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Sharp Practice in the Later Middle Ages: Exploring the Chromatic Semitone and its Implications

KEYWORDS: chromatic; semitone; Tinctoris; Marchetto of Padua; sharp; medieval; fourteenth century; fifteenth century; notation

ABSTRACT: A number of theoretical texts from the 14th and 15th centuries discuss, either explicitly or implicitly, a special heightened sharpening, especially in cadential contexts and sometimes associated with a specific interval termed the 'chromatic semitone'. This article explores the phenomenon from Marchetto of Padua through to Tinctoris, and uses sound files to illustrate and critique some of the theoretical descriptions, as well as opening out the discussion to their implications for other polyphonic repertoires of the period.

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SHARP PRACTICE IN THE LATER MIDDLE AGES: EXPLORING THE CHROMATIC SEMITONE AND ITS IMPLICATIONS

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What does a sharp sign mean in the music of the later Middle Ages? Still more imponderably, what does it sound like? At least the first of these questions, seemingly quite innocuous, has begun to impinge directly or indirectly on a number of musicological studies relating to the theory, repertoires and primary sources of the 14th and 15th centuries. Important contributions to this dialogue between notational theory and performing or compositional practice have included Margaret Bent's recent discussion of false concords, Pedro Memelsdorff's re-thinking of accidentals and scribal layerings in the manuscript ModA, especially in relation to the works of Matteo da Perugia, Lucy Cross's dissertation on chromatic alteration and extra-hexachordal intervals, and Theodor Dumitrescu's fascinating exploration of solmization practice, carried out to some extent in parallel with the present study, in which commonly held assumptions regarding the *mi* status of sharped pitches in the 15th and 16th centuries are subjected to scrutiny.¹

Central to Bent's 2001 article on the practical ramifications of discord and concord theory are several quite remarkable passages from Tinctoris's *Liber de arte contrapuncti* (completed by October 1477), in which different sizes of semitone are described and exemplified. My own larger project of producing a new complete electronic edition of Tinctoris's theoretical

¹ Margaret Bent, "On False Concords in Late Fifteenth-Century Music: Yet Another Look at Tinctoris," *Théorie et analyse musicales 1450–1650*, ed. Anne-Emmanuelle Ceulemans and Bonnie J. Blackburn, Musicologica Neolovaniensia, Studia 9 (Louvain-la-Neuve: Département d'histoire de l'art et d'archéologie, Collège Érasme, 2001): 65–118; Pedro Memelsdorff, "What's in a Sign? The ♯ and the Copying Process of a Medieval Manuscript: The Codex Modena, Biblioteca Estense, α.M.5.24 (olim lat. 568)," *Studi Musicali* 30 (2001): 255–79; Lucy E. Cross, "Chromatic Alteration and Extrahexachordal Intervals in Fourteenth-Century Polyphonic Repertoires," PhD dissertation (Columbia University, 1990); and Theodor Dumitrescu, "The Solmization Status of Sharps in the 15th and 16th Centuries," *Studi Musicali* 33 (2004): 253–83. I am very grateful to David Fallows for drawing my attention to Memelsdorff's article, and to Theodor Dumitrescu for sending me a copy of his article in advance of publication. To these items one may also add important (though not necessarily mutually consensual) contributions such as Thomas Brothers, *Chromatic Beauty in the Late Medieval Chanson: An Interpretation of Manuscript Accidentals* (Cambridge: Cambridge University Press 1997); Elizabeth Eva Leach, "Counterpoint and Analysis in Fourteenth-Century Song," *Journal of Music Theory* 44 (2000): 45–79; and, more distantly related, Peter M. Lefferts, "Signature-systems and Tonal Types in the Fourteenth-Century French Chanson," *Plainsong and Medieval Music* 4 (1995): 117–47.

writings, with linked soundfiles where appropriate,² has brought into stark relief the issue of how one might begin to realize in sound the implications of such texts, and perhaps transmit at least some sense of the musical realities that they represent. The present, unashamedly empirical article focuses on the aural impact of the specific phenomenon termed in various 14th- and 15th-century theoretical sources the “chromatic semitone,” partly because Tinctoris clearly regards it, even as late (relatively speaking) as the 1470s, as a genuine presence in music of his own time, and partly because, even though musicologists have been intellectually and historically aware of it as a theoretical construct for some time now, its actuality in sound—frankly startling beyond expectation—has not hitherto been explored systematically. The particular focus of this topic relates closely, of course,³ to the wider question of *musica ficta*,³ but I have attempted to constrain my treatment here in such a way that the many wider ramifications for *ficta* practice are left more or less open for future study.

Margaret Bent has already engaged with many of the salient passages from the *Liber de arte contrapuncti* in the context of discord theory and its contrapuntal implications for late 15th- and early 16th-century polyphony.⁴ Nevertheless, it is essential here to recapitulate the substance of these texts in order to ground much of the following discussion. It should be admitted at the outset that by and large Tinctoris—or at least the authorial persona of his treatises—had little interest in the nuances of tuning theory: his coverage of the details of semitone classification and the division of the tone is uncharacteristically sporadic, inconsistent, and at times apparently confused, though some elements of this apparent confusion may be due to as yet unidentifiable editorial intrusion by copyists of the principal sources or other, vanished intermediaries in the transmission process.⁵

² Currently hosted as an ongoing internet resource by The Stoa Consortium, University of Kentucky as Ronald Woodley, *Johannes Tinctoris: Complete Theoretical Works*, available at: <www.stoa.org/tinctoris>.

³ The most salient research on this topic is now either contained or discussed in Margaret Bent, *Counterpoint, Composition, and Musica Ficta, Criticism and Analysis of Early Music 4* (New York and London: Routledge, 2002).

⁴ Bent, “On False Concords,” esp. pp. 77–102 and 112–8.

⁵ The *Liber de arte contrapuncti* comes down to us in three manuscript sources contemporary, or near-contemporary, with Tinctoris’s period of service at the Aragonese court in Naples: (i) Brussels, Bibliothèque Royale, MS II 4147, dating from the early 1480s and probably copied by one of Tinctoris’s

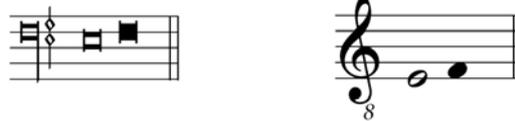
The clearest exposition of Tinctoris's classification of semitone types comes in Book 2, Chapter 2 of the counterpoint treatise:⁶

Capitulum secundum: De semitonio et tono, id est secunda imperfecta et secunda perfecta.

Est autem semitonium discordantia ex mixtura duarum vocum duobus diascismatibus ab invicem distantium constituta, sicut mi E la mi gravis, et fa F fa ut gravis, ut hic:

A semitone, then, is a discord set up by combining two pitches [of different solmization syllable] standing apart from each other by two diaschismata, as with mi on low E la mi and fa on low F fa ut, as here:

EXAMPLE 1



Diciturque semitonium a semus, quod est imperfectus, et tonus, quasi imperfectus tonus. Neque ignorandum est diffinitionem hanc de semitonio

northern colleagues at the court; (ii) Valencia, Biblioteca General i Històrica de la Universitat, MS 835, copied again in Naples in the early to mid-1480s, probably originally for the king's son Cardinal Giovanni d'Aragona, by the Bohemian scribe Wenceslaus Crispus; and (iii) Bologna, Biblioteca Universitaria, MS 2573, probably copied in the 1490s, and perhaps again by Crispus in Naples. A brief description of each of these manuscripts is given by Woodley at <www.stoa.org/tinctoris/tinctoris.html>, with full descriptions forthcoming. The standard print edition of the treatise is in *Johannis Tinctoris opera theoretica*, ed. Albert Seay, 2 vols., Corpus Scriptorum de Musica 22 (n. pl.: American Institute of Musicology, 1975), plus vol. iia (Neuhausen-Stuttgart: American Institute of Musicology 1978), ii. 11–157. All texts quoted in the present article with a cross-reference to Seay's edition have been re-edited and punctuated without further comment, to remove any errors and infelicities. I am grateful to Jan Herlinger for, amongst other helpful comments on an earlier draft of this article, drawing my attention to Bernard Cerquiglini's *Éloge de la variante* (transl. by Betsy Wing as *In Praise of the Variant: A Critical History of Philology* (Baltimore and London: The Johns Hopkins University Press 1999)), as a study of the potency and status of the textual variant in a medieval manuscript culture untrammelled by the desire of 19th-century philology for a single authorial figure, especially in vernacular literature. Tinctoris's generation, however, was working on a fascinating cusp of literary history, when proto-modern notions of authorial and textual integrity were already emerging. I shall be discussing this further in a forthcoming study based on my paper "Did Tinctoris Listen to Okeghem? Questions of Textuality and Authority in the Late Fifteenth Century," delivered at the International Congress on Medieval Studies, Kalamazoo, May 2005.

⁶ Seay, *Tinctoris opera theoretica*, ii. 91–2. My translations and textual punctuation here differ in minor ways from those given by Bent (with Leofranc Holford-Strevens), and I should in any case declare an interest, in having been involved in stimulating and fruitful discussions on these texts with Dr Bent prior to the publication of her article.

minori solum intelligi; ut enim compertum habeo, semitonium per se positum pro minori semper accipitur. Semitonium autem maius, quod duobus diascismatibus et uno comate constat, etiam discordantia est, sicut fa et mi cuiuslibet \flat fa \flat mi, ut hic:⁷

And it is called semitone from “semus,” which is “imperfect,” and “tonus,” as it were an imperfect tone. And we should be aware that this definition applies only to the minor semitone; for, as I understand it, the term “semitone” by itself is always assumed to be minor. The major semitone, however, which comprises two diaschismata and one comma, is also a discord, as with the fa and mi of any \flat fa \flat mi, as here:

EXAMPLE 2



Et hanc discordantiam harmonici falsum unisonum vocant, eo quod apud eos in uno et eodem loco contingat; quiquidem falsus unisonus etiam committitur si contra aliquam notam per semitonium chromaticum sustinendam alia in eodem loco ponatur, ut hic:

Harmonicists [specialists in interval tuning or acousticians] call this discord a false unison, because according to them [sic]⁸ it occurs in the same staff position; a false unison is also produced if, against some note which is to be raised through the chromatic semitone, another is placed in the same staff position, as here:

EXAMPLE 3



⁷ This example is missing from Brussels II 4147.

⁸ The point is of course a self-evident truth, and one might better paraphrase Tinctoris’s Latin as “their argument being that it occurs”

Neque dubium est hoc quoque semitonium chromaticum ceterorum minimum, constans secundum aliquos quinta parte toni, merito inter discordantias numerari. Porro omne semitonium, sive minus <sive maius> sive chromaticum fuerit, secunda imperfecta, ad differentiam perfecte, que tonus est, communiter dicitur.

There is no doubt that this chromatic semitone—the smallest of all of them, comprising one fifth part of a tone according to some—is also rightly numbered among the discords. Moreover, every semitone, whether it be minor [or major] or chromatic, is commonly called an imperfect second, to distinguish it from the perfect second, which is the tone.

A number of things are clear from this basic formulation; others less so. First, Tinctoris is quite sure that the “normal” minor semitone, which articulates linear movements between *mi* and *fa* across adjacent *loci* or *claves*⁹ such as E–F–E, A– \flat *fa*–A, and C– \flat *mi*–C, is slightly smaller in size than the major semitone (called by some writers the *apotome*) which characterizes the interval between *fa* and *mi* in the same *locus*—principally, in the Guidonian gamut, from \flat *fa* to \flat *mi*, but by extension, presumably, any transpositional equivalent on E, A, etc.¹⁰ Secondly, the chromatic semitone, indicated expressly by the double-cross \times sign (or, in practice, represented graphically with various angles of inclination from \times to $\#$), is utterly distinct from the other two classes of semitone, and equally distinct from the use of the *quadrum* \sqsubset sign. We should note that in his *Expositio manus* Tinctoris is very particular in his assertion that the \times sign should be reserved for this special semitonal use, as against the deployment of the *quadrum* sign as indication of \flat *mi*:

Secunda [*sc.* *clavis*] \sqsubset pro \flat *mi* et utriusque \flat *fa* \sqsubset *mi* dum canitur *mi*, quod dicitur *quadrum* a sua forma, eo quod sit inferius *quadra*. Sunt autem

⁹ The term *locus* refers to the position of the note (line or space) on the staff; *clavis* refers to a note’s letter name, often further distinguished by its *vox* or solmization identity.

¹⁰ Tinctoris, usually very conservative on issues of hexachord extension, refers occasionally to “*fa fictum*” on E and low \flat *mi*: for instance in Book 2 of the counterpoint treatise, Chapters 11–16 (Seay, *Tinctoris Opera Theoretica*, ii. 99–104). It should be borne in mind that, counter-intuitively for modern readers, the minor *mi*–*fa* semitone is often referred to by later medieval writers, following Marchetto of Padua, as the “*enharmonic*” semitone, and the major \flat *fa*– \flat *mi* semitone as “*diatonic*.” Since Tinctoris himself avoids this terminology completely, I intend to follow his example in this article.

plerique clavem hanc figurantes taliter ✱ sed male; hoc etenim signum est semitonii cromatici proprium.

