

“I Got Isorhythm: Recreating the *ars nova* Motet in the Classroom”

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The hazy millennium of “early music” thoroughly informs the Western music theory curriculum without its repertoire commanding center stage. Coming from an undergraduate sequence infused with chorales, figured bass, and species counterpoint, students might continue into courses on 16th- and 18th-century counterpoint. The lesson plans here guide an opportunity to peer back another couple centuries and get creative with 14th-century counterpoint. Organized by one of the most influential formal procedures of antiquity, a lesson that models cantus firmus counterpoint, medieval harmony, and isorhythmic form probes deeply into the foundations of many core concepts and could ignite a spark for more specialized pursuits in early music later. These teaching plans are approachable in undergraduate Form Analysis or in a graduate course on early music, in which it has been developed and refined.

The 14th-century isorhythmic motet stands as the culmination of centuries of medieval thinking on mode, counterpoint, rhythmic organization, and systematic formal design. Just as no Western music history survey is complete without this learned repertoire, the lesson here provides step-by-step instruction to restore some of the isorhythmic motet’s undiminished magic to today’s music theory classroom. While the method references historical conceptions of harmony and counterpoint, there is no attempt to reconstruct the way a mature Guillaume de Machaut or Philippe de Vitry may have composed. And while it produces music closely simulating *ars nova* style, historical composition is not the ultimate goal. Of broader value,

rediscovering the medieval motet from the inside-out thoroughly explores the timeless linkage between the harmonic and melodic as well as between the contrapuntal and formal.

The received notion that the medieval motet evolved as a polyphonic elaboration of borrowed chant is undergoing fruitful challenge.¹ The methodology and materials offered here yet proceed from this traditional position for pedagogical efficiency and clarity. Because approaching this repertoire from the tenor up is accessible and familiar (and not invalidated), it serves as the foundation to a composition lesson that reverse-engineers the genre. While I stress the creative flexibility of isorhythmic practice below, this is a graduated introduction to *ars nova* counterpoint in the classroom and not a deep dive into the full spectrum of a century's compositional activity.

Permit me, then, to begin a motet with the selection of chant. Among the vast body of monophonic chant, I recommend curating a group of eight for the students' choosing, one in each of the medieval modes. While mode is a complex and diachronic topic, this lesson on polyphony asks only an acquaintance with finals, octave ranges, and reciting tones.² The extent to which the student's polyphony emphasizes or subverts the chosen mode is an important

¹ Among recent vernacular-first, chanson-hybrid accounts of the medieval French motet, see the essays by Leach, Bradley, Saltzstein, and Saint-Cricq in Hartt 2018.

² If necessary, a brief review of Dorian (D-d, reciting tone=A), Hypodorian (A-a, reciting tone=f), Phrygian (E-e, reciting tone=c), etc. will suffice. The opportunity to put such reverend musical knowledge into aesthetic practice and later to feel the codependence of the melodic, the harmonic, the tonal, and the formal, when a change is made in any one, is worth the trouble.

artistic choice. Figure 1 provides chant samples clearly expressive of their modal designation in the *Liber Usualis* and ripe with polyphonic opportunities.

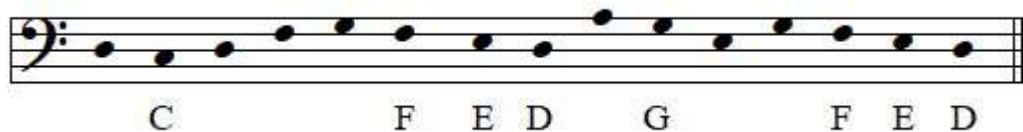
Figure 1 displays eight chant samples, numbered I through VIII, each with a corresponding Latin title and a musical staff showing the melody. The samples are arranged vertically, with the number on the left and the title below the staff.

- I**: *Victimae paschali laudes*
- II**: *Audi filia*
- III**: *Kyrie eleison*
- IV**: *Afferentur regi virgines*
- V**: *Quinque prudentes virgines*
- VI**: *Alleluia*
- VII**: *Alleluia*
- VIII**: *Dilexisti justitiam*

Figure 1: eight chant examples by mode³

In a subsequent class, students can back up one step and compose their own cantus firmus within the modal bounds given above, which could be checked by the instructor before they proceed to raise polyphony above it. For a collaborative exploration, students might trade original cantus firmi with their neighbor to plan into polyphony, then discuss any barriers to stylistic realization together. At the minimum, a cantus firmus ought to be diatonic, mostly stepwise, about twenty notes long, and conclude with a step down to make a final cadence.

