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On Teaching "Tonal Mirror Counterpoint": A Guide to Concepts and Practice

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Contemporary tonal-counterpoint textbooks tend to focus on the most common procedures, such as thematic imitation and stretto; rhythmic augmentation and diminution; the construction of double and triple counterpoint (perhaps with passing references to quadruple and quintuple counterpoint); and the coordination of these and other techniques within the contexts of inventions, canons, and fugues (if not also passacaglias, chaconnes, and chorale preludes).[1] Other topics may be introduced, such as thematic contrary motion (as in fugues, and canons in which the *comes* is the inversion of the *dux*), or even thematic retrograde (as in *cancrizans* [crab] canons). But compositional contrivances considered arcane—e.g., canons of the perpetual (infinite), puzzle (enigma/riddle), and spiral (modulating) types—are described only briefly, if at all.

A focus on the commonplace certainly seems proper. Given the limited time allotted counterpoint in many music curricula, and the difficulties in becoming merely competent in (let alone mastering) the usual topics, one would be hard-pressed to justify the appropriation of time for more esoteric exercises. Consider Angelo Berardi's treatise,

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[1]For a sampling of tonal counterpoint textbooks, see Thomas Benjamin, *Counterpoint in the Style of J.S. Bach* (New York: Schirmer, 1986); Robert Gauldin, *A Practical Approach to Eighteenth-Century Counterpoint* (Englewood Cliffs, NJ: Prentice-Hall, 1988; reprinted Prospect Heights, IL: Waveland Press, 1995); Kent Kennan, *Counterpoint*, 4th ed. (Upper Saddle River, NJ: Prentice-Hall, 1999); Richard S. Parks, *Eighteenth-Century Counterpoint and Tonal Structure* (Englewood Cliffs, NJ: Prentice-Hall, 1984); Walter Piston, *Counterpoint* (New York: Norton, 1947); and H. Gilbert Trythall, *Eighteenth Century Counterpoint* (Dubuque, IA: Wm. C. Brown, 1993). For a textbook with a different focus and coverage of topics, see Felix Salzer and Carl Schachter, *Counterpoint in Composition: The Study of Voice Leading* (New York: McGraw-Hill, 1969; reprinted New York: Columbia Univ. Press, 1989).

Documenti armonici (1687), which presented a three-voice composition by Marco Scacchi, constructed so that it worked well whether its rests—scattered variously among the voices—remained as originally written (forming a fifteen-measure piece) or were removed (compressing the piece into twelve measures).[2] Scacchi's is an ingenious artifice—one of many offered by Berardi as an illustration of *obbligo*, a popular practice in the sixteenth and early seventeenth centuries, in which an arbitrary restriction was imposed on a composition in order to demonstrate contrapuntal skill.[3] No student interested in the *history* of counterpoint should be deprived of such examples, which paint a more complete picture of the art and craft than that suggested by some textbooks. However, students expected to learn the practical *application* of counterpoint rarely have time for such beguilements.

The prior observation not withstanding, I believe that there is one seemingly esoteric technique, generally ignored, that could be incorporated into either a tonal counterpoint or harmony-and-voice-leading course, and that could generate many practical benefits for the student: the writing of simultaneous outer-voice inversion, i.e., a form of note-against-note counterpoint in which the lowest voice descends by as many (generally diatonic) steps as the topmost voice ascends, and vice-versa; inner voices are then added to complete tonal harmonic progressions.[4] Although the practice may be called by various names, I will refer to it as "tonal mirror counterpoint." Terms—especially those used in teaching—should be selected judiciously, and there are reasons that the preceding is to be preferred

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[2]See Angelo Berardi, *Documenti armonici* (Bologna: Giacomo Monti, 1687; facsimile published Bologna: Forni Editore, 1970); trans. in Arved M. Larsen, III, *Angelo Berardi (1636–1694) as Theorist: A Seventeenth-Century View of Counterpoint* (Ph.D. diss., Catholic Univ. of America, 1979): 4–178. The Scacchi piece is included in the "30th Document" of Berardi's treatise.

[3]For a systematic guide to composing such a piece, see ch. 24 ("Counterpoint with and without Rests") in Serge Ivanovitch Taneiev, *Convertible Counterpoint in the Strict Style*, trans. G. Ackley Brower (Boston: Bruce Humphries, 1962).

[4]As for the technique being "generally ignored," I should mention that, of the sources cited in n.1, only Piston's book devotes a brief passage (pp. 222–23) to its general description, although it provides no constructional guidelines.

over, e.g., "simultaneous inversion." For one thing, the alternative term "inversion" is commonly used in three *different* ways in musical discourse. Regarding the spatial arrangement of chord members, it refers to that which is in the lowest position (e.g., "second inversion"). It also refers to two contrapuntal procedures: the registral exchange of melodic lines (i.e., "invertible counterpoint"), and the precise reversal of contour between two voices (i.e., "melodic inversion"). On the other hand, the preferred term "mirror" connotes a visual reflection of notes about an axis; and in conjunction with the term "counterpoint" it can only mean the simultaneous, vertical reflection of contours. Furthermore, whereas the alternative term "inversion" is often associated with intervalic exactness (as in serial works), such precision is generally not found in tonal music, in which mirroring operates primarily within diatonic space. Accordingly, the metaphor of visual reflection evoked by the term "melodic mirroring" seems more appropriate, given that an ascending interval of x steps will be reflected into a descending interval of x steps, without regard for an exact correspondence in interval size, and thus without the addition of new visual symbols (i.e., note accidentals). Of course, the mirrored voices may at times exceed an established diatonic collection, as tonal music encompasses functional chromaticism; consequently "*tonal* mirror counterpoint" is the most apt designation.[5]

Students may well be aware of *successive* inversion in tonal music, as in fugues with inversions of the subject, or canons that employ contrary motion in the *comes*. However, many will not associate mirror counterpoint with tonal practice, except on smaller scales. For example, some students may have studied chord-expansion techniques, and may be familiar with forms of concurrent, stepwise-linear inversions that prolong a single harmony (frequently the dominant). A primarily diatonic form of the device—deviating only with the use of a secondary leading tone—became a cliché of turn-of-the-twentieth-century marches, as illustrated in Figure 1a. There, departure

[5]In this article, I may refer to the operation with similar terms, such as "mirror writing," "contrapuntal reflection," etc. The alternative term "simultaneous inversion" may occasionally be used in a literal fashion, as when contrasting it with successive inversion, but "tonal mirror counterpoint" and its synonyms will remain the preferred usage.

from and arrival on C ($\hat{5}$), in contrary motion, serves to introduce an F-major march by John Philip Sousa. In Figure 1b is a Mozart excerpt, in which the highest and lowest notes diverge to fill D/A♭, the tritone constituents of the V^7 chord in E♭. In the Schumann excerpt of Figure 1c, we find a chromatic form of the device: chromatic passing tones fill the third F/A, of the V^7 chord in B♭. Chromatic forms analogous to this final one are sufficiently common to have earned their own monicker, "omnibus progressions."[6]

Though frequent, such scalar voice-exchange passages are conceptually removed from the juxtaposition of two inversionally-related "melodic" voices—i.e., those with more variegated contour profiles, and which span entire harmonic progressions. When considering the latter, students familiar with twentieth-century music may associate the operation with serialism, and imagine "atonal" passages as per the excerpt of Figure 2, from Anton Webern's Cantata, op. 29 (1938–39). In this choral excerpt, the melodies of the soprano and bass are inversions (reflections) of one another, as are those of the tenor and alto; the voice pairs are inverted around the axis C♯/D.[7] However, just as forms of *successive* melodic retrograde, inversion, and even retrograde-inversion were used a half-millennium before the advent of twentieth-century serialism,[8] so does *simultaneous*

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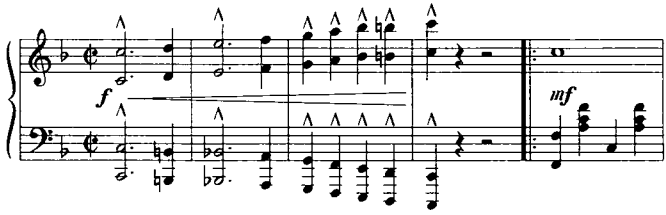
[6]See, e.g., Victor Fell Yellin, *The Omnibus Idea* (Warren, MI: Harmonie Park Press, 1998). The term originated two decades earlier in Yellin, "The Omnibus Idea," paper read at the annual meeting of the American Musicological Society, November 1972 (Dallas, TX).

[7]Having made reference specifically to serial inversion, I should point out that Webern constructed his twelve-tone row (prime form: A-F-A♭-G-B-B♭-D♭-C-E-D♯-F♯-D) so that the retrograde of the last six notes is the same as an inverted (and transposed) form of the first six notes. I mention this because, accordingly, one can interpret two of the voices of Figure 2 as having segments of prime forms, and two as having segments of retrograded prime forms (specifically, from the top down, segments of P6, R0, P4, and R10). Thus, one *could* dispense with reference to inversion when describing the passage, even though inversion is clearly a defining attribute of the excerpt (as it is of many vocal passages in the movement).

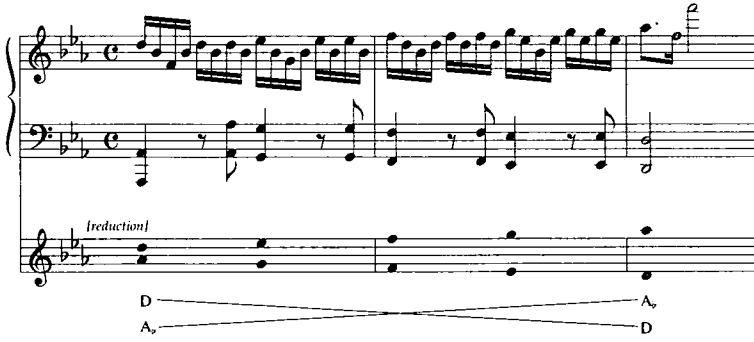
[8]See, for example, the three-voice isorhythmic motet by John Dunstable (ca. 1390–1453), *Veni sancte spiritus*, in Carl Parrish, compiler and editor, *A Treasury of Early Music* (New York: W. W. Norton, 1958): 87-93. It provides a verbal directive (or "canon") indicating that the tenor is to be performed first as written, then (diatonically) inverted, and finally in retrograde-inversion a fifth lower.

Figure 1. Stepwise-filled voice exchanges.

(a) J. P. Sousa, *The Thunderer* (1889): beginnning.



(b) W. A. Mozart, Piano Concerto K. 271 (1777): later cadenza, mm. 10-12.



(c) R. Schumann, Symphony No. 3, Op. 97 (1850): mvmt. I, mm. 542-47.

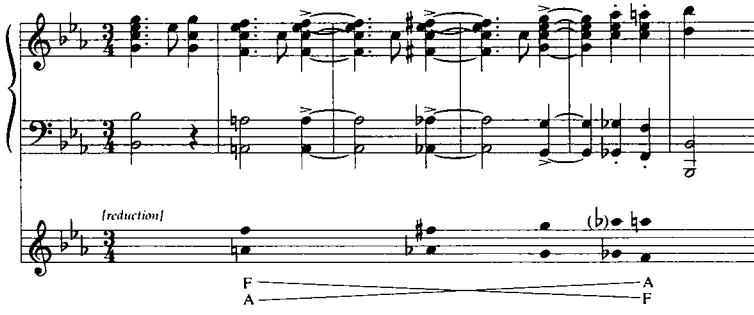
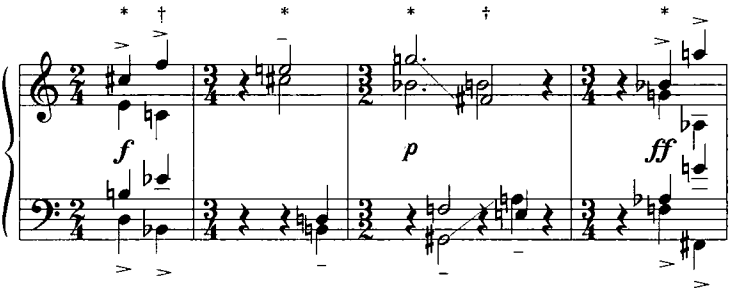


Figure 2. A. Webern, Cantata, Op. 29 (1938—39): mvmt. I, mm. 26—29 (SATB). (Note also linear symmetrical arrangement of set classes: * = 4-10 [0235], † = 4-23 [0257].)



inversion have a lengthy history, stretching back through the tonal and into the modal periods. One certainly does not have to turn to serial or even "atonal" music to find it.

Within the corpus of Western "art music," the perseverance of mirror counterpoint is a valuable fact to stress to students. It is important for them to become familiar with the endurance of it and other compositional procedures, lest they believe that certain undertakings (such as the topical one) are merely quixotic "theory exercises" unrelated to "real music." Accordingly, in the first section of this article, I provide an overview of the historical development and various applications of mirror counterpoint. Then, in the second section, I commence the investigation of the operation's musical attributes and compositional utilization. Brief analyses of three mirror compositions follow; these allow us to confirm, and explore further, certain previous observations in the contexts of extant compositions. In the concluding section, I summarize the benefits a student may obtain through the practice and application of the technique. All sections were written with both teacher and student in mind; the frequent use of the plural "we" is intended to denote this cooperative

community. Suggestions for approaching the material are offered, as are evaluations of problematic aspects and sample exercises and analyses. Indeed, the essay may serve as a model class lecture, and as such can be applied to the needs of teacher and student alike.

An Outline History of Mirror Counterpoint

Mirror counterpoint can trace its compositional roots to the opposition of voices by contrary motion, which has been advocated in counterpoint for centuries. For example, Johannes Affligemensis (a.k.a. John Cotton or Johannes Cotto) advised ca. 1100 that "[t]he simplest method for [constructing organum] is when the various melodic progressions are borne carefully in mind, so that whenever there is an ascent in the original melody, there is at that point a descent in the organal part and vice-versa."[9] By the fifteenth century the advice had become a general directive: in 1482 Bartolomeo Ramis offered six rules of counterpoint, the last being "[i]f the tenor ascends let the counterpoint be careful to descend,"[10] and Franchinus Gafurius echoed the sentiment in his eight rules of 1496, stating that "the parts of a song—tenor, cantus, and contratenor—ought to be in contrary motion to each other."[11]

These prescriptions were for the use of general contrary motion when juxtaposing parts, not strict mirror counterpoint. However, examples of the latter did emerge from comparable types of compositional thinking. The benefit of studying such examples is to increase awareness not only of the historical persistence of the technique, but of its various compositional applications and its stylistic evolution. Regarding matters of style and syntax, much can be learned by comparing tonal specimens, from the eighteenth and nineteenth

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[9]Johannes Affligemensis, *On Music (De Musica)* (ca. 1100), trans. by Warren Babb in *Hucbald, Guido, and John on Music: Three Medieval Treatises* (New Haven: Yale Univ. Press, 1978): 160.

[10]Bartolomeo Ramis (or Ramos), *Musica Practica* (1482), trans. with commentary by Clement A. Miller (s.l.: American Institute of Musicology, 1993): 119.

[11]Franchinus Gafurius, *Practica musicae* (1496), trans. and ed. by Irwin Young as *The Practica musicae of Franchinus Gafurius* (Madison: Univ. of Wisconsin Press, 1969): 135.

centuries, with earlier (i.e., modal) and later (e.g., "pandiatonic") works; and also by analyzing forms of mirroring among the Baroque, Classical, and Romantic eras, in order to assess the diverging practices that have been grouped under the rubric "tonal." To this end, in the following I will cite and briefly comment upon a handful of mirror passages, from the fifteenth through the twentieth centuries, that incorporate the technique in a variety of ways. (Of course, if using these or similar examples in an instructional environment, teachers and students should focus on issues of musical language to an extent not feasible here.) The survey will also permit us to broach, for the first time, some of the vicissitudes of specifically *tonal* mirroring, which is the principal focus of this article.