*The second [clef] is ♭ for ♭ mi and both positions of ♭ fa ♭ mi whenever mi is sung there, and this is called “square” from its form, because it is square-shaped at the bottom. There are many, however, who notate this clef thus ✱, but incorrectly; for this, indeed, is the proper sign of the chromatic semitone.*¹¹

Nevertheless, Tinctoris’s formulation in the counterpoint treatise is not without its difficulties. The interval of the chromatic semitone is construed on the one hand in the context of a false unison, caused by the simultaneous sounding of an uninflected note in one *locus* with another in the same *locus* inflected by the ✱ sign, and thus raised “per semitonium chromaticum,” i.e. either “by means of” or “through the interval of” the chromatic semitone. In the following sentence, however, it is construed as the smallest available semitonal interval (“ceterorum minimum”), produced by a very narrow linear motion from and to its upper neighbour, here G–F✱–G. Although the author’s control of expression here possesses less than his usual rigour, the sense is clear enough, and his implicit acceptance (or at the very least non-contradiction) of the practical fifth-tone division for this interval seems to acknowledge its currency in the 1470s (“for beauty of delivery”)¹²—despite its clear, much older Marchettan origins, to be discussed below—whilst at the same time retaining a healthy, pragmatic scepticism over the feasibility of its accurate measurement. It is surely also this pragmatism—at times intellectualized as Aristotelian—of a working musician¹³ rather than mere ignorance or sloppiness, that leads to the equivocation in Tinctoris’s other texts, especially the printed and manuscript versions of the *Diffinitorium*, and the *Expositio manus*, which seek to define the by-now slippery terms of

¹¹ Woodley, *Tinctoris Theoretical Works*, links to *Expositio manus*, lines 163–5; Seay, *Tinctoris opera theoretica*, i. 40.

¹² “Fit autem [semitonium cromaticum] dum canendo aliqua vox ad pulcritudinem pronuntiationis sustinetur.” (Iohannes Tinctoris, *Diffinitorium Musicae: Un dizionario di musica per Beatrice d’Aragona*, ed. Cecilia Panti (Florence: Galuzzo (Fondazione Ezio Franceschini), 2004), 42; Johannes Tinctoris, *Dictionary of Musical Terms*, ed. Carl Parrish (repr. New York: Da Capo, 1978), 56).

¹³ One is reminded, too, of the numerous overt references, in different contexts, in Tinctoris’s treatises—surely more than mere Aristotelian posturing—to the importance of hearing or “trained ears” (“*ares erudite*”) as arbiter or corroborator of theoretical prescription: see also, in this regard, Christopher Page, “Reading and Reminiscence: Tinctoris on the Beauty of Music,” *Journal of the American Musicological Society* 49 (1996): 1–31.

diaschisma, *comma*, and *diesis* as constituent parts of the various semitonal inflections.¹⁴ An overall picture of Tinctoris's thinking may nevertheless be distilled, boiling down in practice to the question of whether Tinctoris preferred to construe the tone as dividing into five equal parts (sometimes termed *dieses*, after Marchetto, as we shall see shortly), or five unequal parts. In the former case, the minor semitone comprises two-fifths of a tone; the major semitone three-fifths; and the chromatic semitone four-fifths as a measure of sharpward inflection from the base note, or one-fifth as a measure of its distance of normal upward resolution. In the case of the unequal five-fold division of the tone, one should construe the whole tone as comprising four equal *diaschismata* plus one *comma*. The relationship in size, however, between the *diaschisma* and the (smaller interval of the) *comma* in Tinctoris's distinctly post-Boethian thinking, is rather opaque, though some help as to how this historically burdensome terminology was pragmatically reconfigured may be to hand from a reading of Gafori's *Theoricum opus musice discipline* (1480). In Book 4, Chapter 3 of this treatise (devoted entirely to the nature of the tone and semitones) Gafori offers the following route through the thicket of inherited theory, while simultaneously disregarding the Marchettan strand of equal five-fold division entirely:

Constat igitur tonus duobus semitoniiis et uno comate. Semitonium nanque minus Philolaus ipse *diesim* appellavit. Posterii vero, ut ponit Boetius, *diesim* dixerunt semitonii minoris dimidium ... ex quo sequitur tonum ex quatuor *diesibus* et *comata* perfici.... *Coma* enim, ut quibusdam placet, est dimidium *diesis*.¹⁵

¹⁴ These are discussed in some detail by Bent, "On False Concords," 84–6. The various discrepancies may be briefly summarized as follows. In the printed version of the *Diffinitorium* (Treviso: Gerardus de Lisa, 1494 or 1495), the tone is divided into five *dieses*, of which two constitute the minor semitone, and three constitute the major; the chromatic semitone is identified as a separate classification, but its size not quantified; the *diaschisma* is not mentioned, but the *comma* (identified also as the *diastema* [*recte*: *distema*?]) is given its traditional definition as the interval by which a tone exceeds two minor semitones; the *apotome* is equated with the major semitone; the *limma* is equated with the minor semitone; the *stema* is defined as a half of the *comma*. In the only manuscript version of the *Diffinitorium* to cover these terms, Brussels II 4147 (emanating from a source close to the author, though not necessarily the author himself), the *diaschisma* (*diacisma*) is defined as a half of the minor semitone; the *diesis* variously attributed to the minor semitone itself, a half of the minor semitone, or a fifth, third, quarter or eighth part of the tone; furthermore, the *scisma* is here described as a half of the *comma*.

¹⁵ Gafori later equivocates further in his *Theorica musice* of 1492, based on the earlier *Theoricum opus*, in stating that "... some consider the half of the *diesis* as the *comma*. Certain people, however,

The tone, then, comprises two semitones and one comma. Indeed, the famous Philolaus himself called the minor semitone the “diesis.” Later generations, however, as Boethius tells us, said that the diesis is a half of the minor semitone ... from which it follows that the tone is made up of four dieses and a comma.... For the comma, in the opinion of some, is half of a diesis.

This formulation is later also implied, though not quite overtly expressed, by Aaron in his *Libri tres de institutione harmonica* of 1516:

Tonus quidem in quattuor dieses et unum comma dividitur. Coma vero nona est pars toni.... Maius [sc. semitonium] quidem duplici diesi et commate constat.... Minus autem duas tantum pulso commate dieses habet.¹⁶

The tone, then, is divided into four dieses and one comma. The comma, though, is one ninth part of the tone.... The major semitone, then, comprises a double diesis and the comma.... The minor semitone, on the other hand, consists of just the two dieses, with the comma removed.

In this unequal five-fold division of the tone, therefore—or at least this particular rationalisation of such a division—the tone is effectively divided into nine comma-equivalent intervals, of which the minor semitone *mi–fa* relationships comprise four-ninths, and the \flat *fa–b mi* major semitone five-ninths. Neither Gafori nor Aaron acknowledges the chromatic semitone in the sense which we have seen emerging from Tinctoris’s writings;¹⁷ but the ninth-based division

believe that the comma itself exceeds the half of the diesis, which Boethius teaches in the third book of his *On Music*.” (Franchino Gaffurio, *The Theory of Music*, trans. with introduction and notes by Walter K. Kreyszig, ed. Claude V. Palisca (New Haven and London: Yale University Press, 1993), 122.) The passage from the *Theoricum opus* cited here, and the following passage from Aaron, were also discussed in Jan Herlinger’s seminal article “Fractional Divisions of the Whole Tone,” *Music Theory Spectrum* 3 (1981): 74–83, at 80–1.

¹⁶ Pietro Aaron, *Libri tres de institutione harmonica* (Bologna: Benedictus Hectoris, 1516), fol. 12v.

¹⁷ Gafori does nevertheless allude neutrally on one occasion in his *Practica musicae* of 1496 to the use by some of the # sign as indication of the narrow diesis, defined as half the minor semitone: “Sunt et qui appositione huius signi # notulam cui apponitur deprimi volunt minimo dieeseo intervallo, quod enarmonici generis est. Est enim diesis dimidium semitonii minoris intervallum duobus sonis circumscriptum.” (Franchino Gafori, *Practica musicae*, facs. edn., Farnborough, 1967, sig. eiii *recto*.) (“There are those who, by attaching this sign #, wish the note to which it is attached to be lowered by the smallest interval of the diesis, which belongs to the enharmonic genus. For the diesis is the interval of half a minor semitone, bounded by two sounds.”) This passage is also cited by Dumitrescu, “Solmization Status,” 263.

of the tone that they describe explicitly or implicitly would lead to a chromatic semitone inflection of seven-ninths sharpward from base, or two-ninths by upward linear resolution. The sounding implications of these can be heard in Example 4; in present-day, frequency-based tuning terms, the following comparison of basic *recta* positioning may be helpful. If one takes $a = 220$ Hz as a convenient basis for calculation, then a pure Pythagorean (9 : 8) tone to $\flat mi$ sounds at 247.5 Hz, the equal five-fold division of that tone produces an intermediary $\flat fa$ at 231 Hz (i.e. a minor semitone from a of around 85 cents: Example 4(i)), and the unequal (ninth-based) five-fold division sounds that $\flat fa$ at 232.22 Hz (between 8 and 9 cents sharper than the equal five-fold: Example 4(ii)), both compared with a notional Pythagorean minor semitone of around 231.77 Hz, lying more or less mid-way between the two former divisions (Example 4(iii)). In other words, the equal and unequal five-fold divisions of the tone produce a $\flat fa$ respectively flatter and sharper by an almost imperceptible degree ($\pm 4\text{--}5$ cents) than a Pythagorean “norm.” Importantly, though, as well as showing the extremely fine nuances of distinction, these examples demonstrate the remarkable accuracy of the two divisions as pragmatic methods for reconfiguring the intractable Boethian inheritance. Furthermore, again for the benefit of common-practice comparison, an equally-tempered $b\flat$ from this same $a = 220$ Hz emerges at around 233.08 Hz, its 100-cent semitone fractionally sharper and brighter than the medieval divisions (Example 4(iv))—though, compared with the chromatic sharp inflections to be exemplified shortly, the distinctions are much less practically significant than one might perhaps expect.¹⁸ (It should be noted that the G– $B\flat$ dyads in Example 4 are provided simply as comparative aural reference-points for the $\flat fa$ positionings, which are easier to differentiate in this form. They are not intended as historically plausible tunings of the minor 3rd, which, as we shall see later, present their own issues for consideration.)

¹⁸ Soundclips throughout this article were created from vocal (choral) samples re-tuned by means of the AudioSculpt audio processing software developed at the Institut de Recherche et Coordination Acoustique/Musique (IRCAM) in Paris. I am extremely grateful to my colleague at UCE Birmingham Conservatoire, Lamberto Caccioli, for introducing me to the potential of this software for the purposes of the present investigation. The problematics of fundamental frequency estimation are discussed in David Gerhard, “Pitch Extraction and Fundamental Frequency: History and Current Techniques,” Technical Report TR-CS 2003–06 (November 2003), Department of Computer Science, University of Regina, Saskatchewan. A convenient set of tables for conversion between cents and Hertz, which has proved invaluable for the accurate re-tuning of the samples, is available online, at the time of writing, at: <www.petersonstuners.com/support/ctf/index.cfm>.

EXAMPLE 4



- | | | |
|---|-----|-----|
| (i) Equal five-fold division of a - \flat <i>mi</i> tone: | (a) | (b) |
| (ii) Unequal (ninth-based) five-fold division: | (a) | (b) |
| (iii) Pythagorean minor semitone: | (a) | (b) |
| (iv) Equal temperament: | (a) | (b) |

Returning to the texts from Tinctoris's *Liber de arte contrapuncti* referring explicitly to the application of the chromatic semitone, we can proceed to Book 2, Chapter 17 of the treatise, which is devoted to a number of fascinating examples of ways in which normally perfect concords, such as the 5th and the octave (and their compounds) “can become false concords by means of a deficiency or excess caused by the chromatic semitone” (“Quomodo etiam concordantie perfectae, hoc est diapente, diapason et cetera, possunt esse false concordantie per imperfectionem aut superfluitatem ex semitonio chromatico causatam”):¹⁹

Neque pretermittendum est ipsas concordantias perfectas, id est diapente, diapason, diapente supra diapason, bisdiapason, diapente supra bisdiapason, et tridiapason, fieri posse discordantias aut falsas concordantias per imperfectionem ac superfluitatem ex semitonio chromatico causatam: verbi gratia si supra aliquam notam sustinendam quevis istarum perfectarum concordantiarum contraponatur, tunc enim imperfecta quinta parte [*recte*: quattuor partibus]²⁰ unius toni efficietur, ut hic patet:

¹⁹ Seay, *Tinctoris opera theoretica*, ii. 104.