Once a chant is selected or invented, we can begin to draft a tonal script around that starring role. First, we must decide which pitch or pitches across the length of a cantus firmus to tonicize through cadences.⁴ Cadence can be made on any descending tone or ascending semitone in the tenor, though the latter is less common in sacred music. Taking the Dorian chant above for example, descending steps afford tonal articulation on C, D, E, F, and/or G as shown in Figure 2. There is no ascending semitone on offer here.



³ These model tenors are short for pedagogical efficiency. Machaut's average isorhythmic tenor was 26 notes, the longest 48.

⁴ "Cadence" here refers to a range of tonal emphases produced by a particular dyadic progression to be detailed with surface composition below.

Figure 2: plotting potential cadence points afforded by a Dorian cantus firmus

We already begin to see the broad spectrum of tonal possibilities latent in a chant foundation. To this add the consideration that medieval composers did not always import chant wholesale, but artistically excerpted just the notes they wanted from the middle of a tune to suit their polyphonic aims. Such license is most transformative when omitting a chant's original ending, which ultimately determines its modal identity. In the same Dorian chant of Figure 2, for example, we might snip the edges to expose a Phrygian chant within, the way rough diamonds are cut to reveal their inner luster.



Figure 3: Dorian chant excerpted into Phrygian

With the chant's pitch content settled—we will keep the original Dorian⁵—the next task is to decide upon regular (*iso-*) rhythmic divisions. To set all 15 pitches of our chant (the *color*), we can compose a 3- or 5-note rhythmic series (the *talea*) and repeat it either five or three times, respectively.⁶ It is conventional of isorhythmic motets to demarcate these formal

⁵ Students may excerpt from chant however they wish so long as they end with a descending step and not on B, which begs tritone problems. The method for erecting a motet works the same for any cantus firmus.

⁶ Mature medieval composers sometimes divided up chant tenors irregularly. Machaut's Motet 3, for example, takes a *color* of 25 pitches and divides it by a *talea* of 7 rhythms. Machaut

boundaries with cadences and medieval composers usually organized their *talea* boundaries such that the resulting cadence points were modally sensible. Yet, at other times, composers worked ingeniously aberrant formal designs upon their chosen *colores*.⁷ Our two isorhythmic choices, 5x3 or 3x5, are laid out in Figure 4 with bar lines indicating *talea* divisions. Sing them as a class, pausing briefly at the end of each *talea*. A third, unconventional option is included at the bottom as an example of the creative flexibility isorhythm admits and of how transformative a simple alteration to a cantus firmus can be. Simply omitting the chant's final D creates an opportune 7x2 division of a 14-note *color* in which each *talea* can end on an E Phrygian cadence.

abridges the fourth *talea*, which would require 28 pitches to complete (7x4), by omitting its final three rhythms. On the other hand, Motet 6 takes a *color* of 29 pitches and divides it by a *talea* of 9 rhythms. With two pitches remaining after the third *talea* runs out (at 27 pitches, 9x3), Machaut appends two new durations to finish out the *color*.

⁷ Normative does not mean better, but should be understood by students before the expressive effects of novel design can be appreciated. Hartt 2010 details how the planning of isorhythmic divisions can drive tonal articulation.

