colour (rhetorical) upon colour (chromatic). Perhaps one is also intended to hear the returning-note figures of bar 4 in the tenor and bar 5 in the cantus, in the same metrical positions and just a step apart in the same register, as imitation. More subtly, bar 3 in the cantus transposes and varies the second bar of the opening phrase, after which bars 1–2 are transposed and varied as bars 4–5 (Example 5). The recurrence here of the cadential figure (Example 6a), with its trochaic lilt and repetitive anticipation, is memorable, but even

Example 6 Cantus line: (a) cadential figure; (b) TTmT descending pentachord and varied conclusions in section I

Example 7 TmTT descending pentachord in section II

more significant for the passage is the unfolding of the motif of a rising half-step followed by a descending TTmT fifth (where T is tone, i.e., $m+M$), which is presented three times, moving flatwards by cycle of fifths from *e* to *aa* to *d* (Example 6b). In my reading of I.1 and I.2, the third of these offers an exact transposition of this figure only in its second statement. The conclusion of the figure is different each time, progressively cadencing on the bottom pitch, then a step above, then two steps above.

The ballade's *secunda pars* begins with section II. Here we find a varied restatement of I.1/I.2 that has been rhythmically compressed on account of the change of mensuration and continues the flatward swing in tonal content, presenting most of the tonal content of section I down a half step (Example 7). The descending fifth figure is projected in three fresh variations (on $E\flat$, $A\flat$, $D\flat$), whose tonal content has been recoloured from TTmT to TmTT. The first variation of bars 13–15 ($E\flat$, $D\flat$, C , $B\flat$, $A\flat$) lacks its opening $E\flat$, because $D\flat$ is desired as the initial sonority for other reasons (tenor motifs and falling-third accidentals, I would presume). The third variation of bars 16–18 ($D\flat$, $C\flat$, $B\flat$, $A\flat$, $G\flat$) is also truncated and raises its anchoring $G\flat$ so as exactly to repeat the cadential lower half-step returning-note motif. In the tenor (Example 8), the motif of section I, bars 2–3 ($C D E D$), which is taken up a step in bars 5–6

Example 8 Varied tenor figure: (a) section I; (b) section II

Example 9 Cantus line: 'coloured' cadential figures: (a) section I.1; (b) section I.2; (c) section II

(*D E F E*) and varied in bars 11–12 (*D E $\flat$ F E $\flat$*), is varied again in section II (*D $\flat$, E $\flat$, F, E $\flat$*).⁹¹

The ability variously to modify a motif by the use of chromatic inflections, shifting its tonal content and location in pitch space while it remains tied to the same *claves* in the staff, is most dramatically epitomised by the cadential figures of section I.1 (bars 5–6), section I.2 (bars 11–12) and section II (bars 17–18), which include the now notorious acute *c* $\flat$ (Example 9). All these figures are intermediary between the version in which every note is sharpened and the version in which every note is flattened. Each reflects its own individual colour, participating to one or another degree in the extremes of flatness and sharpness. The parallelism to the Aristoxenian dogma of Boethius, *De musica*, Book 5, could not be plainer.

The remainder of the *secunda pars*, with its mensural shift to duply divided semibreves, lacks strong motivic ties to sections I.1, I.2 and II. Nonetheless, tonal links are carefully forged. The first two bars of section III revolve around the same acute *b* $\flat$ that ended section II, but with natural *d*, *a* and *c* (Example 10a). The tenor operates throughout section III within the *F* to *C* fourth whose boundary tones are a half-step lower than the mTT *G* $\flat$ to *D* $\flat$ of section II, returning to the grave *C* that is the lowest pitch of section I. The *F* to *C* fourth is first filled TmT (*F E $\flat$ D C*) and then TTm (*F E $\flat$ D*;

⁹¹ The tenor of II moves entirely within a descending mTT fourth (*G* $\flat$ to *D* $\flat$), which is mirrored up a fifth (*d* $\sharp$ to *a* $\sharp$) by the cantus in bars 13–15.

Example 10 Colouring across sectional boundaries: (a) cantus line, end of section II and beginning of section III; (b) tenor line, section II and section III

Example 11 Transposition and variation in section IV: (a) first half of section IV; (b) second half of section IV

C). The shift in location of the semitone – mTT, TmT, TTm – is surely not coincidental (Example 10b).