²⁰ This slip in Tinctoris's formulation is probably due to an instinctive sense that in the two halves of this chapter—the first describing the effect of sharpening the bottom note, the second of sharpening the top note, of the dyad—the intervallic distance of “deficiency” or “excess” should be inverted to one-fifth and four-fifths respectively. Of course, since the terms “imperfectus” and “superfluous” are already intrinsically in a complementary, inverted relationship with one another, Tinctoris has in consequence committed a kind of double-accounting error, which is not corrected in any of the surviving manuscript sources.

Nor should it be overlooked that these perfect concords, that is, the 5th, octave, 12th, double octave, 19th, and triple octave, can become discords or false concords through a deficiency or excess caused by the chromatic semitone: for example, if above some note which is to be raised [by a chromatic semitone] any of these perfect concords is placed in counterpoint, then the interval will be rendered imperfect [deficient] by a fifth part [recte: four fifths] of a tone, as is shown here:

EXAMPLE 5

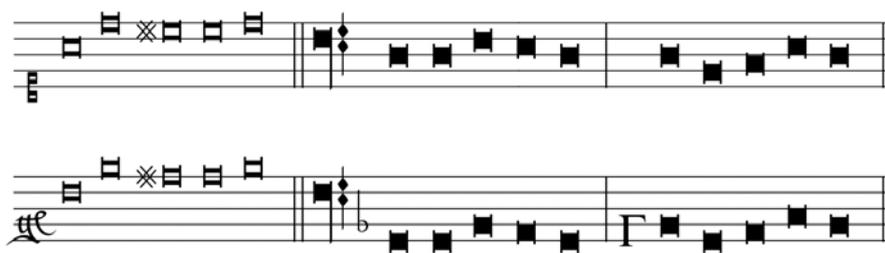


At si infra quamvis notam etiam sustinendam aliqua dictarum concordantiarum perfectarum contrapositiona sit, quattuor partibus toni superflua erit, ut hic probatur:

But if beneath any note also to be raised [by a chromatic semitone] one of these same perfect concords is placed in counterpoint, the interval will be superfluous [excessive] by four parts [i.e. four-fifths] of a tone, as is shown here:

EXAMPLE 6

Exempla



EXAMPLE 6 (continued)

Et quamvis hoc modo omnes concordantie perfecte, ut dictum est, efficiantur discordantie vel false concordantie, diapente tamen ac diapente supra diapason et diapente supra bisdiapason non tam aspere per huiusmodi semitonia chromatica discordant ut cetere, quod et preposita apertissime manifestant exempla.

And although in this way all perfect concords, as has been said, are made into discords or false concords, the 5th and 12th and 19th nevertheless do not sound in such harsh discord as the rest through such use of chromatic semitones, which the preceding examples quite clearly show.

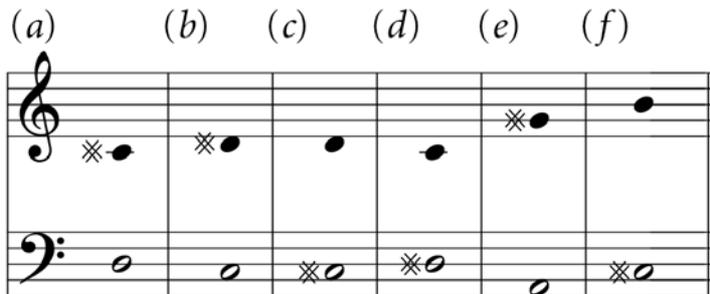
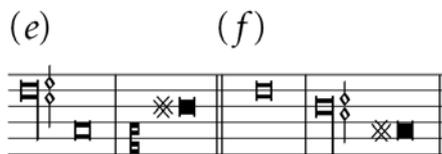
Just how clearly these examples from Chapter 17 show such comparative weighting of dissonance quality will be explored shortly. Finally, however, from the following Chapter 18 of the treatise, Tinctoris takes one stage further this (otherwise very rarely articulated) wish to demonstrate how the particular narrowness of his chromatic semitone can be heard to nuance the perceived dissonance level of intrinsically dissonant intervals:²¹

²¹ Seay, *Tinctoris opera theoretica*, ii. 105.

Solent etiam alie discordantie vere, hoc est septima, nona, quartadecima, et similes, virtute chromatici semitonii vel intensiores vel remissiores effici; verumtamen tunc minime uel parum qualitas earum immutatur: semper enim discordantie sunt, ut hic patet:

Again, other true discords, namely the 7th, 9th, 14th, and similar, are customarily made either more intense or more relaxed by virtue of the chromatic semitone; nevertheless, their intrinsic quality is altered either not at all or very little: for they always remain as discords, as is shown here:

EXAMPLE 7



Although Tinctoris does not state it explicitly, the essential reason for this nuancing of aesthetic effect is that the stretched or squeezed intervals tend either outward or inward towards other neighbouring intervals, with their own intrinsic characteristics. Hence, for instance, a minor 7th D–C becomes stretched by the chromatic sharpening of the C (Example 7a) towards an

extremely narrow, fast-beating and out-of-tune octave (“intensior”);²² a major 9th C–D, on the other hand, becomes stretched by the chromatic sharpening of the upper D outward towards the more emollient or “relaxed” (“remissior”) major 10th (Example 7b).²³ The exchanged position of the ✕ sign with this same C–D interval, however, induces the opposite of the first example, intensifying the already dissonant 9th by squeezing it chromatically towards the sound of a widened, beating D–D octave (Example 7c). The fourth example given, analogous to the second above, mollifies a minor 7th by squeezing it inwards (Example 7d) beyond even the major 6th, almost to the minor 6th (“remissior”); Example 7e stretches the compound minor 7th A–G out towards a near-but-not-quite compound octave (“intensior”); and the final Example 7f squeezes a compound major 7th C– \flat *mi* inward towards a compound major 6th (“intensior”). As will become clear, however, when soundclips are offered for these examples shortly, the ineluctably historicized sensibilities of one’s own ears can hardly avoid re-interpreting the musical effects of these inflections. For instance, this final example must surely, from a theoretical perspective, fall into Tinctoris’s “remissior” category, in its tendency away from seventh-ness towards sixth-ness; but to early 21st-century ears accustomed to the already emollient major 7th within a post-tonal context, the chromatic sharpening of this low C puts the interval somewhere uncomfortably in the cracks between a minor 7th and major 6th, and so some of us may construe the effect as “intensior.”²⁴

²² It should be noted that there was, in fact, a long-standing tradition of using the terms *intensio* and *remissio* to mean simply “raising” and “lowering,” e.g. up and down between adjacent solmization syllables: see, for instance, Johannes Cotto (John of Afflighem), in his *De musica cum Tonario* [c. 1100], ed. J. Smits van Waesberghe, *Corpus Scriptorum de Musica* 1 (Rome: American Institute of Musicology 1950), 70 (with facsimile from Leipzig, Universitätsbibliothek, MS 79). See also n. 24 below.

²³ It is interesting that in this kind of formulation the extreme sharpening of the D produces a pitch sharper by some way than, say, an equal-temperament enharmonic minor 10th would imply, falling short of the major 10th by only one-fifth of a tone, and producing an interval not that far from a compound “blues” 3rd.

²⁴ This was clearly the result of a straw-poll taken when the example was played to a specialist audience at a seminar version of this article, given at All Souls College, Oxford in November 2001. I am grateful to the anonymous *MTO* reviewer for querying whether Tinctoris is really trying to use the terms *intensior* and *remissior* in anything other than the older senses of “raised” and “lowered.” However, whilst it is plausible to equate the widening of an interval, whose upper note is chromatically sharpened, with the older sense of *intensior*, I do not see how any of these intervals, including those whose lower note is similarly sharpened, can be termed *remissior* in any sense inherited from the older usage. The details of Tinctoris’s examples, then, seem to indicate that these terms have been adapted for his more specific, expressive purposes.

It is time to lift some of this mere description from the page and attempt to breathe life into it as sound. Haunting the background to the above readings from Tinctoris is the figure of Marchetto, whose *Lucidarium*, written more than 150 years before the *Liber de arte contrapuncti*, is the seminal, if often controversial, source for the chromatic semitone and equal five-fold division of the tone.²⁵ In a remarkable passage, constituting the bulk of Chapter 8 from the Tractatus secundus of the *Lucidarium*, Marchetto sets out his terms of reference with utmost clarity. Although this is by now a reasonably well-known passage for musicologists,²⁶ we should not in any way underestimate the intellectually ground-breaking nature of Marchetto's thinking here. At a stroke he radically re-conceptualizes the interval of the tone as a space available to be freely divided, rather than as part of a set of ratios constrained in their divisibility by the limitations of Boethian or Pythagorean arithmetical logic:

Capitulum octavum: De semitono cromatico

Cromaticum semitonium est illud quod de quinque dyesibus quas habet tonus quatuor comprehendit, et ut predicatur semper cum dyesi tonum perficit. Fit enim cum aliquis tonus bipartitur propter aliquam dissonantiam colorandam, puta terciam, sextam, sive decimam tendendo ad aliquam consonantiam; nam prima pars toni sic divisibilis, si per ascensum fiat, erit maior, que dicitur croma; pars que restat dyesis est, ut hic:²⁷

²⁵ The standard edition of the *Lucidarium* is Jan W. Herlinger, *The Lucidarium of Marchetto of Padua: A Critical Edition, Translation, and Commentary* (Chicago and London: University of Chicago Press, 1985).

²⁶ See especially the pioneering discussions by Jan Herlinger in his articles "Marchetto's Division of the Whole Tone," *Journal of the American Musicological Society* 34 (1981): 193–216, and "Fractional Divisions"; also more recently, by the same author, "Medieval Canonics," in *The Cambridge History of Western Music Theory*, ed. Thomas Christensen (Cambridge: Cambridge University Press, 2002): 168–92. A useful, brief conspectus of the subject is also provided by Herlinger in "Music Theory of the Fourteenth and Early Fifteenth Centuries," in *Music as Concept and Practice in the Late Middle Ages*, ed. Reinhard Strohm and Bonnie J. Blackburn, *The New Oxford History of Music*, iii. Part 1 (Oxford: Oxford University Press, 2001): 244–300, esp. 249–56.

²⁷ Text taken from Herlinger, *Lucidarium*, 148–55, with minor alterations of punctuation. Herlinger's principal source (Milan, Biblioteca Ambrosiana, MS D. 5 inferiore, of later 14th-century Italian provenance, perhaps close to Marchetto and the Angevin court) uses the sign ꝑ for the chromatic inflection, borrowed from Marchetto's description of the sign in his other treatise, the *Pomerium in arte musice mensurate* (Herlinger, *Lucidarium*, 27); later manuscripts of the *Lucidarium* use the double-cross sign ✕, as recommended by Tinctoris, or a number of alternatives, with varying degrees of consistency (ibid., 29–62, and variants listed on 148–55). Most musicologists read the term *musica falsa* as Marchetto's preferred tag for this specifically chromatic usage. In fact, although the Tractatus quartus of the *Pomerium*, on this topic, is headed "De quodam signo quod a vulgo falsa musica

Chapter 8: On the chromatic semitone

The chromatic semitone is that which comprises four of the five dieses that the tone contains, and, as is stated above, along with the [remaining fifth] diesis it always completes the tone. It occurs, then, whenever any tone is divided in two in order to colour some dissonance, such as the 3rd, 6th or 10th, in striving towards some consonance; for the first part of a tone divisible in this way, if it occurs through ascent, will be the greater part, which is called the “croma”; the remaining part is the diesis, as here:

EXAMPLE 8

(a) (b) (c)

The image shows two staves of musical notation. The top staff is divided into three sections labeled (a), (b), and (c). Section (a) shows an ascending chromatic semitone with a larger note (croma) followed by a smaller note (diesis). Section (b) shows a similar ascending chromatic semitone but with a different division. Section (c) shows a descending chromatic semitone with a larger note (croma) followed by a smaller note (diesis). The bottom staff shows the same three sections (a, b, c) for a different temperament, where the division of the chromatic semitone is more equal.