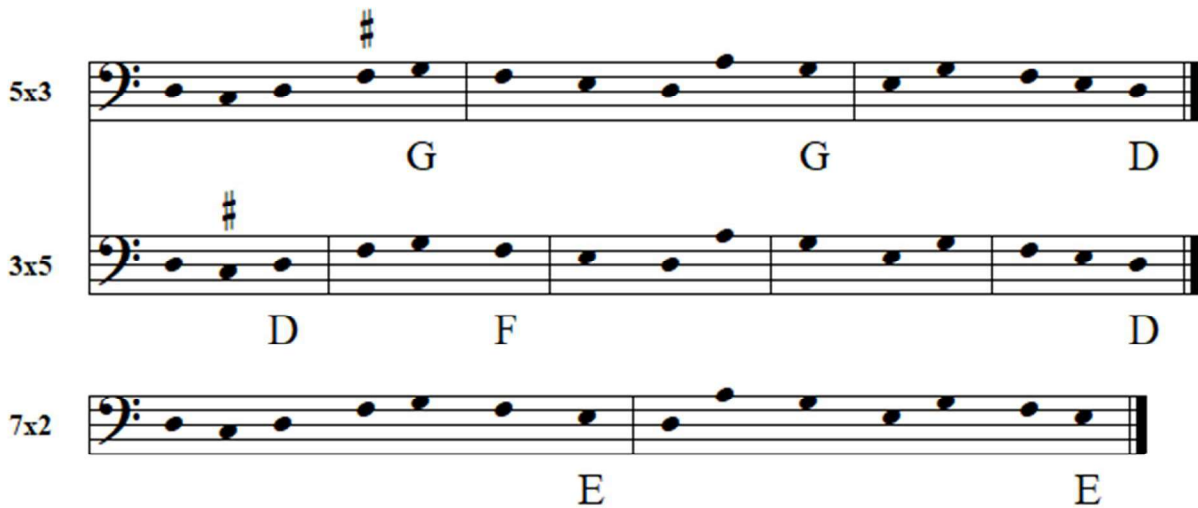


Figure 4: cadences articulating the systematic formal boundaries of isorhythm

Of the two Dorian options, we might select the first because most of its *talea* boundaries are ready-made for cadencing; that is, they end with a descending step. The first *talea*, however, ends with an ascending tone and we might be tempted to inflect its penultimate F to F#, suggested by musica ficta in Figure 4, to avail a weak cadence on G. While chromaticizing borrowed chant is rare (but see Machaut's Motet 1 below), it is worth considering in the spirit of open-minded experimentation within the possibilities of the style. That the second *talea* also ends on G only makes that heterodoxy more attractive. Whether these potential boundary cadences are to be realized or not in the polyphony is a big question, for cadence cannot happen by tenor fiat. The tonal structure of a modal model is in the gift of the upper voice setting, to be considered below.

With our potential *talea* cadences planned out, it is time to decide what other internal pitches we may wish to emphasize in this cantus firmus.⁸ Here, the student's artistic freedom and power is immense. And as that same tenor repeats again and again in isorhythm, students can paint a range of sound-images of the same subject like Monet's series of haystacks in various lighting. As a starting point with our cantus firmus divided 5x3 above, we should first plan to amplify the chant's Dorian identity.



Figure 5: tonal planning of a Dorian cantus firmus; *taleae* I-III

⁸ In his now famous fourteenth-century guide to motet composition, Ægidius de Murino proceeds quickly from selecting an appropriate chant excerpt to setting it in a specific rhythmic pattern, what we now call *talea*. Only then does Ægidius begin to counterpoint upper voices successively against that tenor and then repeat the ensemble according to an isorhythmic plan. Just as my own method does not claim to reproduce the mature practice of a Machaut or Vitry, Ægidius' method was also "written for the teaching of children." Introducing rhythm at this point in the lesson plans would unnecessarily complicate the more abstract contrapuntal tendencies of interval types and the construction of a homophonic scaffolding for later polyphonic elaboration, which rhythm can animate as a separate focus. For a translation and commentary on Ægidius' short treatise, see Leech-Wilkinson 1989, 18-24.

In Figure 5, I have sketched internal pitch stresses on D and F as important to the Dorian modes, both authentic and plagal. While the full chant is mode 1, our brief excerpt (not a tenth of the complete chant *Victimae paschali laudes*) gives no opportunity to highlight the Dorian reciting tone of A because it offers no stepwise descent to it. However, with its small ambitus our cantus firmus might be better ascribed to mode 2, Hypodorian, the plagal form of Dorian. In that case the reciting tone of F is both appropriate and available for emphasis, as has been done in *taleae* II and III of Figure 5. Because *talea* I ascends so much, it is difficult to settle in with any cadences. A weak one on is possible upon the third pitch, D, which entails inflecting the chant to C#.

With the first *color* established, students might get creative in crafting further polyphonic settings of the same tenor. One example among an abundance of tonal possibilities follows as Figure 6, in which the cantus firmus is stated three times; *colores* A, B, and C.⁹ Whereas single bar lines denote *talea* repetitions—the rhythmic setting that would make this clear is not yet implemented—double bars denote repetitions of the *color*.

⁹ *Colores* are conventionally indicated by letters and *taleae* by Roman numerals. Often, the final *color* of a motet will occur in rhythmic diminution and then its *taleae* are indicated by Arabic numerals.