Two instances of "pre-tonal" mirroring will be mentioned. The first is from the English "Fountains Fragment," which probably dates from early in the fifteenth century.[12] In the third Gloria of this anonymous work, there is an isorhythmic tenor of six-notes (the piece ends during its ninth statement). A verbal directive or "canon" indicates that the contratenor, to be performed concurrently, is to be a (diatonic) inversion of the tenor at the fifth below. Together these voices are given, ostinato-like, underneath two more rapid voices. As may be seen in Figure 3, both lower voices move stepwise and are inverted about F (the note upon which they converge); together filling in the fifth D–A, they reinforce the Dorian modality of the piece.

For the second example, we turn to a publication by Giovanni Battista Martini, an esteemed musical authority of the eighteenth century, and a highly sought-after teacher with many famous pupils (including J.C. Bach and, allegedly, W.A. Mozart).[13] Despite its

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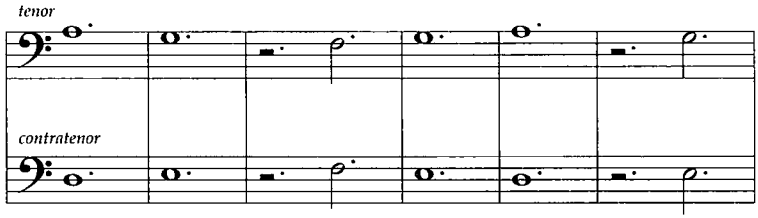
[12]For more, see Manfred F. Bukofzer, "The Fountains Fragment," ch. 3 in his *Studies in Medieval and Renaissance Music* (New York: Norton, 1950): 86–112; see also the editor's "Introduction" in *The Fountains Fragments: Late-Fourteenth-Century Polyphony for the Mass from a Fountains Abbey Memorial Book*, transcribed and ed. by Edward Kershaw (Devon, England: Antico Edition, 1989). Despite the subtitle of the last-named work, both authors hold that the music probably dates from the early fifteenth century—perhaps from, or around, its second decade.

[13]The nature of Mozart's often-cited studies with Martini is a matter of debate. Investigation of documents from the period, especially the cor-

late date, Martini's tract, *Esemplare o sia saggio fondamentale prattico di contrappunto fugato* (1774–75), is actually a monument to the *stile antico* of the sixteenth and seventeenth centuries.[14] Rather than a counterpoint treatise in the usual sense, it is a two-volume collection of annotated musical scores, mostly from the cited centuries. References to and examples of contrary-motion imitation are scattered throughout,[15] and at one point Martini illustrates mirror counterpoint in the forms transcribed in Figure 4.[16] The Mixolydian, imitative passage at *(a)* includes a cantus firmus (voice-1) and its inversion at

Figure 3. "Fountains Fragment" (English, ca. early 15th century): tenor and contratenor ostinato from third Gloria.



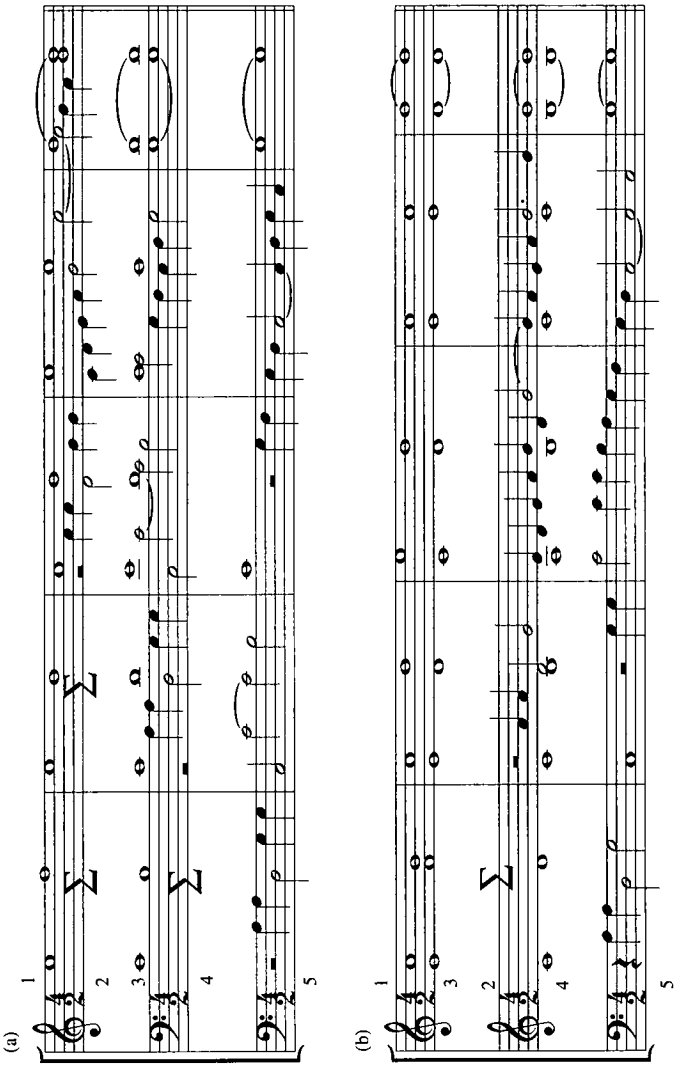
respondence of Mozart's father, suggests that the studies were very brief, if not anecdotal (see Frédéric Gonin, "Mozart et le Padre Martini: Histoire d'une légende?," *Revue de Musicologie* 85/2 [1999]: 277–95).

[14]Giovanni Battista Martini, *Esemplare o sia saggio fondamentale prattico di contrappunto fugato*, 2 vols. (Bologna: Lelio dalla Volpe, 1774–75; facsimile published Ridgewood, NJ: Gregg Press Inc., 1965); some portions are translated in Alfred Mann, *The Study of Fugue* (Mineola, NY: Dover, 1987): 263–314.

[15]See, e.g., vol. 1: 84–85.

[16]From vol. 1: 210. This is a more convenient and accurate transcription than what Martini provided; I have reduced the 5-staff system to 3; placed voices in either treble or bass clefs (eliminating C clefs); replaced the indicated ¢ time signature with the more accurate $\frac{4}{2}$; and corrected the final nine notes of version *(a)*, fifth voice, which were notated a third too low in the source.

Figure 4. G. B. Martini, *Esemplare...*: simultaneous inversion.
(NB: voices numbered as per original ordering, top to bottom, in orig. 5-stave source)



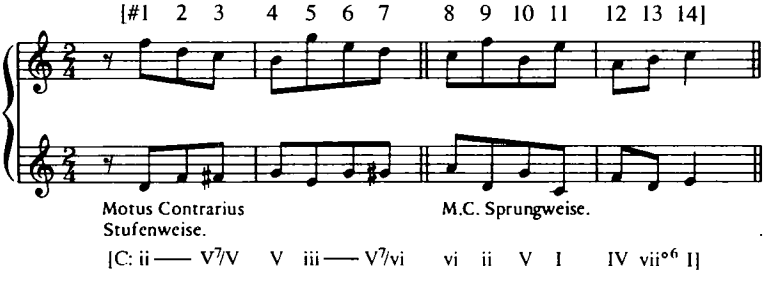
the tenth below (voice-3); the axis of inversion is D, upon which the two voices converge at the ending plagal cadence. The version at *(b)* demonstrates register-invertible counterpoint (i.e., "double counterpoint") by placing voice-1 an octave lower and voice-3 an octave higher; a new voice-4 is in parallel thirds below the repositioned cantus firmus.

Proceeding now into the tonal period, we find problems with the application of mirror counterpoint that would not have been experienced earlier. These arise due to the difficulties of incorporating its symmetrical prescriptions into a musical language in which scale degrees and harmonies are disproportionately weighted—i.e., one with an asymmetrical syntax. Indeed, it can be difficult enough to coordinate matching leaps and steps between voices, even if the reflected intervals do *not* have to be of the same (general) size. This fact was illustrated by an eighteenth-century tract that briefly considered the technique: Joseph Haydn's *Elementarbuch* (1789), which was recorded in manuscript by his student, F.C. Magnus.[17] The text is essentially an abstract of Fux's *Gradus ad Parnassum* (1725), on different species of counterpoint, although its musical examples are usually *not* taken from Fux and some of its techniques are unique.

One such novel specimen arises when Haydn addresses the different kinds of motions in two-voice writing, including contrary motion (*Motus contrarius*). As shown in Figure 5 (which should be read as a single phrase, despite the double bar), he illustrates how contrary motion may be either by step, as in the first two measures; or by skip, as in the last two measures. In brackets above the passage, I have added ordinal numbers which will be keyed to subsequent comments. Underneath, I have provided an interpretation of the harmonic potential of the passage, should one expand the range between the lines and add inner parts; thus we find what is, in the

[17]The *Elementarbuch* subheading reads: "condensed from the larger works of Kapellmeister Fux by Joseph Haydn" (*"aus den grösseren Wercken des Kappm. Fux, von Joesph Hayden zusammengezogen"*). See a diplomatic transcription with parallel translation in Alfred Mann, "Haydn's *Elementarbuch*: A Document of Classic Counterpoint Instruction," *Music Forum* 3 (1973): 197–237. Mann states that it was "possibly taken down from Haydn's dictations, but more likely transcribed from a rough copy prepared by Haydn himself" (p. 200).

Figure 5. J. Haydn, *Elementarbuch* (1789): 2-voice *Motus contrarius*.



main, a reasonable tonal passage. Still, consider the "tweaking" of the voices that had to be made just in the "stepwise" portion: between events #2–4, the top voice descends a *third* while the bottom voice chromatically fills a *second*; the leap between #4–5 is a *sixth* above but a *third* below; and between #6–8 there is another *third* against a filled-in *second*. In the "skips" section, at *no* time does the interval traversed above match that below (*fourths* are placed against *fifths*, etc.). Yet, even with all of these freedoms, notice the unusual features that still persist: e.g., there is a leap away from the leading tone between #10–11, where the implicit V–I takes place; and in the final measure (between #12–13), a *step* has to counter a *skip* in order to create a more conventional cadential gesture.

If irregularities are difficult to overcome even when contour inversion is applied less strictly, one can imagine the challenge of using precise mirror counterpoint and attempting to harmonize appropriately all reflected intervals—of integrating them into reasonable tonal progressions. This is especially true of the secundal mapping that necessarily results (i.e., no matter the diatonic axis, two notes adjacent in the scale will always be amount those that map onto one another). Moreover, one has to consider the octave or

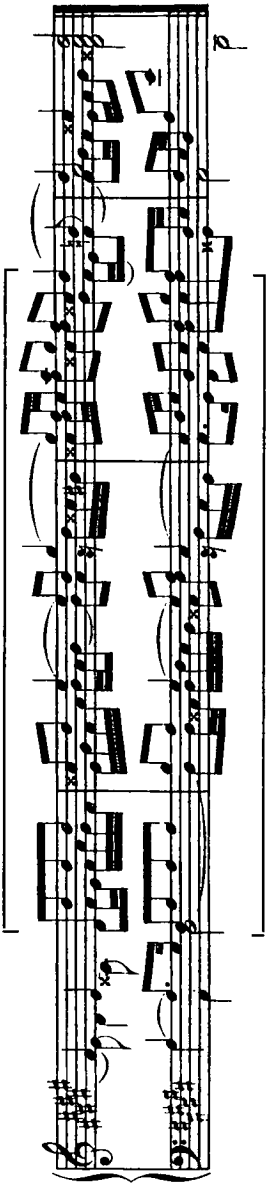
unison convergences upon the axis tone, which may give it undue emphasis (especially if the axis is not a conventionally-stressed scale degree). Accordingly, when tonal mirror counterpoint is found, passages are usually relatively brief. A few such examples will be cited below; as before, in an actual teaching environment, these should be compared and examined more thoroughly.

Given J.S. Bach's contrapuntal mastery, and the fact that various types of *successive* mirror inversions can be found in his music, it may come as little surprise that *simultaneous* inversion also exists within his works. As an example, Figure 6 presents the final four measures of Fugue 8, in D♯-minor, from *The Well-Tempered Clavier*, Book II (1738–42). The two-bar fugue subject, placed in the top voice, is simultaneously mirrored by the tenor-range voice; F♯ ($\hat{3}$) is the axis. In this particular work, the subject's inversion had not appeared previously; however, one can find examples by Bach in which a mirror-counterpoint section suggests an apotheosis due to prior applications of inversion. For example, consider the gigue of his Suite in A Minor, BWV 818 (see also the alternate version, BWV 818a): the original form of the theme is introduced at the beginning; the second strain begins with its inversion (as is often the case); and then, at the end, both forms are combined in mirror counterpoint.[18] Perhaps more striking is Contrapunctus 5, from *The Art of Fugue*, in which fugal entries are first discrete, then overlapped (in *stretto*), and finally combined—conceptually representing the ultimate temporal compression between entries: statements after the duration *zero*.

Muzio Clementi and Johannes Brahms exemplify composers from different halves of the nineteenth century whose interests in counterpoint prompted mirror writing. Clementi offered such a passage in *Gradus ad Parnassum*, vol. 1 (1817); and Brahms featured mirroring within different piano variations, including *Variations on a Theme by Robert Schumann*, op. 9 (1854), and *Variations and Fugue on a Theme*

[18]A Gigue that proceeds in a similar fashion, but whose two sections are more extensively related by inversion, is the one in D Minor from Bach's English Suite No. 6 (BWV 811). In it, the second strain is mostly constructed as the inverse of the first strain (i.e., the melodic contours are inverted *and* the registral order of voices is reversed); however, the axes of inversion are not constant and there are several deviations.

Figure 6. J. S. Bach, *Well-Tempered Clavier* II, Fugue 8 in D♯m (final 4 mm).

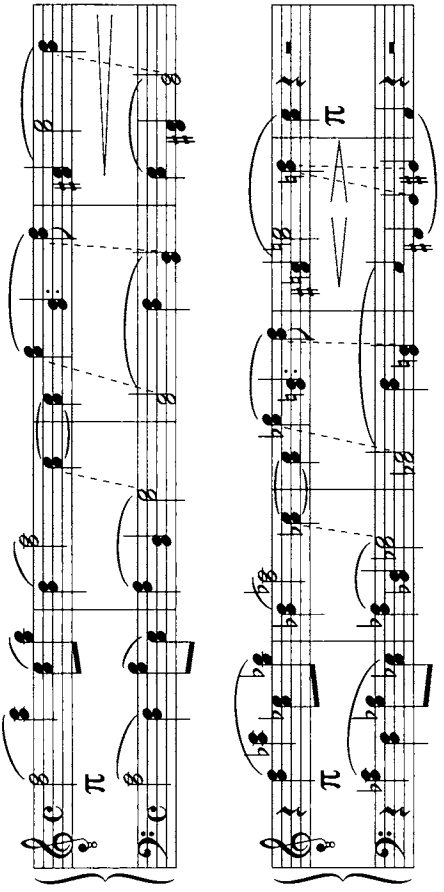


by Handel, op. 24 (1861). We will examine these compositions in detail later, after exploring general aspects of mirror counterpoint, so further comments will not be added here (the musical excerpts can be found as Figures 20–22). However, in passing, it should be noted that Brahms may well be the exemplar of a post-Bach tonal composer who was devoted to the technique of mirror writing. He returned to it several times. In addition to his two variations excerpted herein, see, e.g., his *Variations on a Theme of Haydn*, a.k.a. the "St. Anthony" variations (1873). In variation 8, mm. 350–53 are in tonal mirror counterpoint and are bounded by further, more general contrary motion. One can also find numerous examples of *inexact* mirroring in Brahms's piano music; e.g., see any of several variations in his two sets of *Variations on a Theme of Paganini* (1866).