By the end of section III, the initial *b* $\flat$ –*E* $\flat$ sonority has risen a whole tone to *c*–*F*. Sections III and IV are linked by *F* sonorities and parallel melodic figures: cantus *g f e d* $\flat$ *c* in bars 23–4 is followed by *g f e d c* in bars 25–7 (Example 11a). The gradual sharpening evident in sections III and IV is seen in microcosm within section IV alone, whose second half (bars 29–33) is a varied transposition and sharpward rotation of the first half (bars 25–8), moving from an *F*

environment to a *C* environment in the tenor, with corresponding motivic TmTT fifths in the cantus running first from *g* to *c* and then from *d* to *G* (Example 11b). Full tonal closure on the cantus-tenor octave *c*-*C*, matching the initial sonority of the ballade, is achieved only at the final cadence.

IV. THE TEXT: STANZAS 4 TO 6 AND MENSURAL BEHAVIOUR

Returning once more to the poem, we may now examine the relationship of its fourth to sixth stanzas to the song's mensural behaviour. This requires us first to parse the ballade's phrases into regular mensural units, which is straightforward and yields the following results. Segments I.1 and I.2 last six breves each in *tempus perfectum prolatio maior* for a total length in the *prima pars* of $2 \times 54 = 108$ minims. This total is highly significant numerologically, as it is the product of the second power of 2 and the third power of 3 ($2^2 \times 3^3$). The three segments of the *secunda pars* are articulated by mensuration changes in such a way that the length of section II is six breves in *tempus imperfectum prolatio maior* (36 minims), section III contains six breves in *tempus perfectum prolatio minor* (36 minims), and section IV contains nine breves in *tempus imperfectum prolatio minor* (36 minims), for the same total length in the *secunda pars* as in the *prima pars*, that is, $3 \times 36 = 108$ minims. The mensural features just described are discussed, albeit very obliquely, in the second half of the text.

Stanza 4 refers to the ballade's progression through four different means of mensural organisation under minim equivalence without the use of mensuration signs to signal each in turn, and indeed, the expression *tetras formas* (line 25) surely refers to 'les iiij. prolacions' of Philippe de Vitry.⁹² Here we must remember that the most profound novelty of the Parisian *ars nova* notational advances of

⁹² The use of the Greek *tetras* in this expression is extremely unusual. There is no problem with the sense of it here, but in medieval music theory the word does not otherwise appear outside of compounds (e.g., tetrachord), counting (*monas, dyas, trias, tetras*) and in the frequently encountered definition of the term diatessaron. For *monas, dyas, trias, tetras*, see Remy of Auxerre, *Musica*, GS, I, pp. 63-94, at p. 82. The omnipresent definition of diatessaron explains that 'dicitur diatessaron a dia quod est de et tetra quod est quatuor'. The possibility exists that the author intends a pun on *tetra* (offensive, horrible), a negative association that would prompt a variant translation reading *compelleret* as 'compelled, forced', so that the sense of the stanza is that the forms are being forced on the notes. I reject this possibility, as it seems to reverse the whole point of the stanza and of the mensural demonstration generally.

Johannes de Muris and Philippe de Vitry over the first quarter of the fourteenth century had been a reconceptualisation of the metrical hierarchy, moving from the position that rhythmical values were multiples or fractions of a central value, the breve, to a new posture in which all values were multiples of a fixed smallest unit, the minim. If all minims are equivalent, then on the most local level all rhythmic activity is just a flow of successive minims and groups of minims onto which larger-scale mensural organisation can be imposed by features of rhythm, melody, counterpoint and harmony. The ballade clearly demonstrates this capacity. It remains to be asked whether the demonstration is introductory in original purpose, advertising a new approach to a conservative English audience, or whether it may be defensive in intent, supporting the status quo against further innovative pressures.⁹³ I will defer an answer to this question for a moment.