- (i) Marchettan division: (a) (b) (c)
- (ii) Equal temperament: (a) (b) (c)

Dicitur enim cromaticum a cromate; est namque croma in greco color. Inde cromaticum color pulcritudinis appellatur, quia propter decorem pulcritudinemque dissonantiarum dividitur tonus ultra divisionem dyatonici et enarmonici generis, ut a consonantia que sequitur dissonantias per minorem distantiam per motum utriusque distetur, ita videlicet quod in tali distantia supra vel infra unius toni prolatio semper extet, ut hic:

nominatur,” Marchetto goes to some lengths here to explain why he disapproves of the term, primarily because the notion of “false” connotes “bad”: “in quantum falsum semper sumatur in mala parte potius quam in bona (quod enim falsum est de se nunquam bonum est).” (*Marcheti de Padua Pomerium*, ed. J. Vecchi, *Corpus Scriptorum de Musica* 6 (n. pl.: American Institute of Musicology, 1961), 70). Indeed, he wishes on the contrary to emphasize the ways in which the chromaticism positively enhances the beauty of the consonances of resolution (“ad pulchriores consonantias reperiendas et faciendas”: *ibid.*). For this reason, Marchetto prefers the term *musica colorata* (i.e. closer to the literal sense of our term “chromatic”): “ideo salva reverentia aliorum dicimus quod magis deberet et proprius nominari musica colorata quam falsa ...” (*ibid.*). The distinction has been acknowledged, however, by Thomas Brothers (*Chromatic Beauty*, 35).

It is called the chromatic semitone from “chroma”; for chroma means colour in Greek. Hence it is named chromatic as the colour of beauty, because the tone is divided beyond the division of the diatonic and enharmonic genus²⁸ on account of the elegance and beauty of the dissonances, so that the note should stand at a smaller linear interval from the consonance that follows the dissonances through the motion of each note—that is to say in such a way that there is a whole tone sung above or below this interval.²⁹

EXAMPLE 9

(a) (b) (c)

- (i) Marchettan division: (a) (b) (c)
- (ii) Equal temperament: (a) (b) (c)

nisi forte fiat talis toni bipartitio per descensum, que est minus propria in dissonantias [*recte*: dissonantiis] tendentibus ad consonantias, ut hic:

unless by chance such a division of the tone into two parts occurs through descent, which is less proper for dissonances which are striving towards consonances, as here:

²⁸ That is, the normal major and minor semitones: see note 10 above.

²⁹ Marchetto’s wording is somewhat convoluted, but the following three (and, indeed, previous three) examples show that wherever the chromatically inflected note resolves, the other voice set in counterpoint to it, either above or below, always descends by a linear tone.

EXAMPLE 10

- (i) Marchettan division: (a)  (b)  (c) 
- (ii) Equal temperament: (a)  (b)  (c) 

Hec enim bipartitio toni debet fieri cum colore fictitio, ut qui eam profert fingat in primo descensu, qui est dyesis, ac si vellet post talem descensum sursum redire; post hec chromaticum descendat, et sic consonantia, licet minus naturaliter et proprie, subsequitur.

This two-fold division of the tone should be accomplished as a feigning with the colour [chromaticism], so that anyone performing it should feign on the first descent, which is the diesis, as though he wishes to return upward again after such a descent; then he should descend through the chromatic semitone, and thus the consonance follows, albeit in a less natural and proper manner.

It is essential here to take on board the fact that what Marchetto is describing is a real, expressive, decorative device,³⁰ not just a theoretical construct. In the final paragraph of the above passage the “as though” (“ac si”) is of particular potency and musical interest: the singer should give an aural impression or anticipation of a normal return and resolution upward, but

³⁰ His references to “elegance” and “beauty,” however one may construe these terms, are a clear precursor to (and probably a direct source of) Tinctoris’s reference to the use of the chromatic semitone “for beauty of delivery”: see note 12 above. The terminology, of course, also becomes part of the conventional articulation of *ficta* practice (“causa pulchritudinis”) throughout the 14th and 15th centuries, with respect both to the perfection of vertical sonorities and the melodic inflection of individual lines. This aspect of Marchetto’s thinking is also discussed in Christopher Page, “Polyphony before 1400,” in *Performance Practice: Music before 1600*, ed. Howard Mayer Brown and Stanley Sadie (The New Grove Handbooks in Music; London: Macmillan, 1989): 79–104, at 80–1.

the subsequent continued descent through the large four-fifths interval (the *chroma*) subverts that anticipation. Likewise, of course, Marchetto is implying that the listener is similarly attuned to that sense of musical anticipation, and is being coaxed or teased by that normative expectation when he/she hears the initial diesis descent subverted by the “less natural and proper” downward resolution. Of such performative nuances the attached soundclips can give only a very incomplete view, partly because of the difficulties of synthesizing appropriately musical modifications to the dynamic and timbral parameters in addition to the pitch calculations, but especially because Marchetto’s examples are themselves only skeletal, contrapuntal frameworks for what must surely have often been much more elaborated (either notated or improvised) musical realities.³¹ Nevertheless the reader or listener of the present article is urged to explore and re-explore the soundclips provided, along with their approximately equally-tempered equivalents for (artificially contemporary) comparison, to develop an internalized sense of the special linear motions and vertical sonorities produced by Marchettan theory. The intense narrowness of the “chromatic minor 3rd” between F \times and A, resolving either inward to the unison G (Example 9c) or outward through Marchetto’s “feigning” to the perfect 5th F–C (Example 10c), is particularly arresting, sounding to our ears more like a wide major 2nd. Indeed, as with the wide major 6ths expanding to the octave, these instances—even if somewhat hard to swallow at first—certainly serve well to point up the essentially *dissonant* qualities of the 3rd and 6th within the thinking of the period, when set against their pure intervals of contrapuntal resolution.³²

³¹ As Herlinger has pointed out in a recent essay (“Medieval canonic,” 187), we can reasonably presume that Marchetto is deriving his equal five-fold division of the tone from an empirical, monochord-based calculation of string length. In strict terms, the equal five-fold division of this space does not produce exactly equal intervals, though the differences are so tiny (\pm around 1 cent) as to be acoustically negligible (*ibid.*). At a late stage in the preparation of this article, Jan Herlinger has kindly drawn my attention to Jay Rahn, “Practical Aspects of Marchetto’s Tuning,” *Music Theory Online* 4.6 (1998); this explores the monochordal implications of Marchetto’s theory in considerable detail, with particular (perhaps excessive) emphasis placed on the unequal five-fold (i.e. ninth-based) division of the tone.

³² A number of further examples involving the chromatic semitone are given by Marchetto earlier in the *Lucidarium*, in passages on the diesis itself (§2.6: Herlinger, *Lucidarium*, 141–3) and later on consonance and dissonance (§5.6: *ibid.*, 208–23); some of these are included explicitly as examples of what a composer should *not* write (*ibid.*, 208–9), where the voice-part in counterpoint with an upwardly resolving chromaticism does not follow its “proper” behaviour of descent by a tone.

It is worth noting at this point Marchetto's other recommendations or prescriptions on the minor and major semitones (enharmonic and diatonic respectively, in his terminology), as rationalized into their equal five-fold constituents of two and three dieses, to place alongside the more extreme chromatic semitones just explored. In addition to the texts already cited, a conveniently short passage that exemplifies both linear and vertical implications of these intervals can be found in the chapter immediately preceding that on the chromatic semitone. Here (*Lucidarium* §2.7) the author provides examples of his "permutation" (*permutatio*), that is, linear movement from \flat *fa* to \natural *mi* or vice versa in the same voice—a movement, still rather rare in the actual polyphonic repertoires, which we might be tempted to call "chromatic" from later, anachronistic contexts, although the technical inaccuracy of such a loose usage will by now be apparent:

Semitonium dyatonicum est quando fit permutatio \flat rotundi in \natural quadrum vel e converso propter ascensum vel descensum, ut hic:

It is a diatonic semitone when permutation takes place from round \flat to square \natural , or vice versa, due to an ascending or descending motion, as here:

EXAMPLE 11

(a) (b) (c) (d)

The image shows four examples of a diatonic semitone permutation, labeled (a) through (d). Each example is presented on two staves. The top staff contains a single melodic line with square neumes and a flat sign. The bottom staff contains a single melodic line with square neumes. The examples illustrate the permutation of a round note (flat) to a square note (natural) and vice versa, occurring in both ascending and descending motions.

This, however, is also the point where we need to pause for a moment to consider the competing claims of the horizontal and vertical dimensions when arguing for the tuning characteristics of examples such as these. Although Marchetto is formulating such small-scale contrapuntal

cells in the context of the linear semitone sizes (minor and major), it is difficult to believe that trained singers, at least when not constrained by a fixed-frequency instrumental control such as a keyboard, would not have tended to gravitate toward tuning the minor 3rds $G-\flat fa$ pure. Even apparently straightforward instances, however, such as Example 11, raise curiously awkward questions of prioritisation in this regard. In Example 11*b*, if the lower voice is controlling the motion through ascending pure linear intervals of minor 3rd and tone ($E-G-A$), then the unison A on which the voices converge will be some way sharper than the A which the top-voice singer has in mind when imagining his first descent through the major semitone from $\flat mi$ to $\flat fa$. In easily understood (if somewhat artificially precise) Hertz terminology, based on a notional $a_1 = 440$, the lower voice will begin on $E = 165$, progress through a pure minor 3rd to $G = 198$, to $A = 222.75$ —nearly 3 Hz or more than 21 cents sharper than the $A = 220$ which the upper voice would initially have been aiming at, and sharper, indeed, than the lower voice itself would have arrived at with a single rather than mediated ascent of a perfect 4th. In order to reach a proper unison, therefore, with the lower voice as “control,” the $\flat mi-A$ tone traversed by the upper voice is a distinctly narrower tone to be divided five-fold than Marchetto is in principle considering, and the $\flat fa$ correspondingly sharper at 232.65 Hz, though still considerably flatter than the 237.6 Hz at which the upper voice would have to pitch this $\flat fa$ to tune pure with the lower-voice G . Similarly, at Example 11*d* an upper voice clinging fast to a Marchettan equal five-fold descent (were that even possible), against a lower voice progressing in pure linear 3rds, creates an impossibly wide perfect 5th $E-\flat mi$ on the central dyad, whose upper note is a full 33 cents sharper than the pure 5th required by the positioning of the lower voice. Conversely, however, if we transfer the burden of adjustment to the lower voice, in order to correct the vertical tuning to pure intervals, whilst retaining the Marchettan descent in the upper voice, we can see that the singer of that lower part must compensate, compared with the previous versions, by ascending a noticeably narrower minor 3rd $E-G$ (almost 50 cents flatter than pure) and correspondingly wide tone $G-A$ at Example 11*b*. On the other hand, at Example 11*d* he will need to ascend through a much wider major 3rd $C-E$ (around 33 cents sharper than pure), and correspondingly narrow minor 3rd $E-G$.

Returning now to the first, small polyphonic example of the chromatic semitone that Tinctoris cites in the *Liber de arte contrapuncti* (Book 2, Chapter 2: see Example 3 above), we can hear the striking effect of his “false unison” F/F✳, with the diesis inflection G–F✳–G still construed, for the time being, as a Marchettan one-fifth of the pure G–F tone, set against the *mi–fa* linear minor semitone E–F–E (Example 12(i)).

EXAMPLE 12



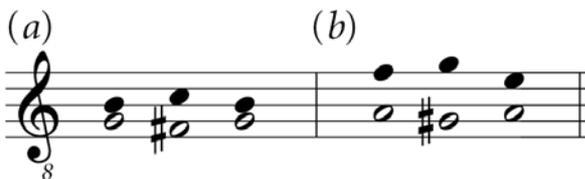
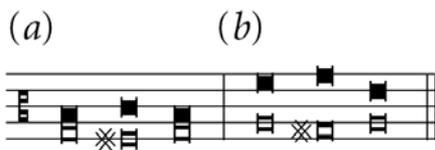
- (i) Based on Pythagorean minor 3rd E–G: 
- (ii) Based on pure minor 3rd E–G: 

A by-product of this particular example is that if the framing minor 3rd E–G is construed pure rather than Pythagorean, then the hypothetical, uninflected F which the upper voice is envisaging in order to position its diesis descent to F✳ (i.e. a pure tone below the opening G) is—at least in theory—considerably sharper (by around 28 cents) at 352 Hz than the F *fa* of 346.5 Hz approached through the Marchettan division from the E below. This widens the false unison F/F✳ even further than the already extremely narrow chromatic inflection provides for, as in Example 12(ii) which on concentrated listening does indeed sound a little brighter and livelier than Example 12(i). In practice, of course, for singers brought up and trained in the use of such inflections, it would surely have been the sheer *sound* and expressive effect of the intervallic nuances that would have been held in the mind and brought into play, rather than any close attention to the underlying mode of calculation.