Lastly, moving into the twentieth century, we note that mirror writing may be found in works that are still somewhat tonal. Edward Elgar's *Falstaff*, op. 68 (1913), provides one such example. There are various pockets of mirroring within this "symphonic study in C-minor," one of which is excerpted in Figure 7. However, here we do not find tonal progressions *per se*; instead, the various, leaping, mirrored thirds form a series of parallel seventh chords, first descending within the C-major collection, and then within the C-minor collection. Although the mirror technique may be found in such predominantly tertian, diatonically oriented passages, it most flourished in the twentieth century *after* adherence to tonality further weakened, and contrapuntal/harmonic possibilities began to expand. With a greater variety of permitted intervallic configurations came an increased potential for simultaneous inversion. Accordingly, it is among the century's "post-tonal" composers that the technique is most prominent. Many of these are known for their use of contrapuntal symmetries (e.g., Bartók and Webern), but in closing this survey, one should be mentioned who is perhaps not as widely recognized: Vincent Persichetti. He went through a period of intense mirror composition, between 1978 and 1980, that yielded forty-eight *Reflective Keyboard Studies*, op. 138; the five-movement *Little Mirror Book*, op. 139; seven *Mirror Etudes*, op. 143; and the "Mirror Sonata" (i.e., the Twelfth Piano Sonata), op. 145.

Techniques of mirror counterpoint in the "pre-" and "post-tonal" eras are no less worthy of study than those of the tonal period. How-

Figure 7. E. Elgar, *Falstaff* (marker [103]), violas and cellos.



ever, for the remainder of the article, we will focus only on the latter, so as to clarify the kinds of compositional approaches that were (and can be) used, the special considerations demanded by tonal mirroring, and ways in which these approaches and demands can well complement what is typically taught in undergraduate music-theory classes. A student can learn much by trying to compose aesthetically pleasing, tonally functional mirror counterpoint, as this article will make manifest. To be as concise as possible in a rather extensive undertaking, only major-key writing will be addressed here. Once its techniques have been mastered, application within minor should not be too difficult. The chief distinction will be that, although $\hat{6}$ and $\hat{7}$ will be considered generally when calculating scale-degree reflections, in application they will need to be transformed into appropriately "natural" or "raised" versions, depending upon local voice-leading requirements.

Axis Notation and Tonic-Triad Emphasis

As we begin to focus on compositional aspects of mirror counterpoint, a logical point of departure will be the determination of appropriate axes for inversion. A composition most strongly asserts its tonality when a tonic triad is present and confirmed, especially at points of musical departure and arrival. Accordingly, we will start with the proposition that an appropriate axis will be one that maps two members of the tonic triad onto one another; such an operation will permit the tonal center to be reinforced at defining moments. In order to form a tonic triad, it is not necessary for either outer voice to have $\hat{1}$; an inner voice could assume it instead. However, if one of the inversionally-related outer voices does contain $\hat{1}$, then closure—or at least a stronger arrival—will be especially facilitated. Before exploring how this premise affects axis determination, we must address how our axis systems will be indicated and modeled.

In the following, a diatonic inversion (dI) operator will be symbolized dI^{x}_{y}, which indicates that scale-degree x is mapped onto y, and vice-versa. When x and y are identical, these entries represent the actual scale-degree axis; when they differ, the axis is the scale degree "in between" the two (e.g., for dI^{1}_{5} the axis is $\hat{3}$). Thus, those inversions that map members of the tonic triad onto one another may

be symbolized: dI^1_1, dI^1_3, dI^1_5, dI^3_3 (which has the same axis as dI^1_5), dI^3_5, and dI^5_5 An advantage of this system is that the inversional analogue to any scale degree (i.e., the scale degree an equal step-distance on the "other side" of the axis) may be calculated easily, by simple addition or subtraction: treating scale degrees as integers, any whose sum is $x+y$ (mod. 7) are inversionally related. That is, if one wants to find the inversional analogue to $\hat{5}$ under dI^1_3, then: $5+\underline{6}=4$ (mod. 7), and so $\hat{6}$ is the corresponding inverted scale degree.[19]

There are different ways to represent notationally the mappings that result from the cited operations, and the strengths and weakness of each should be discussed, by teacher and student, before advocating one to follow. For example, dI^1_1 could be represented in conventional musical notation, with aligned ascending and descending scales, as shown in Figure 8. Here, C-major is used to represent the diatonic scale, and the notation indicates that if C↔C (C maps onto itself), then D↔B (D and B map onto one another), E↔A, etc. In between the staves is indicated the diatonic intervals between voices. This method of notation may seem direct, but in fact it is *too* specific: one is forced to select a particular scale, when one is really interested in the general relationships between scale degrees; and one must represent the notes of that scale in a fixed register (as the notation requires), although other registers may be employed.

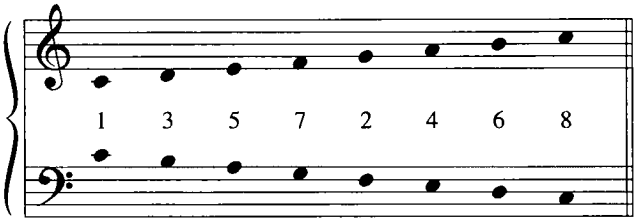
A modified cyclic notation, using scale degrees, provides a more general format in which the results of dI^1_1 could be represented:

$$(\hat{1})_{1/8}\ (\hat{2}\text{-}\hat{7})_{3/6}\ (\hat{3}\text{-}\hat{6})_{4/5}\ (\hat{4}\text{-}\hat{5})_{2/7}$$

Here, parentheses enclose outer-voice mappings, and so the notation indicates that $\hat{1}$ maps onto itself, $\hat{2}$ maps onto $\hat{7}$ (and vice-versa), and so forth. The subscripted numbers to the right of each parentheses-set

[19]For students unaccustomed to modular arithmetic, all one has to remember is that 8=1. That is, when counting, 7 is always followed by 1 (just as when thinking of scale degrees). So, when adding as per the cited example, think: what number added to 5 will equal 4? Then count the steps it takes to arrive at 4: ...6, 7, 1, 2, 3, 4 (= 6 steps). (Some mathematically aware readers may object to the use of mod. 7 arithmetic without the existence of 0, i.e, counting from 1 through 8 [=1] rather than from 0 through 7 [=0]. This is done only to preserve the usual interval numbers [prime, second, etc.].)

Figure 8. Diatonic mappings for axs $\hat{1}$, as represented by C-major scale.



denote the two diatonic intervals that can be formed by the given mapping, depending on which scale degree is placed in the bass. This more abstract notation eliminates the problems cited above, with Figure 8, but it eliminates also one of the benefits of conventional notation: the unambiguous indication of note adjacencies, of which notes are melodically nearest to which other notes—something of great importance when contemplating voice leading.

We will use a compromise notation, as shown in Figure 9a. There, dI^1_1 is represented by two concentric rings containing four scale degrees each. The aligned dyads indicate the scale-degree mappings, and (to facilitate voice leading) each scale degree is also visually adjacent to the next higher or lower degree, either by reading clockwise or counter-clockwise within a single ring (e.g., $\hat{3}$-$\hat{4}$), or by moving from one ring to another at the "break" (e.g., $\hat{4}$-$\hat{5}$). The motion in both rings must be read in the same direction; e.g., as $\hat{1}$ moves to $\hat{2}$ (outer ring) in one voice, concurrently $\hat{1}$ moves to $\hat{7}$ (inner ring) in the other voice. Following the break—i.e., after one "crosses" the rings—one must continue tracing both voices in the same direction. That is, if one is tracing a voice from $\hat{4}$ to $\hat{5}$ (across the rings) and then to $\hat{6}$ (continuing *counterclockwise* in the inner ring), one would trace the mirrored voice from $\hat{5}$ to $\hat{4}$ (across the rings) and then to $\hat{3}$ (continuing *counterclockwise* in the outer ring). Around the perimeter

of the rings are the intervals formed, depending on which dyadic scale degree is assigned to the lower register. Figures 9b–e provide similar displays for the other cited dI operators.

After examining the scale-degree correspondences within each axis system, and considering the chord possibilities for each note-pair, we observe that two systems can be dismissed due to tonally undesirable mappings: dI_5^3 (axis $\hat{4}$) is discarded due to $\hat{1}\leftrightarrow\hat{7}$, and dI_5^5 (axis $\hat{5}$) is treated likewise due to $\hat{1}\leftrightarrow\hat{2}$. In each case, the tonic pitch would be combined with a scale degree a step away, and thus neither axis could produce an unadorned tonic triad with which to conclude a composition. Accordingly, we are left with three alternatives, each viable in terms of mapping $\hat{1}$ onto a tonic-triad member, and thus each permitting a root-position tonic chord: dI_1^1 (axis $\hat{1}$), dI_5^1/dI_3^3 (both with axis $\hat{3}$), and dI_3^1 (axis $\hat{2}$).

The Species Approach

The diagrams of the three remaining axis systems reveal why mirror writing is *not* especially suitable for conventional two-voice, species-counterpoint exercises. Given the simultaneous reflections under discussion, exercises would have to be in note-against-note counterpoint, eliminating all species except the one traditionally ordered as "first." However, as the diagrams indicate, there are only a few scale-degree pairs that would produce the consonances required of note-against-note writing; these are summarized in Table 1. (Given that a unison or octave with $\hat{1}$ can be formed only under a single axis, namely $\hat{1}$, we must relax the common restriction that first-species exercises should end with that combination. In the following, "note-against-note counterpoint" will mean that which employs only consonant intervals between voices: the perfect unison, fifth, and octave; and major and minor thirds and sixths.) As a first step into the practice and problems of mirror writing, the student should compose some brief exercises in note-against-note counterpoint, under each axis; examples are provided in Figure 10. Due to the melodic limitations of each voice, longer exercises will likely be found to be tedious for both composer and listener. Such is the case especially with axis $\hat{2}$, which provides only three scale-degree possibilities. Figure 10b makes the most of the circumstance, in that its upper voice employs

Figure 9. Axis systems in graphic ("rings") notation.
(NB: systems shown are only those that permit members of the tonic triad to map onto one another.)

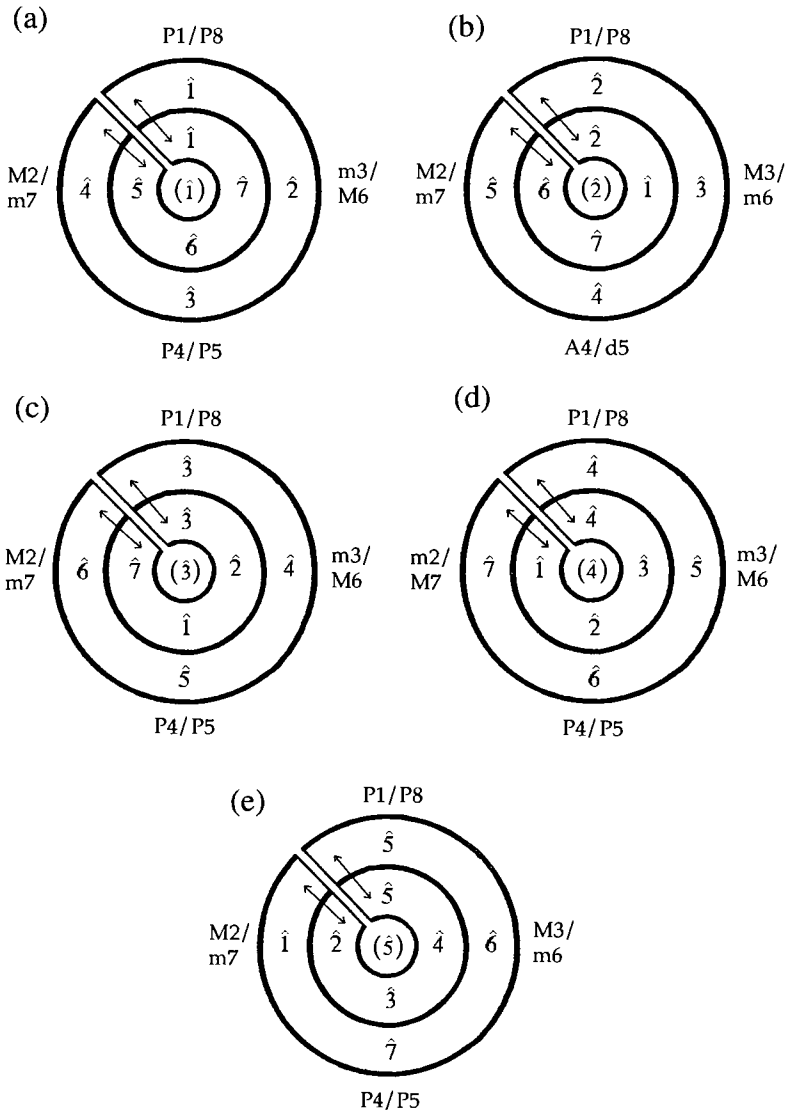


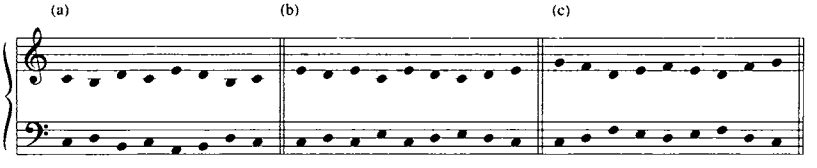
Table 1. Available consonances for note-against-note counterpoint.

axis	scale-degrees that can be used in either voice	scale-degrees that must be used in a specific voice
$\hat{1}$	$\hat{7}$, $\hat{1}$, $\hat{2}$	$\hat{3}$ (top), $\hat{6}$ (bottom)
$\hat{3}$	$\hat{2}$, $\hat{3}$, $\hat{4}$	$\hat{5}$ (top), $\hat{1}$ (bottom)
$\hat{2}$	$\hat{1}$, $\hat{2}$, $\hat{3}$	

all six unique scale-degree successions ($\hat{1}$-$\hat{2}$, $\hat{2}$-$\hat{1}$, $\hat{1}$-$\hat{3}$, $\hat{3}$-$\hat{1}$, $\hat{2}$-$\hat{3}$, $\hat{3}$-$\hat{2}$), and so provides maximum melodic/intervallic variety.

If one wanted to explore two-voice writing further, it would be advantageous to become progressively—and systematically—more liberal in the allowance of dissonances. One could posit different mirror-counterpoint species, each gradually expanding the palette of (controlled) dissonances, as in the five conventional species. For example, after the all-consonances model previously embraced, a "second (mirror) species" might then allow passing and neighboring dissonances on relative weak beats. If so, one will find the axes $\hat{1}$ and $\hat{3}$ generally more suitable than axis $\hat{2}$ not only because the former axes provide more consonant scale-degree combinations to begin with, but also because one of the dissonances under axis $\hat{2}$ is the tritone, which has fewer traditional resolution possibilities than certain other dissonances. Nonetheless, this "second species" will increase compositional potentials only slightly. One reason is that actually *no*

Figure 10. Two-voice counterpoint for axes $\hat{1}$, $\hat{2}$, and $\hat{3}$.



dissonant passing tones can be added under the three axes, because there are no single-scale-degree "gaps" between those scale degrees that can form consonances; e.g., under axis $\hat{1}$, $\hat{4}$ cannot be an upper-voice (dissonant) passing tone between $\hat{3}$ and $\hat{5}$ because goal-tone $\hat{5}$ cannot, itself, form a vertical consonance. Some neighboring tones will be possible; e.g., under axis $\hat{1}$: in the top voice, upper-neighbor $\hat{4}$ and lower-neighbor $\hat{6}$; in the bottom voice, upper-neighbor $\hat{3}$ and lower-neighbor $\hat{5}$. But still, the top and bottom voices will each have one scale degree ($\hat{5}$ and $\hat{4}$, respectively) that cannot be used. Figure 11 offers a "second species" exercise in common time, written under axis $\hat{1}$; intervals of the seventh and the fourth (marked with asterisks) appear on relative weak beats.