Stanzas 5 and 6 reaffirm that their author follows a classically Parisian *ars nova* posture through their insistence on the minim as smallest value, the counting unit of the mensural system. Just as in an arithmetic of whole numbers there is no place for fractional values, there is in stanza 5 the scornful refusal to countenance semiminims. Rather, one builds rhythmically and mensurally in multiples of a unit value (the *prima nota*, line 37), in a process that is both musical and mathematical. The language of calculation (*ratas dando*, line 39) is evoked in these stanzas just as it had been in the first three, reminding us that the discrete values of *musica mensurala* provide a field of numbers within which to play, expanding the way in which music can express number. In particular, on the evidence of the ballade, our composer believes that the notational system's capacity for representing proportions should be expressed in section

⁹³ Looking at the manuscript context, the ballade keeps company with fairly mainstream material. In the St. Paul fascicle the *Turris quoniam totum comprehendit rerum originem creaturarum* immediately preceding the *tabula monacordi* presents a standard gradus system of Muris with five figures, four levels and values from 1 to 81 minims. Other northern French *ars nova* theory in the larger manuscript includes a version of the *Arts nova* attributed to Philippe de Vitry, the *Notitia artis musicae*, *Compendium musicae practicae* and *Libellus cantus mensurabilis* of Muris, and the Muris-derived *Regulae de mensurabili musica* of Imbertus de Francia. In Bodley 842 there are notational treatises by Franco and Willemus (Willemus is mildly progressive in respect to note values), and a fragment from the *Notitia artis musicae* of Muris. Ironically, just three pages further on there is a brief tractatus beginning *Quatuor sunt signa per quae facile cognosci potest omnis cantus* describing the classic four *ars nova* mensuration signs.

lengths computed in minim counts, rather than in any other possibilities.⁹⁴

The lack of signs to announce the changes in mensural organisation seems to be the point of the expression 'temporibus ficticiis absentibus' (lines 25–6). The most difficult word here is *ficticiis*. One way to take it is as 'imagined' (visualised, formed mentally), in the sense that because signs are not used, they must be imposed by the mind ('absent but imagined'). That is reasonable. Also tempting, however, is a more negative connotation, namely that mensuration signs are somehow bogus (fictitious, feigned) and as a consequence they can successfully be done without. The latter is a plausible position for an adherent of minim equivalence to take, and the 'notarum equivocorum' of lines 22–3 are undoubtedly minims. Under minim equivalence, one should not need mensuration signs once the absolute novelty of mensurations has worn off, as long as care is taken to recognise duple and triple organisation (because of the workings of alteration and imperfection in triple metre).

Arguing along lines suggested by the behaviour of accidentals in this ballade (or in Boen's *Musica*), signs ought properly to possess potency; they ought to be agents of change, modifying their environment. If mensuration signs are passive markers, they merely mark a spot, pointing to phenomena that would exist even if signs for them did not. Thus they are inessential, feigning a power they do not possess, and need not be used.

I suspect it is far from coincidental that both stanzas 1–3 and 4–6 involve 'fictising'. The expression *musica ficta*, however much implicit in the ballade's tonal behaviour and first three stanzas, is only shyly referenced now. It would not have suited the first three stanzas because *musica ficta* is hexachordal terminology, and hexachordal behaviours and concepts are not pertinent to this ballade's tonal behaviour. The invocation of *ingere/ficta* at this point in the text is surely self-conscious, an ironic displacement. And it reinforces our historical understanding that it is only in the fourteenth century that the terminology *musica ficta* emerges for the first time as an

alternative to *musica falsa*, though rarely employed and, as here, only in English and northern French sources.⁹⁵

Other technical jargon in stanzas 4 to 6 deserves brief mention. I have read *tempus* as 'time-measures' (in the sense of mensuration signs) in the crucial expression 'temporibus ficticiis absentibus', but I admit that this reads back into the text what I see in the music rather than attempting to take the Latin at face value. In the context of *ars nova* theory, *tempus* most often refers to the mensural relationship of breve to semibreve. Similarly, *prolatio* (line 41) most often refers to the binary or ternary mensural relationship of semibreve to minim. However, in stanza 6 I have interpreted *prolatio* in its most familiar non-technical sense as 'utterance', thus understanding the passage to mean that when all the minims and multiples of minims have been laid out properly, making good music (*eliganter*) and correctly fulfilling all mensural obligations, then a coherent, performable piece arises. Alternatively, this could be an assertion that in the end, there really is only one prolation; the work can be realised by counting the steady succession of minims without concern for whether they group into twos or threes. Another technical term from *ars nova* theory, *gradus* (line 40) may refer to the four mensurations or may evoke the *gradus* system of Muris, a mensural hierarchy based on multiples of the minim.