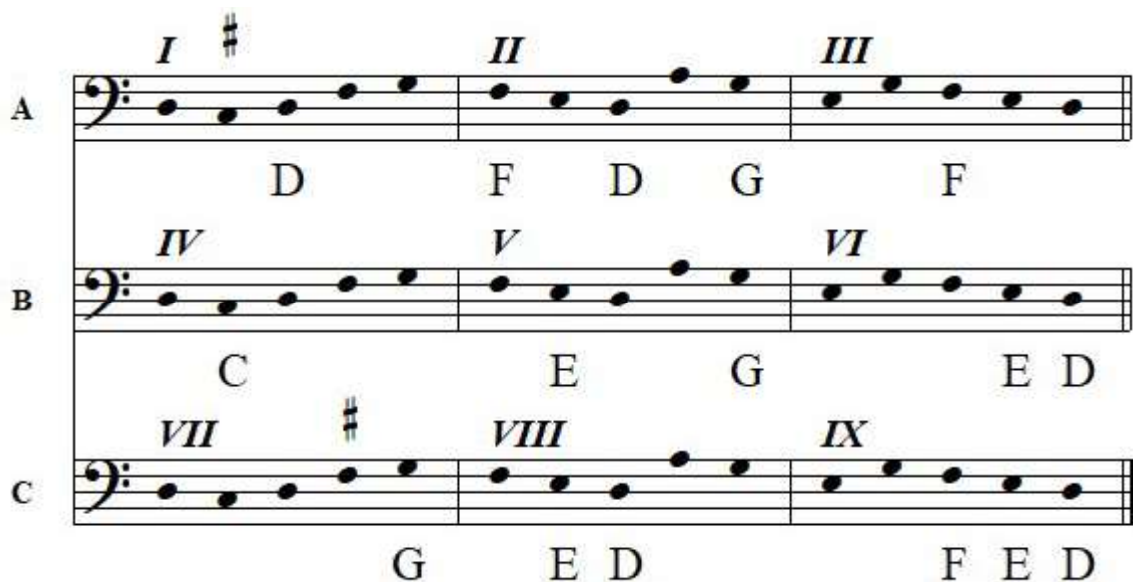


Figure 6: further tonal planning of the same cantus firmus in isorhythm

The simple melody has come into flower. It is the same story told three times, never the same way. Its deeper unity guaranteed, our motet is one tonal narrative set like a triptych across the cumulative segments of isorhythmic form. *Color A* is as before except that the final cadence on D has been artistically suppressed, eliding the phrase over a formal seam into *color B*. That is, where we expected to find a point of modal affirmation on D is instead only another step in a long descent to C, the second pitch of *color B*.

Color B proceeds in a decidedly Phrygian light, not only touching upon its reciting tone C but twice finding home on E. Forgoing *color A*'s cadences on D, the global final only asserts its sovereignty at the very end of *color B*, dramatically undercutting E by acting as its successor. This is the same contrapuntal gambit as bridged *color A* into B above, but this time restoring final authority back to D Dorian. *Color C* makes bold to highlight G in *talea VII*, ratifies the subordination of E to D in *talea VIII* (mirroring *talea VI*), and closes with a propulsive chain of

tonal accents plunging down F - E - D to end the motet, a vivid medieval realization of cadence (from *cadere* = to fall).

Before proceeding to compose out our motet blueprint, it may be instructive to study the tonal planning of a medieval composer. Guillaume de Machaut's Motet 1 (*Quant en moy / Amour et biauté / Amara valde*)¹⁰ is conventional in its regular isorhythmic patterning of tonal articulation. As shown in Figure 7, there are cadences at all *talea* boundaries, with one bold exception, and an interior cadence on the fourth note of every *talea* but the last. That these interior arrivals occur only on C or G, common secondary pitch emphases for a Lydian chant, suggests careful isorhythmic planning on Machaut's part.

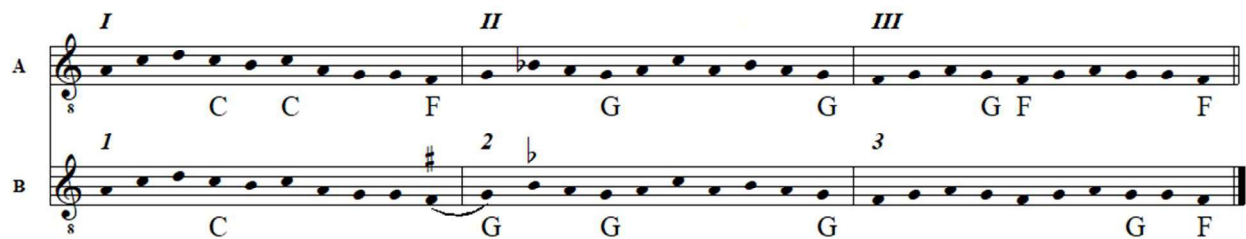


Figure 7: tonal planning in the isorhythmic tenor of Machaut's Motet 1

Although there are almost twice as many cadences on G than on F, Machaut stages a clear hierarchical relationship between those pitches across Motet 1. In the final *talea* of each *color*, Machaut arrives on G only to undercut its finality by driving down further to F, relegating G to a penultimate position. This strategy was implemented in our own motet in the

¹⁰ Machaut's upper-voice poetry of unrequited languishing is typical of French courtly love. The incipits give all away: When Love entered my heart / Love and beauty / Very bitter.

subordination of E to D. On a larger scale in Motet 1, *taleae* I and III bookend *color* A with cadences on F, situating the interior *talea* II's cadences on G as subsidiary.