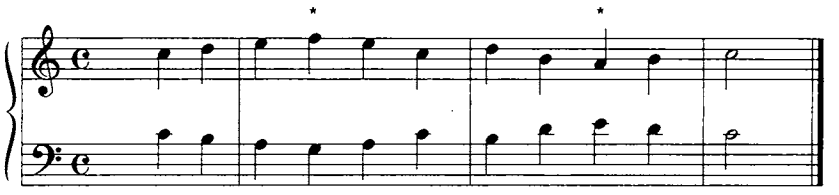
One may contrive other mirror species through the continued incorporation of dissonance types, but at some point too many successive dissonances will likely undermine any real sense of tonality, and exercises will come to sound more like specimens of "pandiatonic" counterpoint, *à la* Stravinsky and certain other twentieth-century composers.[20] Indeed, proceeding from suggestions in the historical-survey section, it could be fruitful to have students continue with the systematic expansion of allowed dissonances, and to debate at what point their exercises ceased to be truly tonal. At any rate, the foregoing observations suggest the reason that tonal composers usually employ mirror counterpoint only when (nonsymmetrical) inner voices are also present: these soften the frequent outer-voice dissonances with added consonances, and complete or suggest tonally-normative chord progressions. Thus, in continuing our evaluation of the three axes, the next issues to consider are the harmonies implied by each mapping, and their immediate voice-leading consequences.

Harmonic Implications

Given the relatively limited set of possible harmonies, can they be incorporated into tonally suitable progressions, considering also exigencies of voice leading (such as resolutions of chord sevenths

[20]See, for example, much of the theme-and-variation movement of Stravinsky's *Sonata for Two Pianos* (1943–44).

Figure 11. "Second (mirror) species," under axis î.



and other dissonant tones)?[21] The entries in Table 2 suggest partial answers to this question. Let us consider the table for axis î. The first column indicates the mappings, i.e., the scale degrees that will be assigned to the outer voices. The second column displays the chords (usually triads) that are most likely to be formed with the outer voices. For example, if î is in both outer voices, then I, vi, and IV are likely harmonies (for consistency, the table does not include figured-bass inversional symbols (e.g., $_3$and $_4$) because the bass tone is not fixed when two *different* scale degrees are in column 1). Finally, the third column lists the most obvious and immediate voice-leading restrictions. In teaching, these should be addressed individually; each implicit chord and its possible resolutions should be illustrated, with special attention paid to the restrictions and potential problems arising therefrom. In practice, the student will learn much about tonal voice leading from taking one of the outer-voice combinations and determining what chords can follow, within the narrow context of a two- to four-element progression. Some of these are detailed below.

[21] A fundamental pedagogical issue is which to teach first, counterpoint or harmony (setting aside, for the moment, the fact that both topics are inextricably intertwined in tonal practice). In my approach to the following discussion, I am assuming prior knowledge of basic harmonic syntax on the part of the student.

Table 2. Possible (common) harmonies, and their voice-leading restrictions.

axis $\hat{1}$ mapping	common chords	common restrictions
$\hat{1}\leftrightarrow\hat{1}$*	I, vi, IV	—
$\hat{7}\leftrightarrow\hat{2}$	V, vii^{o}	$\hat{7}$-$\hat{1}$ (necessitates $\hat{2}$-$\hat{1}$)
$\hat{6}\leftrightarrow\hat{3}$	vi	—
$\hat{4}\leftrightarrow\hat{5}$	V^7	$\hat{4}$-$\hat{3}$ (necessitates $\hat{5}$-$\hat{6}$); works well if $\hat{5}$-$\hat{6}$ in bass

axis $\hat{3}$ mapping	common chords	common restrictions
$\hat{3}\leftrightarrow\hat{3}$*	I, iii, vi	—
$\hat{2}\leftrightarrow\hat{4}$	ii, vii^{o}, V^7	if V^7 of vii^{o}, $\hat{4}$-$\hat{3}$ (necessitates $\hat{2}$-$\hat{3}$); if ii, resolution could be problematic
$\hat{1}\leftrightarrow\hat{5}$*	I	—
$\hat{6}\leftrightarrow\hat{7}$	vii^{o7}	$\hat{6}$-$\hat{5}$ and $\hat{7}$-$\hat{1}$

axis $\hat{2}$ mapping	common chords	common restrictions
$\hat{2}\leftrightarrow\hat{2}$	ii, V, vii^{o}	—
$\hat{1}\leftrightarrow\hat{3}$*	I, vi	—
$\hat{7}\leftrightarrow\hat{4}$	vii$^{o(7)}$, V^7	$\hat{7}$-$\hat{1}$ and $\hat{4}$-$\hat{3}$
$\hat{5}\leftrightarrow\hat{6}$	vi^7; later: V^9	$\hat{5}$-$\hat{4}$ (necessitates $\hat{6}$-$\hat{7}$)

* *indicates that a tonic triad can be formed*

There are no restrictions for $\hat{1}\leftrightarrow\hat{1}$, as any of the three indicated chords may be used without affecting the immediate voice-leading of the scale degrees in column 1. That is, even if the outer-voice $\hat{1}$s are made to form IV $_4$, it is not the *outer* voices that are always compelled to move, it may be the added *inner* voices: in the case of a "neighboring $_4$" which resolves to $_3$ above the same bass tone, the added $\hat{4}$ and $\hat{6}$ must step down to $\hat{3}$ and $\hat{5}$, but the $\hat{1}$s remain, and

so the resolution does not affect the motion of the symmetrically disposed outer voices (see Figure 12a).

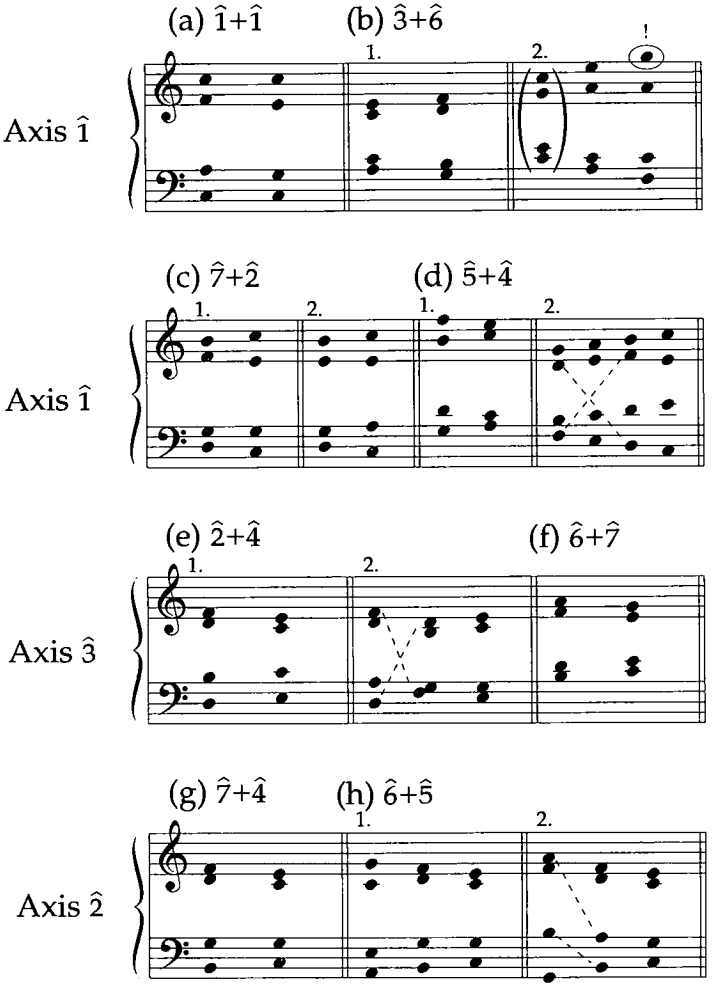
There are also no restrictions for $\hat{6}\leftrightarrow\hat{3}$, which most likely will form vi. True, some progressions will *follow* from vi more logically than others. For example, if vi serves as a prefix to V, then the bass's $\hat{6}$ will step down to $\hat{5}$ as the soprano's $\hat{3}$ steps up to $\hat{4}$, thus forging V^7—a conventional progression (Figure 12b.1). However, the common use of vi as an intermediate chord between I and IV would be problematic, because a bass skipping from $\hat{6}$ to $\hat{4}$ would have to be mirrored by a soprano skipping from $\hat{3}$ to $\hat{5}$, and the latter scale degree is *not* a member of IV (Figure 12b.2). Still, there is nothing about the outer-voice combination of $\hat{6}$ and $\hat{3}$ that *requires* the latter (undesirable) succession; better options (such as the former) do exist.

The same is not true for $\hat{7}\leftrightarrow\hat{2}$, which most likely will fit $vii^{\circ(7)}$ or $V^{(7)}$, thus strengthening harmonically the melodic tension which typically compels the leading tone to ascend to the tonic. The $\hat{7}$-$\hat{1}$ resolution accordingly necessitates a $\hat{2}$-$\hat{1}$ resolution in the mirrored voice (Figure 12c.1). Observe that the same would be true even if $\hat{7}$ and $\hat{2}$ were incorporated into a iii^7 chord: $\hat{7}$ would now be more stable and thus less obliged to resolve upward; but $\hat{2}$, being the chord seventh, would need to resolve downward, meaning that $\hat{7}$ would still be compelled to ascend, as illustrated in Figure 12c.2.

The combination of $\hat{4}$ and $\hat{5}$ likewise suggests V^7 (in either root-position or third inversion), and so $\hat{4}$ (the chord seventh) must step downward to $\hat{3}$; this will cause the mirrored $\hat{5}$ to step to $\hat{6}$, creating a deceptive harmonic resolution. The progression will work especially well if the $\hat{5}$-$\hat{6}$ motion is in the bass, creating a root-position V^7–vi (Figure 12d.1); it will be more problematic if $\hat{4}$-$\hat{3}$ is in the bass, because the "resolution" will be to an unstable vi^{6}_{4} chord. But this too may be reconciled with tonal practice, if the $^{6}_{4}$ behaves normatively (e.g., as a passing chord, as in Figure 12d.2).

Regarding the remaining entries of Table 2, for axes $\hat{3}$ and $\hat{2}$, we will comment only upon the voice-leading restrictions. For axis $\hat{3}$, $\hat{2}\leftrightarrow\hat{4}$ may well be incorporated into a vii° or V^7 chord, which would make $\hat{4}$ an active tone bound to resolve to $\hat{3}$, and thus the mirroring voice would have to progress $\hat{2}$-$\hat{3}$. No matter which registral

Figure 12. Progressions from specified axis-tone combinations, and their harmonic implications.



arrangement is employed, the chord of resolution will be I^6 (Figure 12e.1). The other possible harmonization of $\hat{2}$ and $\hat{4}$ is, of course, ii. However, the motion *from* ii—i.e., considering an appropriate chord to which it could progress—can be problematic; one solution, in which ii leads to V^4_2–I^6, is illustrated in Figure 12e.2. The other voice-leading restrictions for axis $\hat{3}$ occur when $\hat{6}\leftrightarrow\hat{7}$: as the combination suggests vii°^{7}, the leading tone is bound to ascend to $\hat{1}$, and $\hat{6}$ (the chord seventh) must descend (Figure 12f).

Moving to axis $\hat{2}$, we observe that the tritone formed by $\hat{7}$ and $\hat{4}$ requires resolution to $\hat{1}$ and $\hat{3}$. Recall that vii° tends *not* to be used in root position, and occurs only occasionally in second inversion; thus, if $\hat{7}$ is to be in the bass, V^6_5 or vii°^{7} will be most appropriate (Figure 12g). The combination of $\hat{5}$ and $\hat{6}$, when part of vi^7, requires resolution to $\hat{4}$ and $\hat{7}$ (and these, in turn, necessitate resolution to $\hat{3}$ and $\hat{1}$; see Figure 12h.1). Note, however, another possibility for the $\hat{5}$-$\hat{6}$ combination: V^9 (in root position). This option is marked "later" in Table 2—a chronological reference to the fact that such ninth chords were common after the mid-nineteenth century, but are not representative of classical-era music. The V^9 cannot move directly to I, as the ascending fourth in the bass, $\hat{5}$-$\hat{1}$, would have to be answered by a descending fourth in the top voice, $\hat{6}$-$\hat{3}$, which would remove the chord ninth ($\hat{6}$) from an appropriate voice-leading context. A compromise is given in Figure 12h.2, where an arpeggiation from V^9 to vii°^{7} not only lessens the outer-voice gap between V^9 and I, but allows the former chord ninth to be transferred to an inner voice and therefrom resolved properly.

Tonal Progressions

So far, we have tabulated some individual harmonic possibilities and their immediate voice-leading consequences. But what are the implications of longer range, as per coordinating a syntactically appropriate progression, from tonic, through pre-dominant to dominant, and then back to tonic (hereafter abbreviated T–PD–D–T)? In considering such issues, we will utilize non-metered voice-leading

schematics in the form of four-voice, chorale-type settings. This is done only because the student will likely be most familiar with such settings, which make voice leading explicit to a degree not always achieved in, e.g., idiomatic piano arrangements; it is certainly not meant to suggest that composers of mirror counterpoint favored a chorale format.

Under axis $\hat{1}$, there are some significant limitations in terms of coordinating a PD–D progression: given the mandated mappings, there can be no pure ii triad, and IV can only occur as IV^6_4. As previously mentioned, however, vi can also serve as prefix to V^7, thus providing an acceptable PD under the axis. Another limitation is that there cannot be a perfect-authentic cadence, unless one is willing to have the seventh of V^7 resolve in an inner voice, while the top voice (mirroring the bass's descent from $\hat{5}$ to $\hat{1}$) leaps upward by fifth. Figure 13a illustrates how one might achieve a semblance of a conventional I–IV–V–I progression. There, the problematic $\hat{5}$ above $\hat{4}$ is treated as an appoggiatura, which resolves downward as the chord changes from IV to V^7; the subsequent resolution of $\hat{4}$ to $\hat{3}$ occurs in an inner voice, as just described. Despite the limitations of the axis system, longer progressions can be constructed. Figure 13b provides a nine-chord schematic with a conservative outer-voice structure.