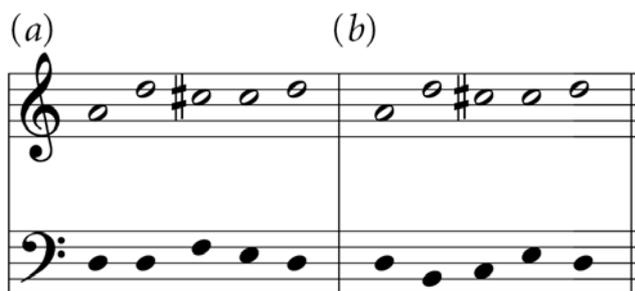
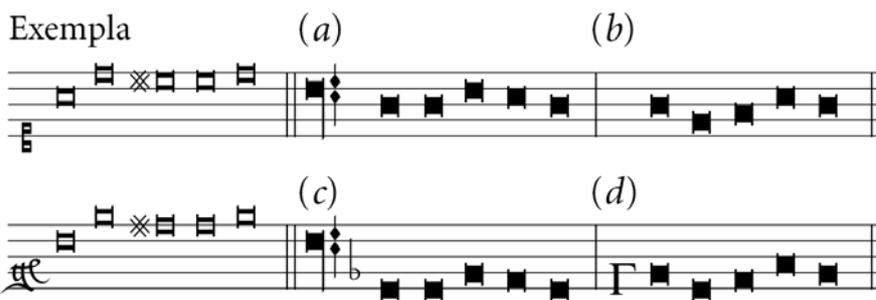
Again, the examples from Book 2, Chapter 17 of the *Liber de arte contrapuncti* (Examples 5 and 6 above), in which Tinctoris describes the categories of intrinsic concords which become discords or false concords through the squeezing or stretching effect of the chromatic semitone, may be realized as in Examples 13 and 14. We are also now in a position to form some kind of judgement on Tinctoris’s subsequent statement in the same chapter that “the 5th and 12th

and 19th nevertheless do not sound in such harsh discord as the rest through such use of chromatic semitones;” here again, intervals other than the chromatic inflections are tuned reasonably pure, though some very small adjustments are necessary in order to reach true final unisons and maintain a plausible stability of pitch:

EXAMPLE 13



EXAMPLE 14



EXAMPLE 14 (continued)

(a) (b) (c) (d)

In the instances given in Example 14, since each contrapuntal group begins with a perfect concord (compound perfect 5th), with the upper voice then ascending by a perfect 4th, the tuning and positioning of the chromatic inflection (again, for the time being, accepting the principle of the Marchettan one-fifth diesis), is not problematical. Placed against the lower parts of Examples 14*a* and 14*c*, they produce false concords F–C✘ and $\flat fa$ –F✘ which may be heard as a wide compound minor 6th or narrow compound major 6th.³³ Placed against the lower parts of Examples 14*b* and 14*d*, they produce false octaves C–C✘ and F–F✘ which sound analogously as somewhere between compound minor and major 2nds.³⁴ In other words, Tinctoris is fully justified in considering the former group less “harsh” than the latter.

Finally from this treatise we may continue to Chapter 18: here, such subjective, musical judgements are taken further, in Tinctoris’s assessment of how the chromatic semitonal inflection may nuance the perceived dissonance levels of intrinsically discordant intervals, rendering each either more intense (“intensior”) or more relaxed (“remissior”) (Example 15, picking up from Example 7 above):

³³ Reduced to frequency ratios of simple (i.e. not octave-compounded) intervals, an 8 : 5 pure minor 6th gives a decimal ratio of 1.6 : 1 and a 5 : 3 pure major 6th gives 1.67 : 1. The false concords here produce a ratio of 1.63 : 1, in other words very slightly closer to the minor than major 6th.

³⁴ Again, reduced to simple decimal frequency ratios, a 16 : 15 pure minor 2nd (defined for these purposes as the difference between a perfect 4th and a pure major 3rd), is equivalent to 1.07 : 1, and a 9 : 8 pure (i.e. Pythagorean) tone 1.125 : 1; these false octaves emerge as the equivalent of 1.1 : 1, or very slightly closer to major than minor 9ths.

EXAMPLE 15

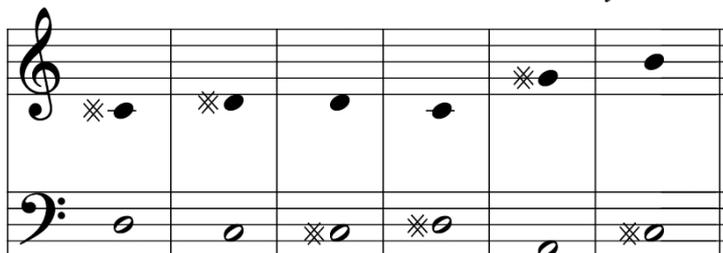
(a) (b) (c) (d)



(e) (f)



(a) (b) (c) (d) (e) (f)



(i) Uninflected

(a)  (b)  (c)  (d)  (e)  (f) 

(ii) Chromatically inflected

(a)  (b)  (c)  (d)  (e)  (f) 

The soundclips here give both the uninflected and inflected versions of these intervals: as noted above, it is not difficult to categorize most of these as more “intense” or more “relaxed,” though possibly some debate may surround (f), for reasons already suggested. In fact, there is a degree of latitude in instances such as these, even within the equal-fifth division of the tone, as to exactly where to place these chromatic inflections, depending on the actual contrapuntal context involved. For example, in Example 15b, the pitch of D* is arrived at by dividing the whole tone D–E, the D itself being derived from a pure tone above C, creating effectively a Pythagorean major 3rd C–E. However, if a real contrapuntal situation involved this D* in a resolution upward to, or motion from, an E tuned pure to a “controlling” C beneath, then this E

would need to be rather flatter (by around 21–22 cents) than that produced by the Pythagorean 3rd; the D \times will therefore be correspondingly lower, and the dissonant vertical interval—especially in view of the wide spacing—noticeably narrower, as can be heard in Example 16 (compare Example 15*b*, and with the analogous Example 12 above):

EXAMPLE 16



At the end of Book 2 of the counterpoint treatise (Chapter 34), Tinctoris returns briefly but significantly to the chromatic semitone, picking up on the earlier Chapter 17, with a three-voiced polyphonic example illustrating the author’s grudging acceptance that most of his contemporaries do indeed write passages which call for an intrinsically perfect concord to be rendered discordant through the use of a chromatic semitone inflection, where the composition is in three or more voice-parts:

Concordantie vero perfecte que per semitonium cromaticum, hoc est per sustentionem, aut imperfecte aut superflue efficiuntur etiam sunt evitande, licet et his uti supra totam aut dimidiam aut maiorem partem note mensuram dirigentis, et perfectionem immediate precedentis, omnes fere compositores in compositione trium aut plurium partium, ut hic sequitur, expertus sim.³⁵

Again, perfect concords which are rendered imperfect or superfluous through the use of the chromatic semitone, that is through a raising of pitch, must also be avoided, although in my experience nearly all composers use even these, in compositions of three or more voices, over the full length, or half, or the greater part, of the note controlling the measure, and immediately preceding a perfection, as follows here:

³⁵ This version of the text is taken primarily from Brussels 4147 (Br), fols. 96v–97, which is basically identical to Valencia 835 (V); for variants in Bologna 2573 (Bu), see Seay, *Tinctoris Opera Theoretica*, ii. 144–5, though these are rather unreliably reported. In the text, Bu reads “tunc” erroneously for “trium,” and an ungrammatical “sum” for “sim.” In Example 17 the sharp in m. 2, and the *signa congruentie* in the Cantus and Contratenor at mm. 2 and 6 are all notated correctly in V and Bu, but are missing in Br. In the Contratenor, the semibreve *d* at m. 7 is split into two minims in V.

EXAMPLE 17 


O de - us prin - ceps ce - lum, me - mor e - sto mu - si - co - rum.

Contratenor

Tenor

As Margaret Bent has noted,³⁶ Tinctoris distances himself from such practice, which he states should, strictly speaking, be avoided. In the practical example that he nevertheless provides himself, to the text “O Deus princeps celorum, memor esto musicorum” (Example 17), at least two clear instances can be seen. The first of these is at m. 3, where the perfect 5th *c–g* between

³⁶ Bent, “On False Concorde,” 113–7.

Cantus and Contratenor is imperfected by the notated chromatic inflection of the leading-tone *c* at a D cadence. Because of the lower-third decoration here, this instance presumably represents Tinctoris's case of the dissonance occupying "the greater part of the note controlling the measure" ("supra maiorem partem note mensuram dirigentis") in uncut tempus perfectum, namely the semibreve. The second instance, at m. 6, involves an unnotated *ficta* sharpening of a *g* in the Cantus as a minim-level resolution of the preceding suspension, sounding simultaneously with an uninflected *g* at the lower octave in the Contratenor (i.e. a compound version of the *falsus unisonus* discussed above from Book 2, Chapter 2). This results in a "superfluous" or "excessive" octave over the duration of half of the controlling value ("supra dimidiam partem") between the two voices as part of a penultimate to a cadence on A, which is then immediately side-stepped to D by the fall of the uninflected Contratenor *g* to *d* after a minim rest. It is less clear whether Tinctoris intends m. 1 of this example to be regarded as an illustration of such a chromatic inflection over the whole duration of the controlling value ("supra totam partem"), though it is difficult to see any other plausible candidate, despite the absence of corroborative *signa congruentie* in the Valencia and Bologna sources. If so, he must be viewing the Cantus *c* on the third beat of this measure as fictively sharpened as part of a normal 6–8 cadence with the Tenor; and although the perfect 4th *g–c* between Cantus and Contratenor is not intrinsically a perfect concord, as demanded by the text of Chapter 34, Tinctoris does hold the interval to be consonant in *res facta* and *faubourdon* when underpinned by a lower 3rd, as in the standard formula here, or 5th, or their compounds (*Liber de arte contrapuncti*, Book 1, Chapter 5).³⁷ However, if this is indeed an intended instance, he is clearly not regarding the Contratenor *g* to be similarly inflected, since to do so would undermine his point; this implies a rejection of the double leading-tone here (an issue to be discussed further shortly), though it is interesting to speculate whether the more emphatic, decorated cadence at m. 10 should lead us to distinguish between "medial" and "final" treatments of such a cadential formula. Tinctoris is usually careful to illustrate the technical detail of his texts with some precision in his examples. Here, m. 1 here is really the only place where an occurrence

³⁷ Seay, *Tinctoris Opera Theoretica*, ii. 26–7.

of the chromatic inflection *supra totam partem* is feasible (the Cantus *c* semibreve at m. 8 is surely beyond the pale!), but we should not rule out the possibility that the *signum congruentie* indications in Valencia and Bologna are to be taken as complete in themselves, and that Tinctoris has not intentionally included an instance of *supra totam partem* inflection in his example. The (untexted) soundfile attached here to Example 17 inflects both m. 1 and m. 10 as double leading-tone chromatics, as well as Tinctoris's two explicit instances of the point under discussion. The intervals here are, again, based on the fifth-tone diesis, though we shall return shortly to this same polyphonic example to explore other nuances of possible tuning. (See Example 21 below.)

Ultimately, though, as suggested earlier, the singer's main criterion in deciding exactly where to place all these chromatically inflected notes, would surely have been the sound itself, the expressive effect being judged from a complex matrix of contingent harmonic, contrapuntal and melodic circumstances allied to the inherited stylistic, cultural and historical attributes that the phenomenon had accrued. So for Tinctoris, a northern-trained Brabantine in his forties working in the cultural mix of the Aragonese court at Naples in the 1470s, how credible or plausible is the persistence of the Marchettan fifth-tone diesis as a measure of such chromatic usage?

As we have seen, there is certainly some slippage between the strict Marchettan formulation and Tinctoris's rather hazy refiguring of it. Just as he qualifies his acceptance of the equal five-fold division of the tone ("according to some") in the counterpoint treatise, it is significant that in the Brussels manuscript version of the *Diffinitorium* (dating from the 1480s and relaying revisions made by some intermediary since the early 1470s) the diesis has become a catch-all term used by some to define a fifth part of the tone, but by others to mean a third, quarter or eighth part.³⁸ Tinctoris himself may or may not have been responsible for this revision to his text, though the subsequent caution *against* using the ear rather than ratio(nal) calculation in distinguishing the diesis (albeit Aristotelian in origin) seems to militate against

³⁸ See note 14 above.

this.³⁹ The passage nevertheless indicates that different sizes of microtonal divisions, or at least different ways of rationalising and articulating semitonal distinctions, were apparently still part of musicians' active discourse at this time. Jumping back a century, an extract from the Berkeley treatise (*Tractatus quintus*) of c. 1375, already cited by Herlinger in this regard,⁴⁰ provides some interesting evidence here, to which I shall return later with regard to the thorny question of the solmization attributes of the chromatic semitone:

Tonus dividitur in tres partes, scilicet in semitono et semitonio.⁴¹ Semitonus habet fieri inter mi et fa et inter fa et mi ubique, et tenet duas partes toni. Semitonium tenet terciam partem toni, et habet fieri inter fa et sol cicius quam alibi, quia si inter fa et sol ponatur ♯, de fa usque sol erit tantum semitonium, et idem dico de sol usque la, de ut usque re, de re usque mi. Et licet in cantu plano non ponatur, tamen in fine cuiuscumque ascensus inter penultimam et ultimam semper subintelligitur ♯, ut hic patet:

The tone is divided into three parts, that is, [consisting of] the semitone and the semitonium. The semitone is made to occur between mi and fa and between fa and mi in all places, and it contains two parts of the tone. The semitonium

³⁹ "Atque si Thome credamus, diesis ipsa semitoniorum est differentia; sed quicquid sit, ut philosophus asserit in decimo Methaphisice, diesis non secundum auditum sed secundum rationem distinguitur." (Brussels II 4147, fol. 119v, correcting Parrish, *Dictionary*, 76). This Brussels addition seems in any case to represent a somewhat bowdlerized reading of the relevant passage from Book 10 of Aristotle's *Metaphysics*. Here, in the context of demonstrating that any measuring unit must in a sense be regarded as indivisible in order to function as a measure, Aristotle nevertheless acknowledges that some such units are not necessarily unitary. He regards the diesis as a case in point, since in his understanding (a long way removed from the later medieval formulations) its purported two forms are distinguishable not by hearing so much as by their differing ratio computations. The problematics of this passage are discussed in Andrew Barker, *Greek Musical Writings. Volume II: Harmonic and Acoustic Theory*, Cambridge Readings in the Literature of Music (Cambridge: Cambridge University Press, 1989), 72–3. A convenient online translation of the *Metaphysics*, with notes and links to the Greek text, is available at the time of writing as part of the Perseus project at Tufts University at: <http://www.perseus.tufts.edu/cgi-bin/ptext?lookup=Aristot.+Met.+1.980a>

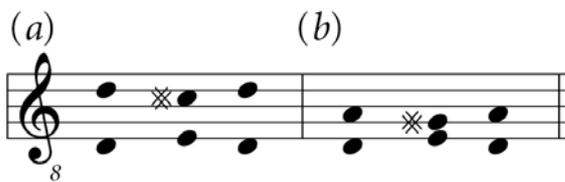
⁴⁰ Herlinger, "Fractional Divisions," 78–9.