Machaut's setting of the final F of *talea* 1 (in diminution) is extraordinarily *not* a cadence. As if he dare not touch the God-given chant himself, Machaut notates a simultaneous F# in the triplum against the tenor's F (breve 119) and repeats it a few times before resolving up to G. The motet's titular foreman, the tenor, must yield. Sung as F#, it too resolves up to *talea* 2's initial G (slurred in the figure) coordinated with text terminations in both upper voices. This remarkable elision bridges *talea* 1 into *talea* 2 by transforming the expected arrival pitch F, no less than the chant's final, into a leading tone.

Returning to our motet in progress, we can now establish some counterpoint against the prepared cantus firmus. Upper voices often come as a pair: motetus (middle) and triplum (top). Following Machaut's practice, our motetus' range should center on the octave A3-A4 with the triplum a third higher, C4-C5. The harmony of the upper-voice pair may be conceived as a unit because there are a standard pair of perfect and a standard pair of imperfect consonances with which to set every tenor pitch. The most stable medieval harmony was that which combined the two perfect consonances, P8 and P5 above the tenor. We commence harmonizing our tenor by establishing stable, perfect sonorities at a few important places. For pedagogical clarity, each *talea* will begin on a perfect 8/5 harmony. Because *talea* typically also end by cadencing on perfect harmony, they are established with a dramatic shape of departure and return. Secondly, any cadences from our tonal planning earlier will get perfect 8/5 harmony. These consonant pillars are realized for *color* A in Figure 8 below.

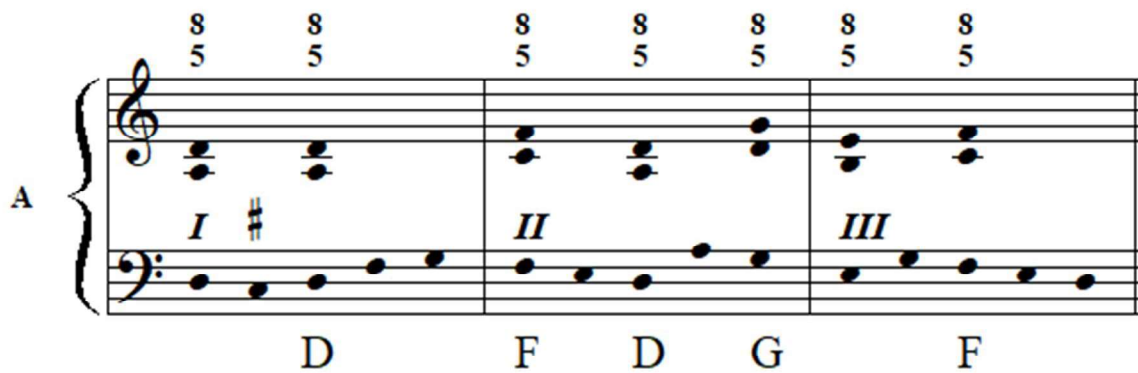


Figure 8: the perfect consonant pillars of *color A*

The next step is to compose out the imperfect sonorities that yearn for resolution in the perfect 8/5s just written. The sonorities that target the doubly-perfect ones are the doubly-imperfect ones, M6 and M3 above the tenor.¹¹ Basically, the tenor steps down a tone while both upper voices resolve up a semitone. This formulaic resolution of imperfect to perfect through stepwise contrary motion is called a directed progression.¹² A crucial driver of 14th-century counterpoint, and a key concept in the present motet lesson, the directed progression is diagrammed in Figure 9. While directed progressions are an important component of

¹¹ Fuller 1986 draws on medieval treatises in her now-standard classification of 14th-century sonority types, their relative stability, and their contrapuntal tendencies, drawing heavily on Machaut's motets.

¹² A ubiquitous concept in fourteenth-century counterpoint treatises, the term *directed progression* is centrally developed in Fuller 1992.

cadences, not all directed progressions are necessarily cadences just as not all V – I successions are cadences in common practice tonality.