Among the obvious problems with axis $\hat{3}$ is that the $\hat{1}\leftrightarrow\hat{5}$ mapping dictates that final cadences must always have $\hat{5}$ in the top voice—a condition undesirable from the standpoint of melodic closure. Root-position $V^{(7)}$ is not possible either, due to the $\hat{1}\leftrightarrow\hat{5}$ mapping. PDs are limited: no pure IV is available, and vi can only occur in second inversion; and, while ii can be constructed in root position or first inversion, one has to be mindful that it can only lead to V^4_3 or V^4_2 (which, in turn, can only lead to I^6) due to the intersection of tonal and axis requirements. Figure 14b shows one means of approaching the dominant: an outer-voice exchange of $\hat{2}$ and $\hat{4}$ (here, F and D) are incorporated into a ii^7–V^4_2 progression. Although no root-position tonic chord can follow an inversion of V^7 or vii°, a useful cadential surrogate does exist in the form of $vii^{\circ 7}$–I. It is found in Figure 14a, which, with only four chords, provides the most compact T–PD–D–T progression possible under the axis system. Figure 14c presents a slightly longer

schematic progression, with two passing six-fours and (as earlier) an appoggiatura resolving as the harmony changes.[22]

Finally, we explore the potential of axis $\hat{2}$. Although one cannot form pure iii or IV triads, there are generally more options here than with the other axes. Axis $\hat{2}$ well facilitates passing between $\hat{1}$ and $\hat{3}$, as illustrated in Figure 15a with an outer-voice exchange on two hierarchic levels. If the harmonic palette is expanded to include V^9, then (as was illustrated earlier) a semblance of a root-position V–I can also be achieved, as shown and interpreted in Figure 15b. The axis can foster a fairly smooth harmonic and melodic progression. Although it is true that melodic (top-voice) closure on $\hat{1}$ will not be as convincing due to the resulting, less-than-conclusive I^6, a more satisfying result can be obtained if the phrase leads melodically to $\hat{1}$ over $\hat{3}$ but then quickly reverses the voices to end with $\hat{1}$ *under* $\hat{3}$. As shown and interpreted in Figure 15a, one may still perceive a definitive melodic descent to $\hat{1}$—albeit one followed by a brief, ancillary return to $\hat{3}$.

Submetrical Embellishments and Unchanging Harmonies

Previously, we considered each outer-voice dyad to contribute to a different harmony—a harmonic enrichment of the "note-against-note" approach. This has enabled us to discern certain limitations of harmonic applicability and chord progression. However, in practice, it is likely that a composer will use two or more melodic notes (and their reflected bass notes) while a single chord is being sounded (or implied). Melodic and bass notes often change more quickly than the underlying chord progression; this is accomplished in a variety of ways, and it is not our intention (nor would it be reasonable) to consider the reflective implications of every conceivable configuration. For example, complete neighboring tones may be used in

[22]In especially Figure 14c, it is important for the student to understand the B (soprano, fourth note) as an appoggiatura. Playing the passage with A substituted for B should clarify the role of B as a melodic displacement of the normative soprano note. If this is not understood, then the student may assume that B–A over A–B forms a secundal voice exchange (which, of course, the exigencies of voice leading would not permit).

Figure 13. Schematic progressions under axis $\hat{1}$.

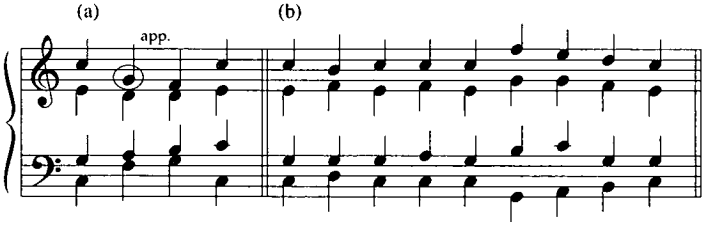


Figure 14. Schematic progressions under axis $\hat{3}$.

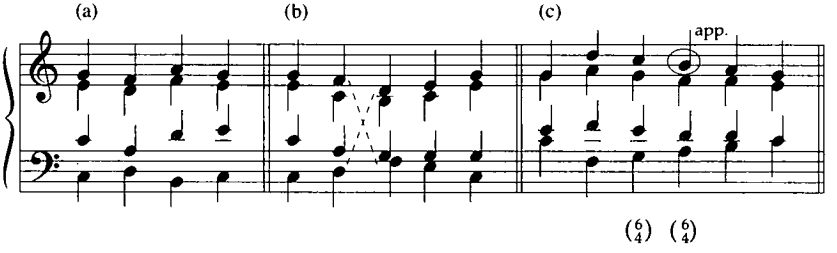
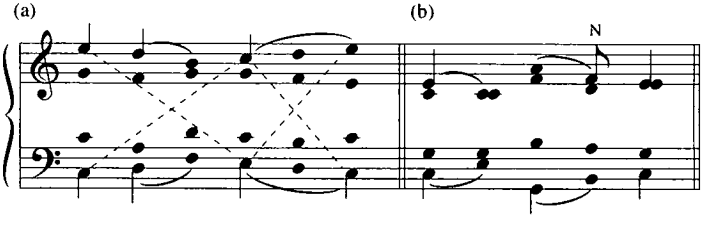


Figure 15. Schematic progressions under axis $\hat{2}$
(with stem-and-slur interpretation).



such contexts; but these present no substantial problems, as the outer harmonic events are identical and the (potential) dissonances arise only in between, perhaps in a relatively brief duration, and in a manner that is easily absolved by the voice leading. Passing tones also present no great problems; e.g., if one has already constructed consonant simultaneities on beats 1 and 2, then adding one or even two passing dissonances in between will likely not offend the ear, due to the clear orientation of the mirrored stepwise lines toward another consonant event. However, a third category of embellishment, submetrical arpeggiations of a chord (i.e., the skip of a third, fourth, fifth, or sixth), can present a special challenge in mirror counterpoint, because the chord suggested by a top-voice arpeggiation may not match the implications of the reflected bass arpeggiation. Accordingly, we will end our survey of the general properties of tonal axes by examining chordal skips (and their reflections), to discover which may be best subsumed under a single harmony.

Table 3 summarizes the possible diatonic chordal skips, and their resulting reflections, under the three axes (the abbreviations "T" and "B" are for top and bottom voices). One may consider these skips to be either ascending or descending, as long as the two voices move in opposite directions and remain in their relative registral positions. (Of course, the student must keep in mind an important stylistic consideration: large leaps, reflected simultaneously in both outer voices, are not common in tonal practice.) As these skips are intended to coincide with the projection of a single harmony, one may wish to think of them as occurring as two eighth notes within a quarter-beat harmony, as a dotted-quarter plus eighth within a half-note harmony, or in any other such configuration in which the second event is of a duration generally no longer than the first.

If the four notes sounded by the reflected dyadic skips can be reconciled in a single harmony (i.e., if one could place the complete set of outer notes against sustained inner chord tones), the Table includes a Roman-numeral representation of that harmony underneath the scale-degree set. In many cases, no such harmony is possible (and thus no chord symbol appears). Consider, for example, under axis $\hat{1}$, the skips $\hat{3}$-$\hat{5}$ above $\hat{6}$-$\hat{4}$. The first vertical dyad naturally suggests vi, and the second V^4_2, and so one can easily align these skips; however, no *single* chord will be suggested by their combination. In contrast,

Table 3. Submetrical chordal skips, and resulting reflections; indication of those that can be reconciled in a single chord.

Axis $\hat{1}$

T	$\hat{1}$-$\hat{3}$	$\hat{2}$-$\hat{4}$	$\hat{3}$-$\hat{5}$	$\hat{4}$-$\hat{6}$	$\hat{5}$-$\hat{7}$	$\hat{6}$-$\hat{1}$	$\hat{7}$-$\hat{2}$	
B	$\hat{1}$-$\hat{6}$	$\hat{7}$-$\hat{5}$	$\hat{6}$-$\hat{4}$	$\hat{5}$-$\hat{3}$	$\hat{4}$-$\hat{2}$	$\hat{3}$-$\hat{1}$	$\hat{2}$-$\hat{7}$	
	vi	V^7			V^7	vi	V^7	
							vii^o	
T	$\hat{1}$-$\hat{4}$	$\hat{2}$-$\hat{5}$	$\hat{3}$-$\hat{6}$	$\hat{4}$-$\hat{7}$	$\hat{5}$-$\hat{1}$	$\hat{6}$-$\hat{2}$	$\hat{7}$-$\hat{3}$	
B	$\hat{1}$-$\hat{5}$	$\hat{7}$-$\hat{4}$	$\hat{6}$-$\hat{3}$	$\hat{5}$-$\hat{2}$	$\hat{4}$-$\hat{1}$	$\hat{3}$-$\hat{7}$	$\hat{2}$-$\hat{6}$	V^7
		V^7	vi	V^7				vi
T	$\hat{1}$-$\hat{5}$	$\hat{2}$-$\hat{6}$	$\hat{3}$-$\hat{7}$	$\hat{4}$-$\hat{1}$	$\hat{5}$-$\hat{2}$	$\hat{6}$-$\hat{3}$	$\hat{7}$-$\hat{4}$	vii^o
B	$\hat{1}$-$\hat{4}$	$\hat{7}$-$\hat{3}$	$\hat{6}$-$\hat{2}$	$\hat{5}$-$\hat{1}$	$\hat{4}$-$\hat{7}$	$\hat{3}$-$\hat{6}$	$\hat{2}$-$\hat{5}$	
					V^7	vi	V^7	
T	$\hat{1}$-$\hat{6}$	$\hat{2}$-$\hat{7}$	$\hat{3}$-$\hat{1}$	$\hat{4}$-$\hat{2}$	$\hat{5}$-$\hat{3}$	$\hat{6}$-$\hat{4}$	$\hat{7}$-$\hat{5}$	
B	$\hat{1}$-$\hat{3}$	$\hat{7}$-$\hat{2}$	$\hat{6}$-$\hat{1}$	$\hat{5}$-$\hat{7}$	$\hat{4}$-$\hat{6}$	$\hat{3}$-$\hat{5}$	$\hat{2}$-$\hat{4}$	
	vi	V^7	vi	V^7			V^7	
		vii^o						

Axis $\hat{2}$

T	$\hat{1}$-$\hat{3}$	$\hat{2}$-$\hat{4}$	$\hat{3}$-$\hat{5}$	$\hat{4}$-$\hat{6}$	$\hat{5}$-$\hat{7}$	$\hat{6}$-$\hat{1}$	$\hat{7}$-$\hat{2}$	
B	$\hat{3}$-$\hat{1}$	$\hat{2}$-$\hat{7}$	$\hat{1}$-$\hat{6}$	$\hat{7}$-$\hat{5}$	$\hat{6}$-$\hat{4}$	$\hat{5}$-$\hat{3}$	$\hat{4}$-$\hat{2}$	
	I	V^7	vi^7	(V^9)	(V^9)	vi^7	V^7	
	vi	vii^o					vii^o	
T	$\hat{1}$-$\hat{4}$	$\hat{2}$-$\hat{5}$	$\hat{3}$-$\hat{6}$	$\hat{4}$-$\hat{7}$	$\hat{5}$-$\hat{1}$	$\hat{6}$-$\hat{2}$	$\hat{7}$-$\hat{3}$	
B	$\hat{3}$-$\hat{7}$	$\hat{2}$-$\hat{6}$	$\hat{1}$-$\hat{5}$	$\hat{7}$-$\hat{4}$	$\hat{6}$-$\hat{3}$	$\hat{5}$-$\hat{2}$	$\hat{4}$-$\hat{1}$	I
		(V^9)	vi^7	V^7	vi^7	(V^9)		V^7, V^9
				vii^o				$vi^{(7)}$
T	$\hat{1}$-$\hat{5}$	$\hat{2}$-$\hat{6}$	$\hat{3}$-$\hat{7}$	$\hat{4}$-$\hat{1}$	$\hat{5}$-$\hat{2}$	$\hat{6}$-$\hat{3}$	$\hat{7}$-$\hat{4}$	vii^o
B	$\hat{3}$-$\hat{6}$	$\hat{2}$-$\hat{5}$	$\hat{1}$-$\hat{4}$	$\hat{7}$-$\hat{3}$	$\hat{6}$-$\hat{2}$	$\hat{5}$-$\hat{1}$	$\hat{4}$-$\hat{7}$	
	vi^7	(V^9)			(V^9)	vi^7	V^7	
							vii^o	
T	$\hat{1}$-$\hat{6}$	$\hat{2}$-$\hat{7}$	$\hat{3}$-$\hat{1}$	$\hat{4}$-$\hat{2}$	$\hat{5}$-$\hat{3}$	$\hat{6}$-$\hat{4}$	$\hat{7}$-$\hat{5}$	
B	$\hat{3}$-$\hat{5}$	$\hat{2}$-$\hat{4}$	$\hat{1}$-$\hat{3}$	$\hat{7}$-$\hat{2}$	$\hat{6}$-$\hat{1}$	$\hat{5}$-$\hat{7}$	$\hat{4}$-$\hat{6}$	
	vi^7	V^7	I	V^7	vi^7	(V^9)	(V^9)	
		vii^o	vi	vii^o				

Table 3. (continued)

Axis $\hat{3}$

T	$\hat{1}$-$\hat{3}$	$\hat{2}$-$\hat{4}$	$\hat{3}$-$\hat{5}$	$\hat{4}$-$\hat{6}$	$\hat{5}$-$\hat{7}$	$\hat{6}$-$\hat{1}$	$\hat{7}$-$\hat{2}$	
B	$\hat{5}$-$\hat{3}$	$\hat{4}$-$\hat{2}$	$\hat{3}$-$\hat{1}$	$\hat{2}$-$\hat{7}$	$\hat{1}$-$\hat{6}$	$\hat{7}$-$\hat{5}$	$\hat{6}$-$\hat{4}$	
	I	ii, V^7 vii^{o}	I	vii^{o7}			vii^{o7}	
T	$\hat{1}$-$\hat{4}$	$\hat{2}$-$\hat{5}$	$\hat{3}$-$\hat{6}$	$\hat{4}$-$\hat{7}$	$\hat{5}$-$\hat{1}$	$\hat{6}$-$\hat{2}$	$\hat{7}$-$\hat{3}$	I
B	$\hat{5}$-$\hat{2}$	$\hat{4}$-$\hat{1}$	$\hat{3}$-$\hat{7}$	$\hat{2}$-$\hat{6}$ vii^{o7}	$\hat{1}$-$\hat{5}$ I	$\hat{7}$-$\hat{4}$ vii^{o7}	$\hat{6}$-$\hat{3}$	ii
T	$\hat{1}$-$\hat{5}$	$\hat{2}$-$\hat{6}$	$\hat{3}$-$\hat{7}$	$\hat{4}$-$\hat{1}$	$\hat{5}$-$\hat{2}$	$\hat{6}$-$\hat{3}$	$\hat{7}$-$\hat{4}$	vi^7
B	$\hat{5}$-$\hat{1}$	$\hat{4}$-$\hat{7}$	$\hat{3}$-$\hat{6}$	$\hat{2}$-$\hat{5}$	$\hat{1}$-$\hat{4}$	$\hat{7}$-$\hat{3}$	$\hat{6}$-$\hat{2}$	vii$^{o(7)}$
	I	vii^{o7}					vii^{o7}	
T	$\hat{1}$-$\hat{6}$	$\hat{2}$-$\hat{7}$	$\hat{3}$-$\hat{1}$	$\hat{4}$-$\hat{2}$	$\hat{5}$-$\hat{3}$	$\hat{6}$-$\hat{4}$	$\hat{7}$-$\hat{5}$	
B	$\hat{5}$-$\hat{7}$	$\hat{4}$-$\hat{6}$	$\hat{3}$-$\hat{5}$	$\hat{2}$-$\hat{4}$	$\hat{1}$-$\hat{3}$	$\hat{7}$-$\hat{2}$	$\hat{6}$-$\hat{1}$	
		vii^{o7}	I	ii, V^7 vii^{o}	I	vii^{o7}		

when $\hat{2}$-$\hat{4}$ skips above $\hat{7}$-$\hat{5}$, the entire unit suggests some form of V^7. (In the Table, V^7 and other chord symbols are given as general labels of chord types and do not necessarily represent root-position chords.)[23]

Students employing submetrical skips must pay careful attention (as always) to subsequent voice leading, as suggested by the registral distribution of the chord components. For example, if an arpeggiation places an active tone in the bass (as in V^4_2), the resolution of that tone dictates, to a large extent, what chord may follow. Consider, for example, $\hat{5}$-$\hat{7}$ over $\hat{4}$-$\hat{2}$, which suggests an inversion of V^7; if followed by the tonic chord, the latter will likely be in first inversion. Because the bass first sounded $\hat{4}$ (the chord seventh), there is a strong tendency for $\hat{3}$ to appear in the bass for the resolution, and the ten-

[23]The observant reader will note that, because voice-pair entries on one row will always be the inverse of those on another (e.g., one row shows $\hat{5}$-$\hat{7}$ above $\hat{4}$-$\hat{2}$, while another shows $\hat{4}$-$\hat{2}$ above $\hat{5}$-$\hat{7}$), the chord symbols are likewise identical for two voice-pair rows (only rotated).

dency is increased by the fact that the bass skipped *over* $\hat{3}$ to $\hat{2}$ (in outlining V^4_3), thereby leaving a "gap" in need of "filling." Another factor is that the *appropriateness* of a chord inversion must always be considered. For example, one must remember that root-position diminished triads are not commonly used in tonal music, although V^6_5 and root-position vii°7 are typical. Likewise, V^9presents a special case, since so-called "ninth chords" tend to occur in root position, with the ninth in an upper (often the highest) voice.[24] Accordingly, the V^9 designation (under axis $\hat{2}$) has been placed in parentheses, to indicate that it may be literally possible, but could be executed only in certain spacings. These resolutions, like those considered earlier, must be practiced to facilitate good mirror writing.