⁴¹ Text taken here from *The Berkeley Manuscript: University of California Music Library, MS 744*, ed. Oliver Ellsworth, *Greek and Latin Music Theory 2* (Lincoln: University of Nebraska Press, 1984), 240–2, with minor modifications of punctuation. The text of this first sentence is a little problematic, and Ellsworth had earlier proposed an explicatory, if perhaps over-elaborate, emendation: "[scilicet] in semitono de duabus partibus et semitono de una" ("A Fourteenth-Century Proposal for Equal Temperament," *Viator* 5 (1974): 447); Ellsworth discusses these textual issues in his 1984 edition (*The Berkeley Manuscript*, 241–3). Throughout this article I am distinguishing the medieval ♯ or # from modern ♯, to avoid possible ambiguity.

problem that theorists had with the whole notion of fractionally dividing the tone, despite its ostensible easing of those intractable Boethian ratios for practical musicians. That is to say, it is very difficult to find a simple, realisable fractional system that allows for a minor/major semitonal distinction as well as making room for a specially sharpened, chromatic inflection which retains its distinctiveness from the minor semitone but which is less extreme than the Marchettan fifth-tone diesis. A three-fold division causes the Berkeley problem, and a four-fold division may create plausible minor and chromatic semitones, but an egregiously wide major semitone of three-quarters of a tone. Marchetto's five-fold division provides, in fact, arithmetically the simplest available solution.⁴⁵ In the end, of course, it is a problem more of the written text than of the musical reality, for many of these writers and musicians, as has already been suggested, will have had a perfectly lucid aural image of the sound of these specially sharpened cadential inflections, but not the language to describe them adequately.

Just how much difference, though, does it make to the actual sound, if we accept the general principle of heightened sharpening, especially in cadential situations, but relax a little the strict Marchettan premise of the fifth-tone diesis as sole criterion, acknowledging its likely status as simply a convenient approximation? Example 19 offers a number of alternative versions of the basic 6–8 and 3–5 cadential formulae, still in just two voices, realising the chromatic inflection, in terms of its linear resolution, as a fifth, quarter and third of a tone—in other words, still perceptibly smaller than a “normal” minor semitone:

EXAMPLE 19



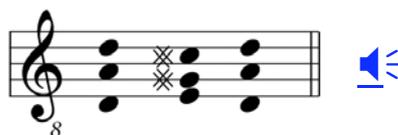
- (i) Fifth-tone division: (a) (b)
- (ii) Quarter-tone division: (a) (b)
- (iii) Third-tone division: (a) (b)

⁴⁵ Herlinger has similarly noted that “Marchetto sacrificed accuracy for comprehensibility” (“Fractional Divisions,” 76; cf. also his “Marchetto’s Division of the Whole Tone,” 213–4).

There may be some readers of this article who will instinctively seek a *via media* in this regard, preferring the quarter- or third-tone division as “musically” more plausible (because closer to our common experience), with the fifth-tone heightening seeming simply a step too far. I do not myself think that the undoubtedly more intense Marchettan division can be so lightly dismissed, even if Marchetto’s own formulation is accepted as an only approximate and imperfect representation of his intentions. There is certainly empirical evidence from, for instance, recordings of string players and singers during the 20th century that extremely narrow leading-tone intervals of around 40 cents (i.e. a direct equivalent of a Marchettan diesis) have been instinctively practised and accepted, for particular expressive purposes, even within standard tonal repertoires.⁴⁶

In turn, these same examples beg the inevitable question, in the context of 14th- and 15th-century polyphony, of how we should construe the tuning of such chromaticized cadential formulae when used in combination, as in a double leading-tone cadence. For as long as one buys into Tinctoris’s axiom that the double-cross \otimes sign should be used uniquely to signify the chromatic inflection (however realized in interval placement), an instance where both leading-tones are explicitly designated is not in principle problematic, even though its actuality (here again, for the sake of argument, in equal five-fold division), is to say the least trenchant (Example 20):

EXAMPLE 20



We can also now combine our previous exploration of quarter- and third-tone substitutions for Marchetto’s (at least notional) fifth-tone diesis (Example 19) with the doubled cadential inflection, in reviewing the three-voiced polyphonic example *O Deus princeps celorum* provided by Tinctoris in Book 2, Chapter 34 of his counterpoint treatise, as discussed above

⁴⁶ See, for example, Peter Johnson, “‘Expressive Intonation’ in String Performance: Problems of Analysis and Interpretation,” in *The Music Practitioner: Research for the Music Performer, Teacher and Listener*, ed. Jane Davison (Aldershot: Ashgate, 2004): 79–90.

and heard in a fifth-tone realization as Example 17. This time, the example can be heard: (a) in the same tuning as before, followed by alternative versions with all chromatic sharps retuned on the basis of (b) quarter-tone, and (c) third-tone intervals of resolution (Example 21):

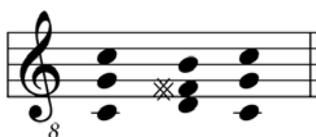
EXAMPLE 21: Tinctoris, *O Deus princeps celorum* (from *Liber de arte contrapuncti*, Book 2, Chapter 34)

The image displays three systems of musical notation for the vocal parts of Tinctoris's *O Deus princeps celorum*. Each system consists of three staves: Soprano (top), Contratenor (middle), and Tenor (bottom). The music is in 3/4 time. The lyrics are: "O de - us prin - - ceps ce - - -
- lo - - - rum, me - mor
e - - sto mu - - si - co - - rum."
The first system shows the original notation with a sharp sign (♯) above the first measure of the Soprano part. The second system shows a quarter-tone division, indicated by a sharp sign (♯) above the first measure of the Soprano part. The third system shows a third-tone division, indicated by a sharp sign (♯) above the first measure of the Soprano part. The lyrics are written below the notes in each system.

(i) Fifth-tone division: ♯ (ii) Quarter-tone division: ♯ (iii) Third-tone division: ♯

These versions shed valuable light on the musical realities involved here within a “real” polyphonic context, and upon our individual perceptions of the viability of the Marchettan formulation. But two important factors complicate such double leading-tone realisations. First, of course, a very significant number of such cadences do not notate the inflection in both voices, and often (including those in this Tinctoris example of *O Deus princeps celorum*) no sharps at all are indicated: this may be for various reasons, including the obvious one of a double inflection not being anticipated in the first place. (See, in this regard, the discussion surrounding Example 17 above.) An even more interesting situation arises where the modality of such a cadence is placed a tone lower than that given in Example 20, and where only the middle voice is explicitly inflected (Example 22):

EXAMPLE 22



- (i) Upper B accommodated to ✕ chromatic inflection 
- (ii) Upper C–B retained as *fa–mi* minor semitone 
- (iii) Derived from Lindley’s F♯ × B tuning scheme 

In this case, even if one were a fully paid-up Tinctorian, how should this be interpreted? The middle voice can be made to “follow the rules” of chromatic semitonal inflection, but the upper-voice linear movement is that of a straightforward *fa–mi–fa* minor semitone. If the singers were stylistically receptive to the sound of the narrow chromatic resolution (and, as we are assuming throughout this study, if they were not constrained by fixed-frequency instrumental doubling), would they expect to accommodate the upper \flat *mi* to the tuning of the F✕ to ensure perfect 4th progression (Example 22(i)), analogously to the double notated sharps of Example 20? If so, is one to extrapolate this sonority to other (apparently simple) 6–8 cadences on, say, C or F (or, indeed, a double leading-tone cadence on F) where no

signed sharps are required or possible, and postulate that the aesthetic effect of the widened penultimate sometimes leaked across from notated chromatic usage? Or, on the contrary, would singers accepting a heightened notated sharp have retained the distinction between the upper minor semitone and the middle chromatic semitone progressions (Example 22(ii))? Or, thirdly, abandon both of the above as sounding altogether too undesirable, cast aside any privileged chromatic status for the $F\sharp$, *pace* Tinctoris, and re-tune the whole either to pure “triadic” intervals or perhaps to something like the scalic formulation described by Mark Lindley as the $F\sharp \times B$ scheme (Example 22(iii))?⁴⁷ In this, all fifths are tuned pure in a cycle down from $\flat mi$ to $G\flat/F\sharp$, with a consequently impure or wolf 5th/4th between B and $F\sharp$. Although principally conceived as an untempered keyboard tuning schema, with examples convincingly adduced by Lindley from, for instance, the Buxheim organ-book, and strong theoretical support from John Hothby and Ugolino of Orvieto, it is not difficult to envisage the sonorous impact of the system carrying across to purely vocal performing situations in, especially, the 15th century. It may not be too far-fetched, indeed, to regard this as one possible component of the *contenance angloise* or *frisque concordance* adumbrated in the much-studied passages of Martin le Franc’s *Le Champion des Dames*.⁴⁸ The proximity of this system to pure tuning in some contexts can be heard at Example 22(iii); as Lindley himself has pointed out,⁴⁹ one significant feature of the $F\sharp \times B$ tuning is that the major 3rd D– $F\sharp$ is extremely close to pure, and, because of the scheme’s structure, a double leading-tone cadence on to D, involving two sharps is—far from the sourness produced by the one-fifth chromatic diesis—in fact even sweeter and closer to pure than that involving only one sharp on to a C final (Example 23; compare with Example 22(iii)):

⁴⁷ See Mark Lindley, “Pythagorean Intonation and the Rise of the Triad,” *Royal Musical Association Research Chronicle* 16 (1980): 4–61; and id., “Temperaments,” *The New Grove Dictionary of Music and Musicians*, 2nd edn., ed. Stanley Sadie and John Tyrrell, 29 vols. (London: Macmillan, 2001), vol. 25, 248–68, esp. 248–9.

⁴⁸ For a recent re-examination of these passages, emphasizing their aural and performative implications, see Margaret Bent, “The Musical Stanzas in Martin Le Franc’s *Le Champion des Dames*,” in *Music and Medieval Manuscripts: Paleography and Performance. Essays dedicated to Andrew Hughes*, ed. John Haines and Randall Rosenfeld (Aldershot and Burlington: Ashgate, 2004): 91–127.

⁴⁹ Lindley, “Pythagorean Intonation,” 16–17.