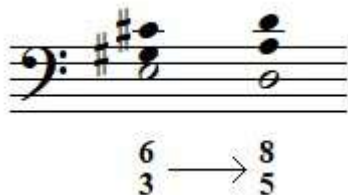


Figure 9: the medieval directed progression

Marking every doubly-perfect sonority of Figure 8, we now build a doubly-imperfect one upon its preceding tenor pitch. These 6/3s added in Figure 10, slurs from imperfect to perfect underscore the fundamental contrapuntal action of directed progressions. The 8/5 sonorities are carried over from before.



Figure 10: directed progressions to perfect consonant pillars in *color A*

In the first directed progression of Figure 10, the ascending semitone C#-D in the tenor is weaker than the standard descending tone (E-D); appropriate for this early moment mid-*talea*. Whatever their disposition, the resolution of each pitch in a directed progression works

the same. That is, we create the same doubly-imperfect sonority on C# (tenor pitch 2) that resolves to the given doubly-perfect sonority on D (tenor pitch 3). In our modern theory exercise, determining these notes and sorting out which goes where is a matter of solving for resolution tendency backwards. The tenor provides the leading tone C#'s resolution up to D. What remains is a note to resolve to A in the motetus, so we provide G# (its leading tone, accepting parallel 5ths against the tenor),¹³ and a note to resolve to D in the triplum, so we provide E (emulating the usual stepwise descent of the tenor). So, while chord 2 is spelled C# 5/-3 (root position) and therefore sounds less yearning, its resolution tendency is like that of the doubly-imperfect E +6/+3 (first inversion) from which it derives its function.¹⁴ With the perfect and imperfect sonorities thus sketched in, the contrapuntal framework of *color* A is nearly complete.

To harmonize the few tenor pitches remaining, begin by sketching in doubly-perfect sonorities on all of them. This could even be a final step, though the paucity of thirds will sound

¹³ Parallel perfects are not unstylistic in medieval counterpoint, either on the surface or in the foundational structure being drafted now. Indeed, they arise frequently while harmonizing a tenor in this way. Some of these parallels will be broken up through melodic decoration later and any remaining ones are perfectly fine.

¹⁴ When teaching such distant music, I am not averse to analogy with more familiar concepts like triads, inversion, leading tones, and anything else hard-earned over the intervening centuries. I duly note that these are not concepts or terms they had in 14th-century France and yearn for the day when a student asks me to explain some history of theory.

a bit antiquated for the fourteenth century (just right for thirteenth-century motets). For harmonic variety, some of these perfect sonorities can be sweetened by a diatonic third. This is done by substituting either the octave or fifth in some upper voice with a tenth or third, resulting in sonorities like 8/3, 5/3, 10/8, and 10/5. Figure 11 combines Figures 8 (perfect harmony) and 10 (imperfect) and also harmonizes the few remaining tenor pitches as described. For illustrative purposes, I have appended an alternative setting of *talea* III in which a characteristic chain of 6/3 chords provides expressive thrust towards the weighty formal closure at the end of a *color*.¹⁵

Figure 11 displays musical notation for two systems of chords, labeled A and alternatively. The notation includes numerical ratios (8/5, 6/3, 10/8, 10/5) and chord labels (I, II, III, D).

System A: The first system shows three measures of two staves each. The ratios above the staves are 8/5, 6/3, 8/5, 8/5, 6/3, 8/5, 6/3, 8/5, 6/3, 8/5, 10/8, 6/3, 8/5, 10/5, 6/3. The chords are labeled I, II, and III. The final chord is D.

System alternatively: The second system shows a single measure of two staves. The ratios above the staves are 8/5, 6-6, 6-6, 6-6, 8/5. The chord is labeled III. The final chord is D.

¹⁵ In the *Musica* of 1357, Johannes Boen describes perfect resolution sounding sweeter for being longer expected; quoted in Fuller 1992, 229-30.

Figure 11: a complete structural framework of *color A*; alternate *talea* III with 6/3 chain

After working through this process of melody harmonization for all *colores*, students will have a complete note-against-note framework for their burgeoning motet. This is a real accomplishment and no two students will have exactly the same.