One type of harmonic usage requires additional comment. Chords related by descending thirds, such as I–vi or vii°–V^7, are common in tonal music, and can arise with a change in just one—or even zero—sustained inner voices; furthermore, the second chord of such a set often prolongs, or functions similarly to, the first (although it is not always the case, as evidenced by the ii–vii° succession). Thus, although outer-voice skips, which suggest these types of chord successions, do not entirely fit the current topic (as *two different* chords literally result), the effect can be similar in that the skips may be integrated into closely-related chord types with minimal changes to the remaining voices. However, the student should be cautioned that these changes often prove difficult, as one cannot always sustain the inner voices during such outer-voice skips. Consider motion from vii°$^6_5$to V , which would be implied by the skips $\hat{2}$-$\hat{4}$ above $\hat{2}$-$\hat{7}$, under axis $\hat{2}$. In the abstract, it is easy enough to imagine moving from vii° to V^7 in a way that keeps common tones, but once the outer-voice skips are considered, it proves infeasible. Figure 16 illustrates two possibilities for a vii°^{6}–V –I succession, in spacings that result from the cited outer-voice skips. We see that the outer voices of V^6_5 assume the tritone of the inner voices of vii°^{6}; as these active tones should not be doubled, the prior inner voices *must* change to different chord tones. They may do so in the two ways shown. In the tenor of *(a)*,

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[24]I will not address here the view that "ninth chords" result from voice leading (that, indeed, "ninths" function as elements of melodic figuration) and are not products of "stacked thirds."

$\hat{7}$ skips to $\hat{2}$ then attains $\hat{1}$ upon resolution to the tonic. The same "circling around the goal tone" technique is employed in the alto of *(b)*, in which $\hat{4}$ skips to $\hat{2}$ before returning to the initially-suggested resolution, $\hat{3}$. If either of these voice-leading types is used in one of the inner voices, then the remaining voice must assume a different pattern, or else the middle chord will not be complete. (I.e., if the tenor of *(a)* and the alto of *(b)* were combined in one progression, then there would be no root for the V^6_5 chord.) The only options for the remaining voice are shown by the alto of *(a)* and the tenor of *(b)*, with the smaller noteheads representing another possibility in each case. (The worst of these options, incidentally, is in *(a)*, should the alto proceed F–G–G; to do so goes against the tendency of F ($\hat{4}$) to resolve downward, even if not immediately.) By now, through the preceding demonstrations and commentary, the student should understand that the best submetrical consonant skips to use are those shown on Table 3, with chord indications underneath. Any others may present more problems in execution than initially imagined, even when they imply the presumedly "simple" descending-third successions.

To the right of Table 3's main entries is a tabulation of the chords available, through submetrical skips, under each axis. To the extent that axis $\hat{3}$ permits a more common PD (ii rather than vi), it may seem especially useful. But remember the limitations already discussed: under axis $\hat{3}$, a ii–V^7–I progression can lead only to I^6, and $\hat{5}$ will always be the ending melodic tone upon an authentic cadence. On the other hand, axis $\hat{2}$ could be considered more desirable by virtue of the voice-exchange which allows a root-position I to be projected ($\hat{1}$-$\hat{3}$ above $\hat{3}$-$\hat{1}$), and the reflected skips which suggest a root-position V^9 ($\hat{4}$-$\hat{6}$ above $\hat{7}$-$\hat{5}$). Axis $\hat{1}$ may be the most impoverished in this regard: it can imply only three chord types, including a root-position V^7 ($\hat{2}$-$\hat{4}$ above $\hat{7}$-$\hat{5}$), but *no* root-position tonic.

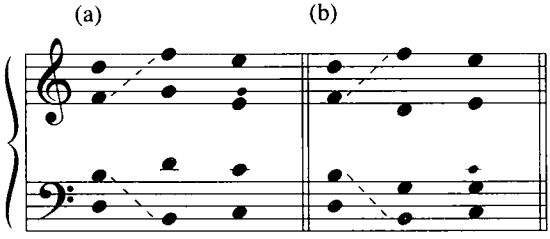
Overall, if the preceding consideration of chordal skips has not provided a criterion by which one axis can be privileged over the others, it does reinforce the positive attributes of axis $\hat{2}$. In certain contexts, axes $\hat{3}$ and especially $\hat{1}$ may have as much utility, but our examinations have shown that axis $\hat{2}$ enjoys an advantage. Perhaps at this point, the teacher and student should consider one other fact about axis $\hat{2}$ that may cause some to favor it: it permits exact

intervallic correspondence between reflected voices. This fact was not cited earlier, as the attribute had nothing to do with our inquiry. Nonetheless, it is true that a major scale is intervallically symmetrical about $\hat{2}$—that the sequence of half steps and whole steps ascending from $\hat{2}$ will be the same as those descending from $\hat{2}$—and accordingly, if that degree of precision is important to a composer, axis $\hat{2}$ may be particularly attractive. Proceeding from this discussion, an instructor might wish to select examples from the literature that employ all three axes, including passages which state reflections successively (as in inversional canons) as well as simultaneously.[25] Following the performance and analysis of such works, aesthetic and perceptual differences can be debated.

On Register and Embellishment

At this stage, a student should compose exercises using the techniques learned so far, with particular attention paid to how register and melodic embellishments can influence the perception of a

Figure 16. Possibilities for moving from vii^{o6} to V^6_5 via outer-voice consonant skips.



[25]For successive (i.e., fugal or canonic) examples of melodic inversion, one might consider J.S. Bach's Canonic Variations on "Vom Himmel hoch, da komm ich her," BWV 769 (1747). The fifth of these is a "canone al rovescio," where $\hat{3}$ is usually the preferred axis, as it allows a subject beginning on $\hat{1}$ to be answered by one on $\hat{5}$.

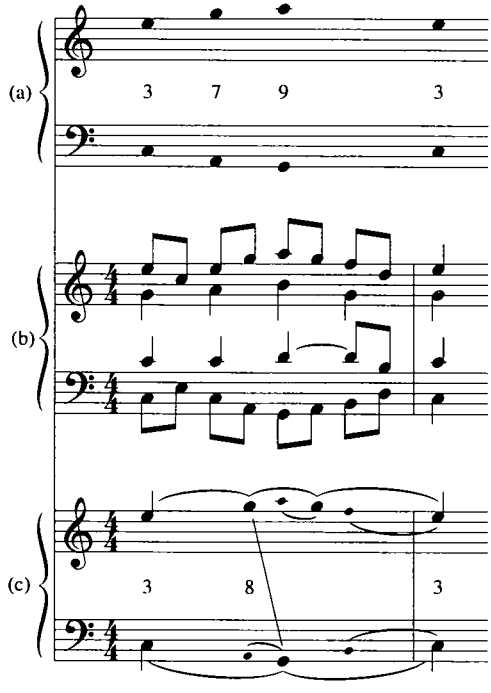
passage—important elements for one to consider, whether or not mirror counterpoint is employed. A profitable manner of doing so would be to compose a conventional structure for one outer voice, but which spawns (as it often will) an unusual structure for the other outer voice; the task will then be to reconcile both voices, within the broader context. A brief example is given in Figure 17a. The bass line is typical: motion from $\hat{1}$ to $\hat{5}$, by way of the latter's upper neighbor, then back to $\hat{1}$. The problem arises when the axis reflections are added. If, for example, one wishes to have $\hat{3}$ in the melody, above $\hat{1}$ (i.e., if one uses axis $\hat{2}$), then a seventh and a ninth will occur above the central bass notes, and neither dissonance will resolve properly. Is there a way to use submetrical skips and other embellishing tones, such that a different structure can be suggested?

One solution is given in Figure 17b, the underlying voice-leading implications of which are indicated in the analysis of Figure 17c. Comparing the two, we should evaluate how the melody suggests its "proper" resolution, despite the literal problematic reflections, outlined above. The melodic A had posed a difficulty, in that it was a dissonance (a ninth) left by leap. Now, the A ($\hat{6}$) occurs as an upper adjacency between two Gs ($\hat{5}$), causing it to sound more like an embellishing tone. This interpretation is suggested by the following factors: First, $\hat{6}$ occurs just as the bass has descended to its lowest note, $\hat{5}$, which coincides with a tonally-strong, root-position dominant chord. Hearing a melodic $\hat{5}$ immediately beforehand, as if in anticipation of V's chord tone, and then again, immediately after $\hat{6}$, while the V chord is still in one's ears, raises $\hat{5}$ to a superordinate level. If the initial melodic $\hat{5}$ sounds like an anticipation, then there is no pressing need to resolve it downward, following the V chord. Still, to the extent that a downward resolution would dissipate any remaining tonal energy, $\hat{5}$ passes through $\hat{4}$ (now itself made a dissonance, above $\hat{7}$) and then to $\hat{3}$, for a consonant repose above the tonic harmony.

Axis Modulation

No matter which axis one finds to have the most general applicability, or to be most suitable for a specific context, its use may become tiresome rather quickly; the static correspondences between

Figure 17. Contextual reconciliation of problematic reflections.



outer voices, and the circulation through the same limited harmonic palette, will eventually exhaust a listener's interest. Accordingly, if students/composers wish to sustain longer exercises/compositions, then they will likely want to employ what we will call *axis modulation*. This is simply the process of changing the axis one or more times after the original axis is established, either to facilitate new outer-voice mappings within the same key (*intrakey* axis modulation), or to effect a temporary change in tonal orientation, as per a tonicization (*interkey* axis modulation). These processes are easy to effect technically, but the selection of new axes does require the consideration of

forthcoming musical goals, with attention focused on both melodic and bass-line events at the same time, so as to achieve an appropriate coordination of the two. In short, axis modulation may require more *compositional* thought than single-axis writing, which can become (once the mappings are internalized) a rather mechanical process. Below, both kinds of axis modulation are discussed and modeled.

In tonal music, phrases are frequently engaged in a melodic descent, and the principal space traversed is often the fifth from $\hat{5}$ to $\hat{1}$. Such a phrase would be difficult to construct using a single axis. If, for example, the initial $\hat{5}$ was to be harmonized with a root-position tonic chord, then axis $\hat{3}$ would be used (wherein $\hat{1}\leftrightarrow\hat{5}$); but, of course, maintaining the axis would cause closure on melodic $\hat{1}$ to occur *above* $\hat{5}$, resulting in an unstable ending on I^{6}_{4}. A better solution would be to change axes, perhaps so that, within the descending melody, all three tonic-triad notes are set against a root-position tonic chord. In composing such passages, it will be beneficial to begin with an underlying voice-leading plan, as per Figure 18a. There, the $\hat{5}$-$\hat{3}$-$\hat{1}$ descent is sketched, and the three different axes are indicated. To fill the space melodically, passing tones have been added, and the bass indicates the two possible supporting tones for these transitional events, depending on whether the preceding or the subsequent axis is employed. (For example, melodic G and E utilize axes $\hat{3}$ and $\hat{2}$, respectively. Thus, the F that connects them could either *continue* using axis $\hat{3}$, and modulate to axis $\hat{2}$ afterward; or *change* to axis $\hat{2}$, and continue with it afterward.)[26] With the tonal plan established, the student should then be able to elaborate it, and produce a fully realized musical phrase.

One such phrase is illustrated in Figure 18b. In addition to having root-position tonic chords accompany all three tonic-triad tones in the melody, $\hat{3}$ over $\hat{1}$ also becomes the goal of a tonicization of vi, thereby adding chromatic interest. In composing such an example, the melody may be considered to be the fixed voice, and the bass may be interpreted as that which shows occasional irregular "seams,"

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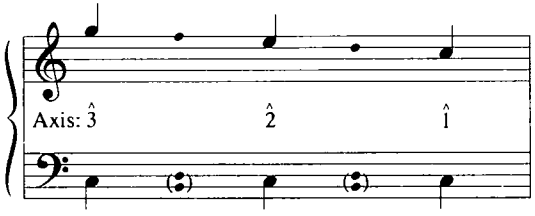
[26]The D-C succession in the bass might seem prohibited, due to the parallel octaves that would result with the melody; but recall that this is only a schematic guide. Through a voice-exchange, or some other type of elaboration, D-C could exist in both voices (just not at the same exact time).

resulting from the changes of axis. In reality, of course, adjustments may be made to both voices as one works, so as to effect the smoothest transition between axes. Here, oblique motion was used to make the transition between axes more fluent—i.e., in the first axis modulation, G was repeated in the melody as the bass skipped from C to A; in the second, C was repeated in the bass as the melody skipped from E to C. Another possibility would have been to maintain contrary motion between bass and melody upon an axis change, even though the precise distance traversed by each voice would be different.

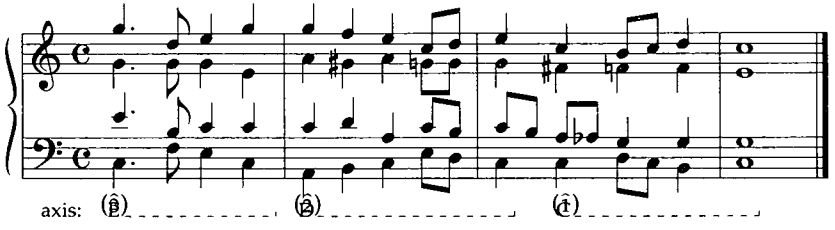
Tonicizations are obviously common in tonal passages, and when they result in outer-voice chromaticism, one does in mirror counterpoint exactly what was done in diatonic axis modulation: one considers outer-voice goals and correspondences, and selects the best axis for the context. The only difference is, one considers the new

Figure 18. Intrakey axis modulation.

(a) initial voice-leading outline.



(b) realization of above.



axis to operate within the diatonic collection of the new (tonicized) key area. One is not constrained to use the same scale-degree axis for the tonicized segment that was being used for the initial (main-key) segment; nor does one have to return to the same scale-degree axis when the original key resumes. The selection depends on the outer-voice correspondences desired at significant moments of arrival, as well as those axes which will foster a musically satisfying line in both outer voices.