EXAMPLE 23



Embedded in these last few, alternative realisations is the much larger historical issue that underlies the second complication to the double leading-tone problem outlined above. For of course, in the manuscript sources, and in the minds of composers, singers and scribes, notated sharp signs—whether written as ⌘ or in some other graphic figuration—were very far from acknowledged as the special and unique indication of such heightened inflections which Tinctoris is claiming for them. It is perfectly clear from even a cursory sweep through the European vocal repertoires of the 14th and 15th centuries that notated sharps were often used to impart a more or less pure 3rd or 6th tuning in relation to surrounding voices, whether construed as a true hexachordal or conjunctal *mi* or—heretical as it may sound—as retaining their uninflected solmization status. (Indeed, it is surely this very spectrum of usage from transpositional or conjunctal *mi* to narrow, chromatic inflection that aided and abetted the confusion of signs, from ♮, ♭, ♯, and others to ⌘ and ⌘, which pepper the sources; *causa pulchritudinis* can, after all, surely apply to both horizontal melodic shaping and harmonic purity.) This is most obviously the case where a cadential sonority of *resolution* itself involves one or more notated sharps, examples of which extend back at least to the first half of the 14th century, and where anything other than pure (or pure-ish) tuning seems highly improbable. Such is also the case in numerous 15th-century *formes fixes* songs, notably by Binchois, Dufay, Busnoys, and their contemporaries, whose principal medial cadence is not infrequently characterized by a notated sharp 3rd at the point of rest, where a heightened chromatic interpretation is unthinkable;⁵⁰ and the same applies to ends of sections in innumerable sacred polyphonic settings of the same period. These, though, are in fact the easy, extreme

⁵⁰ Related to this question, see Brothers, *Chromatic Beauty*, esp. Chapter 4, together with reviews of this book by Bonnie J. Blackburn in *Journal of the American Musicological Society* 51 (1998): 630–6; and by Elizabeth Eva Leach in *Music & Letters* 80 (1999): 274–81.

instances, just as are (relatively speaking) the clearly notated cadential penultimates. The real difficulties of interpretation lie in the proliferation of other examples in the geographically and generically diverse repertoires of the 14th and 15th centuries—Machaut is naturally an obvious focus here—where the contingent contrapuntal circumstances do not allow for the ready identification of a particular notated sharp as either “simply” cadential (potentially with heightened inflection) or “simply” conjunctal (potentially tuned pure, either horizontally with a preceding or succeeding pitch, or vertically with a surrounding voice).

A recent, valuable contribution to this difficult area is Pedro Memelsdorff’s explication of the various accidental signs employed in the manuscript ModA (Modena, Biblioteca Estense, MS α . M. 5. 24), in the context of the manuscript’s scribal layers and likely proximity to the activity of Matteo of Perugia.⁵¹ It is not feasible to attempt here a synopsis of Memelsdorff’s detailed exposition of the later gatherings I and V of ModA, which form the focus of his study. Nevertheless, it is highly significant in terms of the present article that Memelsdorff explores the possibility—even likelihood—that certain pieces in the collection, especially from his “Alpha” group from gatherings I and V, may display notational characteristics which distinguish between “true” *mi* accidentals (signed \sharp or its apparent graphical variant $\#$) and quasi-Marchettan heightened sharpening in a more cadential, often penultimate context (signed $\#$ or \times).⁵² An instance of the kind of differentiation that Memelsdorff brings to our attention is Matteo’s virelai *Helas avril* (fol. 45).⁵³ The first notated accidental in this piece occurs in the Cantus at tempus 3 (Example 24, with facsimile):

⁵¹ Memelsdorff, “What’s in a Sign?”; a colour facsimile of ModA is now available as *Il codice α .M.5.24 (ModA)*, ed. Ernesto Milano, Ars Nova, Nuova serie 1 (Lucca: Libreria Musicale Italiana, 2003).

⁵² Memelsdorff, “What’s in a Sign?,” esp. 260–9.

⁵³ An edition of this piece, admittedly with rather poor and inconsistent treatment of accidentals, is given in *French Secular Compositions of the Fourteenth Century*, ed. Willi Apel, 3 vols., Corpus Mensurabilis Musicae 53 (n. pl.: American Institute of Musicology, 1970–2), i. 111–13. Example 24 has been re-transcribed from ModA, without textual underlay; the first note of the Tenor has been amended from the source reading of imperfect breve to partially imperfect long, as in Apel.

EXAMPLE 24

(a) Matteo da Perugia, *Helas avril*, mm. 1–4

Contratenor

Tenor

(b) facsimile of part of Cantus (ModA, fol. 45)



EXAMPLE 25: Matteo da Perugia, *Helas avril*, facsimile of part of Cantus (ModA, fol. 45)



Memelsdorff argues plausibly (though, as we shall see, not incontrovertibly) that the scribe (his Scribe A, responsible for gatherings I and V, and some corrections to the earlier gatherings II–IV) is deliberately signing *G mi* at this point—hence modern $G\sharp$, and necessary following $F\sharp$ as *F re*); part of the argument for this lies in the later distinction made by the same scribe at tempora 35–6 of the Cantus (“Que desir”: facsimile given as Example 25). In other words, the sharpening of the C to a true *mi* in the descending line of tempus 35 is then further tensioned by the notated \sharp in the second part of the ornamented cadential progression. (Memelsdorff in fact does not illustrate this whole final phrase, so the full cadential impact of the \sharp nuance is lost in his example.) The phrase is then further extended through to the medial cadence (“et lermir.”), which is again reinforced by the notated \sharp not only in the Cantus but as a classic double leading-tone progression (as discussed above) with notated $G\sharp$ in the Contratenor (Example 26). An additional ramification of this cadential heightening, if accepted, concerns the under-third embellishment of the final Cantus cadence: if this B is tuned pure to the Tenor E, the linear Cantus progression, with its exceptionally wide $C\sharp$ –B tone, seems stilted and unvocal; it may be more plausible if the under-third is tuned horizontally as a pure tone below the preceding $C\sharp$, which, although therefore dissonant (acoustically rather than contrapuntally) with the Tenor, nevertheless has a certain advantage of forming a normal minor 3rd with the chromatically sharpened Contratenor.

EXAMPLE 26: Matteo da Perugia, *Helas avril*, mm. 40–2

The musical score for Example 26 consists of three staves. The top staff is the Cantus part, written in treble clef with a common time signature. It begins at measure 40. The middle staff is the Contratenor part, written in bass clef with a common time signature. The bottom staff is the Tenor part, also written in bass clef with a common time signature. The Cantus staff shows a melodic line with a sharp sign above a note in the second measure. The Contratenor and Tenor staves show a double leading-tone progression in the second measure, with the Contratenor and Tenor parts moving in parallel motion.

Memelsdorff extends this argument to hypothesize that, since this nuanced ♯–♯ cadential formulation was so characteristic of Matteo—he goes so far as to tag it the “clausula peruscina” or “Perugian cadence”—it was on occasion necessary to sign only the initial ♯ against some pre-penultimate in order to trigger the subsequent heightened ♯ at the cadence-point proper, as occurs in *Helas avril* at tempora 72–3, presenting essentially the same music as the “fully notated” version of tempora 35–6.⁵⁴ This is an attractive notion in the context of the present study, though I think that the jury is still out on whether this layer of ModA can be viewed as representing consistent notational practice in its differentiation of ♯ *mi* and “Marchettan” ♯ chromatic sharps. Even within *Helas avril*, for instance, tempora 67–8 come to rest on a sustained E “major triad,” with the third degree signed ♯ in the Contratenor, which, as has been explored above, is difficult to countenance as a Marchettan chromatic, and is in any case not cadential in a true contrapuntal sense.⁵⁵ Another question still pending in this regard, and not yet addressed by Memelsdorff, concerns the use of flats. On a number of occasions in this same piece a \flat is signed on, say, D or G (e.g. tempora 6, 13 and 16 in the Cantus) in such a way as to indicate C *mi* or F *mi* respectively—effectively raising these latter to C♯ or F♯ in modern terms.⁵⁶ This usage is intrinsically unproblematic, and other instances of such “indirect” extra-hexachordal *mi* indication are recorded (albeit rarely) elsewhere.⁵⁷ It remains to be explained, however, why the composer or scribe of *Helas avril* retained two different systems for signalling a non-standard *mi* inflection, one with \flat , the other with ♯. It could be argued that the latter practice was intended specifically for the kind of “Perugian” cadential ambivalence that Memelsdorff is advocating; but if so, the practice of ModA is still very inconsistent. (An additional, interesting instance of flat usage in this piece occurs in tempus 6 (and possibly also 13), in which a \flat signed on D in the Cantus seems to indicate an F♯ *la* a “normal” tone

⁵⁴ Memelsdorff, “What’s in a Sign?,” 267.

⁵⁵ Apel, *French Secular Compositions*, i. 113.

⁵⁶ See facsimile edn.; also Apel, *French Secular Compositions*, i. 111.

⁵⁷ Two instances occur in Lucca, Archivio di Stato, MS 184, the anonymous rondeau *Aylas! Quant je pans*, whose Cantus is signed with a flat on G, indicating F *mi*; and Lebertoul’s *O mortalis homo/O pastores/O vos multi*, in which all three voices are signed somewhat tautologically (though at least unambiguously), the Cantus with flats on both G and D and sharps on F and C, and the Tenor and Contratenor with flat on G and sharp on F. (See Brothers, *Chromatic Beauty*, 39–42 and 166–7, note 55 for brief discussions of these.)

above E, rather than C♯ *mi*, though this is overlooked in Apel's transcription.) Memelsdorff's thesis is nevertheless valuable, apart from its intrinsic notational interest, in reminding us that there are genuine questions to be asked concerning the solmization status of sharped notes in this period. It may seem intuitively incontestable, on the basis of theories of *ficta* and false mutation current since the early 14th century, that a notated sharp should necessarily signal solmization as *mi*, by direct analogy with the use of ♭ to signal *fa* status.⁵⁸ But Theodor Dumitrescu has shown that this is far from the case, adducing evidence from the 15th and 16th centuries such as Fernando Estevan's *Reglas* of 1410, Ramos de Pareja's 1482 *Musica Practica*, an Italian counterpoint treatise associated with John Hothby, Gafori's 1496 *Practica musice*, and Pietro Aaron's *Toscanello in musica* of 1529.⁵⁹ To these one might also recall as witness the passage from the Berkeley treatise cited earlier, in which—however implausible the author's three-fold division of the tone for practicable semitone classification—there is a clear implication that the chromatic inflection of a note with ♮ between *fa* and *sol*, or likewise between *sol* and *la*, *ut* and *re*, and *re* and *mi*, need not alter the uninflected solmization status of that note.⁶⁰ On the other hand, one might also take account of the rare instances of sharp signatures in the polyphonic song repertory, such as (a) Antonello da Caserta's *Notés pour moi*, also in ModA (fol. 13v),⁶¹ all three voices of which are signed with one sharp (F♯) and D clef, the signature being notated as ♯ and clearly signalling a positioning for *mi*; and (b)

⁵⁸ See Cross, "Chromatic Alteration," esp. Chapters 2–3. A simple instance is described by Jacobus of Liège in his *Speculum musice*, outlining the solmization, through false mutation, of a descent from ♭ *mi* through A to G♯: "Ex his patet quod descendens a mi de ♭ fa ♭ mi per tonum et semitonium falsam committit musicam, quia oportet tunc ut cum mi in unisono iungatur sol mutetur, quia mi in sol dicendo mi–sol, fa, mi. Hoc autem faciunt quidam cantores in mediatione toni quarti a mi de ♭ fa ♭ mi per tonum et semitonium descendentes." (*Jacobi Leodiensis Speculum Musicae*, ed. Roger Bragard, 7 vols., Corpus Scriptorum de Musica 3 (n. pl.: American Institute of Musicology, 1955–73), vi. 185, with emendations). Note in particular that in such instances the solmization does not *prescribe* the intervals sung, but is a *post factum* rationalization of a musical reality already in the head.

⁵⁹ Dumitrescu, "Solmization Status."

⁶⁰ See note 41 above. Such evidence serves to undermine somewhat the unequivocal statements of some musicologists to the effect that "an accidental always signifies a syllable (♭ = fa, ♮ or ♯ = mi)" or "It follows that the only primary and absolutely indispensable function of an accidental is to indicate the syllable and that only secondarily does an accidental also indicate an inflection." (Karol Berger, "The Expanding Universe of *musica ficta* in Theory from 1300 to 1500," *Journal of Musicology* 4 (1985–6): 410–30 (p. 413).

⁶¹ Edited in Apel, *French Secular Compositions*, i. 11–12.

the already cited anonymous *Ay las quant je pans* (Lucca, Archivio di Stato, MS 184, no. 57), whose lower two voices are signed with one sharp (F#) and the upper with two (F# and C#), each sign re-confirmed as indicating *mi* status with an additional *b fa* signed in the staff space immediately above.⁶²

Of course few scribes, and certainly few composers, were obliging enough to leave us even the equivocal notation of ModA.⁶³ But even though this manuscript transmits the traces of a particularly finely nuanced musical aesthetic, the notion of differently gradated and tuned sharps for use within a variety of melodic, harmonic and contrapuntal situations was presumably nothing more than an everyday musical reality for trained, professional singers of the 14th and 15th centuries. The polyphonic pieces in the *Roman de Fauvel*⁶⁴ are littered with ambivalent instances of notated sharps, some of which must surely be tuned harmonically pure, others of which could be construed as stretched cadential heightenings, still others of which seem to metamorphose from one category to the other in a manner not so different, *mutatis mutandis*, from Matteo. (See, for example, *Bonne est amours/Se mes desirs*.)⁶⁵ The same could be said of many pieces in Biblioteca Apostolica Vaticana, MS Rossi 215,⁶⁶ a source not so far removed geographically from Marchetto himself. Here, it must be said, by far the majority of notated sharps (using the ♯ or # form) do occur in more or less clearly cadential contexts, but the vocal parts often settle on the chromaticized dyad (major 3rd or 6th, for instance) for such an extended

⁶² See note 57 above; the piece is edited in Apel, *French Secular Compositions*, iii. 79–80.