Returning to the matter of the meaning of the refrain line, what might our mensural sieve be? Perhaps the notational minims are as the uniform grains of wheat held in a sieve. Or we could imagine the four mensurations as four different sets of chain lines pressed into the neutral medium of successive minim durations. Thinking diagrammatically along the lines of the *cribrum monochordi*, one could produce a grid by the juxtaposition of four different groupings of $(2^2) \times (3^2) = 36$ minims, aligning 9×4 , $6 \times (3 \times 2)$, $6 \times (2 \times 3)$, and 4×9 . Alternatively, it may simply be that we have a none too burdensome demonstration that there can be more to the notation than immediately meets the eye.

⁹⁴ Other possibilities for the expression of numerical proportion not explored in this ballade could include using four minims in the place of three on the minim level, the equality of binary and ternary semibreves, or the equality of binary and ternary breves.

⁹⁵ For the fourteenth-century instances of the use of the term *musica ficta*, see Anon., *Circa modum discandi* (London, British Library, Add. 21435, fols. 9^v–11, at 10^v); A. de la Fage, *Essais de diphéographie musicale* (Paris, 1864), p. 243 (La Fage, Anon. III, based on Rome, Biblioteca Vallicelliana, B.83); *Philippi de Vitriaco Liber musicalium*, CS, iii, pp. 35–46, at p. 45; Anon., *Arts contrapunctus secundum Philippum de Vitriaco*, *ibid.*, pp. 23–7, at p. 26; and *The Berkeley Manuscript*, ed. Ellsworth, p. 51.

Absent from stanzas 4 to 6 is any mention of colour. Yet the ballade's behaviour requires consideration of one additional role for colour, and this is colour in respect to proportion and mensuration. A well-known innovation of early French *ars nova* notation is the use of red coloration to indicate a change of note values and mensural organisation, usually from ternary (perfect) to binary (imperfect) on one or more levels of the mensural hierarchy. In the late fourteenth and early fifteenth centuries, the use of solid or void note heads in black, red and blue permitted coloration to express very complicated proportional and mensural relationships overriding minim equivalence. Our ballade, of course, uses exclusively black notation. Nonetheless, its mensural behaviour might have been conceived and described in terms of colour. Justification for this assertion comes first from an anonymous English treatise *De origine et effectu musicae* (early fifteenth century) in a brief paragraph, 'De coloribus musicae', which states: 'Tres sunt colores musicae pro arte practica, scilicet perfecta, imperfecta, semiperfecta.'⁹⁶ Without saying if actual visual hues are intended, this compactly defines a system of contraries with an intermediate as it asserts a relationship of colour to mensuration. I take it that *perfecta* refers to ternary organisation and *imperfecta* to binary, which is standard terminology in late medieval mensural theory. Thus, for instance, in respect to breves there could be a *brevis perfecta* of nine minims, a *brevis semiperfecta* of six minims and a *brevis imperfecta* of four minims. This is exactly the sequence of proportional durations of the breve in our ballade. Shall we call them colours? Might they implicitly invoke black, red and white?

Amplification of a doctrine of proportions and mensurations as colours is found in some obscure later English music theory concerning the six major heraldic colours. The first glimpse of this material is c. 1430 in Lansdowne 763, fols. 88^v-89, in a cryptic paragraph about the distinction between musical and armorial colours ('Distincio inter colores musicales et armorum heroum'), in which we learn that there are six natural colours and this is how they are sung in songs when present ('Sex sunt colores naturales . . . et sic vocantur in canticis quando stant'). The given colour sequence (black, white, red, blue, green, yellow) is identified as proceeding

from best to worst in heraldry and from worst to best in music. A different colour sequence is also identified in the same text (black, green, blue, red, white, yellow) and similarly described. But no further explanation of these alternative colour sequences, and no direct musical application of the information, is in fact offered. Nonetheless, the Lansdowne material surely adumbrates several paragraphs in the much later musical commonplace book of John Tucke (London, British Library, Add. MS 10336, first quarter of the sixteenth century).

In Tucke's book, two doctrines of colour and proportion are found. First, we learn that 'The colours requisite to musical proportions are these: black, green, blue, red, yellow.' This series is most similar to the second colour sequence in Lansdowne. An analysis of the specific proportions that are prescribed for each colour pair (e.g., green to black is 9:8, and so on) demonstrates that Tucke's sequence is virtually a musical scale of colours.⁹⁷ Several paragraphs later he announces a different sequence for the heraldic colours (white, black, yellow, blue, red, green) and implies that these are in a gradient from more noble to less noble in a manner reminiscent of the Lansdowne doctrines. He goes on to explain that the quality and quantity of colours, when applied to note shapes, are said to dictate their relative values and proportional relationships.⁹⁸ Without resolving the conflicts in colour order or addressing the practicality of what he seems to be describing, we can safely say that Tucke's broader context makes the clear association of colour to proportion, and of proportions and colours to mensuration.