Again, the most effective way to construct such a passage is to begin with an underlying voice-leading plan, which will indicate the basic tonicization levels and main outer-voice correspondences. Two of these are illustrated in Figure 19a. In the first, a large-scale melodic descent of $\hat{3}$ to $\hat{1}$ is effected, and both IV and V are tonicized. Root position is desired for each principal chord and, given the melody that has been sketched, the resulting axes are as indicated. In the second schematic, the melody passes from $\hat{3}$ to $\hat{1}$ and back; IV is tonicized in the middle, while the melody is on $\hat{1}$. Given the desired bass and melodic notes, the axes have again been calculated and indicated.

Figure 19b is an elaboration of the second schematic, resulting in a four-bar phrase. For the moments of axis change, similar motion is avoided here as it was earlier. As axis $\hat{2}$/C yields to $\hat{3}$/F, contrary motion is employed; as the latter yields back to $\hat{2}$/C, oblique motion is employed. Of course, other elements of design are incorporated into the actual passage. Most obviously, the melodic contour of m. 1 is replicated in m. 2. And the melodic third, taken from the initial sketch as a basic motive, is applied variously: e.g., immediately, within the first two quarter-beats ($\hat{1}$-$\hat{3}$); filled-in, across the first five quarter-beats ($\hat{1}$...$\hat{2}$-$\hat{3}$); and on different scale degrees, as within m. 1 ($\hat{7}$-$\hat{2}$) and m. 2 ($\hat{1}$...$\hat{6}$-$\hat{1}$). An additional third-skip is assigned to the bass at the point of the first axis modulation. Students should be encouraged to treat such exercises as small compositions, and should endeavor to do more than just "map notes" onto one another about an axis. The initial sketching of the underlying voice-leading patterns will help ensure linear coherence (in addition to facilitating specific axis selections), but it is in the actual elaborations of the patterns that much will be learned.

Mirror Counterpoint by Clementi and Brahms: Analyses of Techniques

When cultivating any musical technique, a study of its application by talented composers can be especially enlightening. Thus, before closing, we will analyze mirror writing in music by Muzio Clementi (1752–1832) and Johannes Brahms (1833–97), so as to solidify certain prior assertions, and to explore further the applications (and ramifications) of mirror counterpoint within an established musical context. It was mentioned earlier that Brahms seems to have been particularly attracted to the technique. This should not be surprising; not only was he intrigued with the study of counterpoint,[27] he also crafted many examples of simultaneous hand mirroring for his *51 Exercises for the Piano* (1893).[28] These exercises, both diatonic and chromatic, indicate

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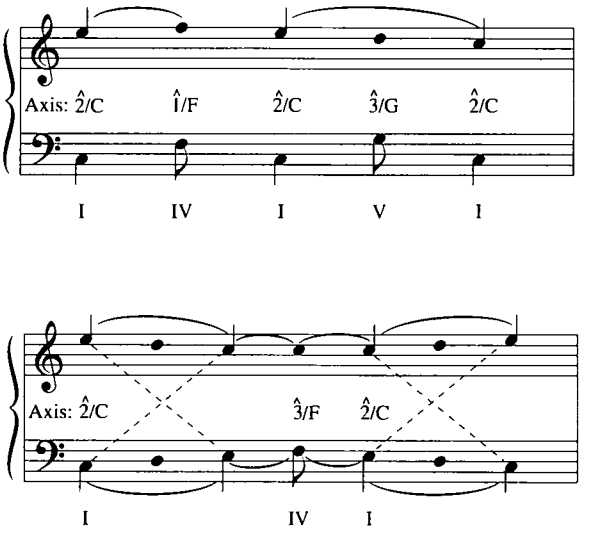
[27]Brahms's keen interest in counterpoint is demonstrated not only by his numerous compositions (including those expressly devoted to contrapuntal artifice, such as his thirteen canons for 3–6 female voices, op. 113), but by the attention he directed toward music-theoretical matters. His personal library contained treatises such as those by Adlung, Forkel, Fux, Gerber, Hiller, Marpurg, Mattheson, and Walther (see, e.g., Karl Geiringer, "Brahms as a Reader and Collector," transl. M. D. Herter Norton, *Musical Quarterly* 19 [1933]: 158–68). He is known too for his personal studies. For example, in the 1850s, he and violinist/composer Joseph Joachim (1831–1907) sent each other their counterpoint exercises for correction in a mutual "correspondence course" of sorts (see, e.g., David L. Brodbeck, "The Brahms-Joachim Counterpoint Exchange, or, Robert, Clara, and 'The Best Harmony Between Jos. and Joh.'," in *Brahms Studies I* [Lincoln: Univ. of Nebraska, 1994]: 30-80; and Isolde Vetter, "Johannes Brahms und Joseph Joachim in der Schule der Alten Musik," in *Alte Musik als asthetische Gegenwart*, vol. I [Kassel: Barenreiter, 1987]: 460–76). He also assembled an annotated collection of around 140 examples of successive octaves and fifths (and other specimens of voice-leading intrigue) he had found in works of various composers; he titled the collection *Octaven u[nd] Quinten u[nd] A[nderes]*. A facsimile of the autograph, with commentary by Heinrich Schenker, has been published (Vienna: Universal, 1933); an edited and translated version by Paul Mast appears as "Brahms's Study, Octaven u. Quinten u. A.," *Music Forum* 5 (1980): 1–196.

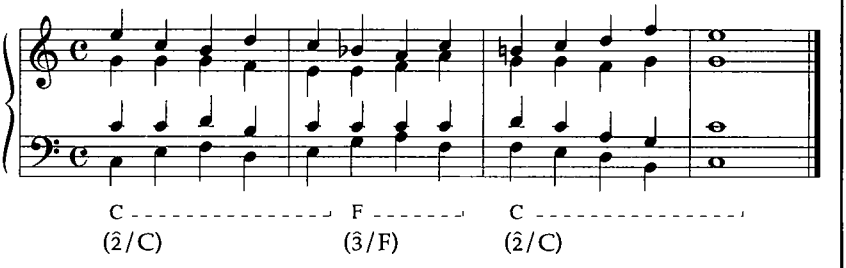
[28]Johannes Brahms, *51 Übungen für Pianoforte*, in *Johannes Brahms: Sämtliche Werke: Ausgabe der Gesellschaft der Musikfreunde in Wien*, ed. Eusebius Mandyczewski (Leipzig: Breitkopf and Härtel); reprinted in Brahms, *Complete Transcriptions, Cadenzas and Exercises for Solo Piano* (New York: Dover, 1971).

Figure 19. Interkey axis modulation.

(a) two voice-leading outlines (flagged notes in bass are tonicized).



(b) realization of no. 2 (above).



exact finger correspondences between reflected hands (a pedagogical benefit), although they do not utilize a consistent scale-degree axis nor result in identical reflected intervals.[29] Nonetheless, they, along with musical passages previously cited, clearly demonstrate his general interest in mirror writing. As for Clementi, those familiar especially with his *Gradus ad Parnassum* (1817–26) will likewise find his use of the technique to be consistent with his compositional inclinations.[30] The *Gradus* includes many specimens of fugue and canon, several of which display ingenious contrapuntal conceits, including forms of inversion-writing other than the simultaneous mirroring under discussion here. E.g., exercise 18 has both inverted entries and stretto by inversion; op. 54 is a double fugue, with inverted entries and a crab canon on one subject; and exercise 10 is a canon by inversion (about axis $\hat{2}$), which exactly preserves reflected intervals even when chromaticism is introduced.[31]

Figure 20a shows a passage from Clementi's *Gradus*, vol. 1 (1817), no. 18; mm. 53–56 feature a melody and bass that are inversions of one another (albeit with octave shifts in the bass on two occasions, so as to keep the outer voices from becoming too close registrally). Except for the two mirrored voices, the only other component of the initial four-bar segment is a line in parallel tenths with the bass (beginning with G above E in m. 53, beat 2, and continuing to C above A in m. 55, beat 2). The excerpt moves through different key areas: it begins in C (which is actually V of the master key, F), moves to F, then implies B♭ (m. 56 is a transposed replica of m. 54) before the subsequent melodic F♯ and E♭ indicate a shift to the relative minor of

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[29]For more on the pedagogical benefits of symmetrical hand exercises for the pianist, see Ronald Rulon Shinn, *The Mirror Inversion Piano Practice Method and the Mirror Music of Vincent Persichetti* (DMA diss., Univ. of Alabama, 1990). Despite the lack of intervallic exactness in Brahms's exercises, those such as nos. 24b and 25c are nonetheless striking. Shinn also cites Brahms's exercises, and notes that if one counts all variations, there are actually 88 examples of which 38 involve some degree of mirroring, no matter how precise (Shinn, p. 41).

[30]Muzio Clementi, *Gradus ad Parnassum*, 3 vols. (1817, 1819, 1826), ed. Nicholas Temperley in *The London Pianoforte School 1766–1860*, vol. 5 (New York: Garland Publishing, 1985).

[31]For example, D♯ is answered by G♮, and G♯ by D♮ (all balanced around B, i.e., $\hat{2}$/A).

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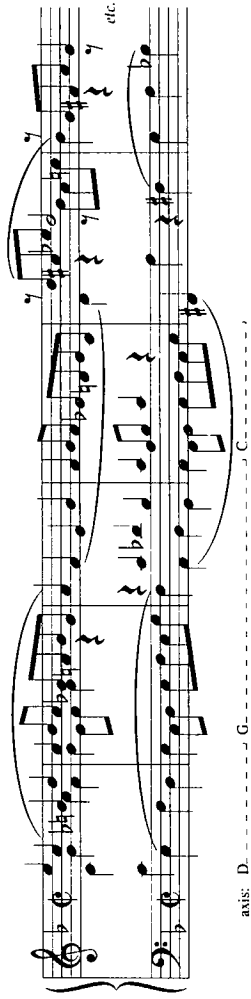
B♭, G-minor (by which point, the mirror writing has ceased). In this case, Clementi has chosen to maintain axis $\hat{2}$ in all three mirrored tonicizations, and thus the axis pitch modulates from D to G to C (i.e., $\hat{2}$/C to $\hat{2}$/F to $\hat{2}$/B♭).

Students of tonal mirror counterpoint should pay particular attention to the placements of the axis shifts, which are rather clever, and show how context can reconcile those sometimes-problematic secundal mappings. The first axis modulation occurs in m. 54, beat 2, just ahead of the melodic B♭, which confirms the change in tonal orientation from C to F. Here D is placed above C (the $\hat{5}\leftrightarrow\hat{6}$ mapping in F); however these notes are *not* fused into an inversion of a seventh chord. Instead, the bass C sounds like the root of a C-major triad—a confirmation of the tonic of m. 53—and the melodic D serves as an upper neighbor between two Cs. (The bass C, as the registral nadir pitch of the measure, also implies a root-position C^7 for beat 3, when literally there is a root-position E-diminished triad, generally impermissible in tonal practice.) As m. 56 is a transposition of m. 54, the same interpretation applies there, with melodic G embellishing an underlying F triad, and the bass F remaining as the active voice until the next measure's F♯. Indeed, the tonal implications of the melody-bass reflections are quite conventional, as demonstrated by the voice-leading graph of Figure 20b. There, one observes a gradual but steady stepwise descent in the melody, and a bass line that suggests the larger-scale motion of C to F, continuing through F♯ to G.

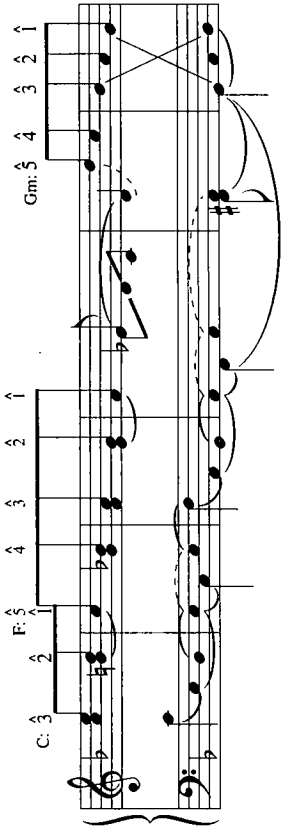
Clementi's success in suggesting the tonally normative structure of Figure 20b is partly due to his choice of axis $\hat{2}$ for each tonal area, which allows the favored $\hat{1}$-$\hat{3}$ voice exchanges. But it is also due, in large part, to his decision as to *where* to place the axis changes—something that can be determined only after a context is established. His choices helped to bring secundal dissonances into compliance with tonal voice-leading and harmonization. However, there is still one problem, inherent to the mirror operation, with which Clementi is not as successful. Octave convergences upon the axis pitch-class can give it undue emphasis; and here the outer-voice octaves (first G, then C) are rather notable, as there is no third voice to ameliorate them harmonically. Still, Clementi admirably avoids most tonal pitfalls that accompany mirror counterpoint, primarily because of his frequent alternation of melodic semitones under axis $\hat{2}$, which result in vii°–I relations.

Figure 20. M. Clementi, *Gradus ad Parnassum*, no. 18 (1817).

(a) score, mm. 53-58.



(b) voice-leading graph of above.



A somewhat more complicated example of mirror composition may be found in Brahms's *Variations on a Theme by Robert Schumann*, op. 9 (1854). Variation 10 consists of four successive (sometimes altered) statements of an eight-bar melody; the setting or accompaniment is varied for each. The first statement (Figure 21a) features a melody and bass exactly inverted about $\hat{2}$ in D-major; inner voices complete harmonies and often include stepwise motion in thirds. The melody is an unusual candidate for inversion, and students should heed the reasons this is so, as well as Brahms's solutions to the problems. First, the melody contains four leaps of a fourth or larger (mm. 1, 3, 5, and 6); when reflected in two voices simultaneously, such leaps are not only unusual in tonal music, but they can be difficult to coordinate harmonically. The leaps occur because the origin of the top voice is not the actual *melody* of Schumann's theme, but the *bass line* of the theme's eight-bar introduction, as shown in Figure 21b. Another unusual facet of Brahms's appropriation is that Schumann's introduction is not in D, but in F♯-minor with a turn to A-major at the very end. Its bass line, however, does *not* contain G♯, the note that would distinguish the diatonic collection of F♯-minor from that of D-major; furthermore, the bass line's first two metric downbeats are F♯ and D (which correspond to $\hat{3}$ and $\hat{1}$ of D). For these reasons, along with its ending tonicization of A (i.e., V/D), Schumann's bassline is able to be transferred to the key of D fairly convincingly.

There are two alterations made by Brahms; these occur in the quarter beats preceding the final measures of each four-bar unit, and the changes are interesting from the dual standpoints of how to adapt a theme written in one key so that it will fit another, and what changes have to be made when adapting a melody for mirror counterpoint, due to the requisite axis mappings. In m. 3, the melody, if adapted exactly, should have had a direct leap from C♯ to F♯ (corresponding to $\hat{5}$-$\hat{1}$ in the original key of F♯-minor). The problem with the leap in the context of D, of course, is that C♯ is the leading tone and needs to ascend by step (not leap downward); and likewise its inverted analogue, the tritone-distant G, needs to descend (not leap upward). Brahms accommodates the problem by altering the ending of the measure so that a C♯/G exchange occurs between outer voices (see Figure 21a), and the resolution to F♯ over D occurs as per the mandates of voice leading. The next change occurs at the end of m.