Having thus far set aside rhythm to focus on pitch organization, we now return to the cantus firmus in order to rhythmicize it. The harmonic rhythm of our structural framework above will take the tenor's shape. The 15-note chant was initially planned to have a *talea* of five notes thrice repeated. The rhythms of these tenor pitches should be quite slow—mainly wholes and halves—and end with a long note for final cadences. While it is practical for *taleae* to include rests for singers to breathe, those rests are not counted among the 5 *color* pitches that need to be rhythmicized in our 5x3 isorhythmic plan. A sample *talea* follows as Figure 12. Each of the nine planned *taleae* of our motet tenor must have exactly this rhythm.



Figure 12: a *talea* pattern of five pitched durations

We have only to map this rhythmic pattern onto our prior *color*, needing three *talea* repetitions, as done in Figure 13. Sing it to appreciate how much life is breathed into this beautiful melody.



Figure 13: the complete isorhythmic tenor, *color* and *taleae*

It's easy to think of a dozen other ways this could have gone. Looking at the *color* alone, ask students to improvise other rhythmic patterns of five durations.¹⁶ Try singing a few of those *taleae* three times across the whole *color* without recourse to writing. A few possibilities are laid out in Figure 14 to demonstrate the process. Mental composition like this revives a bit of medieval practice in the modern classroom and saves on wax tablets and parchment.

**Figure 14: alternative *talea* divisions of the same *color***

Isorhythm distributed across the entire motet, with the cadences we determined earlier, is shown in Figure 15.



¹⁶ Busse Berger 2005 still challenges us to appreciate how much medieval composition was mental, including isorhythmic motets like this.

Figure 15: a full isorhythmic motet blueprint

Note that rests do not cancel directed progressions, as in the very first *talea*. On the contrary, a well-placed rest can deliciously heighten the sense of yearning as imperfect intervals strive for perfection.¹⁷ But what of those instances, frequent in the repertoire, when a single tenor pitch needs to embody both contrapuntal functions: perfect and imperfect, stable and directed? This first happens in our *talea* VI on E. The solution is to harmonize the same pitch first as an arrival 8/5 (coming from F) and then as an unstable 6/3 (going to D), each function occupying a quarter note of the full half-note duration.

The final task is the surface decoration of the consonant, note-against-note framework we have built to this point.¹⁸ The method has ensured that our motet has good bones, so little can go wrong from here. To continue, first decide upon the mensuration of the upper voices: duple or triple subdivision at each of three independent levels called *modus*, *tempus*, and *prolatio*. For our example, let us say 1) the whole note will divide into two halves, 2) the half will divide into two quarters, and 3) the quarter will divide into three triplet eighths (or use dotted quarters). This sounds like 6/8 time and that is enough for the present purpose.¹⁹ The

¹⁷ An example from Machaut's Motet 1 follows below.

¹⁸ A convincing medieval motet surface takes dedicated listening to mimic. The Ensemble Musica Nova's 2002 recording of Machaut's complete motets crackles with fresh energy.

¹⁹ Mensural divisions in modern transcription look like 9/8, 6/8, 3/4, and 2/4, though the deeper divisions can add important, if unfamiliar, complications. For a thorough grounding in the art of medieval mensuration and proportion, see Busse Berger 1993.

predominant subdivision of the beat should be either trochaic (quarter-eighth) or iambic (eighth-quarter) and the triplum voice (at top) should be the more active than the motetus because it conventionally carries more text.²⁰

Coming to melody, we decorate only the upper-voice pair. The tenor was finished at the isorhythm stage and is left alone, stoic and grand. The melodic decoration of the harmonic framework of 8/5s and 6/3s constructed earlier should be mainly stepwise with passing and neighboring dissonance sprinkled liberally on every part of the beat. For directed progressions in particular, the escape tone is a ubiquitous and iconic decoration of the leading tone's ascent to tonic.²¹ Lacking metrical bar lines—which helpfully unfetters the mind from common practice idioms—accidentals should be renotated on every pitch. Flats may be needed to correct for tritones and sharps will be needed whenever directed progressions require *major* 3^{rds} and 6^{ths} above a tenor pitch that does not offer them diatonically.²²

My realization of *color* A follows as Figure 16. Every note of the structural framework in Figure 11 appears here on the beat. Stepwise embellishment of those structural harmonies fills out the spaces between the onset of each tenor pitch. I also made hocket to mark the

²⁰ In this introductory music theory lesson, I must leave aside all considerations of texting, the eponymous heart of the genre, and its abundant possibilities for expressive interplay with counterpoint.

²¹ For example, see the triplum's C#-D resolution decorated by escape tone B in the first directed progression of Figure 16.