The notational sophistication implied by Lansdowne and Tucke is found in sources of English polyphony from the Old Hall Manuscript (London, British Library, Add. MS 57950, c. 1420) down to the early sixteenth century. Their use of semiminims, and of proportional relationships abandoning minim equivalence, would

⁹⁶ Gilbert Reaney, 'The Anonymous Treatise *De origine et effectu musicae*, an Early 15th Century Commonplace Book of Music Theory', *Musica Disciplina*, 37 (1983), pp. 109-19, at p. 115.

⁹⁷ The sequence and the stated proportions between colour pairs predicate a colour scale equivalent to the following diatonic musical scale: C (black), D (green), F (blue), G (red), B $\flat$ (yellow) and C an octave higher (if black void may be understood as white). The analogy to the scale is my own, from information in Woodley, *Tucke*, pp. 68-71; the quotation is from p. 69.

⁹⁸ 'Diaphonics' is a remarkable device, and it occurs when a piece of music is composed through the use of heraldic colours; for this, it should be known that there are six heraldic colours, the names of which are these: the first and principal colour is argent; the second sable; the third or; the fourth azure; the fifth gules; the sixth vert. And it is necessary to bear in mind the nobility of the colours, because a more noble colour is higher in numerical value than a less noble one.' Woodley, *Tucke*, p. 71.

have been abhorrent to the composer of our ballade. (He is as conservative in mensuration as he is progressive in tonal behaviour.) And yet, in an early formulation, an evocation of the relation of colour to proportion and mensuration that would later take such a complex turn might credibly be understood as within the intention of our author. If so, the term *color* is explicit in the first three stanzas and implicit in the second three just as, reversing the order, *ficta* is implicit in the first three and explicit in the second three.

Let us return to the deferred question of fourteenth-century chronology and mensural practice. In *Ut pateat evidenter*, the note of contention, of demonstration of the logic and capacity of a system, and of a delight in hiding and revealing meaning, all speak to the currency in the mind of its author of the issues addressed above. This posture suggests we have arrived at a moment when mensuration signs are beginning to be found necessary (which makes a comfortable fit with a date after mid-century for our ballade) because of experimentation with large-scale sectional changes of mensuration, proportional changes in one voice against all others, or proportional relationships other than minim equivalency between sections. (The latter two are possibilities inherent in fourteenth-century English and Italian notational systems that developed within French *ars nova* practices only over the last third of the century.) And, of course, it would appear to be a moment when semiminims are emerging into *ars nova* notational practice. If there is a local English context for these concerns, it might well be from the era of Johannes Hanboys, in whose *Summa* (c. 1370) there is still discussion of insular 'longa mensura', with smallest values that a Francophile would identify as proportional minims or semiminims, but whose larger preoccupation is in expanding the gradus system of Muris systematically to encompass smaller values than the Parisian minim, perhaps in the face of compositional activity that was already exploring this possibility within a nominally Francophile context.⁹⁹

⁹⁹ See P. M. Lefferts, *Robertus de Handlo, Regule and Johannes Hanboys, Summa* (Lincoln, Nebr., 1991), pp. 38–64. The compositional activity I have in mind consists of the later fourteenth-century large-scale English cantilenas with semiminims and sectional changes of mensuration such as one finds in Cambridge, Gonville and Caius College, MS 230/116; Oxford, Corpus Christi College, MS 144; and New York, Pierpont Morgan Library, MS 978. French *ars nova* notation was no novelty in England in the later fourteenth century, as it had been employed there since

V. FINAL THOUGHTS

The greatest value for us in an exercise like the ballade *Ut pateat evidenter* lies in its evident origins as a self-conscious demonstration piece. In such a work, conceived in a spirit of play and perhaps even of competition, the author challenges his audience to discover his intentions. Even without the lyric's clues, much can be drawn from the notation and the resulting musical fabric alone. Some systems of thought – in this case within the realms of tonal and mensural behaviour – are being demonstrated; some potentialities inherent in some systems are being explored.¹⁰⁰ I would readily grant the argument that what we see here may not be customary and traditional musical behaviour. But it allows us an unusually explicit point of entry into medieval thought about music.