⁶³ Dumitrescu notes a number of cases in which ♯ / # as *mi* sign should be distinguished from the diesis ✕ sign, including the *L'homme armé* mass of Vaqueras in Vatican City, Biblioteca Apostolica Vaticana, MS Sistina 49 (“Solmization Status,” 264, note 29); there is clearly, however, a major exploration of this topic still to be undertaken.

⁶⁴ Edited in *Polyphonic Music of the Fourteenth Century*, i, ed. Leo Schrade (Monaco: Éditions de l’Oiseau-Lyre, 1974): 2–109; facsimile published as *Le Roman de Fauvel in the Edition of Mesire Chaillou de Pesstain: A Reproduction in Facsimile of the Complete Manuscript*, Paris, Bibliothèque Nationale, Fonds Français 146, with introduction by Edward Roesner, François Avril and Nancy Regelado (New York: Broude Brothers, 1990). See also *Fauvel Studies: Allegory, Chronicle, Music, and Image in Paris*, Bibliothèque Nationale de France, MS français 146, ed. Margaret Bent and Andrew Wathey (Oxford: Oxford University Press, 1998).

⁶⁵ Ed. Schrade, 45–7.

⁶⁶ Edited in *Polyphonic Music of the Fourteenth Century*, 8, ed. W. Thomas Marrocco (Monaco: Éditions de l’Oiseau-Lyre, 1960); facsimile published as *Il codice Rossi 215 della Biblioteca Apostolica Vaticana, con i frammenti della Fondazione Opera Pia don Giuseppe Greggiati di Ostiglia*, ed. Nino Pirrotta, Ars Nova 2 (Lucca: Libreria Musicale Italiana, 1992).

duration before their resolution that, if Marchettan principles are adopted, the acoustic strain is particularly noticeable (e.g. the anonymous madrigal *De soto'l verde*, mm. 37–40: see Example 27),⁶⁷ causing us to re-examine any cosy thoughts we may harbour about the uncomplicated purity of the writing:

EXAMPLE 27: Anonymous, *De soto'l verde*, mm. 29–41 (after Marrocco 1960)

The image shows two systems of musical notation for Example 27. The first system, starting at measure 29, consists of a vocal line and a lute line. The vocal line has lyrics 'Che mi so'' and the lute line has a sharp sign on the second staff. The second system, starting at measure 35, also consists of a vocal line and a lute line. The vocal line has lyrics 'ser - - - vo, Cum de - -' and the lute line has a sharp sign on the second staff. The lute line shows a sharp sign on the second staff in the second system, indicating a sharp sign on the second string.

On the other hand, as with *Fauvel* there are places in Rossi where a straight transpositional *mi* seems the only feasible musical solution, as in the non-cadential context of mm. 3–4 of this same piece—though not necessarily in the clearly cadential counterpoint of m. 10 (Example 28):

EXAMPLE 28: Anonymous, *De soto'l verde*, mm. 1–11 (after Marrocco 1960)

The image shows two systems of musical notation for Example 28. The first system, starting at measure 1, consists of a vocal line and a lute line. The vocal line has lyrics 'De so - -' and the lute line has a sharp sign on the second staff. The second system, starting at measure 5, also consists of a vocal line and a lute line. The lute line has a sharp sign on the second staff.

⁶⁷ Marrocco, *Polyphonic Music of the Fourteenth Century*, 8, 18–19. Christopher Page also mentions such potentially extended, stretched penultimates, in relation to Machaut's rondeau *Rose, liz*, in "Polyphony before 1400," 82.

EXAMPLE 28 (continued)

Similar issues can be traced still further back: the very opening motet of the Montpellier Codex, *Deus in adiutorium* (fol. 1), as in a number of other pieces in this manuscript, employs a notated sharp in a manner which surely incontrovertibly connotes modal transposition,⁶⁸ though in the context of the present study one may justifiably wonder whether an F \sharp –G “gathering” appoggiatura at the start of, for instance, Pérotin’s *Alleluia: Posui adiutorium* (fols. 16v–20)⁶⁹ might not have invited the kind of plangent, narrowed inflection that the later chromatic gesture embodies. And if so, what about the musically identical, but chromatically unnotated E–F appoggiaturas that open F-based organa such as the immediately following *Abiecto: Rigat ora lacrimis uberrimis* (fols. 20–22)?⁷⁰ Nor are such issues restricted to polyphonic repertoires, as similar questions need to be asked about the meaning and function of notated sharps (admittedly relatively scarce) in bodies of 13th- and 14th-century monophonic song (including again the *Roman de Fauvel* and songs of Jehan de L’Escurel),⁷¹ especially those non-cadential instances that imply either an acceptance of modal or hexachordal transposition, or (more likely?) a more fundamental irrelevance of the whole theoretical system. Two straightforward examples

⁶⁸ See *The Montpellier Codex*, ed. Hans Tischler, 3 parts, Recent Researches in the Music of the Middle Ages and Renaissance 2–7 (Madison, Wisc.: A-R Editions, 1978), i. 1, with facsimile as Plate I following p. lxxi. On modal transposition see also Hans Tischler, “Mode, Modulation and Transposition in Medieval Songs,” *Journal of Musicology* 13 (1995): 277–83. It is also worth mentioning in this regard those rare pieces in this earlier period which employ a sharp signature, such as a number in the Las Huelgas manuscript, e.g. *Benedicamus Domino* (fol. 129); *Parens patris* (fol. 139v); *Ave maris stella* (fol. 145); *Mater patris et filia* (fol. 154); and *In hoc ortus occidente* (fol. 167): see *The Las Huelgas Manuscript: Burgos, Monasterio de Las Huelgas*, ed. Gordon A. Anderson, 2 vols., *Corpus Mensurabilis Musicae*, 79 (Neuhausen-Stuttgart: American Institute of Musicology, 1982), nos. 33, 69, 60, 61 and 78 respectively.

⁶⁹ Tischler, *The Montpellier Codex*, i. 27.

⁷⁰ Tischler, *The Montpellier Codex*, i. 33.

⁷¹ See *The Monophonic Songs in the Roman de Fauvel*, ed. Samuel N. Rosenberg and Hans Tischler (Lincoln, Nebr. and London: University of Nebraska Press, 1991), and *The Works of Jehan de Lescurel*, ed. Nigel Wilkins, *Corpus Mensurabilis Musicae*, 30 (n. pl.: American Institute of Musicology, 1966).

from the troubadour sources are (i) Albertet de Sestaro, *Tal amor ai en mon cor encubide*, line 3 of which ends with a notated E–F♯–E–D gesture; and (ii) Marcabru’s *Pax in nomine Domini! dist Marcabrunz lou vers del son*, whose final syllable (line 9) ends with the compound neume B–A–B–C♯–A.⁷² Furthermore, it is clear that all of the expressive, linear uses of chromatic inflection discussed in the present study articulate in some deeply connected aesthetic and historical manner with long-established practices within liturgical chant, both of Western Europe and beyond: particularly notable sources in this regard are the late 11th-century Cluny Gradual (Paris, Bibliothèque Nationale, MS lat. 1087) and the early 11th-century Tonary of St-Bénigne, Dijon (University of Montpellier, Faculté de Médecine, MS H159), examined in detail for their microtonal inflections by Manuel Pedro Ferreira.⁷³ Such practices, too—as Ferreira reminds us—certainly carry us out further into other ethnic domains in which multifarious narrow inflections have long been simply part of the normal vocal and instrumental vocabulary, as indeed they may have been for literate and illiterate medieval Europe.⁷⁴

⁷² See *The Extant Troubadour Melodies: Transcriptions and Essays for Performers and Scholars*, ed. Hendrik van der Werf and Gerald A. Bond (Rochester, NY: The Author, 1984), 11* (P-C 16,14) and 227* (P-C 293,35) respectively.

⁷³ Manuel Pedro Ramalho Ferreira, “The Tradition of Gregorian Chant for the Proper of the Mass: Melodic Variants and Microtonal Nuances,” PhD dissertation (Princeton University, 1997).

⁷⁴ An intriguing instance related to this is cited by Christopher Page from the late 14th- or early 15th-century *Tractatulus de differentiis et gradibus cantorum* of Arnulf de St-Ghislain. In this the author apparently revels, with culturally characteristic misogynistic taint, in the simultaneous bewitchment and trepidation evoked by certain women’s Sirenian power to inflect their song with microtones beyond normal semitone division: “E quibus pars altera, favorosi videlicet sexus feminei, que quanto rarior tanto preciosior, dum in dulcinomi gutturis epigloto tonos librate dividit in semitonia, et semitonia in athomos indivisibiles garritat, ineffabili lasciviv melodiomate quod magis putares angelicum quam humanum. Hinc mulieres—dee ymo verius syrene terrestres—incantatas aures incarminant audientium quorum corda, pleraque tali ebrietate sopora, invisibili furto subripiunt subreptaque et voluntari facta sue servituti subiungant terrestremque perducunt naufragantes sui, heu! gratia carceris, in Caribdim in qua nullum redemptionis genus vel precium locum tenet.” In Page’s translation: “Among these there is a second group—that is to say of the favoured female sex—which is so much the more precious the more it is rare; when it freely divides tones into semitones with a sweet-sounding throat, and divides semitones into indivisible microtones, it enjoys itself with an indescribable melody that you would rather deem angelic than human. So it is that these women—goddesses or indeed rather earthly Sirens—enchant the bewitched ears of their listeners and they steal away their hearts, which are for the most part lulled by this kind of intoxication, in secret theft, and having snatched them and made them subject to their will, they then enslave them and lead them, shipwrecked by the beauty, alas! of their prison, into an earthly Charybdis in which no kind of redemption or ransom is of any avail.” (Christopher Page, “A Treatise on Musicians from ?c. 1400: The *Tractatulus de differentiis et gradibus cantorum* by Arnulf de St Ghislain,” *Journal of the Royal Musical Association* 117 (1992): 1–21, on pp. 16 and 20).

For all that Tinctoris is engaging with a still current notational and musical reality in the 1470s, with regard to the chromatic semitone, it is difficult to escape the conclusion that what he is describing is the end of a tradition, gradually becoming compromised by evolving modal and contrapuntal theory, influences from fixed-frequency temperaments such as those of keyboards, and indeed the developing nature of the very contrapuntal fabric that composers were exploring. We have already seen that, even within twenty years of Tinctoris's completion of the *Liber de arte contrapuncti*, Gaforus is scarcely interested in the phenomenon, his one fleeting reference in the 1496 *Practica* to the association of ✕ with the diesis not represented as anything like a common, current practice. By this time, variously formulated extensions to traditional hexachord structure which had been battling through academic and personal dispute for well over a century were gradually becoming incorporated into mainstream thought, modifying musicians' conceptions of the field of play in which notated sharps might be deployed, and further weakening the already largely unrestrictive nature of solmization as an aid to inflection.⁷⁵ What we are probably witnessing, in the 1480s and 90s, is the erosion of the very characteristic sound of the ultra-stretched sharp, and one could legitimately argue that some of those musicians and theorists who resisted hexachordal expansion in the 15th century may have been doing so at least in small part as a way of trying to preserve that characteristic sound-world—just as happened some centuries later, *mutatis mutandis*, with the gradual and similarly resisted arrival of equal temperament. There is a curious, though probably not coincidental, parallel here with a conclusion reached by the present writer in an earlier paper concerning the notational phenomenon of so-called “minor coloration.”⁷⁶ My basic thesis in that article was that there is strong evidence that the strict tripletization of what we term (anachronistically) *minor color* should by and large be respected, around the middle third of the 15th century, much more than editors have shown willing, but that there are clear signs from the 1480s onward that a process of rhythmic homogenization set in, leading to the near-ubiquitous, orthochronic dotted equivalence to which we have become accustomed, even

⁷⁵ See Cross, “Chromatic Alteration” for a valuable exposition of 14th-century theory in this regard.

⁷⁶ Ronald Woodley, “Minor Coloration Revisited: Okeghem's *Ma bouche rit* and Beyond,” in Ceulemans, ed., *Théorie et analyse musicales*, 39–63.

for the earlier repertory. The situation with the chromatic semitone is not by any means exactly parallel: its theoretical and historical context is much more complicated, far-reaching and multivalent for any simplistic analogy to be drawn. Nevertheless, if subsequent research supports my preliminary findings here about the practice and demise of the chromatic semitone around this same period, it raises even deeper, broader questions about the musical and aesthetic shifts that took place in the last twenty years or so of the fifteenth century, and how we construe our notions of “conservatism” and “innovation” at this fascinating turning-point of music history.

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