²² For example, E 6/3 requires the inflection of both G# and C# to drive towards D 8/5.

beginning of *talea* III by writing one melodic line and then distributing it amongst the two upper voices from beat to beat, leaving rests in between. The special audible effect of hocket (meaning hiccup) recurs regularly in medieval isorhythm, so *taleae* VI and IX would also open with it. As planned earlier, notice how *color* A ends not with a conclusive arrival on D 8/5, but with the doubly-imperfect D +10/+6 surging across the formal seam towards arrival on C 12/8 in the next *color*.

The musical score for Figure 16, titled 'a full realization of color A', is presented in two systems. It is written for three voices: Soprano, Alto, and Bass. The first system shows the beginning of Color A, with the Bass line starting on D and the Soprano and Alto lines featuring hocket patterns. The second system shows the continuation of Color A, with the Bass line moving to G and then F, and the Soprano and Alto lines continuing their hocket patterns. The score is labeled 'A' in the bottom left corner.

Figure 16: a full realization of *color* A

Having tried our hand at surface composition, we return to the exemplar of Machaut's Motet 1. A score of *talea* I is given as Figure 17, with editorial *modus* bar lines to aid in visual parsing.²³ This can be compared with the contrapuntal reduction of Figure 18.

Figure 17: score of Machaut's Motet 1, *talea* I; after Boogaart 2018

²³ *Modus* is transcribed as a multiplier to common practice time signatures. In Motet 1, perfect *modus* groups three (3x) measures of 3/4 (perfect *tempus*, minor *prolatio*). In the transcription of Figure 17, Machaut's long is rendered as a whole note, the breve as a half note, etc.

Measure numbers are given here at the level of the long.

Figure 18: contrapuntal reduction of Machaut's Motet 1, *talea* I

Having begun with a doubly-perfect sonority, Machaut's first two directed progressions to C (slurred in Figure 18) are of the inverted kind. These imperfect sonorities amount to the same as the standard D +6/+3 (D/F#/B) and each voice resolves as usual, too, but the pitches are disposed on the surface as B 5/-3 (B/D/F#), as discussed in Figure 10. Both of these directed progressions resolve with unproblematic parallel fifths: B/F# → C/G. The second of them resolves across a rest in the tenor (mm. 5-7), a possibility mentioned above. Notice how the upper-voice pair in m. 6 retains the imperfect dyad D/F# initially set against the tenor's B in m. 5. Keeping the same directed sonority active retains that B in mind—its temporary absence is more a result of precompositional isorhythmic planning than a surface effort to weaken this particular cadence—and all voices resolve properly in m. 7. That the upper voices anticipate their cadential arrival a beat early on the surface further encourages hearing a directed progression across this rest.

In the middle of *talea* I, Machaut makes a bit of triadic hocket in quarter notes over the tenor's A (m. 8). Approaching the end, the penultimate tenor pitch G is repeated before falling to the final. While the first G is set as a stable 8/5 (m. 9), the second is a directed 6/3 (m. 10) driving to the cadence that defines this *talea* boundary. Yet this is only *talea* I and Machaut is careful not to craft too final an ending so early. The triplum's leading tone E, rather than resolve conclusively to F, climbs all the way up to A, effecting a weaker arrival analogous to an imperfect authentic cadence (F/C/a).

As students gain familiarity with *ars nova* motets, more complex isorhythm can be undertaken in later composition projects. For example, they can try adding a second tenor, called the contratenor, below the preceding three-voiced effort. The newly-composed contratenor should be slow and stately, like the tenor, but with an isorhythm all its own: a new *color* and a new *talea* devised to work in conjunction with the original cantus firmus. In Motet 5, Machaut's tenor and contratenor have different *colores* but the same *talea*, only the contratenor reads it in retrograde. The tenor/contratenor pair hardly align rhythmically in Motet 5 and may be quite free in student work, too. Control of harmony amongst them and the upper voice pair is more important. All matters of harmony and counterpoint are as in three voices, with free doubling, voice crossing, and no fear of parallels.

The asymmetrical division of a *color* in sesquialtera (3:2) proportion is not unusual in the repertoire, suggesting another advanced option for class composition. For example, in Machaut's Motet 7 a 21-pitch *color* is divided by a *talea* of 14 notes. Only at the end of *color* B and *talea* III (note 42) do both formal boundaries coincide; a juncture that calls for special surface treatment. Musical coherence assured through the sound structural framework developed in this method, numerical play is a quintessentially medieval way to expound upon a revered melody.

For all its rich opportunities of intricate design and flexible, creative, musical thinking, the isorhythmic motet still has much to teach theory students today. Who could ask for anything more?

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