The poem that is our ballade's lyric dramatically expands the analytical field for us, alerting us to additional dimensions of meaning and allusion. Some of what it says is now obvious, although some is still obscure, and the full richness and intention of its meaning may never be fully recoverable. Its author might rejoice in that, for he is quite evidently having fun, playing with the meanings of words and signs – riffing verbally and musically with material that he would have assumed familiarity with on the part of his elite audience. As is more directly apparent in the roughly contemporaneous *Fumeux fume*, written for a clique of *fumeurs* (a kind of informal and only half-serious French intellectual academy whose charter was written by Deschamps in 1368), we surely have here a piece for an in-crowd of cognoscenti.¹⁰¹ Further, this ballade's intertextuality and musical self-referentiality tie it to a wider international repertoire of polyphonic songs and motets whose texts refer explicitly or

at least the later 1320s or early 1330s, as attested by the music source Berkeley Castle, Select Roll 55.

¹⁰⁰ There is a fundamental difference between *musica ficta* essays that are systematic and those that are not, a point that to my mind is not adequately articulated by Brothers in *Chromatic Beauty*. He is hostile to analytical approaches that insist on a hegemony of uniform, theoretically derived rules (p. 10), welcoming instead the recognition of flexibility, discursiveness, idiosyncrasy, digression, deviation, inconsistency. This position yields many valuable individual insights, but it ultimately blinds him to the potential value of those few remarkable compositions whose very purpose is to reveal a system. Exploration of both kinds of tonal behaviour are necessary, and their results need to be integrated into a larger picture of theory and practice.

¹⁰¹ Lefferts, 'Subtilitas in the Tonal Language of *Fumeux fume*', p. 180 and n. 10.

obliquely to musicians and musical behaviours, from the well-known complex of musicians motets with its own cross-channel connections, to *Fumeux fume* and other chansons.¹⁰²

Details of tonal and mensural practice allow us to contextualise the song within a rigorous discourse that we can identify with an intersecting and evolving network of materials and individuals whose point of origin is England and northern France, although at least two important surviving sources of most immediate interest were copied in Sicily or southern Italy, in the realm of Angevin Naples.¹⁰³ It is at a time when notational signs are being reconceptualised as potent agents, not just as markers, and when proportional innovations are threatening minim equivalence in French *ars nova* practice. As for a date, a reasonable estimate for our song is the third quarter of the fourteenth century, just a few strides beyond positions staked out in the *Musica* (1357) of Johannes Boen. Its author is surely a contemporary of Boen or of Nicolaus de Luduno, but likely to be English. If our knowledge of medieval tonal theory can be likened to a jigsaw puzzle, then *Ut pateat* causes us to realise that the large number of pieces assembled by Karol Berger form a part of the image belonging not in the dead centre of the picture, but lower and to the right, towards Italy as it were, with an upper left part of the puzzle (Anglo-French theory) still lacking many pieces but emerging as a distinct area in its own right, however much it may interlock with other parts of the picture.¹⁰⁴

I will close with the observation that *Ut pateat evidenter*, in as full a context as I can generate for it, teaches us that in the later fourteenth century, western European composers and theorists had

no one single way of thinking about tonal behaviour. Thus we today must reject 'one size fits all' explanations that exclusively champion modality, hexachords, pentachords, tetrachords, keyboard thinking or any other single 'system' as the key to all behaviours, and thus to all analyses, of later medieval music. Rather, we must acknowledge the exploration by musicians of a variety of possible ways to imagine, describe and traverse musical space, with varying degrees of rigour or idiosyncrasy. Our ballade's music and text exemplify certain tonal (and mensural) concepts, demonstrating certain possibilities with a degree of enthusiasm and contention that clearly points to the existence of alternative schools of thought. It sets a challenge to its contemporaries with a riddle and a song.

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¹⁰² For texts of polyphonic songs pertinent to the issue of fixed versus proportional minims and the semiminim, see A. Stone, 'Che cosa c'è di più sottile riguardo l'ars subtiliori?', *Rivista Italiana di Musicologia*, 31 (1996), pp. 3–31, and U. Günther, 'Das Ende der Ars Nova', *Die Musikforschung*, 16 (1963), pp. 105–20.