7, during the tonicization of A. Schumann originally had F♯–E–A, which would have reflected onto D–E–B. The initial two notes (F♯ over D, E over E) could be reconciled with IV–V of A, but the A-over-B combination is untenable for the cadence. Accordingly, Brahms changes the axis here, via an interkey axis modulation: $\hat{2}$/A is now used, and as the top voice ascends to A, the bottom voice descends to C♯. Although the outer voices first diverge from the $\hat{2}$/D axis on m. 7, beat 2, the harmonic move to A-major begins two beats *earlier* (note the inner-voice G♯ on m. 6, beat 2), and mm. 7–8 project the progression ii–V–I of A, as indicated.

Despite Brahms's skillful sculpting of the passage, so that it will sound tonally "normal," some ambiguities can be found (a problem always lurking if the same axis persists for several measures).[32] For example, in m. 2, should the last eighth-note chord be interpreted as IV, with non-chordal $\hat{5}$ in the bass, or does the $\hat{6}$ above $\hat{5}$ suggest V^9? The open seventh in the lower register ($\hat{5}$-$\hat{4}$) would usually suggest a dominant-functioning chord; however, the very next measure clearly sounds another dominant chord, V^4_2. Two factors, common to tonal music, argue for the subdominant interpretation: one would expect a piece to have IV preceding V; and one would probably *not* expect a repetition of the same chord across a barline.[33] For these reasons, one may be inclined to hear the functional harmony as IV, and the bass's A as a non-chord tone—i.e., part of a double-neighbor complex (F♯-A) which leads to G on m. 3, beat 1.

Another issue is the interpretation of the harmonies that end m. 6 and begin m. 7. This is the point at which the internal G♯ indicates a turn to A-major, and so the B–F♯ and A–D of m. 6, beat 2, suggest ii^4_3

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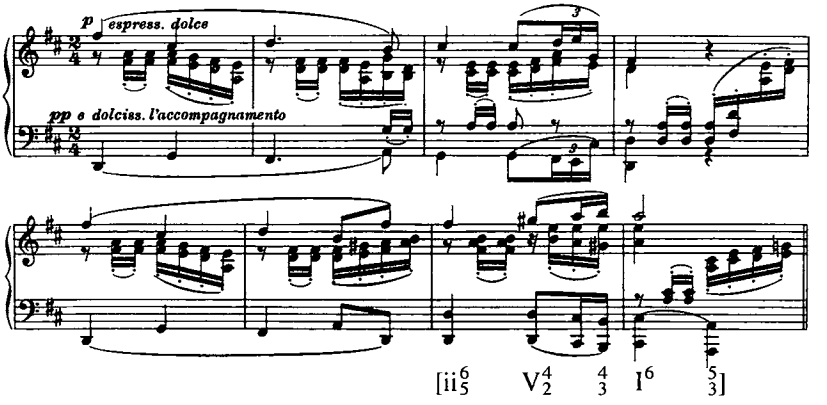
[32]I will set aside, for the moment, the fact that one might well expect—even aesthetically desire—to encounter ambiguities in Brahms's music.

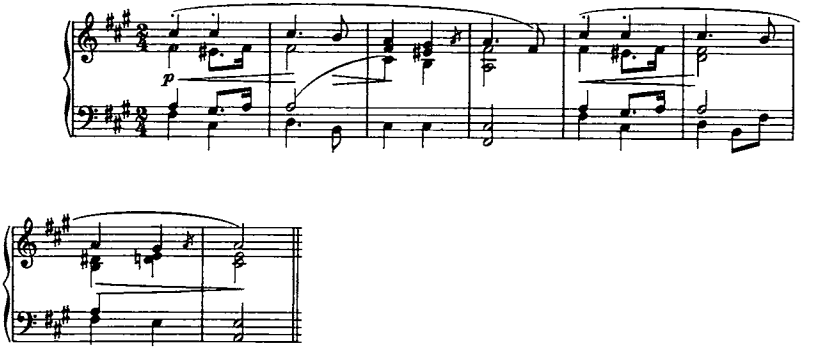
[33]Regarding a listener's not expecting "repetition ... across a barline," I mean simply that, within the established metric grid of a passage, as one moves from a "weaker" event to one that is "stronger," a listener tends to expect a metric accent to be confirmed by various other articulations of change (changes to longer note durations, changes of harmony, etc.). The stronger the metric accent is expected to be (i.e., in $\frac{4}{4}$ time, third beats are not expected to be as strong as first beats; first beats within periodic phrases are not expected to be as strong as first beats which initiate phrases; etc.), the more one expects various other articulations to coincide.

Figure 21. J. Brahms, *Variations on a Theme by Robert Schumann*, Op. 9 (1854).

(a) beginning of var. 10.



(b) theme (the below base line is appropriated for the above variation)



(D is taken as the active bass tone). Indeed, this interpretation seems confirmed by the inner voices, which present the secundal dyad A–B on the last sixteenth-note. But the very next measure keeps the same outer voices (in order to maintain Schumann's model), and the inner voices *once more* complete ii$^4_3$. So here we apparently *do* have a chord sustained across the barline. Should a preconditioning to reject such an occurrence prompt us to reinterpret the function of m. 6, beat 2? If so, how? Should we perhaps try to hear it as a continuation of the previous tonic, D (the measure's boundary notes in the outer voices do suggest I of D: D–F# over F#–D), in which context B would be regarded as an "added sixth"? This would allow us to imagine a root change across the barline, but of course such an interpretation seems fanciful given the strong presence of both D and B throughout both beats. Yet, if one is willing to accept ii/A as continuing across the barline here, why not hear V^7/D as continuing across the barline in the earlier passage? Indeed, such an interpretation of the earlier instance would still confirm the sense of musical "change" one often associates with metric accents, in an important way that the latter instance does not: the *bass* changes between mm. 2 and 3, and so even if one hears both chords as dominant-functioning, the V^4_2 of m. 3, beat 1, is certainly a more "accented" event than the preceding root-position V^9, due to outer-voice intervallic tension.

Observe that both of these interpretively-problematic moments arise when the juxtaposition of $\hat{5}$ and $\hat{6}$ is encountered. We conclude that even in relatively simple, mostly-diatonic settings, outer-voice mirroring often necessitates sonorities and/or chord progressions that "bend" conventional tonal practice.

One final example will be illustrative. A few years after the Schumann variations, Brahms composed another variation set with mirror writing: *Variations and Fugue on a Theme by Handel*, op. 24 (1861). Variation 6 introduces one form of the technique: its first half is a canon at the octave, and its second half a canon in inversion. However, it is in the fugue, which ends the set, that *simultaneous* inversion is presented. As shown in Figure 22a, beginning in m. 75 there are outer-voice reflections, the upper part progressing in parallel sixths and the lower part in parallel thirds. A significant aspect of the passage should be mentioned: it begins 35 measures before the fugue's conclusion (roughly two-thirds of the way through), at a section in

which there is continuous reiteration of the pedal $\hat{5}$ (F in the master key of B♭). In m. 82 (the last measure shown in the excerpt), there is arrival on the complete dominant harmony; but the emphasis of $\hat{5}$ continues afterward, first in the upper voice (as shown by the last three quarter beats of the excerpt), and subsequently again in the bass, each occurrence doubled at the octave and accented. This attribute is described because it is important to realize that the pedal Fs are *independent* of the axis reflections to be discussed. Sometimes an F is added below the bass's true mirror tone (as in m. 77, beat 1, where the lower B♭ is the actual counterpart of the melody's D), but sometimes a bass F fully supplants the mirror tone (as per the fourth sixteenth-beat of m. 78).

If one were to glance casually at the excerpt, it might seem that Brahms was employing only general contrary motion between outer voices, as the axis is not fixed for the entire passage. But, in truth, the passage tonicizes five different scale degrees within the master key ($\hat{1}$ stepwise through $\hat{5}$, of B♭), and so the axis changes five times; yet, it is always positioned as $\hat{2}$ within the tonicized area. These modulations of key area and axis are indicated in the figure. Note that a leading-tone chord—vii°(7)—precedes each change; it is upon the *resolution* of each such chord that the axis changes. This may seem unusual. After all, is not a chief advantage of axis $\hat{2}$ the fact that $\hat{7}\leftrightarrow\hat{4}$ and $\hat{1}\leftrightarrow\hat{3}$ permit vii°–I progressions? So why does Brahms not exploit this potential? Figure 22b illustrates the voice-leading that underpins the passage: a series of ascending (diatonic) tenths, connected by chromatic passing tones. Considering the deeper structure, we can surmise why Brahms changed the axis only upon the arrival of the *tonicized chords*, not before, upon the *leading-tone chords*. As illustrated in Figure 22c, if Brahms had changed the axis to $\hat{2}$/D at the beginning of m. 79, upon the vii°/D chord, then the larger parallel-tenth connection would have taken a different form. But by continuing the prior axis ($\hat{2}$/C) a bit longer—even as chromaticism was introduced in a way that indicated a new tonicization was afoot—he was able to preserve a consistent and thus potentially stronger linear motion: i.e., the chromatic tones now function as passing tones between diatonic steps, and in both outer voices. Thus, regarding axis modulation, once again we find that the only general rule as to *when* one should change the axis tone, is the same one that regulates to *what* scale

Figure 22. J. Brahms, *Variations and Fugue on a Theme by Handel*, Op. 24 (1861).

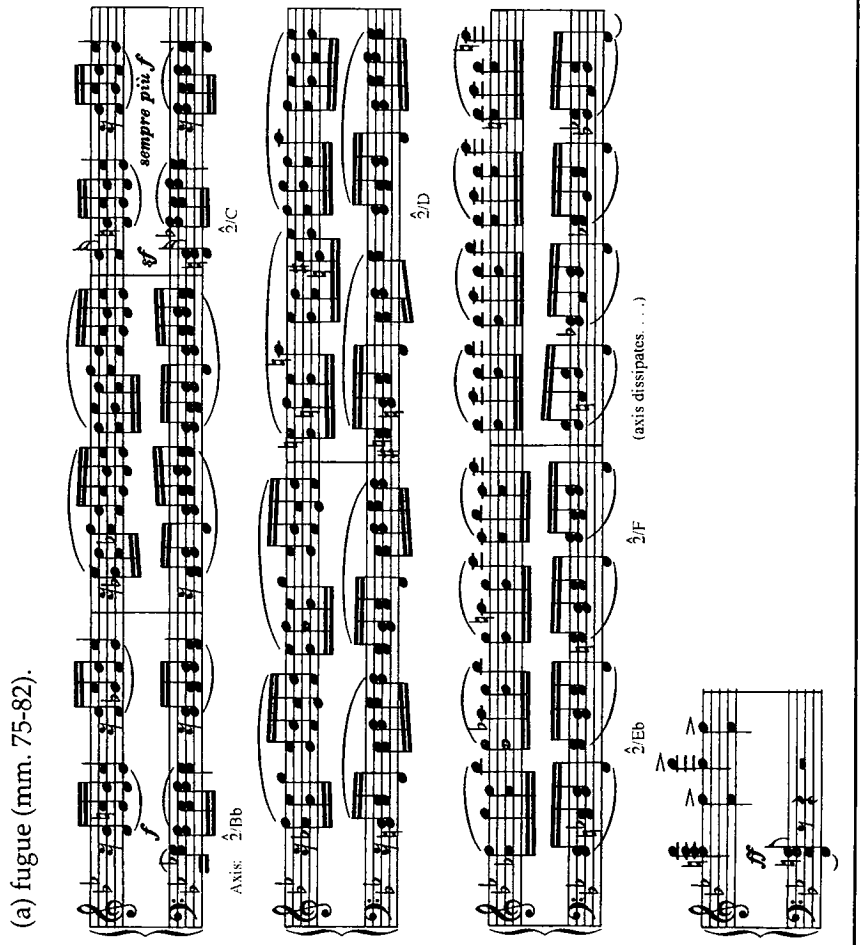
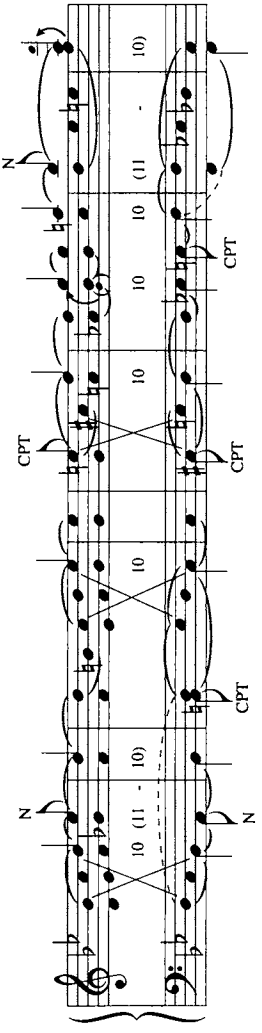
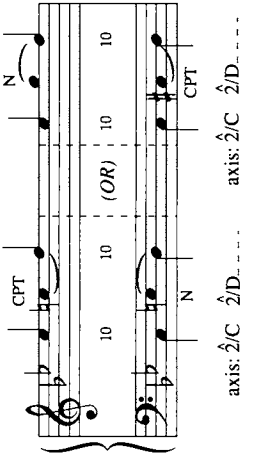


Figure 22. (continued)

(b) voice-leading graph of above.



(c) voice-leading structure, if the axis changed *before* the 10s.



degree one should change it: one should select the axis, and position the change, in the way that best complements the voice leading.

Summary

At the beginning of the article, I mentioned that mirror counterpoint has been virtually ignored in contemporary tonal pedagogical tracts, even though the technique is rich in history and representative composers. Certainly it would be beneficial to introduce it to the student, if only to foster an awareness of an underexplored yet intriguing facet of tonal composition. However, examination of the technique has suggested other benefits—those which relate specifically to the skills and perceptions a student is expected to master during a course on the theory and practice of tonal music. I will close by summarizing some of the most important of these.

Among the efficacies of contrapuntal study in general are that students develop an appreciation for melodic shape, and become sensitive to the numerous voice-leading connotations a single line can embody. Attention must be paid to polylinear aspects (i.e., to registrally-separated voice-leading strands, each suggesting a particular direction of continuation); to notes that may be tonally implicit (though literally absent) and thus impinge upon further developments; and to many other details. These factors are still relevant in mirror counterpoint, but new challenges emerge, with corresponding new benefits. The student must learn to create aesthetically satisfying melodic shapes that, when inverted, can serve well as *either* a melody or a bass. Accordingly, the student must become familiar with the different characteristics of tonal melodies and basses, and find creative ways to compromise them in an effective fusion. In deciding which outer-voice combination to employ at a particular moment, the student must be ever mindful of the melodic and harmonic functions implicit in particular scale degrees. True, these functions must be considered also when one is engaged in melody harmonization or unfigured-bass realizations; but there the outer-voice independence allows a freer coordination, while, with mirror counterpoint, both functions must be considered at once. The contextual, harmonic functions of root-inversions must be evaluated at the same time as the melodic impetus; and this is especially the

case when assessing the degrees of closure suggested by different cadential configurations under different axes.

Finally, it must be acknowledged that one of the more difficult aspects of tonal practice to impart—in that a student must not only understand the concept intellectually, but internalize it and follow it habitually—is that every pitch has both a harmonic and a contrapuntal role; it is this duality of membership, in both chord and line, that gives rise to the art of voice-leading. Mirror writing provides an ideal mechanism for integrating harmonic and contrapuntal principles, for synthesizing the structure of chords and the structure of lines. It demonstrates the fact that music weaves through various patterns at once; the vertical and the horizontal—the immediate and the larger-scale—must all work together. To the extent that mirror counterpoint can lead to an understanding of the rich interplay of musical forces present in tonal music, it is a concept that should not be dismissed lightly from classroom instruction.