¹⁰³ The importation of northern (French and English) theory into Italy is documented not only by the Rome/St. Paul and Catania manuscripts, but also by the activities of the copyist Frazer G. de Anglia in 1391 in Pavia, where he worked on the manuscript now Chicago, Newberry Library, MS 54.1, entering the treatise of Petrus de Sancto Dionysio and perhaps other items. The Chicago manuscript contains on fol. 9^r a seven-figure Torkesey triangle, a version of this illustration otherwise known only from Bodley 842 (see Lefferts, *Handlo and Hanboys*, p. 56). For more on the English influence on Trecento music theory, see P. M. Lefferts, 'An Anonymous Treatise of the Theory of Robertus de Brunham', in *Quellen und Studien zur Musiktheorie des Mittelalters*, iii, ed. M. Bernhard (Munich, 2001), pp. 217–51, at pp. 238–43.

¹⁰⁴ Karol Berger had seen Boen and Nicolaus de Luduno as isolated and exceptional (*Musica ficta*, pp. 30–3).

APPENDIX 1

Text and Translation of *Ut pateat evidenter*

- [1.] *Vt pateat euidenter*
monocordi quot et quibus
pleri licet nescienter
diuersis a communibus
cordis canant decentibus
ut calculi fert ratio
Cribrorum demonstratio
- 5 So that it may be plainly visible
on how many and which
suitable strings of the monochord
different from the ordinary ones
most perform, albeit without understanding,
as the reckoning of calculation bears out
– the demonstration of sieves
- [2.] *Omnes pandi differenter*
veteres has marginibus
albis pure concedenter
pure nigris has tractibus
set mediis coloribus
nouas ut sit distinctio
Cribrorum demonstratio
- 10 Think that all are set out differently:
some old (itches), as is proper,
in the purely white spaces
and others on purely black lines,
but the new ones on intermediate colours,
so that there might be a distinction
– the demonstration of sieves
- [3.] *Inuentasque consequenter*
puta non cum ueteribus
nec etiam tam recenter
ac si cum nouioribus
pandi fuscis tingentibus
sese colore uario
Cribrorum demonstratio
- 15 And that those (itches) invented subsequently,
not together with the old ones,
nor yet so recently
as if together with the newer ones,
are set out with tinted things
20 dipping themselves in varied colour
– the demonstration of sieves
- [4.] *Et notarum contingenter*
equiuocarum sitibus
cautis dari compellenter
tetras formas temporibus
ficticiis absentibus
loco quamque set proprio
Cribrorum demonstratio
- 25 And that the four forms
of equal-valued notes
are presented, brought together
one after the other,
the unneeded time-measures being absent,
with each form in its own place
– the demonstration of sieves
- [5.] *Vtque fiat vehementer*
confusio fauentibus
semiminimis patenter
nequaquam possibilibus
ac prorsus inutilibus
cuius tanquam probacio
Cribrorum demonstratio
- 30 And so that confusion
may thoroughly befall
the supporters of semiminims,
which are clearly in no way possible
and completely useless,
of which fact the proof so to speak
35 is the demonstration of sieves,
- [6.] *Transferendo diligenter*
primam notam ex omnibus
ad quam placet eliganter
ratas dando sequentibus
quod diuersis ex gradibus
una surgat prolacio
Cribrorum demonstratio
- 40 By diligently transferring
the first note of all
to that which one pleases in a fitting way
and giving fixed shares to those after
so that from different degrees
one utterance [i.e., this song] may arise
– the demonstration of sieves

Ob=Oxford, Bodleian Library, Bodley 842; StP=Sankt Paul im Lavanthal in
Kärnten, Stiftsbibliothek (Archiv des Benedictinerstiftes), MS 135.1

7 Ob: Tribulor; StP: Cribriorum *for* Cribrorum

9 Ob: ne te res *for* veteres

19 Ob: sustis/tris, StP: fustis/tris *for* fuscis

19 Ob and StP: tangentibus *for* tingentibus

22 StP: Ex *for* Et

23 StP: sitibus *illeg.*

24 Ob: cantis compellenter; StP: dare *for* dari

27 StP: ad quancunque *for* loco quamque

38 Ob: elegenter StP: eligenter *for* eliganter

40 StP: quam *for* quod

APPENDIX 2
Ballade *Ut pateat evidenter*

I.1 6

I.2 12

II 18

A Riddle and a Song

III 6

IV 12